CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY

(Autonomous)

Kokapet (Village), Gandipet, Hyderabad, Telangana – 500075

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1.1.3 Average percentage of courses having focus on employability/ entrepreneurship/ skill development offered by the institution during the last five years

1.1.3.1 Number of courses having focus on employability/ entrepreneurship/ skill development year-wise during the last five years.

Year	2021-22	2020-21	2019-20	2018-19	2017-18
Number	1166	1106	985	922	984

List of courses courses having focus on employability/ entrepreneurship/ skill development offered by the institution during 2019-20 from S. No. 2649 - 3263

S. No	Course Name	Code
2649	Mathematics -I	18MT C01
2650	Chemistry	18CY C01
2651	Engineering Mechanics	18CEC01
2652	Programming for Problem Solving	18CS C01
2653	Engineering Graphics and Design	18MEC01
2654	Programming for Problem Solving Lab	18CS C02
2655	Chemistry Lab	18CY CO2
2656	Mathematics -II	18MT C03
2657	Optics and Semiconductor Physics	18PY C01
2658	Object-Oriented Programming	18CS C03
2659	English	18EG C01
2660	Optics and Semiconductor Physics Lab	18PY C02
2661	Object-Oriented Programming Lab	18PY C04
2662	Workshop/ Manufacturing Practice	18ME C02
2663	English Lab	18EG C02
2664	Basic Electrical Engineering	18EEC01
2665	Data Structures	18CSC07
2666	Discrete Mathematics	18CSC08
2667	Digital Electronics and Logic Design	18CSC09
2668	Principles of Management	18MEC09
2669	Environmental Science	18CEM01
2670	Basic Electrical Engineering Lab	18EEC02
2671	Data Structures Lab	18CSC10
2672	Digital Electronics and Logic Design Lab	18CSC11
2673	Soft Skills	18EGC03
2674	Basic Electronics	18ECC34
2675	Probability and Statistics	18MTC09
2676	Computer Architecture and Micro Processor	18CSC12
2677	Data Base Management Systems	18CSC13
2678	Indian Constitution	18EGM 01
2679	Basic Electronics Lab	18ECC35

2680	Computer Architecture and Micro Processor Lab	18CSC14
2681	Data Base Management Systems Lab	18CSC15
2682	IT Workshop (Latex/Scilab)	18CSC16 IT
2683	Design and Analysis of Algorithms	16CSC17
2684	Automata Languages and Computation	16CSC18
2685	Operating Systems	16CSC19
2686	Data Communication and Computer Networks	16CSC20
2687	Software Engineering	16CSC21
2688	Mobile Application Development	16CSE04
2689	Computer Graphics	16CSE05
2690	Operating Systems LAB	16CSC22
2691	Data Communication and Computer Networks LAB	16CSC23
2692	Software Engineering LAB	16CSC24
2693	Compiler Construction	16CSC25
2694	Artificial Intelligence	16CSC26
2695	Mobile Computing	16CSC27
2696	Information and Network Security	16CSC28
2697	Internet of Things	16CSC29
2698	Soft Computing	16CSE08
2699	Data Mining	16CSE09
2700	Information and Network security Lab	16CSC30
2701	Internet of Things Lab	16CSC31
2702	Mini Project-II	16CSC32
2703	Data science and big data analytics	16CSC 33
2704	Free and Open Source Software	16CSC 34
2705	Distributed and Cloud Computing	16CSC 35
2706	Machine Learning	16CSC 36
2707	Deep Learning	16CSE 10
2708	Nature Inspired Algorithm	16CSE 12
2709	System & Network Administration	16CSE 13
2710	Disaster Mitigation and Management	16CEO 02
2711	Entrepreneurship	16MEO 01
2712	Research Methodologies	16MEO 06
2713	Data science and big data analytics Lab	16CSC 37
2714	Machine Learning Lab	16CSC 38
2715	Project Seminars	16CSC 39
2716	Cyber Security	16CSE 14
2717	Natural Language Processing	16CSE 16
2718	Bioinformatics	16CSE 18
2719	Human Computer Interaction	16CSE 19
2720	Blockchain Technology	16CSE 21
2721	Intellectual Property Rights	16MEO 04
2722	History of Science and Technology	16PYO 01
2723	Seminar	16CSC 40
2724	Project	16CSC 41
2725	Mathematical Foundation of Computer Science	19CSC 101
2726	Advanced Data Structures	19CSC 102
2727	Machine Learning	19CSE101
2728	Internet of Things	19CSE102

2729	Introduction to Intelligent Systems	19CSE103
2730	Data Science & Big Data Analytics	19CSE113
2731	Distributed Database Systems	19CSE114
2732	Advanced Wireless and Mobile Networks	19CSE115
2733	RM and IPR	19MEC 103
2734	Laboratory 1 Advanced Data Structures	19CSC 103
2735	Laboratory 2 Introduction to Intelligent Systems Lab	19CSE109
2736	Advanced Algorithms	19CSC104
2737	Soft Computing	19CSC105
2738	Data Preparation and Analysis	19CSE104
2739	Human and Computer Interaction	19CSE116
2740	AA & Soft Computing Lab	19CSC106
2741	Data Preparation and Analysis Lab	19CSE110
2742	Mini Projects with Seminar	19CSC107
2743	Project Seminar	16CS C301
2744	Project Work and Dissertation	16CSC 401
2745	Mathematics-1	18MTC01
2746	Chemistry	18CYC01
2747	Engineering Mechanics	18CEC01
2748	Engineering Graphics and Design	18MEC01
2749	Programming for Problem Solving	18CSC01
2750	Programming for Problem Solving Lab	18CSC02
2751	Chemistry Lab	18CYC02
2752	Mathematics-II	18MTC03
2753	Optics and Semi Conductor Physics	18PYC01
2754	Object Oriented Programming through C++	18ITC01
2755	English	18EGC01
2756	Optics and Semi Conductor Physics Lab	18PYC02
2757	Object Oriented Programming through C++ Lab	18ITC02
2758	Workshop/Manufacturing Practice	18MEC02
2759	English Lab	18EGC02
2760	Data Structures and Algorithms	18ITC04
2761	Discrete Mathematics and Applications	18IT C05
2762	Basic Electronics	18EC C34
2763	Principles of Management	18ME C09
2764	Basic Electrical Engineering	18EE C01
2765	Environmental Science	18CE M01
2766	Data Structures and Algorithms Lab	18IT C06
2767	Mini Project – I	18IT C08
2768	Basic Electronics Lab	18EC C35
2769	Soft Skills	18EG C03
2770	Basic Electrical Engineering Lab	18EE C02
2771	Digital Logic and Computer Architecture	18IT C03
2772	Database Management Systems	18IT C09
2773	Java Programming	18IT C10
2774	Design and Analysis of Algorithms	18IT C11
2775	Probability and Statistics	18MT C09
2776	Indian Constitution	18EG M01
2777	IT Workshop	18IT C07

2778	Database Management Systems Lab	18IT C12
2779	Java Programming Lab	18IT C13
2780	Mini Project - II	18IT C14
2781	Principles of Operating Systems	16ITC16
2782	Database Systems	16ITC17
2783	Software Engineering	16ITC18
2784	Web Technology	16ITC19
2785	Theory of Automata	16ITC20
2786	Python Programing	16ITE01
2787	UNIX and Shell Programming	16ITE02
2788	Scripting Languages	16ITE03
2789	Operating Systems and Web Technology lab	16ITC21
2790	Database Systems Lab	16ITC22
2791	Mini Project III	16ITC23
2792	Computer Networks & Socket Programming	16ITC24
2793	Data Warehousing and Data Mining	16ITC25
2794	Artificial Intelligence	16ITC26
2795	Principles of Compiler Design	16ITC27
2796	Object Oriented System Development using UML	16ITE06
2797	Digital Image Processing	16ITE07
2798	Information Retrieval System	16ITE08
2799	E-Commerce	16ITE09
2800	Network Programming Lab	16ITC28
2801	Data Mining Lab	16ITC29
2802	Mini Project IV	16ITC30
2803	Embedded Systems & Internet of Things	16IT C31
2804	Distributed Systems	16IT C32
2805	Information Security	16IT C33
2806	Big Data Analytics	16IT C34
2807	Human Computer Interaction	16IT E10
2808	Natural Language Processing	16IT E13
2809	Business Intelligence	16IT E15
2810	Big Data Analytics Lab	16IT C35
2811	Embedded Systems & Internet of Things Lab	16IT C36
2812	Project Seminar	16IT C37
2813	Social Media Analytics	16IT E17
2814	Research Methodologies	16ME 006
2815	Introduction to Operations Research	16ME 007
2816	Gender Sensitization	16EG 002
2817	Disaster Mitigation and Management	16CE002
2818	Entrepreneurship	16ME001
2819	Seminar	16IT C38
2820	Project	16IT C39
2821	Computational Number Theory	19MTC101
2822	Cryptography and Network Security	19ITC101
2823	Ethical hacking	19ITE106
2824	Data Science	19ITE113
2825	Research methodology and IPR	19MEC103
2826	Audit course-1	AC1

2827	Cryptography and Network Security Lab	16ITC104
2828	Data Science Lab	19ITE119
2829	Cryptography &Network security	19ITC101
2830	Adhoc Sensor networks	19ITC102
2831	Biometric Security	19ITE101
2832	Data Science	19ITE113
2833	Audit course-2	AC2
2834	Cryptography and Network Security LAB	19ITC104
2835	Data Science Lab	19ITE119
2836	MP LAB with Seminars	19ITC106
2837	Project Seminar	16ITC301
2838	Project Work and Dissertation	16ITC401
2839	Mathematics -I	18MTC01
2840	Waves, Optics and Introduction To Quantum Mechanics	18PYC04
2841	Programming for Problem Solving	18CSC01
2842	English	18EGC01
2843	Waves and Optics Laboratory	18PYC07
2844	Programming and Problem Solving Lab	18CSC02
2845	Workshop/Manufacturing Practice	18MEC02
2846	English Lab	18EGC02
2847	Mathematics -II	18MTC03
2848	Chemistry	18CYC01
2849	Engineering Mechanics	18CEC01
2850	Engineering Graphics and Design	18MEC01
2851	Basic Electrical Engineering	18EEC01
2852	Basic Electrical Engineering Lab	18EEC02
2853	Chemistry Lab	18CYC02
2854	Applied mathematics	18MTC07
2855	Analog Electronic Circuits	18EEC03
2856	Electrical Measurements and Instrumentation	18EEC04
2857	Electromagnetic Fields	18EEC05
2858	Electrical Circuit Analysis	18EEC06
2859	Indian constitution	18EGM01
2860	Indian Traditional Knowledge	18EEM01
2861	Analog Electronic Circuits Lab	18EEC07
2862	Electrical Measurements and Instrumentation Lab	18EEC08
2863	Basics of Data Structures	18CSC05
2864	Digital Electronics	18EEC09
2865	Electrical Machines-1	18EEC10
2866	Power Systems-I	18EEC11
2867	Principles of Management	18ME C09
2868	Environmental Science	18CEM01
2869	Basics of Data Structures lab	18CSC06
2870	Digital Electronics Lab	18EEC12
2871	Electrical Machines-1 Lab	18EEC13
2872	Soft Skills Lab	18EGC03
2873	Power Systems – II	16EEC15
2874	Electrical Machinery – II	16EEC16
2875	Power Electronics	16EEC17

2876	Linear Control Systems	16EEC18
2877	Non Conventional Energy Sources	16EE E01
2878	Statistical and Numerical Methods	16MT E01
2879	Electrical Machinery – II Lab	16EEC19
2880	Power Electronics Lab	16EEC20
2881	Linear Control Systems Lab	16EEC21
2882	Electrical Machinery – III	16EEC23
2883	Switchgear and Protection	16EEC24
2884	Power Semiconductor Drives	16EEC25
2885	Microprocessor and Microcontrollers	16EEC26
2886	Artificial Intelligence Techniques in Electrical	16EEE06
2887	Optimization Techniques	16EEE08
2888	High Voltage DC Transmission	16EEE11
2889	Simulation Techniques for Electrical Engineering	16EEE12
2890	Microprocessor and Microcontrollers Lab	16EEC27
2891	Power Systems Lab	16EEC28
2892	Mini Project	16EEC29
2893	Power System Operation and control	16EE C31
2894	Utilization of Electrical Energy	16EE C32
2895	DSP and Embedded Systems	16EE C33
2896	Computer methods in power systems	16EEE15
2897	Power Quality Engineering	16EEE16
2898	Special Electrical Machines	16EEE17
2899	Disaster Mitigation and Management	16CE O02
2900	Machine Learning Using Phyton	16CS O10
2901	Entrepreneurship	16ME O01
2902	Power Systems Simulation Lab	16EE C34
2903	Digital Signal Processor and Embedded Systems Lab`	16EE C35
2904	Project Seminar	16EE C36
2905	Flexible AC Transmission Systems(FACTS)	16EE E19
2906	Electrical Estimation and Costing(EEC)	16EE E25
2907	Technical Writing Skills	16EG O01
2908	Industrial Administration and Financial Management	16 ME O08
2909	Seminar	16EE C37
2910	Project	16EE C38
2911	Power system Analysis	19EEC101
2912	Power Eelctronic Converters	19EEC102
2913	Artificial Intelligence Techniques	19EEE108
2914	Power Quality	19EEE110
2915	Research Methodology and IPR	19MEC103
2916	English for Research Paper Writing	19EGA101
2917	Power Systems Lab	19EEC103
2918	Power Electronics Simulation Lab	19EEC104
2919	Power System dynamics	19EEC105
2920	Advanced Power Electronic Circuits	19EEC106
2921	Renewable Energy System	19EEE107
2922	Energy Auditing & Management	19EEE113
2923	Disaster Mitigation and Management	19CEA101
2924	Power Electronics Lab	19EEC107

2925	Power Systems Simulation Lab	19EEC108
2926	Mini Project with Seminar	19EEC109
2927	Project Seminar	16EEC101
2928	Project Work & Dissertation	16EEC103
2929	Mathematics-I	18MTC01
2930	Chemistry	18CYC01
2931	Engineering Mechanics	18CEC01
2932	Engineering Graphics and Design	18MEC01
2933	Basic Electrical Engineering	18EEC01
2934	Basic Electrical Engineering Lab	18EEC02
2935	Chemistry Lab	18CYCO2
2936	Mathematics -II	18MTC03
2937	Optics and Semiconductor Physics	18PYC01
2938	Programming for Problem Solving	18CSC01
2939	English	18EGC01
2940	Optics and Semiconductor Physics Laboratory	18PYC02
2941	Programming for Problem Solving Lab	18CSC02
2942	Workshop/ManufacturingPractice	18MEC02
2943	English Lab	18EGC02
2944	Applied Mathematics	18MTC07
2945	Basics of Data Structures	18CSC05
2946	Electromagnetic Theory and Transmission Lines	18ECC01
2947	Electronic Devices	18ECC02
2948	Network Theory	18ECC03
2949	Signals and Systems	18ECC04
2950	Environmental Science	18CEM01
2951	Basics of Data Structures Lab	18CSC06
2952	Electronic Devices Lab	18ECC05
2953	Electronic Workshop and Networks Lab	18ECC06
2954	Soft Skills	18EGC03
2955	Analog Circuits	18ECC07
2956	Analog Communication	18ECC08
2957	Antennas and Wave Propagation	18ECC09
2958	Control Systems	18ECC10
2959	Digital Systems Design	18ECC11
2960	Indian Constitution	18EGM01
2961	Indian Traditional Knowledge	18EEM01
2962	Analog Circuits Lab	18ECC12
2963	Analog Communication Lab	18ECC13
2964	Digital Systems Design Lab	18ECC14
2965	Digital Communication	16ECC18
2966	Integrated Circuits and Applications	16ECC19
2967	Microprocessors and Microcontrollers	16ECC20
2968	Control Systems	16ECC21
2969	Computer Organization and Architecture	16ECE01
2970	Digital Communication Lab	16ECC22
2971	Integrated Circuits and Applications Lab	16ECC23
2972	Microprocessors and Microcontrollers Lab	16ECC24
2973	Embedded System Design	16ECC25

2974	Digital Signal Processing	16ECC26
2975	Microwave Engineering	16ECC27
2976	Wireless Mobile Communication	16ECC28
2977	Data Structures	16ITE27
2978	Java Programming	16ITE25
2979	Python Programming	16ITE26
2980	CPLD and FPGA Architectures	16ECE05
2981	Embedded System Design Lab	16ECC29
2982	Digital Signal Processing Lab	16ECC30
2983	Microwave Engineering Lab	16ECC31
2984	Data Communication and Computer Networks	16ECC32
2985	Principles of GNSS	16ECC33
2986	Radar and Satellite Communication	16ECC34
2987	VLSI Design	16ECC35
2988	Principles of Real Time Operating Systems	16ECE09
2989	Speech Processing	16ECE10
2990	Applications of IoT in ECE	16ECE12
2991	Digital Image Processing	16ECE13
2992	Advanced Simulation Lab	16ECC36
2993	Electronic Design and Automation Lab	16ECC37
2994	Project Seminar	16ECC38
2995	DSP Processors and Architectures	16ECE16
2996	VLSI Technology	16ECE18
2997	Voice over IP	16ECE19
2998	Basics of Machine Learning Using Python	16CSO10
2999	Entrepreneurship	16MEO01
3000	Gender Sensitization	16EGO02
3001	History of Science and Technology	16PYO01
3002	Disaster Mitigation and Management	16CEO02
3003	Fundamentals of DBMS	16CSO06
3004	Seminar	16EC C39
3005	Project	16EC C40
3006	Advanced Digital Signal Processing	19EC C102
3007	Wireless and Mobile Communication	19EC C104
3008	Research Methodology and IPR	19ME C103
3009	Global Navigation Satellite Systems	19EC E103
3010	Software Defined and Cognitive Radio	19EC E112
3011	English for Research Paper Writing	19EG A101
3012	Advanced Digital Signal Processing Lab Lab	19EC C106
3013	Wireless and Mobile Communication Lab	19EC C108
3014	Advanced Communication Networks	19EC C101
3015	Antennas and Radiating Systems	19EC C103
3016	Signal Intelligence Systems	19EC E111
3017	Internet of Things	19EC E106
3018	Value Education	19EC A101
3019	Advanced Communication Networks lab	19EC C105
3020	Antennas and Radiating Systems Lab	19EC C107
3021	Mini Project with Seminar	19EC C109
3022	Project work - Project Seminar	16ECC112

3023	Project work - Dissertation	16ECC113
3024	Analog and Digital CMOS VLSI Design	19EC C201
3025	Microcontrollers and Programmable Digital Signal Processors	19EC C203
3026	Research Methodology and IPR	19ME C103
3027	Advanced Computer Organization	19EC E201
3028	VLSI Technology and Physical Design Automation	19EC E213
3029	English for Research Paper Writing	19EG A101
3030	Analog and Digital CMOS VLSI Design Lab	19EC C205
3031	Microcontrollers and Programmable Digital Signal Processors Lab	19EC C206
3032	Embedded System Design using RTOS	19EC C202
3033	VLSI Design Verification and Testing	19EC C204
3034	Low Power VLSI Design	19EC E205
3035	SoC Design	19EC E210
3036	Value Education	19EC A101
3037	RTL Simulation and Synthesis with PLDs Lab	19EC C207
3038	RTOS and VLSI Design Verification Lab	19EC C208
3039	Mini Project with Seminar	19EC C209
3040	Project work - Project Seminar	16EC C212
3041	Project work - Dissertation	16EC C213
3042	Management and Organization Behaviour	19MB C101
3043	Managerial Economics	19MB C102
3044	Financial Accounting for Management	19MB C103
3045	Marketing Management	19MB C104
3046	Statistics for Management	19MB C105
3047	Digital Technology	19MB C106
3048	Business Communication Lab	19MB C107
3049	Statistics Lab	19MB C108
3050	Business Environment	19MB O101
3051	Corporate Social Responsibility	19MB O102
3052	Business Law and Ethics	19MB O103
3053	Human Resource Management	19MB C109
3054	Financial Management	19MB C110
3055	Business Research Methods	19MB C111
3056	Operations Research	19MB C112
3057	Operations Management	19MB C113
3058	Business Analytics	19MB C114
3059	Logistics and Supply Chain Management	19MB C115
3060	Comprehensive Viva	19MB C116
3061	E-Business	19MB O104
3062	Banking Management	19MB O105
3063	Customer Relationship Management	19MB O106
3064	Personality Development	19MBSD01
3065	Strategic Management	19MBC117
3066	Investment Management	19MBE101
3067	Financial Markets and Services	19MBE102
3068	Performance and Compensation Management	19MBE103
3069	Training and Development	19MBE104
3070	Product and Brand Management	19MBE105
3071	Integrated Marketing Communications and Digital Marketing	19MBE106

3072	Business Data Mining	19MBE107
3073	R-Programming	19MBE108
3074	Transport Management	19MBE109
3075	Distribution and Warehouse Management	19MBE110
3076	Career Guidance	19MBSD102
3077	Entrepreneurship Development	19MBC119
3078	Financial Risk Management	19MBE111
3079	Project Appraisal and Financing	19MBE112
3080	International Human Resource Management	19MBE114
3081	Consumer Behaviour	19MBE115
3082	Services and Retail Marketing	19MBE116
3083	Machine Learning and Artificial Intelligence	19MBE117
3084	Cloud Computing	19MBE118
3085	E-Commerce Logistics	19MBE119
3086	International Logistics	19MBE120
3087	Engineering Mathematics - I	18MT C 01
3088	Physics	18PY C 05
3089	Programing for problem solving	18CS C 01
3090	English	18EG C 01
3091	Physics Lab	18PY C 08
3092	Programming for Problem Solving Lab	18CS C 02
3093	Workshop/ Manufacturing Practice	18ME C 02
3094	English Lab	18EG C 02
3095	Mathematics - II	18MT C 03
3096	Chemistry	18CY C 01
3097	Engineering Mechanics	18CE C 01
3098	Engineering Graphics and Design	18ME C 01
3099	Basic Electrical Engineering	18EE C 01
3100	Basic Electrical Engineering Lab	18EE C 02
3101	Chemistry Lab	18CY C 02
3102	Mathematics -III	18MT C 05
3103	Technology of Surface Coatings and Oils	18CH C 01
3104	Chemical Engineering Thermodynamics - I	18CH C 02
3105	Numerical Methods in Chemical Engineering	18CH C 03
3106	Material and Energy Balance Computations	18CH C 04
3107	Indian constitution	18EG M 01
3108	Indian Traditional Knowledge	18EE M 01
3109	Numerical methods in Chemical Engineering Lab	18CH C 05
3110	Technology of Surface Coatings and Oils Lab	18CH C 06
3111	Basics of Data Structures	18CS C 05
3112	Chemical Engineering Thermodynamics - II	18CH C 07
3113	Fluid Mechanics	18CH C 08
3114	Material Science	18CH C 09
3115	Principles of Management	18ME C 09
3116	Environment science	18CE M 01
3117	Soft skills lab	18EG C 03
3118	Basics of Data structures Lab	18CS C 06
3119	Chemical Reaction Engineering - II	16CH C 11
3120	Mass Transfer Operations – I	16CH C 12

3121	Process Instrumentation	16CH C 13
3122	Surface Coating Technology	16CH E 02
3123	Technology of Vegetable Oils and Fats	16CH E 03
3124	Corrosion Engineering	16CH E 04
3125	Mineral Processing Technology	16CH E 05
3126	Mechanical Unit Operations Lab	16CH C 14
3127	Process Heat Transfer Laboratory	16CH C 15
3128	Surface Coating Technology Lab	16CH E 06
3129	Technology Of Vegetable Oils And Fats Lab.	16CH E 07
3130	Bio Chemical Engineering	16CH C 16
3131	Chemical Engineering Thermodynamics – II	16CH C 17
3132	Chemical Process Safety	16CH C 18
3133	Process Dynamics and Control	16CH C 19
3134	Process Modeling Simulation And Optimization	16CH C 20
3135	Energy Engineering.	16CH E 08
3136	Fluidization Engineering	16CH E 09
3137	Pharmaceutical Technology	16CH E 10
3138	Chemical Reaction Engineering Laboratory	16CH C 21
3139	Process Dynamics And Control Laboratory	16CH C 22
3140	Process Modeling Simulation Laboratory	16CH C 23
3141	Mass Transfer Operations –II	16CH C 24
3142	Petrochemical Engineering	16CH C 25
3143	Process Equipment Design	16CH C 26
3144	Transport Phenomena	16CH C 27
3145	Polymer Technology	16CH E 11
3146	Pulp and Paper Technology	16CH E 12
3147	Pollution Control in Process Industries	16CH E 13
3148	Disaster Mitigation and Management	16CE O 02
3149	Entrepreneurship	16ME O 01
3150	Intellectual Property Rights	16ME O 04
3151	Technical Writing Skills	16EG O 01
3152	Equipment Design and Drawing Lab	16CH C 28
3153	Mass Transfer Operations Lab	16CH C 29
3154	Seminar	16CH C 30
3155	Plant Design Economics	16CH C 31
3156	Membrane Separation Technology	16CH E 14
3157	Sugar Technology	16CH E 15
3158	Food Technology	16CH E 16
3159	Nano Materials and Technology	16ME O 05
3160	IoT and application	16CS O 03
3161	History of Science and Technology	16PY O 01
3162	Gender Sensitization	16EG O 02
3163	Project Seminar	16CH C 32
3164	Project	16CH C 33
3165	Structural Dynamics	19CEC106
3166	Advanced Steel Design	19CEE106
3167	Repair & Retrofitting of Structures	19CEE107
3168	Design of Advanced Concrete Structures	19CEE110
3169	Advanced Foundation Engineering	19CEE111

3170	Disaster Mitigation & Management	19CEA101
3171	Model Testing Lab	19CEC107
3172	Numerical Analysis Lab	19CEC108
3173	Mini Project with Seminars	19CEC109
3174	Adv. Strcuctural Analysis	19CE C101
3175	Adv. Solid Mechanics	19CE C102
3176	Theory & Applications of CementComposites	19CE E102
3177	Structural Health Monitoring	19CE E104
3178	Research Methodology & IPR	19ME C103
3179	English for Research paper writing	19EGA101
3180	Structural Design Lab	19CE C103
3181	Adv. Concrete Lab	19CE C104
3182	Mathematics-I	18MT C01
3183	Introduction to Mechanics and Electromagnetic Theory	18PY C03
3184	Programming for Problem Solving	18CS C01
3185	English	18EG C01
3186	Mechanics and Electromagnetic Lab	18PY C06
3187	Programming for Problem Solving Lab	18CS C02
3188	Workshop/Manufacturing Practice	18ME C02
3189	English Lab	18EG C02
3190	Mathematics-II	18MT C03
3191	Chemistry	18CY C01
3192	Engineering Mechanics	18CE C01
3193	Engineering Graphics and Design	18ME C01
3194	Basic Electrical Engineering	18EE C01
3195	Basic Electrical Engineering Lab	18EE C02
3196	Chemistry Lab	18CY C02
3197	Building Construction Practice	18CE 02
3198	Solid Mechanics	18CE 03
3199	Surveying and Geomatics	18CE 04
3200	Fluid Mechanics	18CE 05
3201	Indian Constitution	18EG M01
3202	Indian Traditional Knowledge	18EE A01
3203	Surveying and Geomatics Lab	18CE 06
3204	Fluid Mechanics Lab	18CE 07
3205	Basic Data Structures	18CS C05
3206	Hydraulic Engineering	18CE C08
3207	Reinforced Concrete Design-I	18CE C09
3208	Structural Analysis-I	18CE C10
3209	Principles of Management	18MEC09
3210	Environmental Science	18CE M01
3211	Basics of Data Structures Lab	18CS C06
3212	Solid Mechanics Lab	18CE C11
3213	Hydraulic Engineering Lab	18CE C12
3214	Soft Skills Lab	18EG C03
3215	Reinforced Concrete Design-I	16CE C18
3216	Soil Mechanics	16CE C19
3217	Theory of structures-I	16CE C20
3218	Concrete Technology	16CE C21

3219	Fluid Mechanics-II	16CE C22
3220	Fluid Mechanics Lab	16CE C23
3221	Environmental Engineering Lab	16CE C24
3222	Concrete Laboratory	16CE C25
3223	Rock Mechanics	16CE E01
3224	Advanced Surveying	16CE E02
3225	Advanced Strength of Materials	16CE E03
3226	Theory of Structures-II	16CE C 26
3227	Reinforced Concrete Design-II	16CE C27
3228	Water Resources Engineering-I	16CE C28
3229	Foundation Engineering	16CE C29
3230	Soil Mechanics Laboratory	16CE C30
3231	Hydraulics and Hydraulic Machinery Lab	16CE C31
3232	Transportation Engineering Lab	16CE C32
3233	Finite Element Method	16CE E04
3234	GIS and Remote Sensing	16CE E05
3235	Artificial Neural Networks, Fuzzy Logic and Expert Systems	16CE E06
3236	Industrial Visit	16CE C33
3237	Water Resources Engineering-II	16CE C34
3238	Design of Steel structures-I	16CE C35
3239	Estimation and Specifications	16CE C36
3240	Computer Applications Lab	16CE C37
3241	Project Seminar	16CE C38
3242	Advanced Reinforced Concrete Design	16CE E07
3243	Advanced Environmental Engineering	16CE E08
3244	Ground Improvement Techniques	16CE E09
3245	Elements of Earthquake Engineering	16CE E10
3246	Advanced Transportation Engineering	16CE E11
3247	Design and Detailing of Irrigation Structures	16CE E12
3248	Fundamentals of DBMS	16CS O06
3249	Entrepreneurship	16ME O01
3250	Technical Writing Skills	16EG O01
3251	Energy Management Systems	16EE O02
3252	Seminar	16CE C39
3253	Project	16CE C40
3254	Design of Steel structures-II	16CE E13
3255	Advanced steel Design	16CE E14
3256	Industrial Structures	16CE E15
3257	Intellectual Property Rights	16ME O04
3258	Gender Sensitization	16EG O02
3259	Basics of Artificial Intelligence	16CS O09
3260	Waste Management	16EE O05
3261	Health Monitoring and Retrofitting of Structures	16CE E16
3262	Ground Water Hydrology	16CE E17
3263	Pre-stressed Concrete	16CE E18

18MT CO1

MATHEMATICS–I

(Common to all branches and except for Bio-Tech)

Instruction	3 L+1T Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	4

Course Objectives: The objectives of this course are

1. To solve linear system of equations using Matrix Methods.
2. To know the convergence of the Series.
3. To represent the function in series form.
4. To know the Partial Derivatives and use them to interpret the way a function of two variables behaves.
5. To learn Vector Differential Operator and its Physical interpretations on Scalars and vector functions.
6. To solve improper integrals.

Course Outcomes: On Successful completion of the course, students will be able to

1. Solve system of linear equations and identify the Eigen values and Eigen vectors in engineering problems.
2. Check the series convergence.
3. Find the evolutes of the given curves.
4. Expand and find extreme values of functions of two variables.
5. Understanding the significance of gradient, divergence and curl.
6. An ability to solve the problems and interpret in geometrical approach.

UNIT-I

Matrices: Rank of the matrix, Echelon form, System of linear equations, Linearly dependence and independence of vectors, Eigenvalues, Eigenvectors, Properties of eigenvalues, Cayley-Hamilton theorem, Quadratic forms, Diagonalization of Matrices, Reduction of quadratic form to canonical form by linear transformation, Nature of quadratic forms.

UNIT-II

Sequences and Series: Definition of Convergence of sequence and series. Tests for convergence of series: Comparison test, limit comparison test, D'Alembert ratio test, Raabe's test, Cauchy's n^{th} root test, logarithmic test, alternative series, absolute and conditional convergence.

UNIT-III

Calculus: Rolle's Theorem, Lagranges Mean value theorem, Cauchy's mean value theorem (without proofs). Curvature, radius of curvature, Evolutes and involutes. Fourier series, half range sine and cosine series.

UNIT-IV

Multivariable Calculus (Differentiation): Functions of two variables, Partial derivatives, Total differential and differentiability, Derivatives of composite and implicit functions (Chain rule), Change of variables, Jacobian, Higher order partial derivatives, Taylor's series of functions of two variables, Maximum and minimum values of functions of two variables, Lagrange's multipliers method.

UNIT-V

Vector Calculus (Differentiation): Scalar and vector fields, Gradient of a scalar field, Directional derivative, Divergence and Curl of a vector field, vector identities. Improper integrals: Beta and Gamma functions and their properties.

Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Edition, 2017.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.

Suggested Reading:

1. Veerarajan T., Engineering Mathematics for first year, Tata McGraw- Hill, New Delhi, 2008.
2. R.K. Jain, S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publications, 5th edition, 2016.
3. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/ Cole, 2005.

18CY C01

CHEMISTRY
(Common **to** all branches)

Instruction	3L+1T Hours per Week
Duration of Semester End Examination	3Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	4

Course Objectives: The objectives of this course are

1. The aim of framing the syllabus is to impart intensive and extensive knowledge of the subject so that students can understand the role of chemistry in the field of engineering.
2. This syllabus helps at providing the necessary introduction of the inorganic chemistry principles and concepts of chemical bonding involved in a comprehensive manner understandable to the students aspiring to become practicing engineers.
3. Thermodynamic and Electrochemistry units give conceptual knowledge about spontaneous processes and how can they be harnessed for producing electrical energy and efficiency of systems.
4. To teach students the value of chemistry and to improve the research opportunities knowledge of stereochemistry and organic reactions is essential.
5. New materials lead to discovering of technologies in strategic areas like defense and space research for which an insight into nano and composite materials of modern chemistry is essential.

Course Outcomes: On Successful completion of the course, students will be able to
The concepts developed in this course will aid in quantification of several concepts in chemistry that have been introduced at the 10+2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications. Quantum theory is more than 100 years old and to understand phenomena at nanometer levels; one has to base the description of all chemical processes at molecular levels. The course will enable the student to:

1. Analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
2. Rationalize bulk properties and processes using thermodynamic considerations & Ionic Equilibria.
3. List major chemical reactions that are used in the synthesis of molecules.
4. Apply the various methods used in treatment of water for domestic and industrial use.
5. Discuss the various Engineering materials & Drug synthesis & their applications.

UNIT-I Atomic and Molecular Structure:
Molecular Orbital theory - atomic and molecular orbitals.Linear combination of atomic orbitals (LCAO) method. Molecular orbitals of diatomic molecules. Energy level diagrams of diatomics (H_2 , He_2^+,N_2 , O_2 , O_2^- , CO, NO). Pi- molecular orbitals of butadiene, benzene and their aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties.

UNIT-II Use of Free Energy in Chemical Equilibria and Ionic Equilibria:
Use of free energy in chemical equilibria : Thermodynamic functions: Internal energy, entropy and free energy. Significance of entropy and free energy (criteria of spontaneity). Free energy and emf (Gibbs Helmholtz equations and its applications). Cell potentials –electrochemical series. Nernst equation and its applications. Potentiometric Acid base & Redox Titrations. Numericals.
Ionic Equilibria: Solubility product, Determination of solubility product, Applications of solubility product- Determination of solubilities of sparingly soluble salts; Predicting precipitation reactions; Precipitation of an insoluble salt; Precipitation of soluble salts; Inorganic analysis. Numericals.

UNIT- III Stereochemistry and Organic Reactions
Stereochemistry: Representations of 3 dimensional structures, Symmetry and chirality, Stereoisomers - Configurational isomers (Geometrical & Optical isomers), Conformational isomers - Newman and sawhorse representations of n-butane, enantiomers (lactic acid), diastereomers (Tartaric acid) , optical activity, absolute configurations , Sequence rules for R&S notation.
Organic Reactions Types of Organic reactions:
Substitution Reactions- Electrophilic substitution (Nitration of Benzene) ; Nucleophilic Substitution (S_N1& S_N2) ; Free Radical Substitution(Halogenation of Alkanes)
Addition Reactions:
Electrophilic Addition – Markonikoff's rule
Nucleophilic Addition – (Addition of HCN to carbonyl compounds)
Free radical Addition - Anti Markonikoff's rule (Peroxide effect)
Eliminations-E_1 and E_2 (dehydrohalogenation of alkyl halides) **Oxidation** with $KMno_4$, K_2 Cr_2O_7 ; **Reduction** with $LiAlH_4$,$NaBH_4$ **Cyclization** (Diels - Alder reaction)

UNIT–IV Water Chemistry:
Hardness of water – Types, units of hardness, Disadvantages of hard water , Boiler troubles - scales & sludge formation,

causes and effects , Softening of water by ion exchange method and Reverse Osmosis. Specifications of potable water & industrial water. Disinfection of water by Chlorination, Ozonisation & UV radiation.

UNIT-V Engineering Materials and Drugs:

Nano materials-Introduction to nano materials and general applications, basic chemical methods of preparation- Sol gel method. Carbon nanotubes and their applications.

Composite materials- Definition, types of composites, fibre reinforced, glass fibre reinforced and carbon fibre reinforced composites and applications.

Conducting polymers- Definition, classification and applications.

Drugs-Introduction,Synthesis and uses of Aspirin (analgesic), Paracetamol (Antipyretic), Atenolol (antihypertensive).

Text Books:

1. P.C. Jain and M. Jain, "Engineering Chemistry", Dhanpat Rai Publishing Company Ltd., New Delhi,16th edition (2015).
2. W.U. Malik, G.D.Tuli and R.D.Madan, "Selected topics in Inorganic Chemistry", S Chand & CompanyLtd, New Delhi,reprint (2009).
3. R.T. Morrison, R.N. Boyd and S.K. Bhattacharjee, "Organic Chemistry", Pearson, Delhi, 7thedition(2011).
4. G.L. David Krupadanam, D. Vijaya Prasad, K. Varaprasad Rao, K.L.N. Reddy and C. Sudhakar, "Drugs", Universities Press (India) Limited, Hyderabad (2007).

Suggested Reading:

1. B. H. Mahan, "University Chemistry", Narosa Publishing house, New Delhi, 3rd edition (2013).
2. B.R. Puri, L.R. Sharma and M.S. Pathania, "Principles of Physical Chemistry", S. Nagin Chand & Company Ltd.,46thedition(2013).
3. T.W. Graham Solomons, C.B. Fryhle and S.A. Snyder, "Organic Chemistry", Wiley,12th edition (2017).
4. P.W. Atkins, J.D. Paula, "Physical Chemistry", Oxford, 8thedition (2006).

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18CE C01N

ENGINEERING MECHANICS

(Common to all branches)

Instruction	3L+1T per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	4

Course Objectives: The objectives of this course are

1. Concept of forces, resolution, resultant, moment, couple and equilibrium of force systems.
2. Effect of frictional resistance to force systems and methods of analysing the simple trusses.
3. Centroid, centre of gravity and area moment of inertia for various regular and composite lines, areas and volumes.
4. Basic concepts of dynamics (kinematics and kinetics) and analysis of particle motion and connected bodies.
5. Work energy principle, impulse-momentum equation and their applications for translatory motion bodies.

Course Outcomes: On Successful completion of the course, students will be able to

1. Solve problems dealing with forces in plane systems, draw free body diagrams and analyse problems using equilibrium equations for a smooth surface.
2. Solve problems involving force system with frictional resistance and to analyse simple trusses for forces in various members of a truss.
3. Determine centroid and area moment of inertia for elementary and composite figures.
4. Solve problems in kinematics and kinetics of a particle and connected systems.
5. Solve problems for body motion using work energy principle and impulse-momentum approach for translatory motion bodies.

UNIT–I

Resolution, Resultant and Equilibrium of Force System: Concepts of force, system of forces, components of forces in a plane. Resultant of coplanar- concurrent force systems. Moment of a force and its applications. Couple and its applications. Resultant of coplanar-non-concurrent force systems. Equilibrium of force systems. Free body diagram, equations of equilibrium for coplanar force system.

UNIT–II

Friction and Analysis of Simple Trusses: Types of friction, laws of friction, application of friction to a single body and connecting systems, wedge friction. Analysis of simple trusses using method of joints and method of sections.

UNIT–III

Centroid, Centre of Gravity and Moment of Inertia: Centroid of lines and areas from first principle, centroid of composite figures. Centre of gravity and its implications. Area moment of inertia of a plane section from first principles, theorems of moment of inertia, moment of inertia of composite sections.

UNIT–IV

Particle Dynamics: Kinematics: Rectilinear and curvilinear translation. Rectangular, normal and tangential components of acceleration. General principles of kinetics: D' Alembert's principle and its application to particle motion and connected bodies.

UNIT–V

Work-Energy and Impulse-Momentum: Equation of work energy for translation- applied to particle motion and connected systems. Introduction to linear impulse- momentum, principle of conservation of linear momentum and its applications.

Text Books:

1. 1. K. Vijaya Kumar Reddy and J. Suresh Kumar, "Singer's Engineering Mechanics: Statics and Dynamics", B. S. Publications (SI Units), 3rd edn., Rpt.,2019.

Suggested Reading:

2. Nelson., "Engineering Mechanics", Tata Mc Graw Hill, Delhi, 2010.
3. K. Tayal , "Engineering Mechanics: Statics and Dynamics", Umesh Publications, Delhi, 14th edn., Rpt., 2015.
   1. Basudeb Bhattacharyya, "Engineering Mechanics", Oxford University Press, 2nd edn., 2016.

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18CS C01

PROGRAMMING FOR PROBLEM SOLVING
(Common to All Programs)

Instruction	3 Periods per week
Duration of Semester-End Examination	3 Hours
Semester-End Examination	70 Marks
Sessional	30 Marks
Credits	3

Course Objectives
1. Identification of computer components, Operating environments, IDEs.
2. Understanding the steps in problem solving and formulation of algorithms to problems.
3. Develop programming skills as an means of implementing an algorithmic solution with appropriate control and data structures.
4. Develop intuition to enable students to come up with creative approaches to problems.
5. Manipulation of text data using files.

Course Outcomes: At the end of the course, students will be able to:
1. Identify the computing environments.
2. Formulate solutions to problems and represent them using algorithms/ Flowcharts.
3. Choose proper control statements and data structures to implement the algorithms.
4. Decompose a problem into modules and use functions to implement the modules.
5. Develop applications using file I/O.

UNIT-I
Introduction to computers and Problem Solving: Components of a computer, Operating system, compilers, Program Development Environments, steps to solve problems, Algorithm, Flowchart / Pseudocode with examples.
Introduction to programming: Programming languages and generations, categorization of high level languages.
Introduction to C: Introduction, structure of C program, keywords, identifiers, Variables, constants, I/O statements, operators, precedence and associativity.

UNIT – II
Introduction to decision control statements: Selective, looping and nested statements.
Functions: Introduction, uses of functions, Function definition, declaration, passing parameters to functions, recursion, scope of variables and storage classes. **Case study**

UNIT – III
Arrays: Introduction, declaration of arrays, accessing and storage of array elements, 1-dimensional array, Searching (linear and binary search algorithms) and sorting(selection and bubble) algorithms, 2-D arrays, matrix operations.
Strings: Introduction, string representation, string operations with examples. **Case study**

UNIT – IV
Pointers: Understanding computer's memory, introduction to pointers, declaration of pointer variables, pointer arithmetic, pointers and strings, array of pointers, function pointers, array of function pointers, dynamic memory allocation, advantages and drawbacks of pointers.
Structures: Structure definition, initialization and accessing the members of a structure, nested structures, structures and functions, self- referential structures, unions and enumerated data types.

UNIT-V
Files: Introduction to files, file operations, reading data from files, writing data to files, error handing during file operations.
Preprocessor Directives: Types of preprocessor directives, examples.

Text Books:
1. A K Sharma "Computer Fundamentals and Programming", 2nd Edition, University Press, 2018.
2. PradeepDey and Manas Ghosh, "Programming in C", Oxford Press, 2nd Edition, 2017.

Suggested Reading:
1. Byron Gottfried, Schaum's"Outline of Programming with C", McGraw- Hill.
2. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India.
3. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill.
4. ReemaTharaja "Introduction to C Programming", Second Edition, OXFORD Press,2015.
5. https://www.tutorialspoint.com/cprogramming/index.htm.
6. https://onlinecourses.nptel.ac.in/noc18-cs10/preview.

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18ME C01N

ENGINEERING GRAPHICS AND DESIGN

Instruction	1 Lecture + 4 Drawing Hours per week
Duration of Semester End Examination	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	3

Course Objectives: The objectives of this course are

1. To get exposure to a cad package and its utility.
2. Understanding orthographic projections.
3. To visualize different solids and their sections in orthographic projection
4. To prepare the student to communicate effectively by using isometric projection.
5. To prepare the student to use the techniques, skills, and modern tools necessary for practice.

Course Outcomes: On Successful completion of the course, students will be able to

1. Exposure to graphics package.
2. Exposure to the visual aspects of engineering design.
3. To become familiar with engineering graphics standards.
4. Exposure to orthographic projections.
5. Exposure to engineering communication.

List of exercises:

1. Introduction to CAD package: Settings, draw, modify tools, dimensioning and documentation
2. Construction of Ellipse by General method, Cycloid and Involute
3. Orthographic projection: Principles, conventions, Projection of points
4. Projection of straight lines: Simple position, inclined to one plane
5. Projection of straight lines inclined to both the planes (without traces and mid-point)
6. Projection of planes: Perpendicular planes
7. Projection of planes: Oblique planes
8. Projection of solids: Simple position
9. Projection of solids: Inclined to one plane
10. Sections of solids: Prism, pyramid in simple position
11. Sections of solids: Cone and cylinder in simple position
12. Development of surfaces: Prism and Pyramid
13. Development of surfaces: Cone and Cylinder
14. Isometric projections: Simple solids (Prism, pyramid, cone and cylinder)

Text Books:

1. N.D.Bhatt, "Elementary Engineering Drawing", Charotar Publishers, 2012.
2. K.L.Narayana and P.K.Kannaiah, "Text Book of Engineering Drawing", Scitech Publications, 2011.
3. Basanth Agrawal and C M Agrawal, "Engineering Drawing", 2/e, McGraw-Hill Education (India) Pvt. Ltd.

Suggested Reading:

1. Shaw M.B and Rana B.C., "Engineering Drawing", *2/e,* Pearson, 2009.
2. K.Veenugopal, "Engineering Drawing and Graphics + AutoCAD", New Age International Pvt.Ltd, 2011.
3. Bhattacharya. B, "Engineering Graphics", I. K. International Pvt. Ltd, 2009.

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18CS 02

PROGRAMMING FOR PROBLEM SOLVING LAB

Instruction	4 Periods per week
Duration of Semester-End Examination	3 Hours
Semester-End Examination	50 Marks
Sessional	25 Marks
Credits	2

Course Objectives: The objectives of this course are

1. Setting up programming environment.
2. Develop Programming skills to solve problems.
3. Use of appropriate C programming constructs to implement algorithms.
4. Identification and rectification of coding errors in program.
4. Develop applications in a modular fashion.
5. Manage data using files.

Course Outcomes: On Successful completion of the course, students will be able to

1. Identify and setup program development environment.
2. Implement the algorithms using C programming language constructs.
3. Identify and rectify the syntax errors and debug program for semantic errors.
4. Solve problems in a modular approach using functions.
5. Implement file operations with simple text data.

List of Experiments:

1. Familiarization with programming environment.
2. Simple computational problems using arithmetic expressions.
3. Problems involving if-then-else structures.
4. Iterative problems e.g., sum of series.
5. Simple functions.
6. Recursive functions.
7. 1D Array manipulation.
8. 2D arrays and strings.
9. Matrix problems, String operations.
10. Pointers and structures.
11. Dynamic memory allocation and error handling.
12. File handling Design the experiments in such a way that the students will be able to end up the solution for a real world problem that uses most of the concepts of C programming language. For example: A banking application where it uses the concepts of operators, control structures, switch case for menu, structures, functions, error handling, files etc.

Text Books:

1. Pradeep Dey and Manas Ghosh, "**Programming in C**", Oxford Press, 2nd Edition, 2017.
2. ReemaTharaja "**Introduction to C Programming**", Second Edition, OXFORD Press, 2015.

Suggested Reading:

1. https://www.tutorialspoint.com/cprogramming/index.htm
2. https://www.w3resource.com/c-programming/programming-in-c.php
3. https://www.w3schools.in/c-tutorial/

Professor and Head Department

18CY C02

CHEMISTRY LAB

(Common to all branches)

Instruction:	3 Hours per Week
Duration of Semester End Examination:	3 Hours
Semester End Examination:	50 Marks
Continuous Internal Evaluation:	25 Marks
Credits:	1.5

Course Objectives: The objectives of this course are

1. To impart fundamental knowledge in handling the equipment / glassware and chemicals in chemistry laboratory.
2. The student should be conversant with the principles of volumetric analysis and identification of organic functional groups.
3. To apply various instrumental methods to analyze the chemical compounds and to improve understanding of theoretical concepts.

Course Outcomes:

The chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and engineering. On Successful completion of the course, students will be able to

1. Identify the basic chemical analysis methods to calculate the substances quantitatively.
2. Determine the rate constants of reactions from concentration of reactants/ products as a function of time
3. Calculate the concentration and amount of various substances using instrumental techniques.
4. Develop the basic drug molecule and Identify the organic compounds
5. Analyse the molecular properties such as surface tension and viscosity

Chemistry Lab

1. Estimation of temporary and permanent hardness of water using EDTA solution
2. Estimation of amount of chloride in water.
3. Determination of rate constant for the reaction of hydrolysis of methyl acetate.(first order)
4. Estimation of amount of HCl Conductometerically using NaOH solution.
5. Estimation of (a) amount of CH_3 COOH Conductometerically using NaOH solution. (b) amount of HCl and CH_3 COOH present in the given mixture of acids Conductometerically using NaOH solution.
6. Estimation of amount of HCl Potentiometrically using NaOH solution.
7. Estimation of amount of Fe^{+2} Potentiometrically using $KMnO_4$ solution.
8. Distribution of acetic acid between n-butanol and water.
9. Synthesis of drug - Aspirin.
10. Organic Chemistry- Identification of Functional groups - neutral group (carbonyl groups-acetaldehyde and acetone); acidic group(benzoic acid); basic group (aniline)
11. Determination of surface tension of organic solvents (ethanol, ethyl acetate)
12. Determination of Viscosity.

Text Books:

1. J. Mendham and Thomas,"Vogel' s text book of quantitative chemical analysis",Pearson education Pvt.Ltd. New Delhi ,6th ed. 2002.

Suggested Reading:

1. Dr. Subdharani , "Laboratory Manual on Engineering Chemistry", Dhanpat Rai Publishing, 2012.
2. S.S. Dara , "A Textbook on experiment and calculation in engineering chemistry", S.Chand and Company, 9th revised edition, 2015.

Professor and Head Department

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (AUTONOMOUS)
SCHEME OF INSTRUCTION AND EXAMINATION
II-Semester of B.E, Model Curriculum
COMPUTER SCIENCE AND ENGINEERING

SEMESTER – II

S.No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per week			Duration of SEE inHours	MaximumMarks		
			L	T	P/D		CIE	SEE	
	THEORY								
1	18MT C03	Mathematics -II	3	1	-	3	30	70	4
2	18PY C01	Optics and Semiconductor Physics	3	1	-	3	30	70	4
3	18CS C03	Object-Oriented Programming	3	-	-	3	30	70	3
4	18EG C01	English	2	-	-	2	20	50	2
	PRACTICALS								
5	18PY C02	Optics and Semiconductor Physics Laboratory	-	-	3	3	25	50	1.5
6	18CS C04	Object-Oriented Programming Lab	-	-	4	3	25	50	2
7	18ME C02	Workshop/ Manufacturing Practice	1	-	4	3	25	50	3
8	18EG C02	English Lab	-	-	2	2	15	35	1
Total			**12**	**02**	**13**	**-**	**200**	**445**	**20.5**

L: Lecture D: Drawing CIE - Continuous Internal Evaluation
T: Tutorial P: Practical SEE - Semester End Examination

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18MT C03

MATHEMATICS-II

(Common to all branches and except for Bio-Tech)

Instruction	3 L+1T Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	4

Course Objectives: The objectives of this course are

1. To evaluate double and triple integrals of various functions and their significance.
2. To evaluate vector line, surface and volume integrals.
3. To know the relevant method to solve higher order differential equations.
4. To evaluate complex integration.
5. To evaluate real and definite integrals.
6. To know the methods to solve real life problems.

Course Outcomes: On Successful completion of the course, students will be able to

1. Find the areas, volumes and surface of solids revolution.
2. Use Greens, Gauss and Stoke's theorems to find the surface and volume integrals.
3. Able to solve solutions of differential equations with initial and boundary value problems.
4. Solve the problems on analytic functions, Cauchy's theorem and Cauchy's integral formula.
5. Real and complex integrals by using Cauchy's theorems.
6. Solve physical and engineering problems.

UNIT-I

Multivariable Calculus (Integration): Applications of definite integrals to evaluate surface areas and volumes of revolutions. Double integrals, Change of order of integration, Triple integrals, Change of variables in integrals, Applications: areas and volumes, Centre of mass and Gravity (constant and variable densities).

UNIT-II

Vector Integral Calculus: Line, Surface and Volume integrals, Green's theorem in a plane, Gauss's divergence theorem and Stoke's theorem (without proof). **First Order Ordinary Differential Equations:** Exact first order differential equations , Integrating factors, Linear first order equations , Bernoulli's, Riccati's and Clairaut's differential equations ,Orthogonal trajectories of a given family of curves.

UNIT-III

Ordinary Differential Equations of Higher Orders: Solutions of higher order linear equations with constants coefficients, Method of variation of parameters, solution of Euler-Cauchy equation. Ordinary point, singular point and regular singular point, Power Series solution. Legendre Polynomial of first kind (without proof), Rodrigues formula, Generating function, recurrence relations, orthogonality of Legendre polynomials, Bessel's function of first kind (without proof), recurrence relations and problems.

UNIT-IV

Complex Variables – I: Differentiation, analytic functions, Cauchy-Riemann equations, harmonic functions, finding harmonic conjugate, elementary analytic functions (exponential, trigonometric, logarithm) and their properties. Conformal mappings, Mobius transformations and their properties. Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof).

UNIT-V

Complex Variables – II: Liouville's theorem and Maximum-Modulus theorem (without proof). Taylor's series, Laurent's series, zeros of analytic functions, singularities, Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine. Improper real integrals with singular points on the upper half plane.

Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Edition, 2017.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

Suggested Reading:

1. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
2. R.K. Jain, S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publications,5th edition,2016.
3. G.B. Thomas and R.L. Finney, Calculus and Analytic Geometry, 9th Edition, Pearson, Reprint, 2002.

18PY C01

OPTICS AND SEMICONDUCTOR PHYSICS

(for CSE, ECE & IT)

Instruction	3L+1T Hours per Week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	4

Course Objectives: The objectives of this course are
1. Understands the fundamentals of wave nature of light.
2. Acquires knowledge of lasers.
3. Familiar with Quantum Mechanics.
4. Learns the fundamental concepts of solids.
5. Understands the basics of semiconductors.

Course Outcomes: On Successful completion of the course, students will be able to
1. Demonstrate the wave nature of the light.
2. Describe the types of lasers and their applications.
3. Explain the importance of wave mechanics.
4. Demonstrate the importance of band theory of solids.
5. Identify the semiconductors for engineering applications.

UNIT-I

Wave Optics: Huygens' principle, superposition of waves and interference of light by wave front splitting and amplitude splitting; Young's double slit experiment, Newton's rings, Michelson interferometer. Farunhofer diffraction from a single slit and a circular aperture, the Rayleigh criterion for limit of resolution and its application to vision; Diffraction gratings and their resolving power.

UNIT-II

Lasers: Einstein's theory of matter radiation interaction and A and B coefficients; amplification of light by population inversion, different types of lasers: gas lasers (He-Ne, CO2), solid-state lasers (ruby, Neodymium), dye lasers; Properties of laser beams: mono-chromaticity, coherence, directionality and brightness, laser speckles, applications of lasers in science, engineering and medicine.

UNIT-III

Wave Nature of Particles and Schrodinger Equation: Introduction to Quantum mechanics, Wave nature of Particles, Time-dependent and time independent Schrodinger equation for wavefunction, Born interpretation, probability current, Expectation values, Free-particle wavefunction and wave-packets, Uncertainty principle.

UNIT – IV

Introduction to Solids: Free electron theory of metals, Fermi level, density of states, Application to white dwarfs and neutron stars, Bloch's theorem for particles in a periodic potential, Kronig-Penney model, Scattering from a potential barrier and tunneling; related examples like alpha-decay, field-ionization and scanning tunneling microscope.

UNIT-V

Semiconductors: Intrinsic and extrinsic semiconductors, Dependence of Fermi level on carrier-concentration and temperature (equilibrium carrier statistics), Carrier generation and recombination, Carrier transport: diffusion and drift, p-n junction, Metal-semiconductor junction (Ohmic and Schottky), Thermistor, Hall effect, LED, Solar cell.

Text Books:
1. B.K. Pandey and S. Chaturvedi, *Engineering Physics*, Cengage Publications, 2012.
2. M.N. Avadhanulu and P.G. Kshirsagar, *A Text BookEngineering Physics*, S. Chand Publications, 2014.
3. M. Arumugam, *Materials Science*, Anuradha Publications, 2015.
4. S.L. Gupta and Sanjeev Gupta, *Modern Engineering Physics*, Dhanpat Rai Publications, 2011.

Suggested Reading:
1. R. Murugeshan and Kiruthiga Sivaprasath, *Modern Physics*, S. Chand Publications S. Chand Publications, 2014.
2. V. Rajendran, *Engineering Physics*, McGahill Education Publications, 2013.
3. P.K. Palanisamy, *Engineering Physics*, Scitech Publications, 2012.
4. V. Raghavan, *Materials Science and Engineering*, Prentice Hall India Learning Private Limited; 6th Revised edition, 2015.

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18CS C03

OBJECT ORIENTED P ROGRAMMING

Instruction	3 Periods per week
Duration of Semester-End Examination	3 Hours
Semester-End Examination	70 Marks
Sessional	30 Marks
Credits	3

Course Objectives: The objectives of this course are
1. Describe the principles of Object-Oriented Programming.
2. Enable the students to solve problems using OOPs features.
3. Debugging in programs and files.
4. Use of library modules to develop GUI applications.

Course Outcomes: On Successful completion of the course, students will be able to
1. Understand the concepts Object-Oriented Programming Languages.
2. Adequately use the constructs such as selection, repetition, functions and aggregated data .
3. Develop applications in modular approach with classes/modules.
4. Develop solutions to the problems using exception handling.
5. Build packages for simple real world problems and use libraries/packages for graphics and plotting.

Unit-I
Introduction to Object Oriented Programming: Computer Programming and Programming Languages, Generations of Programming Languages, Programming Paradigms, Features of Object Oriented Programming, Merits and Demerits of OOPs
Basics of Python Programming: Features of Python, Variables, Identifiers, Datatypes, Input/ Output operations, Operators and Expressions, operations on strings, Type conversion.

Unit-II
Decision Control Statement: Selection/Conditional Branching, Loop Control Structures, Nested loops.
Functions and Modules: Uses of functions, Function definition, function call, Variable scope and Lifetime, Recursion, Lambda functions, Recursive Functions, Modules, Packages.

Unit-III
Classes and Objects: Introduction, Classes and Objects,_init method, Class variables, and Object variables, Public and Private Data members , calling methods from other methods, built-in class attributes, garbage collection, class methods, static methods.

Unit-IV
Inheritance: Introduction, Inheriting classes, Polymorphism and method overloading, Composition or Containership, Abstract classes and inheritance. **Operator Overloading**: Introduction, Implementation of Operator Overloading, Overriding.
File Handling: File types, opening and closing files, reading and writing files, file positions.

Unit-V
Error and Exception Handling: Introduction, to errors and exceptions, Handling Exceptions Simple GUI Programming with tkinterpackage, Sample Graphics using Turtle, Plotting Graphs in Python.

Text Books:
1. ReemaThareja "Python Programming", Oxford Press, 2017.
2. Mike McGrath "Python in easy steps: Makes Programming Fun", Kindle Edition,2017.

Suggested Reading:
1. https://anandology.com/python-practice-book/ object_oriented_programming.html
2. http://python-textbok.readthedocs.io/en/1.0/ Object_Oriented_Programming.html
3. http://www.tutorialspoint.com/python/python_classes_objects.html

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18EG C01

ENGLISH

(Common to all branches)

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	20 Marks
Credits	2

Course Objectives: The objectives of this course are

1. To enable the students to understand the role and importance of communication and to develop their basic communication skills in English.
2. To equip the students with basics of writing correct sentences to coherent paragraphs.
3. To equip the students with techniques of writing a précis and an essay by using accurate grammar and appropriate vocabulary.
4. To train the students to describe, define and classify processes and to draft formal reports by adhering to the proper structure.
5. To develop the reading skills and reading comprehension techniques of the students.

Course Outcomes: On Successful completion of the course, students will be able to

1. The students will understand the nature, process and types of communication and will communicate effectively without barriers.
2. The students will write correct sentences and coherent paragraphs.
3. The students will know how to condense passages by writing précis and write essays by using accurate grammar and appropriate vocabulary.
4. The students will demonstrate advanced writing skills by drafting formal reports.
5. The students will apply their reading techniques and analyze reading comprehension passages.

UNIT - I

Understanding Communication in English:

Introduction, nature and importance of communication.Process of communication.Basic types of communication - verbal and non-verbal.Barriers to communication.Intrapersonal and interpersonal communication.Johari Window

Vocabulary and Grammar: The concept of Word Formation. Importance of proper punctuation.Articles.

UNIT - II

Developing Writing Skills I:

Types of sentences.Use of phrases and clauses in sentences.Cohesion and coherence. Paragraph writing. Organizing principles of paragraphs in documents. **Vocabulary and Grammar:** Cohesive devices. Root words from foreign languages and their use in English. Prepositions.

UNIT- III

Developing Writing Skills II:

Techniques for writing precisely. Précis Writing. Essay Writing.

Vocabulary and Grammar: Subject-verb agreement, Noun-pronoun agreement Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives. Redundancies, Clichés.

UNIT - IV

Developing Writing Skills III:

Describing, Defining, Classifying, Providing examples or evidence.Writing introduction and conclusion.

Report writing – Importance, structure and elements of style of formal reports.

Vocabulary and Grammar: Misplaced modifiers. Synonyms, antonyms.

UNIT - V

Developing Reading Skills:

The reading process, purpose, different kinds of texts.Reading comprehension. Techniques of comprehension – skimming, scanning, drawing inferences and conclusions.

Vocabulary and Grammar : Words often Confused. Standard abbreviations

Text Books:

1. Language and Life: A Skills Approach, Board of Editors, Orient Black Swan, 2017.
2. Swan Michael, Practical English Usage.OUP. 1995.

Suggested Readings:

1. Wood F.T,Remedial English Grammar, Macmillan, 2007.
2. Zinsser William,On Writing Well, Harper Resource Book, 2001.
3. Sanjay Kumar and PushpLata,Communication Skills.Oxford University Press, 2011.

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18PY C02

OPTICS AND SEMICONDUCTOR PHYSICS LABORATORY

Instruction	3 Hours per Week
Duration of Semester End Examination	3Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	25 Marks
Credits	1.5

Course Objectives: The objectives of this course are
1. Apply theoretical physics knowledge in doing experiments.
2. Understand the behavior of the light experimentally.
3. Analyze the behavior of semiconductor materials and optoelectronic devices.

Course Outcomes: On Successful completion of the course, students will be able to
1. Understand the concept of errors and find the ways to minimize the errors.
2. Demonstrate interference and diffraction phenomena experimentally.
3. Understand the applications of semiconductor materials.
4. Know the working of optoelectronic devices.
5. Use LCR circuits in different applications.

List of Experiments:
1. Error analysis - Estimation of errors in the determination of time period of a torsional pendulum.
2. Hall effect – Determination of Hall coefficient, carrier concentration & mobility of charge carriers of given semiconductor specimen.
3. Thermistor – Determination of temperature coefficient of resistance of given thermistor.
4. Solar cell - Study of I-V characteristics of given solar cell and calculation of fill factor, efficiency and series resistance.
5. P-N junction diode – Study of V-I characteristics and calculation of resistance of given diode in forward and reverse bias.
6. Energy gap – Determination of energy gap of given semiconductor.
7. Planck's constant – Determination of Planck's Constant using photo cell.
8. I-V characteristics of LED.
9. Photodiode.
10. Laser – Determination of wavelength of given semiconductor red laser.
11. Newton's rings - Determination of wavelength of given monochromatic source.
12. Diffraction grating – Determination of wavelengths of two yellow lines of mercury light.
13. LCR circuit (Resonance).

Suggested Readings:

1. Engineering Physics Manual by Department of Physics, CBIT, 2016.
2. S.K. Gupta, Engineering Physics Practical, Krishna's Educational Publishers, 2014.
3. O.P. Singh, V. Kumar and R.P. Singh, Engineering Physics Practical Manual, Ram Prasad & Sons Publications, 2009.
4. Indu Prakash, Ram Krishna and A.K. Jha, A Text Book of Practical Physics, Kitab Mahal Publications, 2012.

18CS C04

OBJECT ORIENTED PROGRAMMING LAB

Instruction	4 Periods per week
Duration of Semester-End Examination	3 Hours
Semester-End Examination	50 Marks
Sessional	25 Marks
Credits	2

Course Objectives: The objectives of this course are
1. Identification and installation of required software to work with Python.
2. Program development using OOPs concepts.
3. Handling of errors in program code.
4. Use of library modules to develop GUI applications.

Course Outcomes: On Successful completion of the course, students will be able to
1. Set up programming environment to work with Python.
2. Chose appropriate control constructs, data structures to implement the solutions. Design and develop solutions in to the modular approach using OOPs concepts.
3. Debug programs to verify and validate one code.
4. Use of STLs and modules for graphics and plotting.
5. Design and develop solutions to the problems in modular approach using OOPs concepts.

Lab experiments:
1. Installation of any Object Oriented Programming Language and IDE.
2. Simple scripts to demonstrate the use of basic data types and operators.
3. Simple scripts to demonstrate the use of control structures.
4. Functions and Lambda function and parameter passing.
5. Experimentation with Modules.
6. Implementation of classes with attributes and methods.
7. Demonstration of inheritance.
8. Experiments on Overloading.
9. Exceptions and built-in tools.
10. Experiments on System interfaces and GUIs.

Text Book:
1. ReemaThareja "Python Programming", Oxford Press, 2017.

Suggested Reading:

2. https://vknight.org/cfm/labsheets/04-object-oriented-programming/
1. http://learning-python.com/class/Workbook/x-exercises.htm
2. https://inst.eecs.berkeley.edu/~cs61a/fa14/lab/lab06/#inheritance
3. https://anandology.com/python-practice-book/ object_oriented_programming.html
4. http://stanfordpython.com/

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18ME C02

WORKSHOP/ MANUFACTURING PRACTICE

Instruction	1T+4P Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	3

Course Objectives: The objectives of this course are

1. Give a feel of Engineering Practices & develop holistic understanding of various Engineering materials and Manufacturing processes.
2. Develop skills of manufacturing, safety, precision, quality, intelligent effort, optimization, positive & team work attitude to get things right the first time.
3. To provide basic knowledge of Steel, Plastic, Composite and other materials for suitable applications.
4. Study of Principle and hands on practice on techniques of fabrication, welding, casting, manufacturing, metrology, and allied skills.
5. To advance important hard & pertinent soft skills, productivity, create skilled manpower which is cognizant of industrial workshop compo- nents and processes and can communicate their work in a technical, clear and effective way.

Course Outcomes – (Laboratory): On Successful completion of the course, students will be able to

1. Fabricate components with their own hands.
2. Get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.
3. Assembling different components, student will be able to produce small mechanisms/devices of their interest.
4. Gain practical skills of carpentry, tinsmithy, fitting, house wiring.
5. Gain knowledge of different Engineering Materials and Manufacturing Methods and Understand trades and techniques used in Workshop and chooses the best material/ manufacturing process for the application

List of Exercises

CYCLE 1

Exercises in Carpentry

1. To plane the given wooden piece to required size
2. To make a lap joint on the given wooden piece according to the given dimensions.
3. To make a dove tail-joint on the given wooden piece according to the given dimensions.

Exercises in Tin Smithy

4. To make a rectangular box from the given sheet metal with base and top open. Solder the corners.
5. To make a scoop.
6. To make a pamphlet box.

Exercises in Fitting

7. To make a perfect rectangular MS flat and to do parallel cuts using Hack saw
8. To make male and female fitting using MS flats-Assembly1
9. To make male and female fitting using MS flats-Assembly2

Exercises in House Wiring

10. Wiring of one light point controlled by one single pole switch, a three pin socket controlled by a single pole switch, and wiring of one buzzer controlled by a bell push
11. Wiring of two light points connected in series and controlled by single pole switch. Verify the above circuit with different bulbs.Wiring of two light points connected in parallel from two single pole switches and a three pin socket
12. Stair case wiring-wiring of one light point controlled from two different places independently using two 2-way switches.

CYCLE 2

Exercises in Casting

1. Green sand moulding practice for a single piece pattern
2. Green sand moulding practice for a split pattern with a horizontal core
3. Melting and Pouring of Aluminium
4. Study and Demonstration of Injection moulding

Exercises in Welding

5. Study of gas welding equipment and process. Identification of flames, making Butt joint with gas welding.
6. Study of Arc welding process, making Butt joint with DCSP, DCRP
7. Study of Arc welding process, making Lap joint with A.C
8. Study of resistance welding process and making Lap joint with spot welding

Exercises in Machine shop

9. Introduction to Machine Tools, like Lathe, Drilling, Milling and Shaper
10. Plain and step turning operations on Lathe
11. Step turning and Knurling on Lathe machine
12. Taper turning on Lathe

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Text Books:

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
2. Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology",4th edition, Pearson Education India Edition, 2002.

Suggested Reading:

1. Gowri P. Hariharan and A. Suresh Babu,"Manufacturing Technology – I" Pearson Education, 2008.
2. Roy A. Lindberg, "Processes and Materials of Manufacture", 4th edition, Prentice Hall India, 1998.
3. Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGrawHill House,2017.

18EG C02

ENGLISH LAB

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	35 Marks
Continuous Internal Evaluation:	15 Marks
Credits	1

Course Objectives: The objectives of this course are

1. To introduce students to phonetics and the different sounds in English.
2. To familiarize the students with the software and give them sufficient practice in correct pronunciation.
3. To enable students to speak English correctly with focus on stress and intonation.
4. The students will enhance their listening skills by practicing IELTS and TOEFL material.
5. To help students overcome their inhibitions while speaking in English and to build their confidence. The focus shall be on fluency rather than accuracy.

Course Outcomes: On Successful completion of the course, students will be able to

1. Differentiate the speech sounds in English.
2. Interact with the software and understand the nuances of pronunciation in English.
3. Speak with the proper tone, intonation and rhythm and apply stress correctly. The students will demonstrate their listening skills by analyzing the IELTS and TOEFL listening comprehension texts.
4. Speak with clarity and confidence.
5. Work in teams and discuss various topics and demonstrate their presentation skills through posters.

Exercises

1. **Introduction to English Phonetics**: Introduction to auditory, acoustic and articulatory phonetics, organs of speech: the respiratory, articulatory and phonatory systems.
2. **Sound system of English**: Phonetic sounds and phonemic sounds, introduction to international phonetic alphabet, classification and description of English phonemic sounds, minimal pairs . The syllable: types of syllables, consonant clusters.
3. **Word stress**: Primary stress, secondary stress, functional stress, rules of word stress.
4. **Rhythm &Intonation** : Introduction to Rhythm and Intonation. Major patterns, intonation of English with the semantic implications.
5. **Listening skills** – practice with IELTS and TOEFL material
6. **Situational dialogues and role play** – Dialogue writing, – Role behavior and role enactment.
7. **Group Discussions** - Dynamics of a group discussion, group discussion techniques, body language.
8. **Public speaking** – Speaking with confidence and clarity in different contexts on various issues.
9. **Poster presentation** – Theme, poster preparation, team work and presentation.

Suggested Reading

1. T Balasubramanian. A Textbook of English Phonetics for Indian Students, Macmillan, 2008.
2. J Sethi et al. A Practical Course in English Pronunciation (with CD), Prentice Hall India, 2005.
3. Priyadarshi Patnaik. Group Discussions and Interviews, Cambridge University Press Pvt Ltd 2011.
4. Aruna Koneru, Professional Speaking Skills, Oxford University Press, 2016.

Model Curriculum

B.E Syllabus for III and IV Semester

With effect from 2019-20

Specialization /Branch: Computer Science and Engineering

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Hyderabad-500075, Telangana State.

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)
SCHEME OF INSTRUCTION AND EXAMINATION
III-Semester of B.E, Model Curriculum
COMPUTER SCIENCE AND ENGINEERING

SEMESTER – III

S.No	Course Code	Title of the Course	Scheme of Instruction Hours per Week			Duration of SEE in Hours	Scheme of Examination Maximum Marks		Credits
			L	T	P/D		CIE	SEE	
THEORY									
1.	18EEC01	Basic Electrical Engineering	3	1	0	3	30	70	4
2.	18CSC07	Data Structures	3	0	0	3	30	70	3
3.	18CSC08	Discrete Mathematics	3	1	0	3	30	70	4
4.	18CSC09	Digital Electronics and Logic Design	3	0	0	3	30	70	3
5.	18MEC09	Principles of Management	3	0	0	3	30	70	3
6.	18CEM01	Environmental Science	2	0	0	2	-	50	0
PRACTICAL									
7.	18EEC02	Basic Electrical Engineering Lab	0	0	2	2	15	35	1
8.	18CSC10	Data Structures Lab	0	0	2	2	15	35	1
9.	18CSC11	Digital Electronics and Logic Design Lab	0	0	2	2	15	35	1
10.	18EGC03	Soft Skills	0	0	2	2	15	35	1
TOTAL			**17**	**2**	**8**		**210**	**540**	**21**

L: Lecture T: Tutorial D: Drawing P: Practical
CIE - Continuous Internal Evaluation SEE - Semester End Examination

18EE C01

BASIC ELECTRICAL ENGINEERING

Instruction:	3L+1T Hours per Week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	4

Course Objectives: The objectives of this course are
1. To understand the behavior of different circuit elements R,L & C, and the basic concepts of electrical circuit analysis.
2. To know the concepts of AC circuits, RMS value, Average value, Phasor analysis etc.
3. To understand the basic concepts of Transformer.
4. To understand the basic concepts of DC machines and AC machines.
5. To know about different types of electrical wires and cables and to understand safety rules and methods of earthing.

Course Outcomes: On Successful completion of the course, students will be able to
1. Acquire the concepts of Kirchhoff's laws and network theorems and able to get the solution of simple dc circuits Obtain the steady state response of RLC circuits and also determine the different powers in AC circuits
2. Acquire the concepts of principle of operation of Transformers and DC machines
3. Acquire the concepts of principle of operation of DC machines and AC machines
4. Acquire the knowledge of electrical wiring and cables and electrical safety precautions
5. Recognize importance of earthing and methods of earthing and electrical installations

UNIT-I: DC Circuits

Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation, Superposition, Thevenin and Norton Theorems, Time-domain analysis of firstorder RL and RC circuits.

UNIT-II: AC Circuits

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor, Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel). Three phase balanced circuits, voltage and current relations in star and delta connections.

UNIT-III: Transformers

Construction, Working principle, EMF Equation, Ideal and Practical transformer, Equivalent circuit of Transformer, OC and SC tests on a transformer, Efficiency and Regulation, Auto transformer.

UNIT-IV: DC and AC Machines

DC Generators: Construction, Principle of operation, EMF equation, Classification, Characteristics of shunt, series and compound generators. DC Motors: Classification, Torque equation, Characteristics, Efficiency, Speed Control of Series and Shunt Motors. Three - Phase Induction Motors: Construction, Principle of operation, Torque equation, torque-slip characteristics, Power stages, speed control of induction motors.

UNIT-V: Electrical Installations and Electrical Wiring

Types of wires and cables, Electrical Safety precautions in handling electrical appliances, electric shock, first aid for electric shock, safety rules.

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Earthing, Elementary calculations for energy consumption.

Text books:

1. L. S. Bobrow, Fundamentals of Electrical Engineering, Oxford University Press, 2011.
2. E. Hughes, Electrical and Electronics Technology, Pearson, 2010.

Suggested Reading:

1. D. P. Kothari & I. J. Nagrath, –Basic Electrical Engineering Tata McGraw Hill, 2010.
2. V. D. Toro, –Electrical Engineering Fundamentals Prentice Hall India, 1989.
3. D.C. Kulshreshtha, –Basic Electrical Engineering McGraw Hill, 2009
4. P.V.Prasad, S.sivanagaraju, R.Prasad, "Basic Electrical and Electronics Engineering" Cengage Learning, 1st Edition, 2013.

18CS C07

DATA STRUCTURES

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	3

Pre-requisites: Basic knowledge of programming language such as C or C++ is preferred (but not mandatory) and some mathematical maturity also will be expected.

Course Objectives: The objectives of this course are
1. Basic linear and non-linear data structures.
2. Analyzing the performance of operations on data structures.
3. Different balanced binary trees, which provides efficient implementation for data structures.

Course Outcomes: On Successful completion of this course, student will be able to
1. Understand the basic concepts of data structures.
2. Analyze the performance of algorithms.
3. Distinguish between linear and non-linear data structures.
4. Identify the significance of balanced search trees.
5. Establish a suitable data structure for real world applications.

UNIT - I
Introduction: Data Types, Data structures, Types of Data Structures, Operations, ADTs, Algorithms, Comparison of Algorithms, Complexity, Time- space tradeoff. **Recursion**: Introduction, format of recursive functions, recursion Vs. Iteration, examples. **Sorting:** Quick sort, Merge Sort, Selection Sort

UNIT - II
Linked Lists: Introduction, Linked lists, Representation of linked list, operations on linked list, Comparison of Linked Lists with Arrays and Dynamic Arrays, Types of Linked Lists and operations-Circular Single Linked List, Double Linked List, Circular Double Linked List

UNIT- III
Stacks and Queues: Introduction to stacks, applications of stacks, implementation and comparison of stack implementations. Introduction to queues, applications of queues and implementations, Priority Queues and applications

UNIT - IV
Trees: Definitions and Concepts, Operations on Binary Trees, Representation of binary tree, Conversion of General Trees to Binary Trees, Representations of Binary Trees, Tree Traversal. **Binary Search Trees:** Representation and operations. **Heap Tree:** definition, representation, Heap Sort. **Graphs:** Introduction, Applications of graphs, Graph representations, graph traversals, Minimal Spanning Trees.

UNIT - V
Hashing: Introduction, Hashing Functions- Modulo, Middle of Square, Folding, Collision Techniques-Linear Probing, Quadratic Probing, Double Hashing, **Balanced Search Trees:** AVL Trees, Red-Black Trees, Splay Trees, B-Trees

Text Books:
1. Narasimha karumanchi, "Data Structures and Algorithms Made Easy", Career Monk Publications, 2017
2. S. Sahni and Susan Anderson-Freed, "Fundamentals of Data structures in C", E.Horowitz, Universities Press, 2nd Edition.
3. ReemaThareja, "Data Structures using C", Oxford University Press.

Suggested Reading:
1. D.S.Kushwaha and A.K.Misra, "Data structures A Programming Approach with C", PHI.
2. Seymour Lipschutz, "Data Structures with C", Schaums Outlines, Kindle Edition

Online Resources:
1. https://www.tutorialspoint.com/data_structures_algorithms/ index.htm
2. https://www.edx.org/course/foundations-of-data-structures
3. https://sites.google.com/site/merasemester/data-structures/data- structures-1#DS

18CS C08

DISCRETE MATHEMATICS

Instruction	3L+1T Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	4

Course Objectives: The objectives of this course are

1. To provide theoretical foundations of computer sciences.
2. To develop an understanding of logic, set theory, counting, functions, relations and proof techniques.
3. To familiarize with algebraic systems and graph theory.

Course Outcomes: On Successful completion of this course, student will be able to

1. Apply Propositional and Predicate logic for problem solving in various domains.
2. Understand Set Theory, Relations, Functions and Lattices as partially ordered sets.
3. Model and solve the real world problems using Generating Functions and Recurrence Relations.
4. Understand and apply the principles of graphs and trees to simple applications.
5. Study Algebraic systems and their general Properties.

UNIT - I

Fundamental Principles of counting: The Rules of Sum and Product, permutations, Combinations. **Introduction to Propositional Calculus**: Basic Connectives and Truth tables, Logical Equivalence: Laws of Logic, Logical Implication; Rules of Inference. **Predicates**: The Use of Quantifiers, Quantifiers, Definitions and the Proofs of Theorems.

UNIT - II

Sets: Sets and Subsets, Operations on sets and the Laws of Set Theory, Counting and Venn Diagrams. **Relations and Functions:** Cartesian Products and Relations, Functions: Composition of functions, one-one, Onto and Inverse of functions, Pigeon hole principle, partial ordering relations, POSET, Hasse diagrams, Lattices as Partially Ordered Sets, Equivalence relations.

UNIT- III

Generating Functions: Binomial Theorem, Generating Functions, Calculating Coefficient of generating functions.
Recurrence Relations: The First Order Linear Recurrence Relation, Second Order Linear. Homogeneous Recurrence relations with constant coefficients, Non Homogeneous Recurrence relations

UNIT - IV

Introduction to Graphs: Graphs and their basic properties - degree, path, cycle, Sub graphs, Complements and Graph Isomorphism, Euler trails and circuits, Hamiltonian paths and cycles, planar graphs, Euler formula, Graph Coloring and Chromatic polynomial. **Trees**: Definitions, Properties, Rooted Trees, Spanning Trees, Minimum Spanning trees: The Algorithms of Kruskal and Prims.

UNIT - V

Algebraic Structures: Algebraic Systems: Examples and General Properties, Semi groups and Monoids. **Groups:** Definitions and Examples, Subgroups, Homomorphisms and cyclic groups.

Text Books:

1. Ralph P. Grimaldi, "Discrete and Combinatorial Mathematics", An Applied Introduction, 4th edition, Pearson Education, 2003.
2. R.K.Bisht, H.S.Dhami, "Discrete Mathematics", Oxford University Press, Published in 2015.

Suggested Reading:

1. Kenneth H. Rosen, "Discrete Mathematics and its Applications", 7th edition, Tata McGraw-Hill, 2005
2. J.P. Tremblay, R.Manohar, "Discrete Mathematical Structures with Applications to Computer Science", TATA McGraw-Hill Edition, 1995.
3. Joe L.Mott, Abraham Kandel, Theodore P. Baker, "Discrete Mathematics for Computer Scientists & Mathematicians", 2nd Edition, PHI, 1986.
4. David D.Railey, Kenny A. Hunt, "Computational Thinking for the Modern Problem Solving", CRC Press, 2014.

Online Resources:

1. https://nptel.ac.in/courses/111107058/
2. https://nptel-discrete-mathematics-5217

Professor and Head Department

18CS C09

DIGITAL ELECTRONICS AND LOGIC DESIGN

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The objectives of this course are

1. To understand the architecture of basic building blocks, logic gates and minimization techniques including Quine-Mcclusky method.
2. To analyze and design the Combinational and Sequential circuits.
3. To familiarize the notations of HDL descriptions in Verilog.

Course Outcomes: On Successful completion of this course, student will be able to

1. Familiarize with number systems, simplification of Boolean functions.
2. Manipulate simple Boolean expressions using maps and tabulation method.
3. Design basic digital circuits in Computer Hardware and Digital system.
4. Use high level HDLs such as Verilog for the design of Combinational and Sequential circuits.
5. Configure registers and counters for different applications.

UNIT - I

Digital Systems and Binary Numbers: Digital systems, Binary numbers, Number base conversions, Octal and Hexadecimal numbers, Complements of Numbers, Binary codes. **Boolean Algebra and logic Gates:** Binary logic, Basic Definitions, Axiomatic Definition of Boolean Algebra, Basic Theorems and Properties of Boolean Algebra, Boolean Functions, Canonical and Standard Forms, Other Logic Operations, Digital Logic Gates, Integrated Circuits.

UNIT - II

Minimization of Switching Functions: Introduction, the map method, minimal functions and their properties, the tabulation procedure, the prime implicant chart. **NAND and NOR Gates**: NAND Circuits, Two-level Implementation, Multilevel NAND Circuits, NOR Circuits. **Exclusive OR Gates**: Odd Function, Parity Generation and Checking.

UNIT- III

Combinational Logic Design: Combinational Circuits. **Analysis Procedure:** Derivation of Boolean Functions, Derivation of the Truth Table, Logic Simulation. **Design Procedure:** Decoders, Encoders, Multiplexers, Binary Adders, Adder- Subtractor, Binary Multiplier, HDL Representations – Verilog.

UNIT - IV

Sequential Circuits: Sequential circuit definitions, Latches, Flip-Flops, sequential circuit analysis, sequential circuit design, design with D Flip-Flops, designing with JK Flip-Flops, HDL representation for sequential circuits - Verilog.

UNIT - V

Registers: Registers, Shift registers. **Counters**: Ripple Counters, Synchronous Binary counters, Other Counters. **Memory and Programmable Logic**: Introduction, Random-Access Memory, Memory Decoding, Error Detection and Correction, Read-Only Memory, Programmable Logic Array (PLA), Programmable Array Logic (PAL).

Text Books:

1. Morris Mano M. and Michael D.Ciletti, "Digital Design, With an Introduction to Verilog HDL", Pearson 5th edition, 2013.
2. ZVI Kohavi, "Switching and Finite Automata Theory", Tata McGraw Hill 2 edition, 1995.

Suggested Reading:

1. H.T. Nagle, "Introduction to Computer logic", Prentice Hall 1975.
2. Stephen Brown, Zvonko Vranesic, "Fundamentals of Digital Logic with VHDL design, McGraw Hill 2nd Edition, 2009.

Professor and Head Department

18ME C09

PRINCIPLES OF MANAGEMENT

Instruction	3 Hours perweek
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The objectives of this course are to

1. Understand basic fundamentals and insights of management
2. Understand the nature and purpose of planning
3. Gain the knowledge about the frame work of organizing
4. Understand the essence and significance of directing
5. Recognize the importance of controlling and its outcomes

Course Outcomes: On Successful completion of this course, student will be able to

1. Get an exposure to common electrical components and their ratings
2. Make electrical connections by wires of appropriate ratings
3. Understand the circuit analysis techniques.
4. Determine the parameters of the given coil.
5. Understand the basic characteristics of transformer
6. Understand the basic characteristics of dc and ac machines

UNIT - I

Management: Definition of management, science or art, manager vs entrepreneur; managerial roles and skills;. Evolution of management, Basic management theories by FW Taylor, Henry Fayol, Types of Business Organizations, sole proprietorship, partnership, companies, public and private enterprises; Organization culture and environment; Current trends and issues in management

UNIT - II

Planning: Nature and purpose of Planning, types of Planning, objectives, setting objectives, policies, Strategic Management, Planning Tools and Techniques, Planning plant location and layout, Decision making steps & processes.

UNIT- III

Organizing: Nature and purpose of Organizing, formal and informal organizations, organization structure, types, line and staff authority, departmentalization, delegation of authority, centralization and decentralization, job design, human resource management, HR planning, Recruitment selection, Training & Development, Performance Management, Career planning and Management

UNIT - IV

Directing: Individual and group behavior, motivation, theories of motivation, motivational techniques, job satisfaction, job enrichment, leadership, types & theories of leadership, effective communication.

UNIT - V

Controlling: system and process of controlling, budgetary and non-budgetary control techniques, use of computers and IT in management control, productivity problems and management, control and performance, direct and preventive control, reporting.

Text Books:

1. S.P. Robins and M. Couiter, "Management", 10/e., Prentice Hall India, 2009.
2. JAF Stoner, RE Freeman and DR Gilbert, "Management", 6/e., Pearson Education,2004.

Suggested Reading:

1. P.C. Tripathy & P.N. Reddy, "Principles of Management", Tata McGraw Hill,1999
2. Harold Koontz and Cyril O'Donnell "Principles of Management'', Tata McGrawHill, 2017

18CE M01

ENVIRONMENTAL SCIENCE
(MANDATORY COURSE)

Instruction	2L Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	50 Marks
CIE	0 Marks
Credits	0

Course Objectives: The objectives of this course are

1. Identify environmental problems arising due to engineering and technological activities and the science behind those problems.
2. Become aware about the importance of eco system and biodiversity for maintaining ecological balance.
3. To identify the importance of interlinking of food chain.
4. Learn about various attributes of pollution management and waste management practices.
5. To make the students contribute for capacity building of nation for arresting and/or managing environmental disasters.

Course Outcomes: On successful completion of this course, student will be able to

1. Define environment, identify the natural resources and ecosystems and contribute for the conservation of bio-diversity.
2. Suggest suitable remedial measure for the problems of environmental pollution and contribute for the framing of legislation for protection of environment.
3. Relate the social issues and the environment and contribute for the sustainable development.
4. Follow the environmental ethics.
5. Contribute for the mitigation and management of environmental disasters.

UNIT - I

Environmental Studies: Definition, Scope And Importance, Need For Public Awareness. Natural resources: Use And Over Utilization of Natural Resources - Water Resources, Food Resources, Forest Resources, Mineral Resources, Energy Resources, Land Resources.

UNIT - II

Ecosystems: Concept of an Ecosystem, Structure And Function of an Ecosystem, Role of Producers, Consumers And Decomposers, Energy Flow in an Ecosystem, Food Chains, Food Webs, Ecological Pyramids, Nutrient Cycling, Bio-Geo Chemical Cycles, Terrestrial And Aquatic Acosystems.

UNIT- III

Biodiversity: Genetic, Species And Ecosystem Biodiversity, Bio-Geographical Classification of India, India as a Mega Diversity Nation. Values of Biodiversity, Hot-Spots of Biodiversity, Threats to Biodiversity, Endangered And Endemic Species of India, Methods of Conservation of Biodiversity

UNIT - IV

Environmental Pollution: Cause, Effects And Control Measures of Air Pollution, Water Pollution, Marine Pollution, Soil Pollution, Noise Pollution And Solid Waste Management, Nuclear Hazards. Environmental Legislations: Environment Protection Act, Air, Water, Forest & Wild Life Acts, Issues Involved in Enforcement of Environmental Legislation, Responsibilities of State And Central Pollution Control Boards.

UNIT - V

Social issues and the environment: Water Conservation Methods: Rain Water Harvesting And Watershed Management, Environmental Ethics, Sustainable Development and Climate Change: Global Warming, Ozone Layer Depletion, Forest Fires, And Contemporary Issues.

Text Books:

1. Y. Anjaneyulu, "Introduction to Environmental Science", B S Publications, 2004.
2. Suresh K. Dhameja, "Environmental Studies", S. K. Kataria& Sons, 2009.

Suggested Reading:

3. C. S. Rao," Environmental Pollution Control Engineering", Wiley, 1991.
4. S. S. Dara, "A Text Book of Environmental Chemistry &Pollution Control", S. Chand Limited, 2006.

18EE C02

BASIC ELECTRICAL ENGINEERING LAB

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	35 Marks
Continuous Internal Evaluation:	15 Marks
Credits	1

Course Objectives: The objectives of this course are

1. To verify the basic electrical circuit laws and theorems.
2. To determine the parameters and power factor of a coil.
3. To calculate the time and frequency responses of RLC circuits
4. To determine the characteristics of Transformers.
5. To determine the characteristics of dc and ac machines.

Course Outcomes: On Successful completion of the course, students will be able to

1. Make electrical connections by wires of appropriate ratings.
2. Understand the circuit analysis techniques.
3. Determine the parameters of the given coil.
4. Understand the basic characteristics of transformer.
5. Understand the basic characteristics of dc and ac machines.

List of Laboratory Experiments/Demonstrations:

1. Demonstration of Measuring Instruments and Electrical Lab components
2. Verification of KCL and KVL.
3. Time response of RL and RC circuits.
4. Calculation of parameters of a choke coil by Wattmeter Method.
5. Verification of Thevenin's and Norton's theorems.
6. Turns ratio /voltage ratio verification of 1-Ph Transformers.
7. OC and SC tests on a given 1-Ph Transformer.
8. Observation of Excitation Phenomenon in Transformer.
9. Measurement of 3-Ph power in a balanced system (By 2- Wattmeter method).
10. Measurement of 3-Ph Energy by an Energy Meter (Demonstration of Principle).
11. Load test of DC Shunt motor.
12. Speed control of DC Shunt motor.
13. Load test of 3-Ph Induction motor.
14. Demonstration of LT Switchgear Equipment/Components.
15. Demonstration of cut - out section of Machines like DC Machine, Induction Machine etc.

Note: At least **TEN** experiments should be conducted in the semester.

Professor and Head Department

18CS C10

DATA STRUCTURES LAB

Instruction	2 Hours per week
Duration of End Examination	2 Hours
Semester End Examination	35 Marks
Continuous Internal Evaluation	15 Marks
Credits	1

Pre-requisites: Any Programming Language(C/Python)

Course Objectives: The objectives of this course are to:
1. Understand basic concepts data structures and abstract data types.
2. Differentiate between linear and non-linear data structures.
3. Analyze various searching, sorting and hashing techniques.

Course Outcomes: On Successful completion of the course, students will be able to
1. Implement the abstract data type.
2. Implement linear data structures such as stacks, queues using array and linked list.
3. Implement non-linear data structures such as trees, graphs.
4. Analyze various searching and sorting techniques.
5. Design and develop real world problem using suitable data structures.

List of Experiments
1. Implementation of Quick Sort, Merge Sort, Selection Sort.
2. Implementation of Insert, Delete and Search operations on Single Linked List.
3. Implementation of Insert, Delete and Search operations on doubly Linked List.
4. Implementation of Stack using array and linked list.
5. Converting of Infix Expression to Postfix.
6. Implement the algorithm for Evaluation of Postfix.
7. Implementation of Queue using array and linked list.
8. Implementation of Binary Tree Traversals.
9. Implementation of Binary Search Tree.
10. Implementation of Heap Sort.
11. Implementation of Graph Traversal Techniques.
12. Implementation of Hashing.

Text Books

1. Brian W Kernighan, Dennis Ritchie, “C Programming Language”, PH PTR, 2nd Edition.
2. Richard M Reese, “Understanding and Using C Pointers”, O`Reily, 2013.

Online Resources:
1. https://nptel.ac.in/courses/106102064/
2. https://www.udemy.com/algorithms-and-data-structures-in-python/

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18CS C11

DIGITAL ELECTRONICS AND LOGIC DESIGN LAB

Instruction	2 Hours per week
Duration of End Examination	2 Hours
Semester End Examination	35 Marks
CIE	15 Marks
Credits	1

Course Objectives: The objectives of this course are

1. To simulate and synthesize combinational logic circuits.
2. To simulate and synthesize sequential logic circuits.
3. To write a test bench for verifying the functionality and implement procedures for any digital design.

Course Outcomes: On Successful completion of this course, student will be able to

1. Design a Digital circuit using Verilog HDL.
2. Understand various abstraction levels of a digital design.
3. Verify the functionality of a design using Test bench.
4. Simulate and synthesize combinational logic circuits.
5. Simulate and synthesize sequential logic circuits.

Write a Verilog HDL to Simulate and synthesize the following

1. Implement operators and operands using Verilog.
2. Logic Gates: AND, OR, BUFFER.
3. Arithmetic Units: Adders and Subtractors.
4. Magnitude Comparator, BCD to Excess 3, BCD to 7-segment display.
5. Multiplexers and De-multiplexers.
6. Encoders, Decoders, Priority Encoder.
7. Implementation of logic function using Multiplexers and Decoders.
8. Implementation of Ripple Carry Adder.
9. Flip-Flops.
10. Design of Synchronous Counters.

Text Book:

1. Samir Palnitkar, “Verilog HDL, A guide to Digital design and synthesis”, 2/e, Pearson Education, 2008.

Suggested Reading:

1. Michael D. Ciletti, “Advanced Digital Design with Verilog HDL”, PHI, 2005.

Professor and Head Department

18EG C03

SOFT SKILLS

Instruction	2 Hours per week
Duration of End Examination	2 Hours
Semester End Examination	35 Marks
CIE	15 Marks
Credits	1

Course Objectives: The objectives of this course are:
1. Imbibe an impressive personality, etiquette, professional ethics & values, effective time management & goal setting.
2. Understand the elements of professional update & upgrade through industry exposure in a mini-live project. Understand confidence building strategies and thereby to make effective presentations through PPTs.
3. Learn what constitutes proper grooming and etiquette in a professional environment. Acquire the necessary skills to make a smooth transition from campus to corporate.

Course Outcomes: On Successful completion of the course, students will be able to
1. Be effective communicators and participate in group discussions and case studies with confidence. Also be able to make presentations in a professional context.
2. Write Resumes, prepare and face interviews confidently.
3. Be assertive and set short term and long term goals. Also learn to manage time effectively and deal with stress.
4. Make the transition smoothly from Campus to Corporate. Also use media with etiquette and know what academic ethics are.
5. To do a live, mini project by collecting and analyzing data and making oral and written presentation of the same.

Exercise 1
Main Topics: Thinking Skills, Personality Development – Effective Time Management, setting realistic goals, self confidence and assertiveness, stress management, moral values.
Flipped Sessions: Personal Sensitivity & Professional Sensibility (Reading & Discussion),
Writing Input: Writing to Express - Drafting & Delivering a Speech (Free Writing Exercise).

Exercise 2
Main Topics: Advanced Group Discussion with Case studies: Dynamics of group discussion, intervention, summarizing and modulation of voice, body language, relevance, fluency and coherence. **Flipped Sessions:** Importance of Professional Updating & Upgrading (Reading & Discussions).**Writing Input:** Writing with Precision - Writing Abstracts.

Exercise 3
Main Topics: Interview Skills – concept and process, pre-interview planning, opening strategies, answering strategies, mock interviews. Resume' writing – structure and presentation, planning, defining the career objective, projecting ones strengths and skills.
Flipped Sessions: Mock Interviews (Video Sessions &Practice), **Writing Input:**
Writing to Reflect - Resume Writing.

Exercise 4
Main Topic: Corporate Culture – Grooming and etiquette, communication media, academic ethics and integrity, **Flipped Sessions:** Corporate Culture, Etiquette & Grooming (Video Sessions and Practice through Role-play), **Writing Input:** Writing to Define - Writing an effective SOP.

Exercise 5
Main Topic: Mini Project – General/Technical. Research, developing a questionnaire, data collection, analysis, written report and project seminar.Elements and Structure of effective presentation. Presentation tools – Body language, Eye-contact, Props and PPT.
Flipped Sessions: Effective Presentations (Video & Writing Sessions, Practice through Emulation), **Writing Input:** Writing to Record - Writing minutes of meeting.

Suggested Reading:

1. Madhavi Apte , "A Course in English communication", Prentice-Hall of India, 2007.
2. Dr. Shalini Verma, "Body Language- Your Success Mantra", S Chand, 2006.
3. Ramesh, Gopalswamy, and Mahadevan Ramesh, "The ACE of Soft Skills", New Delhi: Pearson, 2010.
4. Van Emden, Joan, and Lucinda Becker, "Presentation Skills for Students", New York: Palgrave Macmillan, 2004.

5. Flipped Class-room: Students explore the concept first and then trainer explains it, students work on their own.

Web Resources:
1. https://www.goskills.com/Soft-Skills
2. https://www.trainerbubble.com
3. https://www.skillsconverged.com

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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (AUTONOMOUS)
SCHEME OF INSTRUCTION AND EXAMINATION
IV-Semester of B.E, Model Curriculum
COMPUTER SCIENCE AND ENGINEERING

SEMESTER – IV

S.No	Course Code	Title of the Course	Scheme of Instruction				Scheme of Examination		
			Hours per week			Duration of SEE in Hours	Maximum Marks		Credits
			L	T	P/D		CIE	SEE	
THEORY									
1	18ECC34	Basic Electronics	3	-	-	3	30	70	3
2	18MTC09	Probability and Statistics	3	1	-	3	30	70	4
3	18CSC12	Computer Architecture and Micro Processor	3	-	-	3	30	70	3
4	18CSC13	Data Base Management Systems	3	-	-	3	30	70	3
5	18EGM01	Indian Constitution and Fundamental Principles	2	-	-	2	-	* 50	0
PRACTICALS									
6	18ECC35	Basic Electronics Lab	-	-	2	2	15	35	1
7	18CSC14	Computer Architecture and Micro Processor Lab	-	-	3	3	25	50	1.5
8	18CSC15	Data Base Management Systems Lab	-	-	3	3	25	50	1.5
9	18CSC16	IT Workshop (Latex/Scilab)	-	1	2	3	25	50	2
		TOTAL	**14**	**2**	**10**	**-**	**210**	**515**	**19**

L: Lecture D: Drawing CIE - Continuous Internal Evaluation
T: Tutorial P: Practical SEE - Semester End Examination

18ECC34

BASIC ELECTRONICS

Instruction	3 L Hours per week
Duration of Semester End Examination	3Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Knowledge about semiconductor physics and basic electrical engineering.

Course Objectives: The objectives of this course are

1. Describe semiconductor devices principle and to understand the characteristics of junction diode and transistors.
2. Understand working principles of Oscillators and Amplifiers.
3. Understand the working principle of the regulators and transducers.

Course Outcomes: On Successful completion of the course, students will be able to

1. Use semiconductor devices in making circuits like rectifiers, filters, regulators etc.
2. Design amplifier and oscillators
3. Compare various types of power amplifiers.
4. Analyze the principles and practices for instrument design to development the real world Problems.
5. Apply concepts of various electronic circuits.

UNIT – I

Semiconductor Theory: Energy levels, Intrinsic and Extrinsic Semiconductor, Mobility, Diffusion and Drift current, Hall effect, Law of mass action, Characteristics of P-N Junction diode, current equation, Parameters and Applications. **Rectifiers:** Half wave and Full wave Rectifiers Bridge and center tapped with and without filters, Ripple factor, regulation and efficiency.

UNIT – II

Transistors: Bipolar and field effect transistors with their h-parameter equivalent circuits, Basic Amplifiers classification and their circuits (Qualitative treatment only). **Regulators and Inverters**: Zener Diode**,** Breakdown mechanisms, Characteristics, Effect of Temperature, Application as voltage regulator.

UNIT – III

Feedback Amplifiers: Properties of Negative Feedback Amplifier, Types of Negative Feedback, Effect of negative feedback on Input impedance and Output impedance, Applications (Qualitative treatment only).
Oscillators: principle of oscillations, LC Type-Hartley, Colpitt and RC Type- Phase shift, Wien Bridge and Crystal Oscillator (Qualitative treatment only).

UNIT – IV

Operational Amplifiers: Basic Principle, Ideal and practical Characteristics and Applications-Summer, Integrator, Differentiator, Instrumentation Amplifier. **Power Amplifiers:** Operation of Class A, Class B, Class AB and Class C power amplifiers

UNIT – V

Data Acquisition systems: Study of transducers-LVDT, Strain gauge. **Photo Electric Devices and Industrial Devices:** Photo diode, Photo Transistor, LED, LCD, SCR, UJT Construction and Characteristics and their applications only. **Display Systems:** Constructional details of C.R.O and Applications.

Text Books:

1. Robert L. Boylestad, Louis Nashelsky, “Electronic Devices and Circuits Theory”, Pearson Education, 9^{th}edition, LPE, Reprinted, 2006.
2. Morris Mano, “Digital Design”, Pearson Education, Asia 2002.

Suggested Reading:

1. Jacob Millman and C., Halkias, “Electronic Devices”, McGraw Hill, Eight Edition, Reprint1985.
2. Ramakanth A. Gayakwad, “Op-Amps and Linear Integrated Circuits”, Prentice Hall of India, 3rd edition,1985.
3. W. D. Cooper, A. Helfric, “Electronic Instrumentation and Measurement Techniques”, PHI, 4th edition,2010.

18MT C09

PROBABILITY AND STATISTICS
(For CSE and IT)

Instruction	3 L+1T Hours per week
Duration of Semester End Examination	3Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	4

Course Objectives: The objectives of this course are

1. To Able to learn and Analyzing data in Linear and Non-Linear form.
2. To Able to fit the hypothetical data using probability distribution.
3. To Understand the data using the testing of Hypothesis.
4. To Able to Analyzing time series data using trend analysis.
5. To Able to formulate and get the solution of real world problem.

Course Outcomes: On Successful completion of the course, students will be able to

1. Use the principle of Least Squares approximating for estimating the value.
2. Use the basic probability for fitting the Random phenomenon.
3. Analyzing data using different methods of hypothesis testing.
4. Use the Moving Averages Methods for trend analysis.
5. Analyze the random phenomena of real world data.

UNIT – I

Basic Statistics: Measures of Central Tendency, Measures of Dispersion, Skewness (SKP & SKB) For Frequency Distribution, Kurtosis, Curve Fitting by The Method of Least Squares, Fitting of Straight Lines, Second Degree Parabola And Growth Curve. ($y = ae^{bx}, y = ax^b$ & $y = ab^x$.)

UNIT – II

Discrete Probability Distributions: Basic Probability, Conditional Probability, Bayes Theorem, Random Variable, Discrete Random Variable, Continuous Random Variable, Properties of Probability Mass Function, Probability Density Function, Mathematical Expectation Variance, Co-Variance And Properties, Poisson Distribution, MGF, CGF, Fitting of Poisson Distribution.

UNIT – III

Continuous Probability Distribution And Bivariate Distribution: Continuous Probability Distribution-Normal Distribution-Standard Normal Random Variable (MGF, Expectation, Variance, Properties of Normal Curve)-Areas Under Normal Curve-Exponential Distribution (MGF, CGF, Expectation, Variance)-Uniform Distribution (MGF, Expectation, Variance)-Bivariate Data Two Dimensional Discrete Random Variable, Continuous Random Variable, Marginal Probability Function, Properties of Joint Probability Function-Sum And Differences.

UNIT – IV

Small Sample Test: Inferential Statistics-Test of Significance-Large Sample Test For Single Proportion, Difference of Proportions, Single Mean, Difference of Means And Differences of Standard Deviations. Small Sample Test-Test For Single Mean, Differences of Means, Test For Ratio of Variances, Chi-Square Test For Goodness of Fit And Independent of Attributes.

UNIT – V

Time Series Analysis and ANOVA: One Way Classification-Assumptions For ANOVA Test-ANOVA For Fixed Effect Model-Two Way Classification-ANOVA For Fixed Effect Model-Components of Time Series-Measurement of Trend - Method of Semi Averages- Moving Averages Method (3 Years And 5 Years).

Text Books:

1. S.C.Gupta, V.K.Kappoor, "Fundamentals of Mathematical Statistics", Sultan Chand and Sons, 2014.
2. S.C.Gupta, V.K.Kappoor, "Fundamentals of Applied Statistics", Sultan Chand and Sons, 2014.
3. Sheldon Ross, "A First Course in Probability", 9th Edition, Pearson publications, 2014.

Suggested Reading:

1. W. Feller, "An Introduction to Probability Theory and its Applications", Vol. 1, 3rd Ed., Wiley, 1968.

18CS C12

COMPUTER ARCHITECTURE AND MICRO PROCESSOR

Instruction	3 Hours perweek
Duration ofEnd Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	3

Pre-requisites: Digital Electronics and Logic Design.

Course Objectives: The objectives of this course are
1. To understand the basic principles of Instruction Level Architecture and Instruction Execution, Memory System Design.
2. To learn various I/O devices and its operations, knowledge on Instruction Level Parallelism.
3. To impart the knowledge on Micro Programming and Pipelining techniques.

Course Outcomes: On Successful completion of the course, students will be able to
1. Understand the functional block diagram of single bus architecture of a computer and describe the function of the instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set.
2. Design assembly language program for specified computing 16 bit multiplication, division and I/O device interface.
3. Derive flowchart for Concurrent access to memory and cache coherency in Parallel Processors and describe the process.
4. Design a memory module and analyze its operation by interfacing with the CPU.
5. Apply design techniques to enhance performance using pipelining, parallelism and RISC methodology.

UNIT - I

Basic Structure of Computers: Computer Types, Functional Units, Basic Operational Concepts, Bus Structures, Software, Performance, Multiprocessors and Multi-computers. **Arithmetic:** Addition and Subtraction of Signed numbers, Design of fast adders, Multiplication of positive numbers, Signed-Operand Multiplication, Integer Division.

UNIT - II

Basic Processing Unit: Fundamental concepts, Execution of a complete instruction, Multiple-Bus organization, Hardwired control, Micro programmed control. **8086 Architecture:** CPU Architecture, Internal operation, Machine language instructions Addressing modes, Instruction formats, Instruction execution timing.

UNIT- III

Assembly Language Programming: Instruction format, Data transfer instructions, Arithmetic instructions. **Assembly Language Programming:** Branch instructions, Loop instructions, NOP and HLT, Flag manipulation instructions, Logical instructions, Shift and Rotate instructions, Directives and Operators. **Modular Programming:** Linking and Relocation, Stacks, Procedures, Interrupts and Interrupt routines, Macros and String instructions, REP prefix.

UNIT - IV

Peripheral devices and their characteristics: Input-output subsystems, I/O device interface, I/O transfers –Program Controlled, Interrupt Driven and DMA, privileged and non-privileged instructions, software interrupts and exceptions. Programs and processes – role of interrupts in process state transitions, I/O device interfaces – SCSI, USB.
Pipelining: Basic concepts, Data hazards, Instruction hazards, Influence on instruction sets, Data path and control considerations, Superscalar operation, Performance considerations.

UNIT – V

The Memory System: Semiconductor RAM Memories, Cache Memories, Performance considerations, Virtual Memories, Memory Management requirements, Secondary Storage. **Large Computer Systems:** Forms of Parallel Processing, Array Processors, Structure of general purpose multiprocessors, Program parallelism and shared variables.

Text Books:

1. Carl Hamacher, ZvonkoVranesic, SafwatZaky, "Computer Organization", 5th Edition, McGrawHill Education Edition 2011.
2. Yu-chengLiu, Glenn A.Gibson, "Microcomputer Systems: The 8086/ 8088 Family", 2nd Edition, PHI Learning 2011.

Suggested Reading:

1. M. M. Mano, "Computer System Architecture", 3rd edition, Prentice Hall, 1994.
2. William Stallings, "Computer Organisation and Architecture, Design for Performance", Pearson, 9th Edition, 2013.
3. Douglas Hall. "Microprocessor and Interfacing programming and Hardware", Tata McGraw Hill, Revised 2nd Edition, 2007.
4. Brey B.Brey, "The Intel Microprocessor, 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium and Pentium Pro-Processors-Architecture, Programming and Interfacing", 4thEdition, Prentice Hall.

18CS C13

DATABASE MANAGEMENT SYSTEMS

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Discrete mathematics of computer science, Programming and data structures.

Course Objectives: The objectives of this course are
1. To become familiar with fundamental concepts of database management. These concepts include aspects of database design, database languages and database-system implementation.
2. To understand about data storage techniques and indexing.
3. To impart knowledge in transaction management, concurrency control techniques and recovery procedures.

Course Outcomes: On Successful completion of this course, student will be able to
1. Classify the difference between FMS and DBMS; describe the roles of different users and the structure of the DBMS.
2. Design the database using ER modeling and Write queries using DDL, DML and DCL of SQL, Relational Algebra and Procedures, Functions using PL/SQL
3. Outline the inference rules for functional dependencies and apply the principles of normal forms to decompose the relations in a database.
4. Summarize basic concepts of storage techniques like indexing, hashing and familiar with states and properties of transaction.
5. Illustrate locking, time stamp, graph and validation-based protocols for concurrency control.
6. Relate log based, ARIES recovery techniques to increase the robustness of the database, identify to resolve the deadlocks in the transaction.

UNIT - I

Introduction : Database System Applications, Purpose of Database Systems, View of Data, Database Languages, Relational Databases, Database Users and Administrators, Database System Architecture, Application Architectures.

Database Design and E-R Model: Overview of the Design Process, Data Models, The E-R Model, Constraints, E-R Diagrams, E-R Design Issues, Extended E-R Features, Reduction to Relation Schemas.

UNIT - II

Relational Model: Structure of Relational Databases, Database Schema, Keys, Relational Algebra, Fundamental Operations, Additional Relational Algebra Operations, Extended Relational Algebra Operations.

Structured Query Language: Overviews, SQL Data Types, Basic Structure of SQL Queries, Modification of the Database, Set Operations, Aggregate Functions, Data-Definition Language, Integrity Constraints, Null Values, Views, Join Expression. Index Definition in SQL.

UNIT- III

Relational Database Design: Undesirable Properties in Relational Database Design, Functional Dependencies, Trivial and Nontrivial Dependencies, Closure of Set of Functional Dependencies, Closure of Set of Attributes, Irreducible Set of Functional Dependencies, Normalization–1NF,2NF and 3 NF, Dependency Preservation, BCNF, Comparison of BCNF and 3NF.

Indexing: Basic Concepts, Primary Index, Dense and Sparse Indices, Secondary Indices, Tree-Structured Indexing, Indexed Sequential Access Method (ISAM), B+ Tree Index Files.

UNIT - IV

Hash based Indexing: Static Hashing, Extendible Hashing. **Transaction Management and Concurrency Control:** Transaction Concept – ACID Properties, States of Transaction, Implementation of Atomicity and Durability, Concurrent Executions, Serializability, Recoverability, Lock-Based Protocols, Timestamp-Based Protocols, Validation-Based Protocols, Multiple Granularity.

UNIT - V

Deadlocks: Deadlock Prevention, Deadlock Detection and Recovery. **Recovery System:** Failure Classification, Storage Structure, Recovery and Atomicity, Log-Based Recovery, Recovery with Concurrent Transactions, Buffer Management, Failure with Loss of Nonvolatile Storage, ARIES Recovery Method, Remote Backup Systems.

Text Books:

1. Abraham Silberschatz, Henry F Korth, S Sudarshan, “Database System Concepts”, Sixth Edition, McGraw-Hill International Edition, 2011.
2. Date CJ, Kannan A, Swamynathan S, “An Introduction to Database Systems”, Eight Editions, Pearson Education, 2006.
3. Raghu Ramakrishnan, Johnnes Gehrke, “Database Management Systems”, Third Edition, McGraw Hill, 2003.
4. Ramez Elmasri, Durvasul VLN Somayazulu, Shamkant B Navathe, Shyam K Gupta, “Fundamentals of Database Systems”, Fourth Edition, Pearson Education, 2006.

Suggested Reading:

1. J.D.Ullman, “Principles of Database Systems”, Galgotia.

Online Resources:

1. http://www.nptelvideos.in/2012/11/database-management- system.html

Professor and Head Department
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[illegible] Hyderabad 500 075 (T.S.)

18EG M01

INDIAN CONSTITUTION AND FUNDAMENTAL PRINCIPLES

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
SEE	50 Marks
CIE	-
Credits	-

Course Objectives: The objectives of this course are
1. The history of Indian Constitution and how it reflects the social, political and economic perspectives of the Indian society.
2. Address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. Have knowledge of the various Organs of Governance and Local Administration.

Course Outcomes: On Successful completion of the course, students will be able to
1. Understand the making of the Indian Constitution, its features and know the importance of Directive Principles of State Policy.
2. Identify the difference between Right to Equality and Right to Freedom and acquires the legal status of Fundamental Duties.
3. Analyze the structuring of the Indian Union, distribution of powers between the Union and the States, and the role and position of President in Union Government.
4. Distinguish between the Lok Sabha and Rajya Sabha in law making while appreciating the importance of Judiciary in interpretation of law.
5. Differentiate between the Municipalities and Panchayats in their structure and functions.
6. Apply the knowledge of Indian Constitution to real-life or professional situation for better civic society

UNIT - I
Constitution of India: Introduction and salient features, Constitutional history, Directive principles of state policy - Its importance and implementation.

UNIT - II
Union Government and its Administration: Structure of the Indian Union: Federalism, distribution of legislative and financial powers between the Union and the States, Parliamentary form of government in India. **President**: role, power and position.

UNIT- III
Emergency Provisions in India: National emergency, President rule, Financial emergency

UNIT – IV
Local Self Government: District's Administration Head: Role and Importance. Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation.
Panchayati Raj: Introduction, Zilla Panchayat, Elected officials and their roles, CEO Zilla Panchayat: Position and role. Block level: Organizational Hierarchy (Different departments). Village level: Role of Elected and officials.

UNIT – V
Scheme of the Fundamental Rights & Duties: Fundamental Duties - the legal status.
Scheme of the Fundamental Rights: To Equality, to certain Freedom under Article 19, to Life and Personal Liberty under Article 21.

Text Books:
1. Indian Government & Politics, Ed Prof V Ravindra Sastry, Telugu Akademy, 2nd edition, 2018.
2. Indian Constitution at Work, NCERT, 10th edition, 2018.

Suggested Reading:
1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar, Framing of Indian Constitution, 1st Edition,2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

Online Resources:
1. http://www.nptel.ac.in/courses/103107084/Script.pdf

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18EC C35

BASIC ELECTRONICS LAB

Instruction	2 Hours per week
Duration of End Examination	2 Hours
Semester End Examination	35 Marks
Continuous Internal Evaluation	15 Marks
Credits	1

Prerequisite: Knowledge about semiconductor physics and basic electrical engineering.

Course Objectives: The objectives of this course are
1. Learn about various electronic components and devices.
2. Study the transistor characteristics in different modes.
3. Learn about oscillators and amplifiers.

Course Outcomes: On Successful completion of the course, students will be able to
1. Familiarize on basic electronic components, devices and system.
2. Analyze the measurements of time period, amplitude and phase of different waveforms.
3. Design and analyze the behavior of the regulator and rectifier.
4. Develop various types of oscillators and power amplifiers
5. Design the various circuits using operational amplifiers.

LIST OF EXPERIMENTS:
1. Study of Electronic components.
2. Characteristics of Semiconductor diodes (Ge, Si and Zener).
3. CRO and its Applications.
4. Half, Full wave rectifiers with and without filters.
5. Voltage Regulator using zener diode.
6. Characteristics of BJT in CE Configuration.
7. Characteristics of FET in CS Configuration.
8. Amplifier with and without feedback.
9. RC Phase shift oscillator
10. Operational Amplifier and its applications.
11. Power Amplifiers Characteristics
12. Realization of Half and Full adder

Text Books:

1. Paul B. Zbar, Albert P. Malvino, Michael A. Miller, "Basic Electronics, a Text - Lab Manual", 7th Edition, TMH, 1994.
2. Paul B. Zbar, "Industrial Electronics, a Text - Lab Manual", 4th Edition, 2008.

18CS C14

COMPUTER ARCHITECTURE AND MICRO PROCESSOR LAB

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	25 Marks
Credits	1.5

Pre-requisites: Digital Electronics and Logic Design, Computer Architecture.

Course Objectives: The objectives of this course are
1. To become familiar with the architecture and Instruction set of 8086 microprocessor.
2. To provide practical hands on experience with Assembly Language Programming.
3. To provide solid foundation on interfacing the external devices to the processor according to the user requirements to create novel products and solutions for the real time problems.

Course Outcomes: On Successful completion of this course, student will be able to
1. Describe the architecture and comprehend the instruction set of 8086.
2. Understand and apply the principles of Assembly Language Programming in developing microprocessor based applications.
3. Get familiarized with different assembly language software tools.
4. Work with standard microprocessor interfaces to know how a processor will communicate with the External world.
5. Design and develop of various Embedded Applications.

LIST OF EXPERIMENTS:
1. Examining and understanding the working nature of internal components of computer like North bridge and South bridge of mother board, Memories like cache, ROM, RAM, Secondary storage devices, understanding CMOS and analyzing configuration using inbuilt or external tools.
2. Implementation of 2's complement to represent signed numbers in C/ Java/Python for a user specified bit length like 8/16 bit.
3. Implementation of Booth's Binary Multiplication algorithm in C/Java/ Python.
4. Implementation of Non restoring Division algorithm in C/Java/Python.
5. Tutorials with 8086 kit / MASM / NASM software tool.
6. Addition of 32-bit numbers using 16-bit registers.
7. Fixed-point multiplication and division.
8. Sorting hexadecimal array.
9. Code conversion from hexadecimal to decimal.
10. Packed and Unpacked BCD numbers.
11. Sum of set of BCD numbers.
12. Searching.
13. Display a string of characters using 8279.

Suggested Reading:

1. Yu-cheng Liu, Glenn A.Gibson, "Microcomputer Systems: The 8086/ 8088 Family", 2nd Edition, PHI Learning 2011.
2. Douglas Hall. "Microprocessor and Interfacing programming and Hardware", Tata McGraw Hill, Revised 2nd Edition, 2007.
3. B. Brey, "The Intel Microprocessor, 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium and Pentium Pro-Processors-Architecture, Programming and Interfacing", 4th Edition, Prentice Hall, 1993.

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18CS C15

DATABASE MANAGEMENT SYSTEMS LAB

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	25 Marks
Credits	1.5

Course Objectives: The objectives of this course are
1. To become familiar with the concepts of structured query language.
2. To understand about programming language / structured query language (PL/SQL).
3. To become familiar with generation of form and open database connectivity.

Course Outcomes: On Successful completion of this course, student will be able to
1. Apply the built-in functions and write simple queries on various databases.
2. Perform definition and manipulation of data using SQL commands.
3. Develop complex queries using joins and nested queries.
4. Add constraints on Databases implement DCL, TCL and advanced SQL commands.
5. Develop programs using cursors, triggers, exceptions, procedures and functions in PL/SQL.

LIST OF EXPERIMENTS:

SQL:
1. Queries using Built-In functions, like aggregate functions, String Functions, Numeric Functions, Data Functions, Conversion Functions and other miscellaneous.
2. Queries using operators in SQL.
3. Queries to Retrieve and Change Data: Select, Insert, Delete and Update.
4. Queries using Group By, Order By and Having Clauses.
5. Queries on Controlling Data: Commit, Rollback and Save point.
6. Queries to Build Report in SQL *PLUS.
7. Queries for Creating, Dropping and Altering Tables, Views and Constraints.
8. Queries on Joins and Correlated Sub-Queries.
9. Queries on Working with Index, Sequence, Synonym, Controlling Access and Locking Rows for Update, Creating Password and Security features.

PL/SQL:
1. Write a PL/SQL code using Basic Variable, Anchored Declarations and Usage of Assignment Operation.
2. Write a PL/SQL code Bind and Substitution Variables, Printing in PL/ SQL.
3. Write a PL/SQL block using SQL and Control Structures in PL/SQL.
4. Write a PL/SQL code using Cursors, Exception and Composite Data Types.
5. Write a PL/SQL code using Procedures, Functions and Packages.

Note: The creation of sample database for the purpose of the experiments is expected to be pre-decided by the instructor.

Text Books / Suggested Reading:

1. "Oracle: The complete Reference", by Oracle Press.
2. Nilesh Shah, "Databse Systems Using Oracle", PHI, 2007.
3. Rick F Van der Lans, "Introduction to SQL", Fourth Edition, Pearson Education, 2007.

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18CS C16

IT WORKSHOP (Latex / Scilab)

Instruction	1T + 2P Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	25 Marks
Credits	2

Course Objectives: The objectives of this course are
1. Familiarize the students with documentation and visualization tools like Latex and Scilab.
2. Development of proficiency in documentation for presentation and report writing.
3. Explore the utilities in Latex and Scilab.

Course Outcomes: On Successful completion of this course, student will be able to
1. Understand the need of documentation tools.
2. Install the documentation tools.
3. Generate templates for generation report using Latex.
4. Generate templates for presentation using Beamer.
5. Explore the utilities of Scilab

LIST OF EXPERIMENTS:
1. Installation of Latex and Scilab.
2. Understanding Latex compilation, basic syntax, writing of equations, matrices, tables.
3. Page Layout –Titles, abstract, chapters, sections, references, equation, references, citation, table of contents, generating new commands, figure handling, numbering, list of figures, list of tables, generating index.
4. Packages: Geometry, hyperref, amsmath, amssymb, algorithms, algorithmic graphic, color, tiles listing.
5. Understanding of Classes: article, book, reports,
6. Beamer, slides preparation.
7. Writing Resume, question paper, articles, research papers, Presentation using beamer.
8. Basic syntax, Mathematical Operators, Predefined constants, Built in functions.
9. Scilab Programming: Functions, loops, conditional statements, handling .sci files.
10. Graphics handling: 2D, 3D, Generating .jpg files, function plotting, data plotting.
11. Solving linear equations, Eigen values and numerical analysis, iterative methods, ordinary differential equation, plotting solution curves,
12. Comparison OS Scilab with C / C++/ Matlab.

Text Books / Suggested Reading / Online Resources:
1. https://www.latex-project.org/help/documentation/
2. https://spoken-tutorial.org/tutorial ef,search?search_foss=LaTeX& search_language=English
3. https://www.scilab.org/sites/default/files/Scilab_beginners_0.pdf
4. https://www.scilab.org/tutorials\

Professor and Head Department

Choice Based Credit System (CBCS)

Name of the Programme (UG):

B.E Syllabus for Semester V and VI - Semester

With effect from 2018 - 2019

Specialization /Branch: Computer Science and Engineering

Chaitanya Bharathi Institute of Technology (A)

Chaitanya Bharathi (P.O), Gandipet

Hyderabad-500075, Telangana State.

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (AUTONOMOUS)

SCHEME OF INSTRUCTION AND EXAMINATION
V-Semester of B.E under CBCS
COMPUTER SCIENCE AND ENGINEERING

SEMESTER-V

Sl.No	Course Code	Title of the Course	Scheme of Instruction		Scheme of Examination			Credits
			Hours per week		Duration of SEE in Hours	Maximum Marks		
			L/T	P/D		CIE	SEE	
THEORY								
1	16CSC17	Design and Analysis of Algorithms	3/1	-	3	30	70	3
2	16CSC18	Automata Languages and Computation	3/1	-	3	30	70	3
3	16CSC19	Operating Systems	3	-	3	30	70	3
4	16CSC20	Data Communication and Computer Networks	3	-	3	30	70	3
5	16CSC21	Software Engineering	3	-	3	30	70	3
6	16CSE 04/05/06	Elective - II	3	-	3	30	70	3
PRACTICALS								
7	16CSC22	Operating Systems Lab	-	3	3	25	50	2
8	16CSC23	Data Communication and Computer Networks Lab	-	3	3	25	50	2
9	16CSC24	Software Engineering Lab	-	3	3	25	50	2
TOTAL			20	9	-	255	570	24

Elective-II:
16CSE 04 - Mobile Application Development
16CSE 05 - Computer Graphics
16CSE 06 - Advanced Computer Architecture

L: Lecture **T: Tutorial** **D: Drawing** **P: Practical**
CIE - Continuous Internal Evaluation **SEE - Semester End Examination**

16CSC17 DESIGN AND ANALYSIS OF ALGORITHMS

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:
1. To provide an introduction to formalisms to understand, analyze and denote time complexities of algorithms.
2. To introduce the different algorithmic approaches for problem solving through numerous example problems.
3. To provide some theoretical grounding in terms of finding the lower bounds of algorithms and the NP-completeness.

Course Outcomes:
1. Describe asymptotic notation used for denoting performance of algorithms.
2. Analyze the performance of a given algorithm and denote its time complexity using the asymptotic notation for recursive and non-recursive algorithms.
3. List and describe various algorithmic approaches.
4. Solve problems using divide and conquer, greedy, dynamic programming, backtracking and branch and bound algorithmic approaches.
5. Apply graph search algorithms to real world problems.
6. Demonstrate an understanding of NP- Completeness theory and lower bound theory

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	1	1	-	-	-	-	-	-	-	-	-	-	-
2	2	3	3	-	-	-	-	-	-	-	-	-	1	1
3	3	3	3	-	-	-	-	-	-	-	-	-	-	-
4	2	2	2	-	-	-	-	-	-	-	-	-	1	1
5	2	2	2	-	-	-	-	-	-	-	-	-	1	1
6	3	3	3	-	-	-	-	-	-	-	-	-	1	1

UNIT-I
Introduction: Notation for Algorithm Specification, Insertion sort specification and analysis
Growth of functions: Asymptotic notation, standard notation and common functions.
Recurrences: The substitution method, the recursion-tree method, the Master method
Set representation: Simple UNION and FIND, Weighted Union and collapsing Find.

UNIT-II
Divide-and Conquer: The general method, specification and analysis of: finding maximum minimum of a set of values, quick sort, merge sort, Strassen's Matrix multiplication:
Greedy Method: The general method, Knapsack problem, Optimal Storage on tapes, Job sequencing with deadlines, Optimal merge patterns, Huffman codes.

UNIT-III
Dynamic Programming: The general method, Multistage graph, Floyd-Warshall algorithm, Bellman-Ford algorithm, Optimal Binary Search trees, 0/1 Knapsack, Traveling Salesman Problem, Matrix-Chain multiplication and Longest Common Subsequence.

UNIT-IV
Backtracking: The general method,8-Queens Problem, Sum of subsets, Graph Coloring, Hamiltonian cycle, 0/1 Knapsack Problem
Branch and Bound: The general method, Least cost search, control abstraction for LC-Search, Bounding, FIFO branch and bound,LC branch and bound, 0/1 knapsack problem, Traveling salesperson problem.
Depth first Search: Bi-connected components, topological sorting, strongly connected components.

UNIT-V
Lower Bound Theory: Comparison trees for searching and sorting
NP-Completeness: Basic concepts, Polynomial time, polynomial time verification, reducibility
NP-complete problems: The clique problem, the vertex-cover problem, the Hamiltonian cycle problem, the traveling salesman problem and the subset sum problem.

Text Books:
1. Horowitz E. Sahani S:"Fundamentals of Computer Algorithms",Galgotia Publications.
2. Cormen, Leiserson, Rivest,Stein: "Introduction to Algorithms", Second Edition, PHI Learning.
3. Aho, Hopcroft, Ulman, "The Design and Analysis of Computer Algorithms", Pearson Education, 2000.

Online Resources:
1. http://nptel.ac.in/courses/106101060/

16CSC18 AUTOMATA LANGUAGES AND COMPUTATION

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:
1. To introduce the students to the theoretical concepts of computer science
2. To know the various languages and grammars that are associated with various recognizers.
3. To understand the language by considering the idea of a decision problem
4. To understand language recognition problem and different classes of a problem

Course Outcomes:
1. Identify the fundamental Concepts of automata theory and discuss about the various levels of Chomsky hierarchy
2. Define regular expressions, grammars and Design automata for different languages
3. Define the regular, closure and decision Properties of the language and prove the membership
4. Examining the key properties of formal languages and automata by performing prove and disprove theorems
5. Demonstrate the principles behind the basic abstract computing model and its variants
6. Distinguish decidability and un decidability problems and variants of language models

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	3	-	1	-	-	-	-	-	-	-	2	-	-
2	3	2	1	2	-	-	-	-	-	-	-	1	-	-
3	3	2	1	1	-	-	-	-	-	-	-	1	1	-
4	3	3	1	2	-	-	-	-	-	-	-	1		-
5	3	2	1	2	2	-	-	-	-	-	-	2	1	-
6	3	3	1	2	-	-	-	-	-	-	-	2	-	-

UNIT-I

Automata: Introduction to Chomsky's Hierarchy, The need to study automata theory, Central Concepts of Automata Theory.

Finite Automata: An Informal Picture of Finite Automata, Deterministic Finite Automata, Non-deterministic Finite Automata, Finite automata for text search, Finite Automata with Epsilon Transitions.

UNIT-II

Regular expressions & Languages: Regular Expressions, Finite Automata and Regular Expressions, Applications of Regular Expressions, Algebraic Laws for Regular Expressions.

Properties of Regular Languages: Pumping Lemma for regular languages, Closure properties of Regular Languages, Decision Properties of Regular Languages, Equivalence and Minimization of Automata.

UNIT-III

Context Free Grammars and Languages: Context free grammars, Parse Trees, Right Linear and Left Linear Grammars, Applications of CFGs, Ambiguity in Grammars and Languages.

Pushdown Automata: Definition of the Pushdown Automaton, Languages of PDA, Equivalence of PDA's and CFG's, Deterministic Pushdown Automata.

UNIT-IV

Properties of Context Free Languages: Normal Forms for Context Free Grammars, Pumping Lemma, Closure Properties of CFLs, Decision Properties of CFLs. LR(0) grammars, LR(0) and DPDA, LR(k) grammars.

UNIT-V

Introduction to Turing Machines: Problems that Computers cannot Solve, The Turing machines, Programming Techniques for Turing Machines, Extensions to the basic Turing Machine, Restricted Turing Machines, Turing machines and Computers.

Un-decidability: A language that is not Recursively Enumerable, An undecidable problem that is recursively enumerable, Undecidable problems about Turing Machines, Post's Correspondence Problem, Other Undecidable Problems.

. Text Book:

1. John. E. Hopcroft, Rajeev Motwani, Jeffery, D. Ullman, "Introduction to Automata Theory, Languages and Computation", 3rd edition, Pearson Education, 2008.

Suggested Readings:

1. John C.Martin, "Introduction to Languages and the Theory of Computation", 3rd edition Tata McGraw Hill, 2007.
2. Mishra and Chandrashekaran, "Theory of Computer Science – Automata languages and computation", 3rd edition, PHI,2008.

16CSC19 **OPERATING SYSTEMS**

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits 6	3

Course Objectives:

1. To understand the services an operating system provides to users, processes and other systems
2. To understand how to manage various resources like CPU, Memory, Files and I/O.
3. To understand Process Synchronization, multiprogramming, Deadlocks.
4. To understand the Architecture and implementation of different operating systems.

Course Outcomes:

1. To develop the knowledge of the role of operating system and its design
2. To implement the knowledge of multiprogramming, multithreading, deadlocks.
3. To analyze the concept of IPC and resource sharing among the users.
4. To understand of memory management including virtual memory.
5. Analyze various Disk scheduling algorithms and I/O operation implementation techniques
6. Familiar with security mechanisms and understand the features of Linux and Windows Operating systems

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	3	2	-	-	-	-	2	1	-	2	-	-
2	2	3	3	2	-	-	-	-	3	2	-	2	-	-
3	3	3	2	2	-	-	-	-	3	2	-	3	-	-
4	3	2	2	2	-	-	-	-	3	2	-	2	-	-
5	2	2	3	2	-	-	-	-	2	1	-	2	-	-
6	3	2	3	3	-	-	-	-	2	2	-	2	-	-

UNIT-I

Introduction: Definition, Operating System Structure, Operating System Services, System Calls, System programs, Operating System Design and Implementation.

Processes & Threads: Process concept, Process Scheduling, Inter-process communication, Threads, Multithreading Models.

CPU Scheduling: Basic Concepts, Scheduling Criteria, Scheduling Algorithms, Multiprocessor scheduling.

UNIT-II

Memory Management: Swapping, Contiguous allocation, Paging, Segmentation, Segmentation with Paging.

Virtual memory: Demand paging, Page replacement Algorithms, Allocation of Frames, Thrashing.

File System Interface: File Concept, Access Methods, Directory and Disk Structure, File System Mounting.

File System Implementation: File-System Structure, File-System Implementation, Directory Implementation, Allocation Methods, Free Space management.

UNIT-III

Process synchronization: Critical Section problem, Synchronization Hardware, Semaphores, Classical problems of Synchronization, Monitors

Deadlocks: System model, Deadlock Characterization, Methods for handling deadlocks, Prevention, Avoidance, Detection, Recovery from Deadlock.

UNIT-IV

Mass-Storage Structure: Overview of Mass-Storage Structure, Disk Structure, Disk Attachment, Disk Scheduling, Disk Management, Swap-Space Management, RAID Structure, Stable-Storage Implementation.

I/O System: I/O hardware, Application I/O Interface, Kernel I/O Subsystem, Transforming I/O request to hardware operation, Streams, Performance.

UNIT-V

Protection: Goals of Protection, Domain of protection, Access matrix, Implementation of Access matrix.

Security: The Security Problem, Program Threats, System and Network Threats, User Authentication, Implementing Security Defenses, Firewalling to Protect Systems and Networks, Computer-Security Classifications

Case Studies: Linux System: Design Principles, Kernel Modules, Process Management, Network Structure, And Security. Windows - Design Principles, Architecture, Environmental Subsystem.

Text Books:

1. AviSilberchatz, Peter B. Galvin, Greg Gagne, "Operating System-Concepts", John Wiley & sons, 9th Edition, 2016

Suggested Reading:

1. Andrew S. Tanenbaum, "Modern Operating Systems", 2nd Edition (2001), Pearson Education, Asia
2. W. Richard Stevens; Stephen A. Rago, "Advanced Programming in the UNIX Environment", Third Edition, Addison-Wesley professional Publication Date:14-MAY-2013
3. Dhananjay, Dhamdhere.M, Operating System-concept based approach, 3rd edition (2009), Tata McGraw Hill, Asia

16CSC20 DATA COMMUNICATION AND COMPUTER NETWORKS

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:
1. Understanding the concepts of data communications
2. Understanding the concepts of network reference models
3. Analysis of routing algorithms and congestion control algorithms
4. Functionality of the transport layer
5. Understand different application layer protocols

Course Outcomes:
1. Understand the communication protocol suites like ISO-OSI and TCP/IP.
2. Understand and explain Data Communications System and its components
3. Identify and evaluate various routing algorithms, congestion control algorithms.
4. Identify and use internet protocols like IP, ARP, ICMP, IGMP, BGP, OSPF, and DHCP etc.
5. Know the working of transport layer protocols like TCP, UDP, RTCP etc.
6. Understand about the applications (like WWW, DNS, email etc.) and the underlying protocols.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	2	3	1	-	-	-	-	-	-	-	-	-
2	1		2		3	-	-	-	-	-	-	-	-	-
3	2	3		2		-	-	-	-	-	-	-	1	1
4	2	1	2	-	-	-	-	-	-	-	-	-	-	-
5	1	2	1	-	-	-	-	-	-	-	-	-	-	-
6	2		2	-	2	2		1	-	-	-	-	-	1

UNIT-I

Introduction: Data Communication, Network Types, Network Models – Protocol Layering, TCP/IP Protocol Suite, OSI Model, OSI vs TCP/IP

Physical Layer: Transmission Media, Switching

UNIT-II

Data Link Layer:DLL design issues, Error detection and correction, elementary data link protocols, sliding window protocols, Multiple access protocols

LAN: Wired LAN, Wireless LAN, Connecting devices and Wireless LAN

UNIT-III

Network Layer: Network layer design issues, Routing algorithms, congestion control algorithms, Quality of service, Internetworking, Network layer in the internet

UNIT-IV

Transport Layer : Elements of transport protocol, congestion control, TCP, UDP

UNIT-V

Application Layer :WWW and HTTP, FTP, Email, TELNET, SSH, DNS

Multimedia : Compression, Multimedia data, Multimedia in the internet, Real-time interactive protocols

Text Books:

1. Behrouz A. Forouzan, “Data communication and Networking”, Tata McGraw– Hill, Fifth Edition, 2013.
2. A. S. Tanenbaum, "Computer Networks", Pearson Education, Fifth Edition, 2013
3. William Stallings, “Data and Computer Communication”, Eighth Edition, Pearson Education, 2007.

Suggested Reading:

1. Larry L.Peterson, Peter S. Davie, “Computer Networks”, Elsevier, Fifth Edition, 2012.
2. James F. Kurose, Keith W. Ross, “Computer Networking: A Top–Down Approach Featuring the Internet”, Pearson Education, 2005.

16CSC21 **SOFTWARE ENGINEERING**

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:
1. To Understand the software Engineering Practice & Process Models
2. To understand Design Engineering and Software Project management
3. To gain knowledge of the overall project activities

Course Outcomes :
1. Assessment in each module gives the overall Software engineering practice
2. Demonstrate the necessary skills to enhance the software project management
3. Understand the systematic methodologies involved in SE
4. Understand design and develop a software product in accordance with SE principles

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	1	-	1	1	-	1	1	1	1	2	1	-
2	2	1	1	1	1	1	-	1	3	2	2	1	1	-
3	2	2	1	-	1	-	-	-	-	2	2	1	2	1
4	2	2	3	3	2	1	-	1	2	2	2	3	3	1

UNIT-I

Introduction to Software Engineering: The nature of Software, Software Engineering, The Software Process, software Engineering Practice.

Process Models: A Generic Process Model, Process Framework, CMMI, Prescriptive Process Models: Waterfall Model, Incremental Process Models, Evolutionary Process Models – Prototyping, The Spiral Model, ConcurrentModels;

An agile view of Process: Agility, Agile Process and Agile Process Models –Extreme Programming (XP), Adaptive Software Development(ASD).

UNIT-II

Requirement Engineering – Understanding Requirements : Establishing the Groundwork, Requirement Engineering tasks, Initiating the Requirements Engineering Process, Eliciting Requirements, Feasibility Study,

Software RequirementsAnalysis and Specification: Software Requirements, Problem Analysis, Requirements Specification, Decision Tables, SRS Document, IEEE standards for SRS, Case Studies

Planning and Managing the project: Managing Software Project, Project Personnel, Effort Estimation, Risk Management, the project plan, Software project estimation – Empirical estimation models.

UNIT-III

Design Engineering: Design Principles, Design Notation and Specification, Design concepts, Flow oriented modeling; The function-oriented design for the case studies; OO Design Concepts; Modeling Component-Level Design,

Architectural Design: Software Architecture, Data Design, A brief Taxonomy of Architectural Styles.

Implementation: Coding Principles and Standards, Coding Process, Code Verification.

UNIT-IV

Testing Strategies: A strategic approach to software testing, strategic issues, test strategies for Conventional and OO Software, Validation Testing, System Testing, Art of Debugging.

Testing Tactics: Software Testing Fundamentals, White Box Testing: Basis Path Testing, Control Structure Testing, O-O Testing methods. Black Box.Software quality.

UNIT-V

Software Quality Assurance – Managing Software Project, Quality concepts, Software Quality Assurance Software Reviews, Technical Reviews, Software reliability;

Software Configuration Management: Identification of Objects in the Software Configuration, Configuration Audit, SCM Standards

Software Maintenance: Categories of Maintenance, Maintenance Process models, Software reuse, Metrics for maintenance.

Text Books:
1. Software Engineering: A practitioner's approach, McGraw Hill, Roger S. Pressman.
2. Software Engineering Theory and Practices, 4th Edition Shari Lawrence Pfleeger, Pearson Education, India, 2011.
3. An integrated approach to Software Engineering, Springer/Narosa, Pankaj Jalote

Professor and Head Department

16CSE04 MOBILE APPLICATION DEVELOPMENT

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives

1. Understand J2ME and Android architecture and solve problems with J2ME, Android application
2. Design, implement and evaluate a User Interface for a mobile application .
3. Understand how to create working mobile application for small computing devices uisng Android.
4. Understand to manage repository of data information for mobile application
5. Categories the challenges posed by developing mobile applications and able to propose and evaluate and select appropriate solutions.

Course Outcomes

1. Ability to evaluate and select appropriate solutions to the mobile computing platform.
2. Ability to develop the user interface.
3. Ability to develop database management system to retrieve data for mobile application
4. Ability to build a simple mobile application.
5. Develop and Deploy mobile applications

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	1	-	-	-	-	-	-	-	-	-	-	-
2	3	2	3	-	2	-	-	-	1	-	1	1	1	1
3	3	2	3	-	2	-	-	-	1	-	1	1	1	1
4	3	3	3	-	2	-	-	-	1	-	-	-	-	-
5	3	3	3	-	2	-	-	-	1	-	1	1	1	1

UNIT- I

Developing for Mobile and Embedded Devices, J2ME Overview: Java 2 Micro Edition and the World of Java, Inside J2ME, J2ME and Wireless Devices.

J2ME Architecture and Development Environment: J2ME Architecture, Small Computing Device Requirements, Run-Time Environment, MiDlet Programming, J2ME Software Development Kits, Multiple MIDlets in a MIDlet Suite.

UNIT-II

Commands, Items, and Event Processing: J2ME User Interfaces, Display Class, Command Class, Item Class, Exception Handling

Record Management System: Record Storage, Writing and Reading Records, Record Enumeration, Sorting Records, Searching Records, Record Listener

UNIT- III

Generic Connection Framework: The Connection, Hypertext Transfer Protocol, Communication Management Using HTTP Commands, Session Management, Transmit as a Background Process

Android: An Open Platform for Mobile Development, A Little Background, Native Android Applications, Android SDK Features, Developing for Android, Android Development Tools

UNIT- IV

Creating Applications and Activities:Introducing the Application Manifest File, Externalizing Resources, The Android Application Lifecycle, A Closer Look at Android Activities,

Building User Interfaces:Fundamental Android UI Design, Android User Interface Fundamentals, Introducing Layouts

UNIT- V

Databases and Content Providers: Introducing Android Databases, Working with SQLite Databases, Creating Content Providers, Using Content Providers, Adding Search to Your Application

Text Books:

1. J2ME: The Complete Reference, James Keogh, Tata McGrawHill, 2017.
2. Professional Android Application Development, Reto Meier, Wiley India, 2012.

Suggested Reading:

1. Mobile Design and Development, Brian Fling, O'Reilly, SPD, 2011.
2. Beginning Android Application Development, Wei-Meng Lee, Wiley Publishing, Inc, 2012
3. Android a Programming Guide, Jerome(J.F.) DiMarzio, McGrawHill, 2010
4. https://onlinecourses.nptel.ac.in/noc16_cs13
5. https://developer.android.com/index.html

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16CSE05 COMPUTER GRAPHICS

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:
1. To Identify and explain the core concepts.
2. To Acquire knowledge about device level algorithms for displaying two dimensional output primitives for raster graphics system.
3. To Acquire knowledge about the basic concepts of representing 3D objects in 2D.
4. To Introduce computer graphics techniques transformations, clipping, curves and surfaces.

Course Outcomes:
1. Review the core concepts of computer graphics.
2. Analyse graphics techniques for rasterization, clipping, curve generation etc.
3. Evaluate pictures using various algorithms.
4. Understand the pipeline of typical graphics
5. Interpret and apply relevant problem solving methodologies

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	-	2	-	-	-	-	-	-	-	-	-	3	1
2	3	2	2	-	-	-	-	-	-	-	-	-	3	1
3	3	3	2	2	3	-	-	-	-	-	-	-	3	1
4	3	-	1	-	-	-	-	-	-	-	-	-	3	1
5	3	3	3	2	3	-	-	--	-	-	-	-	3	1

Prerequisites:
Knowledge of Linear Algebra (vectors and matrices), Good programming skills

UNIT-I
Graphics Systems and Models: Graphics system; Images; Physical and synthetic; Imaging system; synthetic camera model; programming interface ; graphics architectures programmable pipelines; performance characteristics.
Graphics Programming: Programming two-dimensional applications; OpenGL API; Primitives and attributes; color; viewing, control functions

UNIT-II
Input and Interaction: Input device; clients and servers; displays lists; display lists and modeling; programming event driven input; picking ; building interactive models; animating Interactive programs; logic operations.
Geometrics Objects: Three - dimensional primitives; coordinates systems and frames; frames in OpenGL; Modeling colored cube.

UNIT-III
Transformations: Affine Transformations; Transformations in homogenous coordinates; concatenation of Transformations; OpenGL transformation matrices; **Viewing:** Classical and Computer views; Viewing with a computer; Positioning of camera; Simple projections; Projections in OpenGL; Hidden surface removal; Parallel-projection matrices; Perspective projection matrices

UNIT-IV
Lighting and Shading: Light sources; The Phong lighting model; Computational vectors; Polygonal shading; Light sources in OpenGL; Specification of matrices in OpenGL; Global illumination;
From Vertices To Frames: Basic implementation strategies; line-segment clipping; polygon clipping; clipping of other primitives; clipping in three dimensions; Rasterization ; Bresenham's algorithm; Polygon Rasterization ; Hidden surface removal; anti-aliasing; display considerations.

UNIT-V
Modelling & Hierarchy: Hierarchal models; trees and traversal; use of tree data structure; animation; Graphical objects; Scene graphs; Simple scene graph API; Open Scene graph; other tree structures;
Curves and Surfaces: Representation of curves and surfaces; design criteria; Bezier curves and surfaces; Cubic B-splines; General B-splines; rendering curves and surfaces; curves and surfaces in OpenGL.

Professor and Head Department

Text Books:

1. Edward Angel ,Computer Graphics A Top-Down Approach with shader based openGL, Peasrson Education, 6th edition -2011.
2. Hearn Donald, Pauline Baker M: Computer Graphics with openGL, 4th edition ,Prentice Hall PTR, 2010.
3. **Fransis S Hill Jr., Stephen M Kelley, Computer Graphics Using OpenGL, Prentice**-Hall Inc., 3rd edition , 2007.
4. Edward Angel ,Computer Graphics A Top-Down Approach using openGL, Peasrson Education, 5th edition -2009.
5. Jim X. Chen, Foundation of 3D Graphics Programming Using JOGL and Java3D, Springe Verlag, 2006.
6. Hearn Donald, Pauline Baker M: Computer Graphics, 2nd edition ,Prentice Hall PTR, 1995.

Online Resources:

1. http://nptel.ac.in/courses/106106090/
2. http://nptel.ac.in/courses/106102065/

Professor and Head Department

16CSE06 ADVANCED COMPUTER ARCHITECTURE

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course objectives:
1. To provide concepts on performance measurement of processor architectures
2. To provide knowledge about the need of parallel processing
3. To provide basics about parallelism techniques implemented in uniprocessor technologies.
4. To gain knowledge of state-of-the art technologies like superscalar and vector processor
5. To gain knowledge on multiprocessor and multi-core technologies.

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Course Outcomes:
1. Acquire skills to measure the performance of various processor architectures
2. Apply parallel processing techniques
3. Gain knowledge on parallelism techniques implemented in uniprocessor technologies.
4. Understand the state-of-the art technologies like superscalar and vector processor
5. Gain knowledge multiprocessor and multi-core technologies.
6. Understand the parallel program development.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1	1	-	-	-	-	-	-	-	1	1	1
2	1	2	1	2	1	-	-	--	-	-	-	-	1	1
3	1	1	1	1	-	-	-	-	-	-	-	-	1	1
4	2	2	2	2	2	-	-	-	-	-	-	-	1	1
5	2	1	1	2	2	--	-	-	-	-	-	-	1	1
6	2	2	3	3	2	-	-	-	-	-	-	-	1	1

UNIT-I

Measuring Performance and cost: Performance measurement, Enhancements to Uniprocesssor models, Benchmarks, Basic model of advanced computer architectures.

UNIT-II

Pipelining and superscalar techniques: Basic pipelining, data and control hazards, Dynamic instruction scheduling, Branch prediction techniques, Performance evaluation, Case study- Sun Microsystems - Microprocessor.

UNIT-III

Vector Processors: Vector Processor Models, Vector architecture and Design, Performance evaluation, and Programming Vector processors.

Array Processors: Parallel array processor model, and Memory organization Interconnection networks: performance measures, static and dynamic topologies

UNIT-IV

Multiprocessors and Multi computers: Multiprocessor models, Shared-memory and Distributed memory architectures, Memory organization, Cache Coherence and Synchronization Mechanisms, Parallel computer, and Performance models.

UNIT-V

Software for parallel Programming: Parallel models, languages, and compilers, Parallel Program Development and Environments, and Trends in Parallel systems- Heterogeneous Computing multi-core architectures, and Asymmetric multi-core architectures.

Text Books:
1. John L. Hennessey and David A. Patterson , "Computer Architecture, A QuantitativeApproach ", 4 th Edition, Elsevier, 2007.

Suggested Reading:
1. Sajjan G. Shiva, "Advance Computer Architecture ", Taylor Series Group, CRC press, 2006.
2. Kai Hwang and Naresh Jotwani, "Advanced Computer Architecture", Mc Graw Hill, 1999.

Professor and Head Department
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16CSC22 **OPERATING SYSTEMS LAB**

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	2

Course Objectives:

1. To understand the design aspects of operating system.
2. To design and apply the process management concepts.
3. To design and apply the storage management concepts.

Course Outcome:

1. To use Unix utilities and perform basic shell control of the utilities
2. To use the Unix file system and file access control.
3. To write programs systems based on multiple cooperating processes or threads
4. To implement process scheduling, synchronization and memory management algorithms.
5. To implement process synchronization problems
6. To implement process deadlocks.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	1	1	1	-	-	-	2	2	-	2	-	-
2	3	3	2	2	1	-	-	-	3	3	-	3	-	-
3	3	3	3	2	1	-	-	-	3	2	-	2	-	-
4	3	3	3	3	1	-	-	-	2	3	-	2	-	-
5	3	3	3	2	1	-	-	-	2	2	-	2	-	-
6	3	3	3	2					2	2		2		

List of experiments:

1. Programs using LINUX shell scripts.
2. Programs using process related system calls.
3. Programs to illustrate threads
4. Implement CPU scheduling algorithms (a) Round Robin (b) SJF (c) FCFS
5. Echo server using pipes
6. Echo server using messages
7. Producer- Consumer problem using shared memory.
8. Dining philosopher problem using semaphore
9. Implement page replacement algorithms (a) FIFO (b) LRU
10. Bankers algorithm for Deadlock detection and avoidance
11. Programs to illustrate different file related System calls.
12. Printing file flags for specified descriptor.

Text Books:

1. Deitel and Deitel, "Operating System", Pearson Education, New Delhi, Third Edition, 2007.

Professor and Head Department

16CSC23 DATA COMMUNICATION AND COMPUTER NETWORKS LAB

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	2

Course Objectives:
1. Understand different types of network medium and devices
2. Learn basic network commands
3. Installation and working of simulation tools
4. Performance measurement of network
5. Create network topologies using simulation tools

Course Outcomes:
1. Become familiar with different types of equipment and cables used in the networks lab
2. Identification of various network devices
3. Familiarity of basic network commands
4. Ability to assign an IP address to a PC
5. Ability to connect a PC to the LAN
6. Design network topologies using simulation tools

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1		-	-	2		1	-	-	-	-	-	-	1
2	2	1	-	-	2	-	-	-	-	-	-	-	-	1
3	1	1	-	-		-	-	-	-	-	-	-	-	1
4	2	2	1		1	-	-	-	-	-	-	-	-	2
5	2	2	2	2	2	-	-	-	-	-	-	-	-	2
6	3	2	3	2	3	-	-	-	-	-	-	-	-	2

List of Experiments:
1. Study of Network medium and devices
2. Study of basic network commands and configuration tools (ifconfig, ping, traceroute, nslookup,dig,arp,netstat, nmap etc.,)
3. Introduction to Network Simulation tools and Installation of any one tool
4. Simulation of a simple network with three nodes and identifying as a central node
5. Study and simulationany two topologies
6. Simulation of a network with multiple routers and nodes by using hybrid topology
7. Installation and configuration of NetAnim
8. Implementation of FTP using TCP bulk transfer
9. Calculationof the performance for the network implemented in experiment 6
10. Analysisof network traces using wireshark or any tool

Text Books:
1. https://www.nsnam.org/docs/release/3.18/tutorial/ns-3-tutorial.pdf

16CSC24 **SOFTWARE ENGINEERING LAB**

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	2

Course Objectives:

1. To identify Project Scope, Objectives and infrastructure.
2. To understand Software Engineering methodologies for project development
3. To gain knowledge about Computer Aided Software Engineering (CASE) tools.
4. To use effective communication skills and technical skills to assure production of quality software.

Course Outcomes:

1.Identify the problem scope and constraints of the problem.
2.Prepare the requirements specification for the system to be developed according to IEEE standards.
3.Apply the design notations of structured approach to develop ER and Data Flow Diagrams.
4.Apply/Use the design notations of Object-oriented approach to develop UML diagrams using Rational tools.
5. Develop the Test cases to validate the proposed system.
6. Analyze the implementation and prepare the documentation for the proposed system.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	1	2	2	3	3	3	3	3	3	3	3	2
2	3	3	2	3	2	3	3	3	3	3	3	3	2	2
3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
4	3	2	3	2	3	2	1	2	1	1	1	3	2	3
5	3	2	2	2	2	2	2	3	3	3	3	3	3	2
6	3	3	3	3	3	3	3	3	3	3	3	3	3	3

A group of five students are identified as a team and the team should be able to develop mini project on the case studies like:

(i) Online Library Management system in college.
(ii) Online Feedback system in college.
(iii) Online Leave Management System for staff in college
(iv) Online Attendance Management system in college.
(v) Online Canteen Management System in college.

The team need to do the following experiments to develop the mini project.

Week 1: Introduction to Software product Development and Tools.
Week 2: roblem Definition
Week 3: Software Requirement Specification-Standard IEEE SRS document.
Week 4: Data dictionary
Week 5,6: System Design-structural diagrams, UML diagrams
Week 7,8: Implementation using Computer Aided Software Engineering tools(CASE).
Week 9: Generating Test Cases
Week 10: Document Writing.

Text Books:

1. Grady Booch, James Rumbaugh, Ivar Jacobson : The Unified Modeling Language User Guide, Pearson Education, 2007
2. Roger S. Pressman, “Software Engineering –A Practitioners Approach”, 7th Edition, Pearson Education, India, 2010

Professor and Head Department

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (AUTONOMOUS)
SCHEME OF INSTRUCTION AND EXAMINATION
VI-Semester of B.E under CBCS
COMPUTER SCIENCE AND ENGINEERING

SEMESTER-VI

Sl.No	Syllabus Ref. No	SUBJECT	Scheme of Instruction		Scheme of Examination			Credits
			Periods per Week		Duration Credits of SEE in Hours	Maximum Marks		
			L/T	P/D		CIE	SEE	
THEORY								
1	16CSC25	Compiler Construction	3	-	3	30	70	3
2	16CSC26	Artificial Intelligence	3	-	3	30	70	3
3	16CSC27	Mobile Computing	3	-	3	30	70	3
4	16CSC28	Information and Network Security	3	-	3	30	70	3
5	16CSC29	Internet of Things	3	-	3	30	70	3
6	16CSE 07/08/09	Elective-III	3	-	3	30	70	3
PRACTICALS								
7	16CSC30	Information and Network security Lab	-	3	3	25	50	2
8	16CSC31	Internet of Things Lab	-	3	3	25	50	2
9	16CSC32	Mini Project-II	-	3	3	50	-	1
		TOTAL	18	9	-	280	520	23

Elective-III:
16CSE07 – Computer Vision
16CSE08 – Soft Computing
16CSE09 – Data Mining

L: Lecture **T: Tutorial** **D: Drawing** **P: Practical**
CIE - Continuous Internal Evaluation **SEE - Semester End Examination**

16CSC25 **COMPILER CONSTRUCTION**

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To implement the concept learned in automata theory and languages to the field of Computer Science.
2. Analyze the basic steps involved in converting a source language to target code.
3. Understands the concepts of parsers and can write solutions for various grammars by using tools, and also analyzes different storage techniques, error recovery strategies.
4. Gain the knowledge to write a compiler program or can able to build a compiler.

Course Outcomes:

1. Identify the basic concepts needed for the development of a compiler
2. Analyze the various phases and Tools of a Compiler
3. Describe the differences between Top down and Bottom up Parsers and apply parsing methods for various grammars.
4. Compare and Contrast Symbol table organization for Block structured and non-Block structured languages.
5. Analyze the concepts involved in Intermediate, code generation and Code Optimization Process.
6. Recognize the various types of errors and error recovery strategies in phases of Compilation.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	-	1	-	-	-	-	-	-	-	3	-	-
2	2	2	1	2	3	-	-	-	-	-	-	-	-	3
3	3	2	1	1	-	-	-	-	-	-	-	1	-	-
4	3	3	1	2	-	-	-	-	-	-	-	1	-	-
5	3	2	1	1	2	-	-	-	-	-	-	2	-	-
6	3	3	1	2	-	-	-	-	-	-	-	2	-	-

UNIT-I

Introduction – Programs related to compilers. Translation process.Major data structures.Other issues in compiler structure. Boot strapping and porting.

Lexical analysis – The role of Lexical Analyzer, Input Buffering, Specification of Tokens, Recognition of Tokens, The Lexical-Analyzer Generator Lex.

UNIT-II

Syntax Analysis – Introduction, Top-Down parsing, Brute Forcing, Recursive Descent, Predicative LL(1), Bottom-Up parsing : Introduction to LR Parsing, Powerful LR parsers SLR, CALR, LALR, Using Ambiguous Grammars,

Parser Generators - YACC.

UNIT-III

Syntax Directed Translation – Syntax Directed Definitions. Evaluation Orders for SDDs. Applications of Syntax Directed Translation.

Symbol Table Organization - Structure of Symbol table, Symbol Table organization for Block Structured and non-block Structure languages, Data Structures of symbol Table.

UNIT-IV

Intermediate code generation: Variants of syntax trees. Three-Address Code, Types and Declarations, Translation of Expressions, Type Checking, Control Flow.

Storage Organization.Stack, Heap Management, Garbage Collection.

Code Generation – Issues in the Design of a Code Generator.The Target Language. Addresses in the Target Code Basic Blocks and Flow Graphs. Optimization of Basic Blocks.Peephole Optimization.

UNIT-V

Machine Independent Optimizations – The Principal Sources of Optimizations, Introduction to data flow analysis, Foundation of data flow analysis.

Error Recovery : Error detecting and Reporting in various Phases.

Introduction to Advanced Topics : Review of compiler structure, advanced issues in elementary topics, the importance of optimizations, Structure of optimizing compilers

Professor and Head Department

Text Books:

1. Alfred V Aho, Monica S Lam, Ravi Sethi, Jeffrey D Ullman, "Compilers: Principles Techniques & Tools", Pearson Education 2nd Edition 2013.
2. Muchnik, "Advanced Compiler Design and Implementation", Kauffman(1998)

Suggested Reading:

1. Kenneth C Louden, "Compiler Construction: Principles and Practice", Cengage Learning. Lex &Yacc, John R Levine, Oreilly Publishers.
2. Keith D Cooper & Linda Tarezon, "Engineering a Compiler", Morgan Kafman, Second edition. Lex &Yacc, John R Levine, Tony Mason, Doug Brown, Shroff Publishers.

Online Resources:

1. http://www.nptel.ac.in/courses/106108052
2. https://web.stanford.edu/class/archive/cs/cs143/cs143.1128/
3. http://en.wikibooks.org/wiki/Compiler_Construction
4. http://dinosaur.compilertools.net/
5. http://epaperpress.com/lexandyacc/

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16CSC26 **ARTIFICIAL INTELLIGENCE**

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:
1. To list the significance of AI.
2. To discuss the various components that are involved in solving an AI problem.
3. To analyze the various knowledge representation schemes, Reasoning and Learning techniques of AI.
4. Apply the AI concepts to build an expert system to solve the real world problems.

Course Outcomes:
1. Differentiate between a rudimentary Problem and an AI problem, it's Characteristics and problem solving Techniques.
2. Determine and evaluate the various search strategies.
3. Compare and contrast the various "knowledge representation" schemes of AI.
4. Understand and Analyze the various reasoning techniques involved in solving AI problems.
5. Understand the different learning techniques.
6. Apply the AI techniques to solve the real world problems using Prolog.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	3	2	2	-	-	-	-	-	-	-	3	3	-
2	3	3	2	2	-	-	-	-	-	-	-	3	3	-
3	3	3	2	1	-	-	-	-	-	-	-	3	3	-
4	3	3	2	3	-	-	-	-	-	-	-	3	3	2
5	3	3	2	3	-	3	-	-	-	-	-	3	3	2
6	3	3	2	2	-	-	-	-	-	-	-	3	3	2

UNIT I

Intelligent Agents: Intelligent agents**,** structure of agents

Introduction & Problem Solving: AI problems, AI Technique, Defining problem as a State-Space Search, Production Systems, Problem Characteristics.

Heuristic Search Techniques: Generate–and–test, Hill Climbing, Best–First Search,Problem Reduction, Constraint Satisfaction.

UNIT II

Game Playing: Overview, Min-Max search Procedure, Adding Alpha-beta Cutoffs, AdditionalRefinements, Iterative Deepening.

Using Predicate Logic: Representing simple facts in logic, Representing Instance and ISARelationships, Computable Functions , propositional calculus and predicates, Resolution.

UNIT III

Uncertainty and Reasoning Techniques: Non monotonic reasoning, Logics for Non monotonicreasoning, Implementation issues.

Statistical reasoning: Probability and Bayes theorem, Certainty factors and Rule-based systems,Bayesian Networks, Dempster-Shafer Theory.

UNIT IV

Learning: What is Learning, Rote learning, Learning by taking advice, learning in problem?solving, learning from examples: Induction.

Expert System: Representing and Using Domain Knowledge, Expert systems shells,Explanation, Knowledge Acquisition.

UNIT V

Natural Language Processing: Introduction, Syntactic Processing, Semantic Analysis,Statistical NLP, Spell Checking.

PROLOG-The Natural Language of AI: Prolog facts and rules, variables, control structures, arithmetic operators, matching in prolog ,backtracking.

Text Books:
1. Elaine Rich, Kevin Night, Shivashankar B Nair, "Artificial Intelligence",3rd Edition.,2008
2. Russell Norvig, "Artificial Intelligence-Modern Approach", 3rd edition, 2009.

Suggested Reading:
1. Saroj Kaushik, "Artificial Intelligence", Cengage Learning India, 2012.
2. Nelson M. Mattos, "An Approach to Knowledge Base Management", Springer Berlin Heidelberg, 1991.

Online Resources:
1. http://nptel.ac.in/courses/106106126/
2. http://nptel.ac.in/courses/106105077/

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16CSC27 MOBILE COMPUTING

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To impart fundamental concepts in the area of mobile computing
2. To provide a computer systems perspective on the converging areas of wireless networking, embedded systems and software
3. To study the specification and functionalities of various protocols / standards of mobile networks
4. To understand transactions and m-Commerce principles

Course Outcomes:

1. Gain knowledge in the fundamental concepts of mobile computing
2. Understand the principles of wireless transmission and cellular networks
3. Compare various telecommunication systems and broadcasting techniques
4. Identify various wireless LAN and routing protocols for different environments
5. Understand file systems and transaction for mobility support
6. Will have an understanding of social and ethical issues of mobile computing and privacy issues

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	-	-	-	-	-	-	-	-	-	-	2	-	-
2	2	1	-	-	-	1	-	-	-	-	-	1	-	-
3	2	1	-	-	-	1	-	-	-	2	-	1	1	1
4	3	1	1	2	-	1	-	-	-	1	-	2	1	1
5	2	1	1	-	-	2	-	2	-	-	-	2	2	1
6	2	-	-	-	-	2	-	-	-	-	-	2	1	-

UNIT-I

Introduction: Wireless Transmission, Frequencies for Radio Transmission, Signals, Antennas, Signal Propagation, Multiplexing, Modulations, Spread Spectrum, MAC, SOMA, FDMA, TDMA, CDMA, Cellular Wireless Networks.

UNIT-II

Telecommunication Systems: GSM, GPRS, Satellite Networks, Basics, Parameters and Configurations, Capacity Allocation, FAMA and DAMA, Broadcast Systems, DAB, DVB, CDMA and 3G.

UNIT-III

Wireless LAN: IEEE 802.11 Architecture, Services, MAC – Physical Layer, IEEE 802.11a – 802.11b standards, Bluetooth, HIPER LAN.

UNIT-IV

Routing in Ad-hoc Networks: Ad-hoc Network Routing Protocols, Destination Sequenced Distance Vector Algorithm, Cluster Based Gateway Switch Routing, Global State Routing, Fish-eye state Routing, Dynamic Source Routing, Ad-hoc on-demand Routing, Location Aided Routing, Zonal Routing Algorithm.

Mobile IP - Dynamic Host Configuration Protocol.

Traditional TCP - Classical TCP Improvements – WAP, WAP 2.0.

UNIT-V

Publishing & Accessing Data in Air: Pull and Push Based Data Delivery models, Data Dissemination by Broadcast, Broadcast Disks, Directory Service in Air, Energy Efficient Indexing scheme for Push Based Data Delivery.

File System Support for Mobility: Distributed File Sharing for Mobility support, Coda and other Storage Manager for Mobility Support.

Mobile Transaction and Commerce: Models for Mobile Transaction, Kangaroo and Joey transactions, Team Transaction, Recovery Model for Mobile Transactions, Electronic Payment and Protocols for Mobile Commerce, Social Issues, Mobile Privacy and Ethics.

Text Books:

1. Jochen Schiller, *Mobile Communications*, Pearson Education, 2nd Edition, 2009.
2. Kurnkum Garg, *Mobile Computing : Theory and Practice*, Pearson Education , 2010
3. AsokeK Talukder, Roopa R Yavagal, *Mobile Computing*, TMH 2008.

Suggested Reading:

1. Raj Kamal,"*Mobile Computing"*, Oxford University Press, 2nd edition,2014.
2. S. Acharya, M. Franklin and S. Zdonil, "*Balancing Push and Pull for Data Broadcast, Proceedings of the ACM SIGMOD*", Tuscon, AZ, May 1997.
3. Prasant Kumar Pattnaik, Rajib Mall, "Fundamentals of Mobile Computing", PHI, 2012
4. "*A Survey of Mobile Transactions appeared in Distributed and Parallel databases*" 16,193- 230, 2004, Kluwer Academics Publishers.

16CSC28 **INFORMATION AND NETWORK SECURITY**

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:
1. Deal with the underlying principles of information and network security.
2. To understand the network security, services, attacks, mechanisms, types of attacks on TCP/IP protocol suite.
3. To comprehend and apply network layer security protocols, Transport layer security protocols, Web security protocols.
4. To comprehend and apply authentication services, authentication algorithms
5. Deal with the key exchange problem and solutions using the Diffie-Hellman and Message Authentication Codes (MAC) and signature schemes.

Course Outcomes:
1. Understand the most common type of information and network threat sources.
2. Be able to determine appropriate mechanisms for protecting the network.
3. Design a security solution for a given application, system with respect to security of the system
4. Understand the information and network security issues and apply the related concepts for protection and communication privacy.
5. Understand application security using smart- cards.
6. Understand the operation of e-payments, micro- payments and related security issues, protocols.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	1	1	1	-	2	-	2	1	1	1	2	-	1
2	3	3	2	1	1	2	-	2	1	1	1	2	-	2
3	3	3	3	3	2	2	-	2	2	1	1	2	-	2
4	3	2	3	2	3	2	-	2	2	2	1	2	-	2
5	3	1	1	1	-	2	-	2	1	1	1	2	-	1
6	3	2	1	1	-	2	-	2	1	1	1	2	-	1

UNIT-I
Planning for Security: Introduction, Information Security Policy, Standards, and Practices; The Information Security Blue Print; Contingency plan and a model for contingency plan
Security Technology: Introduction; Physical design; Firewalls; Protecting Remote Connections Intrusion Detection Systems (IDS); Honey Pots, Honey Nets, and Padded cell systems; Scanning and Analysis Tools.

UNIT-II
Cryptography: Introduction; A short History of Cryptography; Principles of Cryptography; Cryptography Tools; Attacks on Cryptosystems.

UNIT-III
Introduction to Network Security, Authentication Applications: Attacks, services, and Mechanisms; Security Attacks; Security Services; A model for Internetwork Security; Internet Standards and RFCs Kerberos, X.509 Directory Authentication Service.

UNIT-IV
Electronic Mail Security: Pretty Good Privacy (PGP); S/MIME
IP Security: IP Security Overview; IP Security Architecture; Authentication Header; Encapsulating Security Payload; Combining Security Associations; Key Management.

UNIT-V
Web Security: Web security requirements; Secure Socket layer (SSL) and Transport layer Security (TLS); Secure Electronic Transaction (SET).

Text Books:
1. Michael E. Whitman and Herbert J. Mattord: Principles of Information Security, 6thEdition, Cengage Learning, 2017.
2. William Stallings: Cryptography and Network Security, 7thEdition, Pearson Education, 2015.

Suggested Reading:
1. Behrouz A. Forouzan “Cryptography and its principles”.

16CSC29 **INTERNET OF THINGS**

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:
1. Understand vision and Introduction to IoT.
2. Explore Data and Knowledge Management and use of Devices in IoT Technology.
3. Understand State of the Art – IoT Architecture.
4. Understand IoT protocols.
5. Programming with Raspberry Pi
6. Explore the Real World IoT Design Constraints, Industrial Automation and Commercial Building Automation in IoT.

Course Outcomes:
1. Understand the Architectural Overview of IoT
2. Use of Devices, Gateways and Data Management in IoT.
3. Building state of the art architecture in IoT.
4. Understand various protocols used in IoT.
5. Understand Application of IoT in Industrial and Commercial Building Automation.
6. Understand Real World Design Constraints.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	-	2	2	1	1	1	1	2	1	-	2	1	1
2	1	1	2	2	3	2	2	1	2	2	2	2	2	2
3	-	1	1	2	1	1	1	2	2	2	1	1	2	2
4	1	1	2	1	1	2	1	-	2	1	1	2	2	2
5	2	2	3	3	3	3	3	2	3	2	3	3	2	2
6	3	3	3	3	3	2	2	3	2	2	2	2	2	3

UNIT-I

Overview: IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. M2M and IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service(XaaS), M2M and IoT Analytics, Knowledge Management

UNIT-II

IoTReference Architecture: IoT Architecture-State of the Art – Introduction, State of the art, Reference Model and architecture, IoT reference Model - IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views. Real-World Design Constraints- Introduction, Technical Design constraints-hardware is popular again, Data representation and visualization, Interaction and remote control.

UNIT-III

IoT Protocols:Infrastructure (ex: 6LowPAN, IPv4/IPv6, RPL), **Identification** (ex: EPC, uCode, IPv6, URIs), **Comms / Transport** (ex: Wifi, Bluetooth, LPWAN), **Discovery** (ex: Physical Web, mDNS, DNS-SD), **Data Protocols** (ex: MQTT, CoAP, AMQP, Websocket, Node), **Device Management** (ex: TR-069, OMA-DM), **Semantic** (ex: JSON-LD, Web Thing Model), **Multi-layer Frameworks** (ex: Alljoyn, IoTivity, Weave, Homekit)

Unit-IV

Raspberry Pi: Exemplary Device: RaspberryPi, About the Board, Linux on Raspberry Pi, Raspberry Pi Interfaces, Programming Raspberry Pi with Python.
NODEMCU (ESP8266) : Introduction and Architecture.

Unit-V

Domain Specific IOTs: Introduction, Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry.

Text Books:
1. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, **"**From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence**"**, 1st Edition, Academic Press, 2014.
2. ArshdeepBahga, Vijay Madisetti, Internet of Things: A hands on approach, 2014, VPT publishers;

Suggested Reading:
1. Peter Waher**, "**Learning Internet of Things", PACKT publishing, BIRMINGHAM – MUMBAI

2. Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet of Things", ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2, Springer
3. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", ISBN: 978-1-118-47347-4, Willy Publications

Online Resources:

1. https://www.postscapes.com/internet-of-things-protocols/
2. https://www.cse.wustl.edu/~jain/cse570-15/ftp/iot_prot/

16CSE 07 **COMPUTER VISION**

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:
1. To develop algorithms and techniques to analyze and interpret the visible world around us.
2. To understand the Fundamental Concepts Related To Multi-Dimensional Signal Processing,
3. To understand Feature Extraction algorithms
4. To analyze Patterns in images
5. To understand Visual Geometric Modeling
6. To understand Stochastic Optimization

Course Outcomes:
1. To understand concepts necessary in this field, to explore and contribute to research and further developments in the field of computer vision.
2. To apply in the field of Biometrics, Medical diagnosis, document processing, mining of visual content, to surveillance, advanced rendering etc.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	2	1	2	-	1	-	-	-	-	2	-	-
2	1	2	1	2	1	-	1	-	-	-	-	2	-	-

Unit-I

Introduction to Computer Vision and Image Formation: Introduction, Geometric primitives and transformations,Photometric image formation, Digital Camera image formation.

Image Processing: Point operators , Linear filtering , More neighborhood operators , Fourier transforms , Pyramids and wavelets ,Geometric transformations , Global optimization

Unit-II

Feature detection and matching: Points and patches, Edges ,Lines.

Segmentation: Activecontours ,Split and merge ,Mean shift and mode finding ,Normalized cuts , Graph cuts and energy-based methods.

Feature-based alignment: 2D and 3D feature-based alignment ,Pose estimation Geometric intrinsic calibration

Unit-III

Structure from motion: Triangulation , Two-frame structure from motion , Factorization ,Bundle adjustment , Constrained structure and motion

Dense motion estimation: Translational alignment ,Parametric motion ,Spline-based motion ,Optical flow , Layered motion.

Unit-IV

Recognition : Object detection ,Face recognition , Instance recognition ,Category recognition ,Context and scene understanding ,Recognition databases and test sets

Unit-V

3D reconstruction : Shape from X , Active rangefinding , Surface representations ,Point-based representations, Volumetric representations , Model-based reconstruction ,Recovering texture maps.

Image-based rendering : View interpolation ,Layered depth images , Light fields and Lumigraphs ,Environment mattes ,Video-based rendering

Text Books:

1. “Computer Vision: Algorithms and Applications” by Richard Szeliski; Springer-Verlag London Limited 2011 .
2. Digital Image Processing”; R. C. Gonzalez and R. E. Woods; Addison Wesley;2008.

References

1. “Pattern Recognition: Statistical. Structural and Neural Approaches”; Robert J. Schallkoff; John Wiley and Sons; 1992+.
2. “Computer Vision: A Modern Approach”; D. A. Forsyth and J. Ponce; Pearson Education; 2003.
3. Multiple View geometry. R. Hartley and A. Zisserman. 2002 Cambridge university Press
4. Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, March 2004.
5. K. Fukunaga; Introduction to Statistical Pattern Recognition, Second Edition, Academic Press, Morgan Kaufmann, 1990.

Online links
1. CV online: http://homepages.inf.ed.ac.uk/rbf/CVonline
2. Computer Vision Homepage: http://www2.cs.cmu.edu/afs/cs/project/cil/ftp/ html/vision.html

16CSE 08 **SOFT COMPUTING**

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:
1. To learn various types of soft computing techniques and their applications.
2. To acquire the knowledge of neural network architectures, learning methods and algorithms.
3. To understand Fuzzy logic, Genetic algorithms and their applications.

Course Outcomes:
1. Understand various soft computing techniques.
2. Understand various learning models.
3. Design and develop various Neural Network Architectures.
4. Understand approximate reasoning using fuzzy logic.
5. Analyze and design Genetic algorithms in different applications.
6. Ability to apply soft computing techniques to solve different applications.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	-	-	-	-	-	1	-	-	-	-	-	-	-
2	2	2	1	2	1	-	2	-	1	1	-	-	2	3
3	3	1	-	1	1	-	3	-	-	-	-	-	3	2
4	1	-	-	-	-	-	3	-	-	-	-	-	2	2
5	2	1	1	1	1	-	-	-	1	1	-	-	2	2
6	2	2	-	1	1	-	-	-	1	1	1	1	3	

UNIT-I
Soft computing vs. Hard computing, Various types of soft computing techniques.
Artificial Neural Networks: Fundamental concepts, Evolution of neural networks, Basic models of artificial neural network, Important terminologies of ANNs. McCulloch-Pitts neuron, Linearseparability, Hebb network.

UNIT-II
Supervised Learning Neural Networks: Perceptron networks, Adaptive linear neuron (Adaline), Multiple Adaptive linear neuron (Madaline), Back propagation network

UNIT-III
Unsupervised Learning Neural Networks: Kohonenself organizing networks, Adaptive resonance theory.
Associate Memory Networks: Bidirectional associative memory network, Hopfield networks.

UNIT-IV
Fuzzy Logic: Introduction to classical sets and Fuzzy sets, Fuzzy relations, Tolerance and equivalence relations, Membership functions, Defuzzification,

UNIT-V
Genetic Algorithms: Introduction, Basic operators and terminology, Traditional algorithm vs. genetic algorithm, Simple genetic algorithm, General genetic algorithm, Classification of genetic algorithm, Genetic programming, Applications of genetic algorithm.

Text Books:
1. S.N. Sivanandam& S.N. Deepa, ”Principles of soft computing”, Wiley publications, 2nd Edition, 2011.

Suggested Readings:
1. S. Rajasekaran& G.A. Vijayalakshmipai, "Neural Networks, Fuzzy logic & Genetic Algorithms, Synthesis & Applications", PHI publication, 2008.
2. LiMin Fu, “Neural Networks in Computer Intelligence”, McGraw-Hill edition, 1994.
3. K.L.Du& M.N.S Swamy, "Neural Networks in a Soft Computing Framework", Springer International edition, 2008.
4. Simon Haykins, "Neural Networks a Comprehensive Foundation", PHI, second edition.
5. Goldberg, David E., "Genetic Algorithms in Search, Optimization and Machine Learning", Addison Wesley, New Delhi, 2002.
6. N.P. Padhy and S.P. Simon,“Soft Computing: With Matlab Programming”, Oxford University Press, 2015

Online Resources:
1. https://onlinecourses.nptel.ac.in/noc18_cs13/preview

Professor and Head Department

16CSE09 **DATA MINING**

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:
1. To understand the principles of Data warehousing and Data Mining
2. To be familiar with the Data Warehouse Architecture and its implementation.
3. Learn how to produce a quantitative analysis report/memo with the necessary information to make decisions.
4. Provide understanding of mathematical concepts and algorithms used in data mining.
5. Identifying business applications of data mining
6. Develop and apply critical thinking, problem-solving, and decision-making skills.

Course Outcomes:
1. Understand the process, issues and challenges of knowledge discovery
2. Identify and analyze the significance and working of various data preprocessing methods.
3. Understand operational database, warehousing, and multidimensional need of data base to meet industrial needs.
4. Explore the concepts of market basket analysis to generate association rules.
5. Analyze and Evaluate the performance of Classification and Clustering algorithms
6. Understand the significance and methodologies of outlier detection Schemes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	-	2	-	-	2	-	-	-	-	1	2	-
2	3	3	1	-	-	-	-	-	-		-	-	1	2
3	2	2	2	2	-	-	-	-	-	-	-	-	1	1
4	3	2	2	2	2	2	-	-	-	-	-	-	1	2
5	3	2	2	3	2	3	-	2	-	1	-	-	2	2
6	3	3	3	-	-	-	2	-	-	-	-	-	1	1

UNIT-I

Introduction: Fundamentals of data mining, Data Mining Functionalities, Issues in Data Mining.

Data Objects and Attribute types, Basic Statistical descriptions of data, Data Visualization, Measuring data similarity and Dissimilarity.

Data Preprocessing: An Overview, Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization.

UNIT-II

Data Warehouse and Online Analytical Processing: Basic Concepts of Data Warehouse, Data Warehouse Modeling: Data Cube and OLAP, Data Warehouse Architecture, Data Warehouse Design and Usage, Data Warehouse Implementation, Data Generalization by Attribute-Oriented Induction.

Data Cube Computation: Preliminary Concepts, Data Cube Computation Methods

UNIT-III

Mining Frequent Patterns, Associations and Correlations: Basic Concepts and Methods, Frequent Item set Mining Methods, Pattern Evaluation Methods: From Association Analysis to Correlation Analysis.

UNIT-IV

Classification: Basic Concepts, Decision Tree Induction, Bayes Classification Methods, Rule-Based Classification, Model Evaluation and Selection, Techniques to improve Classification Accuracy, Classification by Back propagation Prediction, Support Vector Machines, Lazy Learners.

UNIT-V

Cluster Analysis: Basic Concepts and Methods, Partitioning Methods: K-means Technique, Hierarchical Methods: Agglomerative and Divisive, Density Based Methods: DBSCAN technique, Evaluation of Clustering.

Outlier Detection: Outlier Detection Methods, Statistical Approaches, Proximity-Based Approaches, Clustering Based Approaches.

Text Books:

1. Jiawei Han, Micheline Kamber and Jian Pei, "Data Mining – Concepts and Techniques", 3rd edition, Morgan Kaufmann Publishers, ELSEVIER, 2013.
2. Pang-Ning Tan, Michael Steinbach and Vipin Kumar "Introduction to Data Mining", Pearson Education, 2006.

Suggested Reading:

1. Sam Aanhory& Dennis Murray "Data Warehousing in the Real World", Pearson Edn Asia.
2. K.P.Soman, S.Diwakar, V.Ajay ,"Insight into Data Mining", PHI, 2008.
3. Ralph Kimball Wiley "The Data Warehouse Life cycle Tool kit", student edition
4. William H Inmon, John Wiley & Sons Inc "Building the Data Warehouse", 2005.
5. Margaret H Dunham "Data Mining Introductory and advanced topics", Pearson education.
6. Arun K Pujari "Data Mining Techniques", 2nd edition, Universities Press.

16CSC30 INFORMATION AND NETWORK SECURITY LAB

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	2

Course Objectives:

1. Understand basic cryptography principles, including some well-known algorithms for symmetric and public key encryption, digital signatures, key management.
2. To provide a practical exposure of both the principles and practice of advanced cryptography.
3. Understand and fulfill the requirements C.I.A.
4. Understand the underlying principles of information and network security.

Course Outcomes:

1. Demonstrate detailed knowledge of the role of encryption to protect data.
2. Analyze security issues arising from the use of certain types of technologies.
3. Master protocols for security services.
4. Master on the key exchange and Authentication protocols.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	3	3	3	3	-	2	2	2	1	3	-	-
2	2	3	2	3	2	3	-	2	2	2	1	3	-	-
3	3	3	3	3	3	2	-	2	2	2	1	3	-	-
4	3	3	3	3	3	2	-	2	2	2	1	3	-	-

List of Programs:

1. To perform encryption and decryption using the following algorithms
   a. Ceaser cipher b. Substitution cipher c. Hill Cipher
2. Implement the DES algorithm logic in C.
3. Implement the DES algorithm logic in JAVA.
4. JAVA program that contains functions, which accept a key and input text to be encrypted/decrypted. This program should use the key to encrypt/decrypt the input by using the triple DES algorithm. Make use of Java Cryptography package.
5. Implement the Blowfish algorithm logic
6. Implement RSA algorithm.
7. Implement Message Authentication Code (MAC)
8. Calculate the message digest of a text using the SHA-1 algorithm
9. Calculate the message digest of a text using the MD5 algorithm
10. Explore the Java classes related to digital certificates.
11. Create a digital certificate of your own by using any tool.
12. Create the awareness on open SSL.

Suggested Readings:

1. Michael Gregg "Build Your Own Security Lab", Wiley India.
2. Cryptography and Network Security Principles and Practice, William Stallings, 5th Edition, Prentice Hall,2011
3. Alfred Basta, Wolf Halton, "Computer Security, concepts, issues and implementation: Cengage Learning".

Professor and Head Department

16CSC31 **INTERNET OF THINGS LAB**

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	2

Course Objectives:
1. To understand how sensors are used in IoT systems.
2. To understand how to program on embedded and mobile platforms including ESP8266 and Raspberry-Pi.
3. To understand how to communicate with mobile devices using various communication platforms such as Bluetooth and Wi-Fi.
4. To understand how to make sensor data available on the Internet.
5. To understand how to analyze and visualize sensor data.
6. To understand how to work as a team and create end-to-end IoT applications.

Course Outcomes:
1. Use different types of sensors in various IoT Systems.
2. Use of devices, Gateways and Database Management in IoT.
3. Working with ESP8266 to implement various IoT systems.
4. Working with Raspberry-Pi to implement various IoT Systems.
5. Understand Application of IoT in Agriculture and Industries.
6. Understand Real World Design Constraints.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	-	2	1	2	2	1	-	1	-	1	2	2	2
2	1	1	2	2	3	2	2	1	2	2	2	2	2	2
3	2	2	2	1	2	2	2	1	2	2	2	1	2	1
4	2	2	2	1	2	2	2	1	2	2	2	1	2	1
5	2	2	3	3	3	3	3	2	3	2	3	3	2	2
6	3	3	3	3	3	2	2	3	2	2	2	2	2	3

List of Experiments:
1. Implementation of Home Automation System using WiFi Module.
2. Design and develop Rain Sensing Automatic Wiper System.
3. Develop a system to identify accident and send alert messages.
4. Implementation of Traffic Light System based on density, to decrease congestion.
5. Design and develop IoT Solar Power Monitoring System.
6. Design and develop patient health monitoring system.
7. Design and develop IoT based Fire Altering System to give alert message to fire department.
8. Implementation of Smart Agriculture Monitoring System.

Suggesting Reading :
1. ArshdeepBahga, Vijay Madisetti, Internet of Things: A hands on approach, 2014, VPT publishers;

Reference Books:
1. Daniel Minoli, “Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications”, ISBN: 978-1-118-47347-4, Willy Publications

Professor and Head Department

16CSC32 **MINI PROJECT-II**

Instruction	3 Hours per week
Duration of Semester End Examination	-
Semester End Examination	-
CIE	50 Marks
Credits	1

The students are required to carry out mini projects in any of the areas such as Design and Analysis of Algorithms, Automata Languages and Computation, Operating Systems, Data Communication and Computer Networks, Software Engineering, Compiler construction, Artificial Intelligence and Mobile Computing etc.

Course Outcomes: At the end of the course, students will be able to:

1. Practice acquired knowledge within the chosen area of technology for project development
2. Identify, discuss and justify the technical aspects of the chosen project with a comprehensive and systematic approach
3. Reproduce, improve and refine technical aspects for engineering projects
4. Work as an individual or in a team in the development of technical projects
5. Interpret, analyze and evaluate the experimental results
6. Effectively communicate and report the project effectively activities and findings

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	--	--	--	--	--	--	--	--	--	2	2	2	2
2	2	2	3	--	--	--	--	2	--	--	--	2	--	--
3	2	--	--	3	2	--	--	1	--	--	--	--	--	--
4	--	--	--	--	--	--	--	1	3	--	--	--	--	--
5	2	--	--	3	2	2	2	--	--	--	--	--	--	--
6	2	--	--	--	2	--	--	2	--	3	--	--	--	2

Students are required to submit a report on the mini project at the end of the semester

Choice Based Credit System (CBCS)

Name of the Programme (UG):

B.E Syllabus for Semester VII and VIII - Semester

With effect from 2019 - 2020

Specialization /Branch: Computer Science and Engineering

Chaitanya Bharathi Institute of Technology (A)
Chaitanya Bharathi (P.O), Gandipet
Hyderabad-500075, Telangana State.

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY(A)

SCHEME OF INSTRUCTION AND EXAMINATION

VII-Semester of B.E under CBCS

COMPUTER SCIENCE AND ENGINEERING

SEMESTER-VII

Sl.No	Course Code	Title of the Course	Scheme of Instruction		Scheme of Examination			Credits
			Hours per week		Duration of SEE in Hours	Maximum Marks		
			L/T	P/D		CIE	SEE	
THEORY								
1	16CSC 33	Data Science and Big Data Analytics	3	-	3	30	70	3
2	16CSC 34	Free and Open Source Software	3	-	3	30	70	3
3	16CSC 35	Distributed and Cloud Computing	3	-	3	30	70	3
4	16CSC 36	Machine Learning	3/1	-	3	30	70	4
5		Elective-IV	3	-	3	30	70	3
6		Elective-V	3	-	3	30	70	3
PRACTICALS								
7	16CSC 37	DSBDA Lab	-	3	3	25	50	2
8	16CSC 38	ML Lab	-	3	3	25	50	2
9	16CSC 39	Project Seminar	-	3	3	50	-	2
TOTAL			**19**	**9**		**280**	**520**	**25**

ELECTIVE-IV	
16CSE 10	Deep Learning
16CSE 11	Design Patterns
16CSE 12	Nature Inspired Algorithm
16CSE 13	System and Network Administration

ELECTIVE-V (OE1)	
16CEO 02	Disaster Mitigation and Management
16MEO 01	Entrepreneurship
16MEO 06	Research Methodologies
16EGO 02	Gender Sensitization

L: Lecture T: Tutorial D: Drawing P: Practical
CIE - Continuous Internal Evaluation SEE - Semester End Examination

NPTEL Courses (Enrollment :15-05-2019 to 29-07-2019)				
Exam Registration (Open and Close Dates) : 1-Jun-19 to 23-09-2019 10.00 am				
Courses	**Elective**	**Course Start Date**	**Course End Date**	**Exam Date**
Software Project Management	Elective - IV	29-07-2019	18-10-2019	02-11-2019
Ethical Hacking		29-07-2019	18-10-2019	02-11-2019
Natural Language Processing		29-07-2019	18-10-2019	02-11-2019
Block Chain Architecture Design and Use cases	Elective - V	29-07-2019	18-10-2019	03-11-2019
Social Networks		29-07-2019	18-10-2019	02-11-2019
Computer Vision		29-07-2019	18-10-2019	02-11-2019

Assessment Procedure				
Course (in terms of credits)	**Continuous Internal Evaluation (Marks)**	**Semester end Examination (Marks)**	**Remarks**	**Duration of Semester End Examination**
Three(3)Credits/ Four(4)credits	30*	70**	Theory Course/ Engg . Graphics	3 Hours
Two(2) Credits	25	50	Lab Course/Workshop	3 Hours
One(1) Credit	15	35	Lab Course	2 Hours
One(1) Credit	50	-	Mini Project	-

* Out of 30 CIE, 10 marks are allotted for slip-tests (Three slip tests will be conducted, each of ten marks, and average of best two is considered) and the remaining 20 marks are based on the average of two tests, weightage for each test is 20 marks.

** The question paper will be in two parts, Part-A and Part-B. Part A is compulsory and contains short answer questions covering the entire syllabus, and carries 20 marks. Part-B carries 50 marks and covers all the units of the syllabus (student has to answer five out of seven questions).

Note: A course that has CIE but no SEE as per scheme is treated as PASS/FAIL for which pass marks are **50%** of CIE.

A candidate has earned the credits of a particular course, if he/she secures not less than the minimum marks/ grade as prescribed. Minimum pass marks in the SEE plus CIE shall be 40% for theory courses/subjects and **50%** for lab courses /Mini Project/ Project.

16CSC 33

DATA SCIENCE AND BIG DATA ANALYTICS

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre Requisites: DBMS, Probability and Statistics

Course Objectives: The main objectives of this course are:
1. Introduce a data analytics problem solving framework
2. Develop technical skills in probability modeling and statistical inference for the practical application of statistical methods.
3. Use existing and develop new statistical tools for data science problems across different applied domains.

Course Outcomes: On successful of this course **s**tudent will be able to:
1. Understands various phases of the data analytics life cycle.
2. Apply statistical methods to data for inferences.
3. Analyze data using Classification, Graphical and computational methods.
4. Understands Big Data technologies and NOSQL.
5. Analyze various types of data using Data Analytics Techniques.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	-	-	-	-	1	-	-	-	-	-	-	1	-
2	3	1	2	2	2	1	-	-	2	1	1	2	1	2
3	3	3	2	3	3	-	-	-	2	1	-	3	3	3
4	3	-	-	-	3	-	-	-	-	-	-	-	2	3
5	3	3	2	2	3	-	-	-	-	-	1	2	3	3

UNIT - I

Data Analytics Life cycle: Data Analytics Life cycle Overview, Discovery, Data Preparation, Model Planning, Model Building, Communicate Results, Operationalise, Exploratory Data Analysis, Statistical Methods for Evaluation, ANOVA.

UNIT - II

Overview of Supervised Learning: Variable Types and Terminology, Two Simple Approaches to Prediction: Least Squares and Nearest Neighbors, Model Selection and Bias–Variance Tradeoff. **Association Analysis:** Association rules, Apriori algorithm, FP-Growth Technique

UNIT - III

Time Series Analysis: Overview of Time Series Analysis, ARIMA Model; **Text Analysis:** Text Analysis Steps, Stop Word Removal, Tokenization, Stemming and Lemmatization, Representing Text: Term-Document Matrix, Term Frequency--Inverse Document Frequency (TFIDF).

UNIT - IV

Introduction to Big Data: Defining big data, 4 V's of big data, Big data types, Analytics, Examples of big data, Big data and Data Risk, Big data technologies, benefits of big data, Crowd sourcing analytics; **Hadoop Distributed File Systems:** Architecture of Apache Hadoop HDFS and other File Systems, HDFS File Blocks, HDFS File Commands

UNIT - V

NoSQL Data Management: Types of NOSQL data bases, Benefits of NO SQL, **Map Reduce:** Introduction, Map reduce example, Job Tracker, Map Operations. **Data Stream Mining:** The stream data model, streaming applications, continuous query processing and optimization, Distributed query processing.

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Text Books:

1. EMC Education Services “Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data”, Wiley Publishers, 2012.
2. Hastie, Trevor, et al., “The elements of statistical learning: Data Mining, Inference, and Prediction”, Vol. 2. No. 1. New York: Springer, 2009.
3. V.K. Jain,“Big Data & Hadoop”, Khanna Publishing House,2017.

Suggested Reading:

1. Anand Rajaraman and Jeffrey David Ullman, “Mining of Massive Datasets”, Cambridge University Press, 2012
2. Mark Gardener, “Beginning R The statistical Programming Language”, Wiley, 2015.
3. Han, Kamber, and J Pei, “Data Mining Concepts and Techniques”, 3rd edition, Morgan Kaufman, 2012.
4. Big Data Black Book, DT Editorial Services, Wiley India
5. V.K. Jain, “Data Science & Analytics”, Khanna Publishing House Beginner’s Guide for Data Analysis using R Programming, Jeeva Jose, ISBN: 978-93-86173454.
6. Montgomery, Douglas C., and George C. Runger John, “Applied statistics and probability for engineers”, Wiley & Sons, 6th edition, 2013.

16CSC 34 FREE AND OPEN SOURCE SOFTWARE

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The main objectives of this course are:
1. Familiarity with Open Source Technologies
2. Study some FOSS Projects to under the principles, methodologies of FOSS.
3. Understand the policies, licensing procedures and ethics of FOSS.

Course Outcomes: On successful of this course student will be able to:
1. Differentiate between Open Source and Proprietary software and Licensing.
2. Recognize the applications, benefits and features of Open Source Technologies.
3. Understand and demonstrate Version Control System along with its commands.
4. Gain knowledge to start, manage open source projects.
5. Understand and practice the Open Source Ethics.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	1	2	2	2	-	-	-	2	1	1	1	3
2	2	2	3	3	2	2	1	1	1	1	2	2	1	3
3	3	3	3	3	3	3	1	-	2	2	3	1	2	3
4	3	3	3	2	3	3	2	2	2	3	2	3	1	3
5	3	3	2	2	2	2	2	3	1	2	2	2	1	3

UNIT - I

Introduction to Open Source: Open Source, need and principles of OSS, Open Source Standards, Requirements for Software, OSS success, Free Software, Examples, Licensing, Free Vs. Proprietary Software, Public Domain software, History of free software, Proprietary Vs Open Source Licensing Model, use of Open Source Software.

UNIT - II

Fault Tolerant Design: **Principles and Open Source Methodology-** History, Open Source Initiatives, Open Standards Principles, Methodologies, Philosophy, Software freedom, Open Source Software Development, Licenses, Copyright vs. Copy left, Patents, zero marginal cost, income-generation Opportunities, Internationalization.

UNIT - III

Case Studies: Apache, BSD, Linux, Mozilla Firefox, Wikipedia, Git, GNU CC, Libre Office.

UNIT - IV

Open Source Project: Starting and Maintaining an Open Source Project, Open Source Hardware, Open Source Design, Open Source Teaching (OST), Open Source Media

What Is A License, Creation of our own Licenses, Important FOSS Licenses (Apache, BSD, PL, LGPL), copyrights and copy lefts, Patent.

UNIT - V

Open Source Ethics: Open Source Vs. Closed Source, Open Source Government, Ethics of Open Source, Social and Financial Impact of Open Source Technology, Shared Software, Shared Source, Open Source as a Business Strategy.

Text Books:
1. Kailash Vadera, Bhavyesh Gandhi, "Open Source Technology", University Science Press, 1st Edition, 2009.
2. Fadi P. Deek and James A. M. McHugh, "Open Source Technology and Policy", Cambridge University Press, 2008

Suggested Reading:
1. Wale Soyinka, "Linux Administration- A beginner's Guide", Tata McGraw Hills, 2009
2. Andrew M. St. Laurent, "Understanding Open Source and Free Software Licensing", O'Reilly Media, 2004.
3. Dan Woods, Gautam Guliani, "Open Source for the Enterprise", O'Reilly Media, 2005.
4. Bernard Golden, "Succeeding with Open Source", Addison-Wesley Professional,2004.
5. Clay Shirky and Michael Cusumano, "Perspectives on Free and Open Source Software", MIT press, 2005.

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16CSC 35 DISTRIBUTED AND CLOUD COMPUTING

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The main objectives of this course are:

1. To present the principles underlying the function of distributed computing
2. To understand key mechanisms of remote execution
3. To impart the fundamentals and essentials of Cloud Computing.
4. To enable students explore cloud computing driven real time systems

Course Outcomes: On successful of this course student will be able to:

1. Understand the characteristics and models in distributed computing.
2. Define Cloud Computing and related concepts and describe the characteristics, advantages, risks and challenges associated with cloud computing.
3. Explain and characterize various cloud services and deployment models, virtualization techniques.
4. Illustrate the concepts of cloud storage and demonstrate their use.
5. Analyze various cloud programming models and apply them to solve problems

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	3	1	2	1	-	-	-	-	-	-	-	-
2	3	3	2	1	1	1	-	-	-	-	-	-	-	-
3	3	2	3	2	1	1	-	-	-	-	-	-	-	-
4	3	3	2	1	1	1	-	-	-	-	-	-	-	-
5	3	3	3	2	1	1	-	-	-	-	-	-	-	-

UNIT - I

Characterization of Distributed Systems: Introduction, Examples of distributed systems, Resource sharing and the web, Challenges, **System Models:** Introduction, Architectural models, Fundamental models, **Interprocess Communication:** Introduction, The API for the internet protocols, External data representation and marshalling, Client server communication, Group communication, Interprocess communication in UNIX

UNIT - II

Distributed objects and Remote Invocation: Introduction, Communication between distributed objects, Remote procedure call, Events and notifications, **Time and Global States:** Introduction, Clocks, events and process states, Synchronizing physical clocks, Logical time and logical clocks, Global states, distributed debugging, **Coordination and Agreement:** Introduction, Distributed mutual exclusion, Elections, Multicast communication, Consensus and related problems.

UNIT - III

Introduction to Cloud Computing: Scalable Computing Over the Internet, System Models for Distributed and Cloud Computing, Grid and Cloud, Layers and Types of Clouds, Desired Features of a Cloud, **Virtual Machines and Virtualization of Clusters and Data Centers:** Implementation Levels of Virtualization, Virtualization Structures/Tools and Mechanisms, Virtualization of CPU, Memory, and I/O Devices, Virtual Clusters and Resource Management, Virtualization for Data-Center Automation.

UNIT - IV

Cloud computing architecture over Virtualized Data Centers: Data-Center design and Interconnection networks, Architectural Design of Compute and Storage Clouds, Public Cloud Platforms, GAE, AWS, Azure, Inter-cloud Resource Management.

UNIT - V

Cloud Programming and Software Environments: Features of Cloud and Grid Platforms, Parallel and distributed Programming Paradigms, Programming Support of Google App Engine, Programming on Amazon AWS and Microsoft Azure, Emerging Cloud Software Environments, **Common Standards in Cloud Computing:** The Open Cloud Consortium, the Distributed Management Task Force, Standards for Messaging, Internet Messaging Access Protocol (IMAP)

Text Books:

1. Colouris, Dollimore, Kindberg, “Distributed Systems concepts and Design”,5th Ed. Pearson Education, 2016.
2. Kai Hwang. Geoffrey C.Fox, Jack J. Dongarra, “Distributed and Cloud Computing From Parallel Processing to the Internet of Things”, Elsevier, 2012.

Suggested Readings:

1. Sunita Mahajan and Seema Shah,"Distributed Computing", Oxford University Press, 2013.
2. S.Ghosh, Chapman and Hall/CRC, ”Distributed Systems”, Taylor & Francis Group, 2010.
3. Pradeep K.Sinha, “Distributed Operating Systems Concepts and Design”, PHI,
4. Andrew S. Tanenbaum, Van Steen, “Distributed Systems”, Pearson Education, 2002.

16CSC 36 **MACHINE LEARNING**

Instruction	4 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	4

Pre-requisites: Linear Algebra and Probability theory basics

Course Objectives: The main objectives of this course are:
1. Understand the need and elements of Machine Learning
2. Study various machine learning techniques
3. Design solutions for real world problems using machine learning techniques

Course Outcomes: On successful of this course **s**tudent will be able to:
1. Define the basic concepts related to Machine Learning
2. Recognize the underlying mathematical relationships within and across Machine Learning algorithms and their paradigms
3. Determine the various applications of machine learning
4. Model the problems using various machine learning techniques
5. Design and develop solutions to real world problems using Machine Learning Algorithms
6. Evaluate and interpret the results of the various machine learning techniques

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	1	3	-	-	-	-	-	-	-	3	3	2
2	3	3	1	3	-	-	-	-	-	-	-	3	3	2
3	3	3	1	3	-	-	-	-	-	-	-	3	3	2
4	3	3	1	3	-	-	-	-	-	-	-	3	3	2
5	3	3	1	3	3	-	-	-	-	-	-	3	3	2
6	3	3	1	3	3	-	-	-	-	-	-	3	3	2

UNIT - I

Introduction to Machine Learning: Introduction, Classic and Adaptive machines, learning types, deep learning, bio-inspired adaptive systems, Machine Learning and big data; **Elements of Machine Learning:** Data formats, Learnability, Statistical learning concepts, Class balancing, Elements of Information theory

UNIT - II

Feature Selection and Feature Engineering: Data sets, Creating training and test sets, managing categorical data, missing features, data scaling and normalization, Withering, Feature selection and filtering, PCA, Visualization of high-dimensional datasets; **Regression Algorithms**: Linear models for regression, Regression types, **Linear Classification Algorithms:** Linear classification, logistic regression, grid search, classification metrics, ROC curve

UNIT - III

Naïve Bayes and Discriminant Analysis: Bayes theorem, Naïve Bayes classifiers, Discriminant analysis; **Support Vector Machines**: Linear SVM, Kernel-based classification; **Decision Trees and Ensemble Learning**: Binary Decision trees, Introduction to Ensemble Learning-Random Forests, AdaBoost, Gradient Tree Boosting, Voting classifier

UNIT - IV

Clustering Fundamentals: Basics, k-NN, Gaussian mixture, K-means, Evaluation methods, DBSCAN, Spectral Clustering, Hierarchical Clustering; **Introduction to Neural Networks**: Introduction to deep learning, MLPs with Keras, deep learning model layers, introduction to Tensorflow

UNIT - V

Machine Learning Architectures: Data collection, Normalization and regularization, Dimensionality reduction, Data augmentation, Modeling/Grid Search/Cross-validation, Visualization, GPU support, introduction to distributed architectures, Scikit-learn tools for ML architectures, pipelines, Feature unions

Text Books:

1. Giuseppe Bonaccorso, “Machine Learning Algorithms”, 2nd Edition, Packt, 2018,
2. Tom Mitchel “Machine Learning”, Tata McGraW Hill, 2017

Suggested Reading:

1. Abhishek Vijavargia “Machine Learning using Python”, BPB Publications, 1st Edition, 2018
2. Reema Thareja “Python Programming”, Oxford Press, 2017
3. Yuxi Liu, “Python Machine Learning by Example”, 2nd Edition, PACT, 2017

Online Resources:

1. https://www.guru99.com/machine-learning-tutorial.htm
2. https://www.tutorialspoint.com/machine_learning_with_python/index.htm
3. https://www.geeksforgeeks.org/machine-learning/

Professor and Head Department

16CSC 37 DATA SCIENCE AND BIG DATA ANALYTICS LAB

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	2

Course Objectives: The main objectives of this course are:
1. To introduce practical exposure on basic data science techniques.
2. To develop the skills in using data science tools for solving data intensive problems.
3. To explore the fundamental concepts of big data analytics.

Course Outcomes: On successful of this course student will be able to:
1. Implement and apply data science algorithms to solve problems
2. Implement various the exploratory data analysis techniques to understand the data.
3. Work with big data platform and explore the big data analytics techniques business applications.
4. Design efficient algorithms for analyzing the data from large volumes.
5. Analyze the HADOOP and Map Reduce technologies associated with big data analytics.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	1	2	2	2	1	-	-	2	1	1	2	1	2
2	3	1	2	2	2	1	-	-	2	1	1	2	1	2
3	3	1	1	-	-	2	-	-	-	-	-	1	-	-
4	3	3	2	2	3	-	-	-	-	-	1	2	3	3
5	3	3	2	2	3	-	-	-	-	-	1	2	3	3

List of Experiments:
1. Identification and Installation of required softwares/Technologies (Python/modules)
2. Important modules for statistical methods: Numpy, Scipy, Pandas etc.
3. Demonstration of Inferential Statistics-sampling, Hypothesis testing-Z/t tests
4. Demonstration of statistical methods Anova, Correlation and Chi-square
5. Important modules for Machine Learning: (ScikitLearn, Statsmodels, SciPy, NLTK etc.)
6. Demonstration of Sentiment analysis using NLTK
7. Time Series Forecasting with ARIMA model
8. Installation of Big data technologies and building a Hadoop cluster
9. Experiment for data loading from local machine to Hadoop
10. Demonstration of Map Reduce concept
11. Experiment for loading data from RDBMS to HDFS by using SQOOP
12. Demonstration of developing and handling a NOSQL database with HBase

Text Books:
1. Tom White, “Hadoop: The Definitive Guide: Storage and Analysis at Internet Scale”, 4th Edition, O'Reilly Publications, 2015.
2. Samir Madhavan, “Mastering Python for Data Science”, Packt Publishing, 2015.
3. Seema Acharya, Subhasinin Chellappan, “Big Data and Analytics”, Wiley publications.
4. Big Data, Black Book TM , Dream Tech Press, 2015 Edition

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16CSC 38 MACHINE LEARNING LAB

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	2

Course Objectives: The main objectives of this course are:

1. Make use of Data sets in implementing the machine learning algorithms.
2. Implement the machine learning concepts and algorithms in any suitable language of choice.
3. Make use of real world data to implement machine learning models.

Course Outcomes: On Successful completion of this course, student will be able to:

1. Understand complexity of Machine Learning algorithms and their limitations.
2. Identify and understand modern tools that are useful in data analysis
3. Implement analyze Machine Learning algorithms
4. Use Keras and Tensorflow packages to implement the solutions
5. Design and develop solutions to real world problems using ML techniques
6. Evaluate and interpret the results of the various machine learning techniques

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	-	2	-	-	-	-	-	-	-	1	2	2
2	3	2	-	3	2	-	-	-	-	-	-	2	2	2
3	3	3	1	3	2	-	-	-	-	-	-	2	3	3
4	3	3	1	3	3	-	-	-	-	-	-	2	3	3
5	3	3	1	3	3	-	-	-	-	-	-	2	3	3
6	3	3	3	3	3	-	-	-	-	-	-	2	3	3

LIST OF EXPERIMENTS:

1. Identification and Installation of python environment towards the machine learning, installing python modules/Packages Import Scikitlearn, Keras and Tensorflows etc.
2. Demonstration of decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a News sample.
3. Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate datasets.
4. Demonstration of Naïve Bayesian classifier for a sample training data set stored as a .CSV file. Calculate the accuracy, precision, and recall for your dataset.
5. Demonstration of Bayesian network by considering standard dataset, by using Java/Python ML library classes/API.
6. Demonstration of Clustering algorithms - k-Means, K-Nearest Neighbor a, Agglomerative and DBSCAN to classify for the standard datasets. Print both correct and wrong predictions using Java/Python ML library classes can be used for this problem.
7. Experiment the non-parametric locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graph
8. Demonstration of SVM and use for character recognition task..
9. Build the decision tree classifier compare its performance with ensemble techniques like random forest. Demonstrate it with different decision trees.
10. Experiments on mobile Robots
11. Line, path following
12. Autonomous distance traversing
13. Autonomous distance traversing using GPS
14. Miniature self-driving car using machine learning

Text Books:

1. Giuseppe Bonaccorso, “Machine Learning Algorithms”, 2017, Packt Publishing.

16CSC 39 **PROJECT SEMINARS**

Instruction	3 Hours per week
CIE	50 Marks
Credits	2

The objective of 'Project Seminar' is to enable the student take up investigative study in the broad field of Engineering / Technology, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on an individual basis or two/three students in a group, under the guidance of a supervisor. This is expected to provide a good initiation for the student(s) towards R&D. The work shall include:

Course Outcomes:

1. Survey and study of published literature on the assigned topic;
2. Working out a preliminary Approach to the Problem relating to the assigned topic;
3. Conducting preliminary Analysis/Modeling/Simulation/Experiment/Design/Feasibility;
4. Preparing a Written Report on the Study conducted for Presentation to the Department;
5. Final Seminar, as oral Presentation before a Department Review Committee.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	--	--	--	2	--	--	--	--	--	2	2	2
2	2	--	--	--	--	2	--	--	--	--	--	2	3	3
3	2	--	--	--	--	--	--	2	--	2	--	--	--	--
4	--	--	--	--	1	--	--	2	--	3	--	--	--	--
5	--	--	--	--	1	--	--	2	--	3	--	--	--	--

Guidelines for the award of Marks: (**Max. Marks: 50**)

Evaluation by	Max. Marks	Evaluation Criteria / Parameter
Supervisor	20	Project Status / Review
	5	Report
Department Review Committee	5	Relevance of the Topic
	5	PPT Preparation
	5	Presentation
	5	Question and Answers
	5	Report Preparation

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16CSE 10 **DEEP LEARNING (ELECTIVE-IV)**

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The main objectives of this course are:
1. To learn Deep learning techniques and their applications.
2. To acquire the knowledge of neural network architectures, Deep learning methods and algorithms.
3. To understand CNN and RNN algorithms and their applications.

Course Outcomes: On successful of this course **s**tudent will be able to:
1. Understand various learning models.
2. Design and develop various Neural Network Architectures.
3. Understand approximate reasoning using Convolution Neural Networks.
4. Analyze and design Deep learning algorithms in different applications.
5. Ability to apply CNN and RNN techniques to solve different applications.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	1	1	-	-	-	-	-	-	1	-	-	-	-
2	1	1	2	2	2	-	-	-	-	-	-	-	2	3
3	3	1	1	2	-	-	-	-	-	1	-	-	2	2
4	-	2	1	-	-	-	-	-	-	1	-	1	3	3
5	1	2	1	-	-	-	-	-	-	-	-	1	2	2

UNIT - I

Introduction: Historical Trends in Deep Learning, McCulloch Pitts Neuron, Thresholding Logic, Perceptrons, Perceptron Learning Algorithm. Representation Power of MLPs, Sigmoid Neurons, Gradient Descent, Feed forward Neural Networks, Representation Power of Feed forward Neural Networks

UNIT - II

Feed Forward Neural Networks, Back propagation, Gradient Descent (GD), Momentum Based GD, Nesterov Accelerated GD, Stochastic GD, AdaGrad, RMS Prop, Adam, Eigenvalues and eigenvectors, Eigenvalue Decomposition, Basis Principal Component Analysis and its interpretations, Singular Value Decomposition

UNIT - III

Auto encoders : relation to PCA, Regularization in auto encoders, Denoising auto encoders, Sparse auto encoders, Contractive auto encoders, **Regularization:** Bias Variance Tradeoff, L2 regularization, Early stopping, Dataset augmentation, Parameter sharing and tying, Injecting noise at input, Ensemble methods, Dropout, Greedy Layer wise Pre-training, Better activation functions, Better weight initialization methods, Batch Normalization

UNIT - IV

Convolutional Neural Network: The Convolution Operation, Motivation, Pooling, Convolution and Pooling as an Infinitely Strong Prior, Variants of the Basic Convolution Function, Structured Outputs, Data Types. LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet, Visualizing Convolutional Neural Networks, Guided Back propagation, Deep Dream, Deep Art, Fooling Convolutional Neural Networks

UNIT – V

Recurrent Neural Networks, Back propagation through time (BPTT), Vanishing and Exploding Gradients, Truncated BPTT, GRU, LSTMs, Encoder Decoder Models, Attention Mechanism, Attention over images

Text Books:
1. Goodfellow. I., Bengio. Y. and Courville. A., “Deep Learning”, MIT Press, 2016.

Suggested Reading:
1. Tom M. Mitchell, "Machine Learning", MacGraw Hill, 1997.
2. Stephen Marsland, "Machine Learning - An Algorithmic Perspective ", CRC Press, 2009.
3. LiMin Fu, “Neural Networks in Computer Intelligence”, McGraw-Hill edition, 1994.

Online Resources:
1. https://onlinecourses.nptel.ac.in/noc18_cs41/

16CSE 11 DESIGN PATTERNS (ELECTIVE-IV)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The main objectives of this course are:
1. To understand the fundamental concepts of C++ and the design patterns,
2. User interfaces, standards of designing a document editor.
3. To understand the Structural Patterns, and the Behavioral pattern.
4. To learn about the dynamics of the design patterns.

Course Outcomes: On successful of this course **s**tudent will be able to:
1. Apply formal notations of C++, design and develop pattern of user choice and accomplish UI and design an efficient editor.
2. Determine the prototypes, abstract factory to design and develop catalog pattern.
3. Apply the behavioral modeling principles design the behavioral pattern for a system.
4. Use design patterns for real world situations.
5. List consequences of applying each pattern.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	3	3	3	2	2	3	3	3	3	3	2	3
2	3	3	3	3	3	2	2	2	2	3	3	3	2	2
3	3	2	3	3	2	2	3	3	3	3	3	3	3	3
4	3	3	3	3	3	3	2	3	3	2	3	3	3	3
5	3	2	2	2	2	3	2	3	3	2	3	3	2	2

UNIT - I

Review of Formal Notations and Foundation Classes in C++: Class Diagram, Object Diagram, Interaction Diagram Examples, List, Iterator, List Iterator, Point, Rect, Coding in C++. **Introduction to Design Patterns:** Design Pattern Definition, Design Patterns in Small Talk MVC, Describing Design Patterns, Catalog of Design Patterns, Organizing The Catalog, Solving of Design Problems Using Design Patterns, Selection of A Design Pattern, Use of Design Patterns.

UNIT - II

Designing a Document Editor: A Case Study: Design Problems, Document Structure, Formatting, Embellishing the User Interface, Supporting Multiple Look and Feel Standards, Supporting Multiple Window Systems, User Operations, Spelling Checking and Hyphenation.

UNIT - III

Design Patterns Catalog: Creational Patterns, Abstract Factory, Builder, Factory Method, Prototype, Singleton, Discussion of Creational Patterns.

Structural Patterns-1: Adapter, Bridge, Composite, Decorator. Structural Patterns-2 and Behavioral Patterns-1: Structural Patterns: Façade, Flyweight, Proxy, Discuss of Structural Patterns.

UNIT - IV

Behavioral Patterns: Chain of Responsibility Command, Interpreter. **Behavioral Patterns-2:**Iterator, Mediator, Observer, State, Strategy, Template Method, Visitor, Discussion of Behavioral Patterns.

UNIT - V

Behavioral Patterns-3: State, Strategy, Template Method, Visitor, Discussion of Behavioral Patterns, Expectations from Design Patterns.

Text Books:
1. Gamma, Belm, Johnson, “Design Patterns: Elements of Reusable Object Oriented Software”, 1995, Pearson Education ISBN:10:0201633612.
2. Eric Freeman, “Head First Design Patterns”, Oreilly-SPD,ISBN:10:0596007124.

Suggested Reading:
1. Cooper, “Java Design Patterns”, Pearson Education, ISBN:6201-48539-7.
2. Horstmann, “Object Oriented Design and Patterns”, Wiley, ISBN:10:0471744875.

Online Resources:
1. shop.oreilly.com/product/9780596007126.do
2. ww.amazon.com/Design-Patterns-Elements.../dp/0201633612

16CSE 12 NATURE INSPIRED ALGORITHM (ELECTIVE-IV)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Prerequisites: Design and Analysis of Algorithms

Course Objectives: The main objectives of this course are:
1. Understand the fundamentals of nature inspired techniques which influence computing
2. Study the Swarm Intelligence and Immuno computing techniques
3. Familiarize the DNA Computing

Course Outcomes: On successful of this course student will be able to:
1. Understand The basics Natural systems
2. Learn the concepts of Natural systems and its applications
3. Understand different basic Natural systems functions(operations)
4. Understand Natural design considerations
5. Apply to real world problems

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	-	-	-	-	-	-	-	-	-	-	-	-	-
2	2	-	-	-	-	-	-	-	-	-	-	-	-	-
3	2	-	3	-	-	-	-	-	-	--	-	-	-	-
4	-	3	3	-	-	-	-	-	-	-	-	-	2	-
5	-	3	2	-	-	-	-	-	-	-	--	-	2	-

UNIT - I

Introduction: From Nature to Nature Computing , Philosophy , Three Branches: A Brief Overview, Individuals, Entities and agents - Parallelism and Distributivity Interactivity ,Adaptation- Feedback-Self-Organization-Complexity, Emergence and ,Bottom-up Vs Top-Down- Determination, Chaos and Fractals.

UNIT - II

Computing Inspired by Nature: Evolutionary Computing, Hill Climbing and Simulated Annealing, Darwin's Dangerous Idea, Genetics Principles, Standard Evolutionary Algorithm -Genetic Algorithms , Reproduction-Crossover, Mutation, Evolutionary Programming, Genetic Programming

UNIT - III

Swarm Intelligence: Introduction - Ant Colonies, Ant Foraging Behavior, Ant Colony Optimization, SACO and scope of ACO algorithms, Ant Colony Algorithm (ACA), Swarm Robotics, Foraging for food, Social Adaptation of Knowledge, Particle Swarm Optimization (PSO)

UNIT - IV

Immuno computing: Introduction- Immune System, Physiology and main components, Pattern Recognition and Binding , Immune Network Theory- Danger Theory, Evaluation Interaction- Immune Algorithms , Introduction – Genetic algorithms , Bone Marrow Models , Forest's Algorithm**,** Artificial Immune Networks

UNIT - V

Computing With New Natural Materials: DNA Computing: Motivation, DNA Molecule , Adleman's experiment , Test tube programming language, Universal DNA Computers, PAM Model , Splicing Systems , Lipton's Solution to SAT Problem , Scope of DNA Computing, From Classical to DNA Computing

Text Books:

1. Leandro Nunes de Castro, “Fundamentals of Natural Computing, Basic Concepts, Algorithms and Applications”, Chapman & Hall/ CRC, Taylor and Francis Group, 2007
2. Floreano D. and Mattiussi C., “Bio-Inspired Artificial Intelligence: Theories, Methods, and Technologies”, MIT Press, Cambridge, MA, 2008

Suggested Reading:

1. Albert Y.Zomaya, “Handbook of Nature-Inspired and Innovative Computing”, Springer, 2006.
2. Marco Dorrigo, Thomas Stutzle, “Ant Colony Optimization”, PHI,2005

16CSE 13 SYSTEM AND NETWORK ADMINISTRATION (ELECTIVE-IV)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Operating System Concepts, Computer networking basics

Course Objectives: The main objectives of this course are:

1. Understand the basic operation of system and networking.
2. Familiarize the students with system and network administration.
3. Analyze the system and network performance, issues.

Course Outcomes: On successful of this course **s**tudent will be able to:

1. Understand the basics of systems administration and networking.
2. Identify and apply various system network administration tools/commands.
3. Configure various services like mail, ftp, web hosting, security.
4. Analyze various system and network performance and issues.
5. Troubleshoot various system and network services.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	2	2	1	1	-	-	1	2	1	2	3	2
2	3	3	3	3	3	2	1	-	2	2	2	3	3	3
3	2	2	2	2	3	1	1	-	2	2	1	2	2	2
4	2	3	3	2	2	1	1	-	1	3	2	2	3	2
5	2	3	2	3	2	-	-	-	1	2	1	2	2	1

UNIT - I

Networking Overview: Protocol standards, Reference Models (ISO-OSI, TCP/IP), Networking basics of Windows and Linux, switching and routing basics

Server Administration Basics: Server and Client Installation, boot process and startup Services: Xinetd, Managing user and group accounts, File Systems and Quota Management , Job Scheduling with *cron*, *crontab*, *anacron* and system log analysis, Process controlling and management, online server updation process.

UNIT - II

Network Configuration Basics: IPv4 and IPv6 addressing, Network Interface Configuration, Diagnosing Network startup issues, Linux and Microsoft, Firewall configuration, Network troubleshooting commands

Dynamic Host Configuration Protocol (DHCP), DHCP Principle, DHCP Server Configuration, DHCP Options, Scope, Reservation and Relaying and troubleshooting

UNIT - III

Name Server and Configuration: DNS principles and Operations, Basic Name Server and Client Configuration, Caching Only name server, Primary and Slave Name Server, DNS Zone Transfers, dynamic updates, delegation, DNS Server Security, Troubleshooting

Web and Proxy Server Configuration: HTTP Server Configuration Basics, Virtual Hosting, HTTP Caching, Proxy Caching Server Configuration, Proxy ACL, Proxy-Authentication Mechanisms, Troubleshooting

UNIT - IV

FTP, File and Print Server: General Samba Configuration, SAMBA SWAT, NFS and NFS Client Configuration, CUPS configuration basics, FTP Principles, Anonymous FTP Server, Troubleshooting

Mail Server basics: SMTP, POP and IMAP principles, SMTP Relaying Principles, Mail Domain Administration, Basic Mail Server Configuration, SPAM control and Filtering

UNIT - V

Remote Administration and Management: Router Configuration, webmin/usermin, Team Viewer, Telnet, SSH, SCP, Rsync

Text Books

1. Thomas A. Limoncelli, Christina J. Hogan , Strata R. Chalup,"The Practice of System and Network Administration", Second Edition, 2007
2. Roderick W. Smith, "Advanced Linux Networking", Addison-Wesley Professional (Pearson Education), 2002.
3. Tony Bautts, Terry Dawson, Gregor N. Purdy, "Linux Network Administrator's Guide", O'Reilly, Third Edition, 2005

Online Resources:

1. https://nptel.ac.in/courses/106106157/25
2. https://onlinecourses.nptel.ac.in/noc17_ee15/preview

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16CEO 02 DISASTER MITIGATION AND MANAGEMENTELECTIVE-V (OE1)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The main objectives of this course are

1. To equip the students with the basic knowledge of hazards, disasters, risks and vulnerabilities including natural, climatic and human induced factors and associated impacts.
2. To impart knowledge in students about the nature, causes, consequences and mitigation measures of the various natural disasters.
3. To enable the students to understand risks, vulnerabilities and human errors associated with human induced disasters.
4. To enable the students to understand and assimilate the impacts of any disaster on the affected area depending on its position/ location, environmental conditions, demographic, etc.
5. To equip the students with the knowledge of the chronological phases in a disaster management cycle and to create awareness about the disaster management framework and legislations in the context of national and global conventions.

Course Outcomes: On Successful completion of this course, student will be able to

1. Analyze and critically examine existing programs in disaster management regarding vulnerability, risk and capacity at different levels.
2. Understand and choose the appropriate activities and tools and set up priorities to build a coherent and adapted disaster management plan.
3. Understand various mechanisms and consequences of human induced disasters for the participatory role of engineers in disaster management.
4. Understand the impact on various elements affected by the disaster and to suggest and apply appropriate measures for the same.
5. Develop an awareness of the chronological phases of disaster preparedness, response and relief operations for formulating effective disaster management plans and ability to understand various participatory approaches/strategies and their application in disaster management.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1	2	2	2	2	1	2	2	2	1	1	
2	1	1	2	2	2	3	3	1	2	1	1	1		2
3	2	2	2	2	2	2	3	2	1	1	2	1	1	
4	2	2	2	2	3	2	1	1	1	1	1	1		2
5	2	1	2	1	2	3	1	2	2	2	2	1	2	

UNIT - I

Introduction: Basic definitions- Hazard, Disaster, Vulnerability, Risk, Resilience, Mitigation, Management; classification of types of disaster- Natural and man-made; International Decade for natural disaster reduction (IDNDR); International strategy for disaster reduction (ISDR), National disaster management authority (NDMA).

UNIT - II

Natural Disasters: Hydro meteorological disasters: Causes, Early warning systems- monitoring and management, structural and non-structural measures for floods, drought and Tropical cyclones; Geographical based disasters: Tsunami generation, causes, zoning, Early warning systems- monitoring and management, structural and non-structural mitigation measures for earthquakes, tsunami, landslides, avalanches and forest fires. Case studies related to various hydro meteorological and geographical based disasters.

UNIT - III

Human induced hazards: Chemical disaster- Causes, impacts and mitigation measures for chemical accidents, Risks and control measures in a chemical industry, chemical disaster management; Case studies related to various chemical industrial hazards eg: Bhopal gas tragedy; Management of chemical terrorism disasters and biological disasters; Radiological Emergencies and case studies; Case studies related to major power break downs, fire accidents, traffic accidents, oil spills and stampedes, disasters due to double cellar construction in multi-storied buildings.

UNIT - IV

Disaster Impacts: Disaster impacts- environmental, physical, social, ecological, economical, political, etc.; health, psycho-social issues; demographic aspects- gender, age, special needs; hazard locations; global and national disaster trends; climate change and urban disasters.

UNIT - V

Concept of Disaster Management: Disaster management cycle – its phases; prevention, mitigation, preparedness, relief and recovery; risk analysis, vulnerability and capacity assessment; Post-disaster environmental response- water, sanitation, food safety, waste management, disease control; Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR programmes in India and the activities of National Disaster Management Authority.

Text Books:

1. Pradeep Sahni, "Disaster Risk Reduction in South Asia", Prentice Hall, 2003.
2. B. K. Singh, "Handbook of Disaster Management: techniques & Guidelines", Rajat Publication, 2008.

Suggested Reading:

1. Ministry of Home Affairs. Government of India, "National disaster management plan, Part I and II".
2. K. K. Ghosh," Disaster Management", APH Publishing Corporation, 2006.
3. Hazards, Disasters and your community: A booklet for students and the community, Ministry of home affairs.

Online Resources:

1. http://www.indiaenvironmentportal.org.in/files/file/disaster_management_india1.pdf
2. http://www.ndmindia.nic.in/ (National Disaster management in India, Ministry of Home Affairs)

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16MEO 01 **ENTREPRENEURSHIPELECTIVE-V (OE1)**

Instruction	3Hours per week
Duration of Semester End Examination	3Hours
Semester End Examination	70 Marks
CIE	30Marks
Credits	3

Course Objectives: The main objectives of this course are:

1. The environment of industry and related opportunities and challenges
2. Concept and procedure of idea generation
3. Elements of business plan and its procedure
4. Project management and its techniques
5. Behavioral issues and Time management

Course Outcomes: On Successful completion of this course, student will be able to

1. Identify opportunities and deciding nature of industry
2. Brainstorm ideas for new and innovative products or services
3. Analyze the feasibility of a new business plan and preparation of Business plan
4. Use project management techniques like PERT and CPM
5. Analyze behavioural aspects and use time management matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1	1	2	1	2	2	2	2	2	2	2	1
2	2	2	2	2	2	2	-	1	2	2	2	1
3	2	2	2	2	2	2	1	1	2	2	2	1
4	3	3	1	2	2	-	-	-	1	1	3	2
5	1	1	1	1	2	-	1	1	1	1	2	2

UNIT - I

Indian Industrial Environment: Competence, Opportunities and Challenges, Entrepreneurship and Economic growth, Small Scale Industry in India, Objectives, Linkage among small, medium and heavy industries, Types of enterprises, Corporate Social Responsibility.

UNIT - II

Identification and Characteristics of Entrepreneurs: First generation entrepreneurs, environmental influence and women entrepreneurs, Conception and evaluation of ideas and their sources, Selection of Technology, Collaborative interaction for Technology development.

UNIT - III

Business Plan: Introduction, Elements of Business Plan and its salient features, Technical Analysis, Profitability and Financial Analysis, Marketing Analysis, Feasibility studies, Executive Summary.

UNIT - IV

Project Management: During construction phase, project organization, project planning and control using CPM, PERT techniques, Human aspects of project management, Assessment of tax burden

UNIT - V

Behavioral Aspects of Entrepreneurs: Personality, determinants, attributes and models, Leadership concepts and models, Values and attitudes, Motivation aspects, Change behavior

Time Management: Approaches of time management, their strengths and weaknesses. Time management matrix and the urgency addiction

Text Books:

1. Vasant Desai, "Dynamics of Entrepreneurial Development and Management", Himalaya Publishing House, 1997.
2. Prasanna Chandra, "Project-Planning, Analysis, Selection, Implementation and Review", Tata Mcgraw-Hill Publishing Company Ltd. 1995.
3. S.S. Khanka, "Entrepreneurial Development", S. Chand & Co. Pvt. Ltd., New Delhi

Suggested Reading:

1. Robert D. Hisrich, Michael P. Peters, "Entrepreneurship", 5/e, Tata Me Graw Hill Publishing Company Ltd., 2005.
2. Stephen R. Covey and A. Roger Merrill, "First Things First", Simon and Schuster Publication, 1994.
3. Sudha G.S., "Organizational Behavior", National Publishing House, 1996.

16MEO 06 RESEARCH METHODOLOGIES ELECTIVE-V (OE1)

Instruction	3Hours per week
Duration of Semester End Examination	3Hours
Semester End Examination	70 Marks
CIE	30Marks
Credits	3

Course Objectives: The main objectives of this course are:
1. To make the students to formulate the research problem
2. To identify various sources for literature review and data collection.
3. To prepare the research design
4. To equip the students with good methods to analyze the collected data
5. To explain how to interpret the results and report writing

Course Outcomes: On successful of this course **s**tudent will be able to:
1. Define research problem
2. Review and asses the quality of literature from various sources.
3. Understand and develop various research designs.
4. Analyze problem by statistical techniques: ANOVA, F-test, Chi-square
5. Improve the style and format of writing a report for technical paper/ Journal report

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2	1	1	-	1	-	-	1	2	2	2	1	2
2	-	2	1	2	1	-	-	-	-	2	2	2	-	2
3	1	2	3	2	2	1	-	-	1	2	-	1	1	2
4	2	2	-	3	2	-	-	-	-	2	1	1	2	2
5	-	1	-	-	1	1	-	-	1	3	-	2	-	1

UNIT – I

Research Methodology: Objectives and Motivation of Research, Types of Research- Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, Conceptual vs. Empirical, Research Approaches, Significance of Research, Research Methods verses Methodology, Research process, Criteria of Good Research, Problems Encountered by Researchers in India, Technique involved in defining a problem.

UNIT–II

Literature Survey: Importance of Literature Survey, Sources of Information-primary, secondary, tertiary, Assessment of Quality of Journals and Articles, Information through Internet.

UNIT – III

Research Design: Meaning of Research Design, Need of Research Design, Feature of a Good Design Important Concepts Related to Research Design, Different Research Designs, Basic Principles of Experimental Design, Steps in sample design

UNIT – IV

Data Collection: Collection of primary data, Secondary data, Measures of central tendency-mean, mode, median, Measures of dispersion- Range, Mean deviation, Standard deviation, Measures of asymmetry (skewness), Important parametric tests -z, t, F, Chi-Square, ANOVA significance

UNIT – V

Research Report Writing: Format of the Research report, Synopsis, Dissertation, Thesis its Differentiation, References/Bibliography/Webliography, Technical paper writing/Journal report writing, making presentation, Use of visual aids. Research Proposal Preparation- Writing a Research Proposal and Research Report, Writing Research Grant Proposal.

Text Books:

1. C.R Kothari, “Research Methodology, Methods & Technique”, New Age International Publishers, 2004.
2. R. Ganesan, “Research Methodology for Engineers”, MJP Publishers, 2011

Suggested Reading:

1. Vijay Upagade and Aravind Shende, “Research Methodology”, S. Chand & Company Ltd., 2009
2. G. Nageswara Rao, “Research Methodology and Quantitative methods”, BS Publications, 2012.
3. Ratan Khananabis and Suvasis Saha, “Research Methodology”, Universities Press, Hyderabad, 2015

16EGO 02

GENDER SENSITIZATION
ELECTIVE-V (OE1)

Instruction	3Hours per week
Duration of Semester End Examination	3Hours
Semester End Examination	70 Marks
CIE	30Marks
Credits	3

Course Objectives: The main objectives of this course are:

1. To develop students' sensibility with regard to issues of gender in contemporary India.
2. To provide a critical perspective on the socialization of men and women.
3. To expose the students to debates on the politics and economics of work. To help students reflect critically on gender violence.

Course Outcomes: On successful of this course **s**tudent will be able to:

1. Develop a better understanding of important issues related to what gender is in contemporary India.
2. Be sensitized to basic dimensions of the biological, sociological, psychological and legal aspects of gender. This will be achieved through discussion of materials derived from research, facts, everyday life, literature, and film.
3. Attain a finer grasp of how gender discrimination works in our society and how to counter it. Students will acquire insight into the gendered division of labour and its relation to politics and economics.
4. Understand what constitutes sexual harassment and domestic violence and be made aware of New forums of Justice.
5. Draw solutions as to how men and women, students and professionals can be better equipped to work and live together as equals.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	-	-	-	-	-	1	-	1	-	-	-	1	1	-
2	-	-	-	-	-	-	-	1	1	1	-	1	1	-
3	-	-	-	-	-	1	-	1	1	1	-	1	1	-
4	-	-	-	-	-	1	-	1	1	1	-	1	1	-
5	-	-	-	-	-	1	-	1	1	1	-	1	1	-

UNIT – I

Understanding Gender: Gender: Why Should We Study It? (*Towards a World of Equals*: Unit -1) **Socialization:** Making Women, Making Men (*Towards a World of Equals*: Unit -2)
Introduction. Preparing for Womanhood. Growing up Male. First lessons in Caste. Different Masculinities.

UNIT – II

Gender and Biology: Missing Women: Sex Selection and Its Consequences (*Towards a World of Equals*: Unit -4) Declining Sex Ratio. Demographic Consequences. **Gender Spectrum:** Beyond the Binary (*Towards a World of Equals*: Unit -10) Two or Many? Struggles with Discrimination.

UNIT – III

Gender and Labour: Housework: the Invisible Labour (*Towards a World of Equals*: Unit -3) "My Mother doesn't Work." "Share the Load." **Women's Work**: Its Politics and Economics (*Towards a World of Equals*: Unit -7) Fact and Fiction. Unrecognized and Unaccounted work. Additional Reading: Wages and Conditions of Work.

UNIT-IV

Issues of Violence: Sexual Harassment: Say No! (*Towards a World of Equals*: Unit -6) Sexual Harassment, not Eve-teasing- Coping with Everyday Harassment- Further Reading: "*Chupulu*". **Domestic Violence:** Speaking Out (*Towards a World of Equals*: Unit -8) Is Home a Safe Place? -When Women Unite [Film]. Rebuilding Lives. Additional Reading: New Forums for Justice. Thinking about Sexual Violence (*Towards a World of Equals*: Unit -11) Blaming the Victim-"I Fought for my Life…." - Additional Reading: The Caste Face of Violence.

UNIT – V

Gender: Co – Existence : Just Relationships: Being Together as Equals (*Towards a World of Equals*: Unit -12) Mary Kom and Onler. Love and Acid just do not Mix. Love Letters. Mothers and Fathers. Additional Reading: Rosa Parks-The Brave Heart.

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Text Books:

1. Suneetha, Uma Bhrugubanda, DuggiralaVasanta, Rama Melkote,VasudhaNagaraj, AsmaRasheed, GoguShyamala, DeepaSreenivas and Susie Tharu "Towards a World of Equals: A Bilingual Textbook on Gender" published by Telugu Akademi, Hyderabad, Telangana State, 2015.

Suggested Reading:

1. Menon, Nivedita. Seeing like a Feminist. New Delhi: Zubaan-Penguin Books, 2012
2. Abdulali Sohaila. **"I Fought For My Life…and Won."** Available online at:
3. http://www.thealternative.in/lifestyle/i-fought-for-my-lifeand-won-sohaila-abdulal/

Online Resources:

1. https://aifs.gov.au/publications/gender-equality-and-violence-against-women/introduction
2. https://theconversation.com/achieving-gender-equality-in-india

Note: Since it is an Interdisciplinary Course, Resource Persons can be drawn from the fields of English Literature or Sociology or Political Science or any other qualified faculty who has expertise in this field from engineering departments.

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY(A)

SCHEME OF INSTRUCTION AND EXAMINATION
VIII-Semester of B.E under CBCS
COMPUTER SCIENCE AND ENGINEERING

SEMESTER-VIII

Sl.No	Syllabus Ref. No	SUBJECT	Scheme of Instruction		Scheme of Examination			Credits
			Periods per Week		Duration Credits of SEE in Hours	Maximum Marks		
			L/T	P/D		CIE	SEE	
THEORY								
1	16CSE XX	Elective-VI	3	-	3	30	70	3
2	16CSE XX	Elective-VII	3	-	3	30	70	3
3	6MT/ME/PY OXX	Elective-VIII	3	-	3	30	70	3
PRACTICALS								
7	16CSC 40	Seminar	-	3	3	50	-	2
8	16CSC 41	Project	-	6	3	50	100	6
		TOTAL	**9**	**9**		**190**	**310**	**17**

ELECTIVE-VI		ELECTIVE-VII	
16CSE 14	Cyber Security	16CSE 18	Bioinformatics
16CSE 15	Optimization Techniques	16CSE 19	Human Computer Interaction
16CSE 16	Natural Language Processing	16CSE 20	Social Networking and its Impact
16CSE 17	Virtual Reality	16CSE 21	Blockchain Technology

ELECTIVE-VIII (OE2)	
16MTO 04	Quantum Computing
16MEO 02	Robotics
16MEO 04	Intellectual Property Rights
16PYO 01	History of Science and Technology

L: Lecture T: Tutorial D: Drawing P: Practical
CIE - Continuous Internal Evaluation SEE - Semester End Examination

Assessment Procedure				
Course (in terms of credits)	**Continuous Internal Evaluation (Marks)**	**Semester end Examination (Marks)**	**Remarks**	**Duration of Semester End Examination**
Three(3)Credits/ Four(4)credits	30*	70**	Theory Course/ Engg . Graphics	3 Hours
Two(2) Credits	25	50	Lab Course/Workshop	3 Hours
One(1) Credit	15	35	Lab Course	2 Hours
One(1) Credit	50	-	Mini Project	-

* Out of 30 CIE, 10 marks are allotted for slip-tests (Three slip tests will be conducted, each of ten marks, and average of best two is considered) and the remaining 20 marks are based on the average of two tests, weightage for each test is 20 marks.

** The question paper will be in two parts, Part-A and Part-B. Part A is compulsory and contains short answer questions covering the entire syllabus, and carries 20 marks. Part-B carries 50 marks and covers all the units of the syllabus (student has to answer five out of seven questions).

Note: A course that has CIE but no SEE as per scheme is treated as PASS/FAIL for which pass marks are **50%** of CIE.

A candidate has earned the credits of a particular course, if he/she secures not less than the minimum marks/ grade as prescribed. Minimum pass marks in the SEE plus CIE shall be **40%** for theory courses/subjects and **50%** for lab courses /Mini Project// Project.

16CSC 40 **SEMINAR**

Instruction	3Hours per week
CIE	50 Marks
Credits	2

The goal of a seminar is to introduce students to critical reading, understanding, summarizing, explaining and preparing report on state of the art topics in a broad area of his/her specialization. Seminar topics may be chosen by the students with advice from the faculty members and the student shall read further relevant articles in the domain.

The seminar must be clearly structured and the power point presentation shall include following aspects:
1. Introduction to the field
2. Literature survey
3. Consolidation of available information
4. Summary and Conclusions
5. References

Course Outcomes: On successful of this course **s**tudent will be able to:

1. To study current emerging areas of professional interest.
2. To identify promising new directions of various cutting edge technologies
3. To analyze and make use of appropriate methodologies .
4. To pursue their interest in Computer Science & Engg., through design, research, theoretical and experimental approach.
5. To effectively use modern technologies for presentation before an evaluation committee
6. To acquire skills in preparing detailed report.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	2	2	2	1	-	-	-	-	-	-	3	3
2	2	2	2	2	2	1	-	-	-		-	-	2	3
3	2	2	1	2	2	-	-	-	-	-	-	-	2	2
4	2	2	2	2	2	-	-	-	-	-	-	-	3	3
5	2	2	2	2	3	1	-	-	3	2	-	-	3	3
6	2	2	2	2	2	1	-	-	2	3	-	-	-	-

Each student is required to:
1. Submit a one page synopsis of the seminar talk for display on the notice board.
2. Deliver the seminar for a maximum duration of 30 minutes, where the presentation should be for 20 minutes in PowerPoint, followed by Question and Answers session for 10 minutes.
3. Submit the detailed report of the seminar in spiral bound in a précised format as suggested by the department.
4. Seminars are to be scheduled from **3rd week to the last week** of the semester and any change in schedule shall be discouraged.
5. For the award of Sessional marks students are **judged by three (3) faculty** members and are based on oral and written presentations as well as their involvement in the discussions during the oral presentation.

Note: Topic of the seminar shall preferably be from any peer reviewed recent journal publications.

Guidelines for awarding marks		
SNo	Description	Max Marks
1.	Contents and relevance	10
2.	Presentation skills	10
3.	Preparation of PPT slides	05
4.	Questions and answers	05
5.	Report in a prescribed format	20

Professor and Head Department

16CSC 41 **PROJECT**

Instruction	6 Hours per week
CIE	50 Marks
SEE	100 Marks
Credits	6

The object of Project is to enable the student extend further the investigative study, either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry. This is expected to provide a good training for the student(s) in R&D work and technical leadership. The assignment to normally include:

1. In depth study of the topic assigned;
2. Review and finalization of the Approach to the Problem relating to the assigned topic;
3. Preparing an Action Plan for conducting the investigation, including team work;
4. Detailed Analysis/Modeling/Simulation/Design/Problem Solving/Experiment as needed;
5. Final development of product/process, testing, results, conclusions and future directions;
6. Preparing a paper for Conference presentation/ Publication in Journals, if possible;
7. Preparing a Dissertation in the standard format for being evaluated by the Department.
8. Final Seminar presentation before Department Review Committee.

Course Outcomes: By the end of course, students will be able to:

1. Demonstrate a sound technical knowledge of their selected topic
2. Design engineering solutions to complex problems utilizing a systematic approach
3. Conduct investigations by using research-based knowledge and methods to provide valid conclusions
4. Create/select/use modern tools for the modeling, prediction and understanding the limitation of complex engineering solutions
5. Communicate with engineers and the community at large in written and oral forms
6. Demonstrate the knowledge, skills and attitudes of a professional engineer

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	--	--	--	--	--	--	--	--	--	--	--	2	2
2	2	--	3	--	--	--	--	--	--	--	--	--	2	2
3	2	--	--	3	--	--	--	--	--	--	--	--	--	--
4	2	--	--	--	3	--	--	--	--	--	--	--	--	3
5	--	--	--	--	--	--	--	--	--	3	--	--	--	1
6	2	2	--	--	2	2	--	1	3	--	2	2	--	--

Guidelines for the award of marks in CIE: (Max. Marks: 50)

CIE (Continuous Internal Evaluation) Max. Marks: 50

Evaluation by	Max .Marks	luation Criteria / Parameter
Department Review Committee	05	Review 1
	08	Review 2
	12	Submission
Supervisor	05	Regularity and Punctuality
	05	Work Progress
	05	Quality of the work which may lead to publications
	05	Report Preparation
	05	Analytical / Programming / Experimental Skills

Guidelines for awarding marks in SEE: (Max. Marks: 100)

Max. Marks: 100

Evaluation by	Max .Marks	Evaluation Criteria / Parameter
External and Internal Examiners together	20	Power Point Presentation
	40	Thesis Evaluation
	20	Quality of the project • Innovations • Applications • Live Research Projects • Scope for future study • Application to society
	20	Viva-Voce

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16CSE 14 **` (ELECTIVE-VI)**

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Operating System, Computer Network, Cryptography.

Course Objectives: The objectives of this course are

1. To Identify and present indicators that a cybercrime has occurred and understand methods and tools used in cybercrimes.
2. To collect, Process, Analyze and Present Computer Forensics Evidence.
3. To understand the legal perspectives and Organizational implications of Cyber Security

Course Outcomes: On Successful completion of this course, student will be able to

1. Discuss different types of cybercrimes and analyze legal frameworks to deal with these cybercrimes.
2. Describe Tools used in cybercrimes and laws governing cyberspace.
3. Analyze and resolve cyber security issues.
4. Recognize the importance of digital evidence in prosecution.
5. Analyze the commercial activities in the event of significant information security incidents in the Organization.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	1	2	1	3	1	1	1	-	-	2	-	1
2	3	2	2	3	3	2	1	2	2	1	-	2	-	2
3	2	3	1	3	3	3	1	2	3	2	2	3	-	1
4	2	2	1	3	3	3	1	2	3	2	1	2	-	1
5	2	3	2	3	3	2	1	2	3	2	2	3	-	1

UNIT - I

Introduction to Cyber Crime: Cyber Crime: Definition and Origins of the Word, Cyber crime and Information Security, Classification of Cyber Crimes, Cyber Crime: The Legal Perspective, Cyber Crime: An Indian Perspective, A Global Perspective of Cyber Crime.

UNIT - II

Cyber Offenses: Introduction, How Criminals plan the Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector; **Tools and Methods Used in Cybercrime:** Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horse and Backdoors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Overflow.

UNIT - III

Cyber Security: The Legal Perspectives**:** Cyber Crime and the Legal Landscape around the World, Need of Cyber laws: the Indian Context, The Indian IT Act, Challenges to Indian Law and Cyber Crime Scenario in India, Digital Signatures and the Indian IT Act, Cyber Crime and Punishment, Cyber Law, Technology and Students: The Indian Scenario.

UNIT - IV

Understanding Cyber Forensics: Introduction ,Digital Forensics Science, Need for Computer Forensics, Cyber Forensics and Digital Evidence, Forensics Analysis of Email, Digital Forensics Life Cycle, Chain of Custody Concept, Network Forensics, Approaching a Cyber Forensics Investigation, Challenges in Computer Forensics.

UNIT - V

Cyber Security: Organizational Implications: Introduction, Cost of Cybercrimes and IPR issues, Web threats for Organizations, Security and Privacy Implications, Social media marketing: Security Risks and Perils for Organizations, Social Computing and the associated challenges for Organizations.

Text Books:

1. Sunit Belpre and Nina Godbole, "Cyber Security: Understanding Cyber Crimes, Computer Forensics And Legal Perspectives", Wiley India Pvt.Ltd, 2011.
2. Kevin Mandia, Chris Prosise, "Incident Response and computer forensics", Tata McGraw Hill, 2006.

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Suggested Reading:

1. Alfred Basta, Nadine Basta, Mary Brown, Ravinder Kumar, “Cyber Security and Cyber Laws”, Paperback – 2018.
2. Mark F Grady, Fransesco Parisi, “The Law and Economics of Cyber Security”, Cambridge university press, 2006.

Online Resources:

1. https://www.edx.org/learn/cybersecurity
2. https://www.coursera.org/courses?query=cyber%20security
3. https://swayam.gov.in/course/4002-cyber-law

16CSE 15 OPTIMIZATION TECHNIQUES (ELECTIVE-VI)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The main objectives of this course are:

1. To introduce fundamentals of Operation Research and Linear Programming
2. To impart knowledge on various methods to solve balanced & unbalanced transportation problems
3. To learn the working solutions of Sequencing Problems and Assignment Problems
4. To study the categories of Integer Programming Problems and Linear Programming Approach for Game Theory
5. To obtain familiarity on Construction of Network and obtaining of Critical Path

Course Outcomes: On successful of this course student will be able to:

1. Calculate the optimum values for given objective function by LPP
2. Solve the solution for maximise the profit with minimum cost by Transportation problem.
3. Determine the optimum feasible solution for sequencing the Jobs
4. Solve and analyze problems on Integer programming and other mathematical programming algorithms.
5. Learn how to deal with real world scenarios of Network analysis, Project Management, for their optimal solutions.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	2	-	-	-	-	1	-	-	2	-	2	-
2	2	2	2	-	-	-	-	1	-	-	2	-	2	-
3	2	2	2	-	-	-	-	-	-	-	2	-	2	-
4	2	2	2	-	-	-	-	-	-	-	-	-	2	-
5	2	2	2	-	-	-	-	2	1	1	-	-	2	-

UNIT - I

Operation Research: Introduction, Models, Areas of Application. Linear Programming (L.P.) - Mathematical Formulation of L.P. problem, Graphical Method, Simplex Method – Concept of slack, surplus & artificial variables, Manual solutions of LPP, Minimization & Maximization Problems, Special Cases – (i) Alternative optima (ii) Unbounded solutions & (iii) Infeasible solutions to be shown graphically & also by simplex method.

UNIT - II

Definition of the transportation model, Balanced / Unbalanced, Minimization / Maximization, Determination of the initial basic feasible solution using (i) North-West Corner Rule (ii) Least cost method & (iii) Vogel's approximation method for balanced & unbalanced transportation problems. Optimality Test & obtaining of optimal solution (Considering per unit transportation cost)

UNIT - III

Assignment model, Assignment Problem Formulation, Hungarian method for optimal solution, Solving unbalanced problem, Traveling salesman problem and assignment problem, Sequencing models, Solution of Sequencing Problem – Processing n Jobs through 2 Machines – Processing n Jobs through 3 Machines – Processing 2 Jobs through m machines – Processing n Jobs through m Machines.

UNIT - IV

Integer Programming Problem: Introduction, Types of Integer Programming Problems, Gomory's All-IPP Method, All IPP Algorithm, Branch and Bound Technique

Game Theory: Introduction, Game with Pure Strategies, Game with Mixed Strategies, Dominance Property, Graphical Method for 2 X n or m x 2 Games, Linear Programming Approach for Game Theory.

UNIT - V

Construction of Network – Rules & Precautions, C.P.M. & P.E.R.T. Networks, Obtaining of Critical Path, Time estimates for activities, Probability of completion of project, Determination of floats (total, free, independent & interfering)

Text Books:

1. Kanti Swarup, P. K. Gupta, Man Mohan, "Operations Research", Sultan Chand Publications.
2. R. Pannerselvam, "Operations Research", PHI

16CSE 16 NATURAL LANGUAGE PROCESSING (ELECTIVE-VI)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The main objectives of this course are:

1. To learn the fundamentals of natural language processing.
2. To understand the various Parsing techniques NLP.
3. To understand the role of semantics of sentences and pragmatics and apply the NLP techniques to IR applications.

Course Outcomes: On successful of this course student will be able to:

1. Define the basic concepts of grammars languages and applications of Natural Language processing --
2. Discuss about the language modelling techniques
3. Identify the basic words, parsers and various levels in processing of natural language.-
4. Explain the various semantics discourse and pragmatic levels of NLP
5. Analyze Natural language Generation and apply machine translation.
6. Implement levels of NLP system using the Components or lexical resources to demonstrate Morphology / syntax of a language.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	-	1	-	-	-	-	-	-	-	3		
2	3	2	1	2	3	-	-	-	-	-	-	1	1	3
3	3	2	1	1	-	-	-	-	-	-	-	1	-	-
4	3	3	1	2	-	-	-	-	-	-	-	1	-	-
5	3	2	1	2	2	-	-	-	-	-	-	2	-	-
6	3	3	1	2	-	-	-	-	-	-	-	2	-	-

UNIT - I

Overview and Language Modeling

Overview: Origins and challenges of NLP-Language and Grammar-Processing Indian Languages-NLP Applications-Information Retrieval. **Language Modeling:** Introduction-Various Grammar-based Language Models-Statistical Language Model.

UNIT - II

Word Level and Syntactic Analysis

Word Level Analysis: Introduction Morphological Parsing-Spelling Error Detection and correction-Words and Word classes-Part-of Speech Tagging. **Parsing:** Constituency Parsing - Probabilistic Parsing.

UNIT - III

Semantic Analysis and Discourse Processing

Semantic Analysis: Introduction- Meaning Representation-Lexical Semantics Ambiguity-Word Sense Disambiguation. **Discourse Processing:** Introduction- cohesion-Reference Resolution Discourse Coherence and Structure.

UNIT - IV

Natural Language Generation and Machine Translation

Natural Language Generation: Introduction-Architecture of NLG Systems Generation Tasks and Representations-Application of NLG. Problems in Machine Translation, Characteristics of Indian Languages-Machine Translation Approaches-Translation involving Indian Languages.

UNIT - V

Applications and Lexical Resources: Information Extraction, Automatic Text Categorization and Text Summarization, Question-Answering System. LEXICAL RESOURCES: Introduction - WordNet- FrameNet – Stemmers - POS Tagger, Research Corpora, NLTK.

Text Books:

1. Tanveer Siddiqui, U.S. Tiwary, “Natural Language Processing and Information Retrieval”, Oxford University Press, 2008.

Suggested Reading:

1. Daniel Jurafsky and James H Martin, “Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition”, Prentice Hall, 2nd Edition, 2008.
2. James Allen, Bejamin/cummings, “Natural Language Understanding”, 2nd edition, 1995.

16CSE 17 VIRTUAL REALITIES (ELECTIVE-VI)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The main objectives of this course are:
1. Provide detailed understanding of the concepts of Virtual Reality and applications
2. Understand geometric modeling and virtual environment
3. Prepare the students to develop Virtual Reality applications

Course Outcomes: On successful of this course **s**tudent will be able to:
1. Understand the fundamental concepts of Virtual Reality
2. Identify the applications of Virtual Reality
3. Know the virtual hardware and software
4. Familiarize with various VR technologies
5. Design and Develop Virtual Reality based applications

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	-	-	-	1	-	-	-	-	-	-	-	1	1
2	1	2	2	2	1	-	-	-	-	-	-	-	1	1
3	2	2	2	2	1	-	-	-	-	-	-	-	1	1
4	1	1	1	1	2	-	-	-	-	-	-	-	1	2
5	2	2	3	2	3	1	-	-	-	-	-	-	1	1

UNIT - I

Introduction to Virtual Reality- Introduction, Computer Graphics, real time computer graphics, flight simulation, virtual environment requirement, benefits of virtual reality, historical development of VR, scientific landmark; **3D Computer Graphics:** Introduction, virtual world space, positioning the virtual observer, perspective projection, human vision, stereo perspective projection, 3D clipping, color theory, simple 3D modeling, illumination models, reflection models, shading algorithms, radiosity, Hidden surface removal, realism0stereographic image

UNIT - II

Geometric Modeling: Introduction, 2d to 3D, 3D space curves, 3D boundary representation, **Geometric Transformations:** Introduction, frames of reference, modeling transformations, instances, picking, flying, scaling the VE, collision detection; **Generic VR system**: Introduction, virtual environment, computer environment, VR technology, Model of interaction, VR systems

UNIT - III

Virtual Environment: Introduction, dynamics of numbers, linear and non-linear interpolation, animation of objects, linear and non-linear translation, shape and object in between, free from deformation, particle system, **Physical Simulation:** Introduction, objects falling in a gravitational field, rotarotating wheels, elastic collisions, projectivities, simple pendulum, springs, flight dynamics of an aircraft

UNIT - IV

VR Hardware and Software: Human factors-eys, ear and somatic senses; **VR Hardware**: Introduction, sensor hardware, hed-coupled displays, acoustic hardware, integrated VR system; **VR Software:** Modeling virtual world, physical simulation, VR toolkits, introduction to VRML

UNIT - V

VR Applications: Engineering, Entertainment, Science, Training, **Future:** Virtual environment, modes of interaction

Text Books:
1. John Vince, "Virtual Reality Systems", Pearson Education Asia, 2007
2. Anad R., "Augmented and Virtual Reality", Khanna Publishing House, Delhi

Suggested Reading:
1. Adams, "Visualization of Virtual Reality", Tata McGraw Hill, 2000
2. Grigore C. Burdea, Philippe Coiffet, "Virtual Reality Technology", Wiley Inter Science, 2nd Edition, 2006
3. William R Sherman, Alan B Craig, "Understanding Virtual Reality: Interface, Applications and Design", Morgan Kaufman, 2008

Online Resources:
1. www.vresources.org
2. www.vrac.iastate.edu
3. www.w3.org/MarkUp/VRM

16CSE 18 **BIOINFORMATICS (ELECTIVE-VII)**

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The main objectives of this course are:

1. Understand the basic concepts, search and visualize information.
2. Learn various bioinformatics algorithms.
3. Understand various data mining and pattern matching techniques.

Course Outcomes: On successful of this course student will be able to:

1. Understand the basics concepts of Bioinformatics and its significance in Biological data analysis.
2. Represent biological information using various algorithms
3. Apply data mining and pattern matching techniques
4. Choose and apply appropriate statistical methods for solving complex biological problems.
5. Reviewing the various bioinformatics tools and their Applications.
6. Design real-time solutions by using basic principles of biology, Computer Science and mathematics.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	3	2	2	3	3	3	3	2	2	2	2	1	2
2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
3	3	3	2	2	3	3	3	3	3	2	2	3	3	3
4	3	3	2	3	2	2	2	2	2	2	2	3	3	2
5	3	2	2	3	3	2	2	3	3	2	3	3	2	2
6	2	2	3	3	3	3	3	3	3	3	3	3	2	2

UNIT - I

Introduction to Bio-Linux and Networks: Introduction to networking in Linux, Basic commands in linux-pwd, awk, grep, sed, ls, remote login, ftp, wget, different shells such as c shell, Network basics and tools, File Transfer protocol in Linux, Network File System, Domain Name Services, Networks, Geographical Scope, Communication Models, Transmissions Technology.

UNIT - II

Bio-Basics: Kingdom of life-Bacteria, virus, plant, animal-Central dogma-chromosome-Prokaryotic genes and eukaryotic genes, Gene expression,-Genetic code-Protein synthesis basics, protein structures.

UNIT - III

Pattern matching: Pair-wise sequence alignment, Local versus global alignment, BLAST and its versions, Multiple sequence alignment, Dot Matrix analysis, Substitution matrices, Dynamic Programming, Word methods, Bayesian methods, Multiple sequence alignment, Dynamic Programming, Progressive strategies ,Iterative strategies, Tools, Nucleotide Pattern Matching, Polypeptide pattern matching, Utilities, Sequence Databases protein structure determination- abinito-threading- homology modeling methods.

UNIT IV

Bio-Statistics: Statistical concepts, Imperfect Data, Randomness, Variability, Approximation, Interface Noise, Assumptions, Sampling and Distributions, Hypothesis Testing, Quantifying Randomness, Data Analysis, Tool selection statistics of Alignment, Clustering and Classification.

UNIT V

Biodatabases and Data Mining: Biodatabase- basics of PHP, MySQL or MongoDB, HTML, CSS, java scripting Basics or Wordpress, Data Mining: Methods, Selection and Sampling, Preprocessing and Cleaning, Transformation and Reduction, Data Mining Methods, Evaluation, Visualization, Designing new queries, Pattern Recognition and Discovery, Machine Learning ,Text Mining , Tools.

Text Books:

1. Bryan Bergeron, "Bio Informatics Computing", Second Edition, Pearson Education, 2015.
2. T.K.Attwood and D.J. Perry Smith, "Introduction to Bio Informatics, Longman Essen, 1999.
3. JinXiong, "Essential Bio Informatics", Cambridge University Press,2006.

Suggested Readings:

1. Neil C.Jones, PaveA. Pevzner, "An Introduction to, Bioinformatics Algorithms (Computational Molecular Biology)", MIT Press 2004.

Online Resources:

1. https://nptel.ac.in/courses/102106065/
2. https://www.ncbi.nlm.nih.gov/

16CSE 19

HUMAN COMPUTER INTERACTION (ELECTIVE-VII)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The main objectives of this course are:
1. Learn the foundations of Human Computer Interaction.
2. Familiarize with the design technologies for computer interaction.
3. Learn the design strategies, guidelines, models and theories for developing a user friendly interface.

Course Outcomes: On successful of this course student will be able to:
1. Understand the structure of models and theories of human computer interaction.
2. Understand the vision of a computer user.
3. Understand the recognition and remembrance limitations of a computer user.
4. Understand the design rules and design process.
5. Apply the models and theories of human computer interaction to real-time problems

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	1	1	1	-	-	-	-	-	1	-	1		
2	3	1	2	1	1	-	-	-	-	1	-	1		
3	3	1	2	1	1	2	-	-	-	1	-	1		
4	3	1	1	1	1	2	1	-	1	1	-	1		
5	3	1	1	1	1	2	1	-	1	1	-	1		

UNIT - I

Foundations: The human, The computer, The Interaction, Paradigms. Introduction, Our perception is biased, Our vision is optimized to see structure

UNIT - II

We Seek and Use Visual Structure, Our Color Vision is Limited, Our Peripheral Vision is Poor, Reading is Unnatural, Our Attention is Limited; Our Memory is Imperfect, Limits on Attention Shape Our Thought and Action

UNIT - III

Recognition is Easy; Recall is Hard, Problem Solving and Calculation are Hard, Many Factors Affect Learning, Human Decision Making is Rarely Rational

UNIT - IV

Our Hand–Eye Coordination Follows Laws, We Have Time Requirements, Well-known User-Interface Design Rules, Design Process**:** Interaction design basics, HCI in the software process, Design rules

UNIT - V

Models and Theories: Cognitive models, Socio-organizational issues and stakeholder requirements, Communication and collaboration models, Task analysis, Hypertext, multimedia and the World Wide Web.

Text books:

1. Jeff Johnson, “Designing with the Mind in Mind – Simple Guide to Understanding”, 2nd edition, Elsevier Inc., 2010.
2. Alan Dix, Janet Finlay, Gregory D. Abowd, Russell Beale, “Human Computer Interaction”, 3rd edition, Pearson Education Limited, 2004.

Suggested Reading:

1. Ben Shneiderman, Catherine Plaisant, Maxine Cohen, Steven Jacobs, “Designing the User Interface”, 5th Edition, Pearson Education Limited, 2013.
2. John Haugeland, “Mind Design II”, 2nd Edition, Revised and enlarged edition, The MIT Press, 1997.

16CSE 20 **SOCIAL NETWORKING AND ITS IMPACT(ELECTIVE-VII)**

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The main objectives of this course are:

1. Familiarize the students with social networks and their representation.
2. Understand the impact of social networks on society.
3. Study and Analyze the social network search models.

Course Outcomes: On successful of this course **s**tudent will be able to:

1. Understand a broad range of social networks concepts and theories.
2. Appreciate how network analysis can contribute to increasing knowledge about diverse aspects of society.
3. Analyze social network links and web search.
4. Communicate the analysis results and impact of social networks.
5. Differentiate between centralized and decentralized search models.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	-	1	1	-	1	1	-	1	1	-
CO2	3	2	1	-	-	-	-	-	-		-	-	1	1
CO3	2	2	2	1	-	1	-	-	-	1	-	-	1	1
CO4	2	2	1	2	1	1	-	-	-	-	-	-	1	1
CO5	3	2	2	1	-	-	-	-	-	1	-	-	1	1

UNIT - I

Introduction: to Social Networks: Introduction to Social Networks, Challenges, Google page rank, Searching on network, link prediction, contagious, marketing on social networks; **Graphs**: Basic definitions, paths and connectivity, distance and breadth first search, network datasets. **Strong and Weak Ties**: Triadic closure, strength of weak Ties, Tie strength and network structure in large-scale data, Tie strength, social media and passive engagement, closure, structured holes and social capital.

UNIT - II

Networks in surrounding contexts: Homophily, selection and social influence, affiliation, tracking link formation in online data, spatial model of segregation. **Positive and negative relationships**: Structural balance, characterizing the structure of balanced networks, applications of structured balance.

UNIT - III

Link analysis and Web search: Searching the web, ranking, link analysis using hubs and authorities, page rank, link analysis in modern web search, applications beyond web.

Cascading behavior in networks: Diffusion in networks, modeling diffusion, cascades and clusters, diffusion, thresholds and role of weak Ties, extensions of cascade model, knowledge, thresholds and collective actions

UNIT - IV

Power Laws and Rich-get-Richer Phenomena: Popularity as a network phenomenon, power laws, rich-get-richer models, unpredictability of rich-get-richer effects, effects of search tools and recommender systems, analysis of rich-get-richer processes. Pseudo core- how to go viral on the web

UNIT - V

Small world phenomenon: Six degrees of separation, structured and randomness, decentralized search, modeling the process of decentralization search, empirical analysis and generalized models, core-peiphery structures and difficulties in decentralized search, analysis of decentralized search.

Text Books:

1. David Easley, Jon Kleinberg, "Networks, Crowds and Markets", Cambridge Press, 2010 (available for free download).
2. Mathew O Jackson "Social and Economic Networks", Princeton University, 2010.

Online Resources:

1. https://nptel.ac.in/downloads/106106169/

Professor and Head Department

16CSE 21 BLOCKCHAIN TECHNOLOGY (ELECTIVE-VII)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Prerequisites: Computer Networks, Network Security

Course Objectives: The main objectives of this course are:
1. Understand the basic concepts and architecture of blockchain
2. Interpret working of Hyperledger Fabric
3. Applications of blockchain in various domains

Course Outcomes: On successful of this course student will be able to:
1. State the basic concepts of blockchain
2. Understand the list of Consensus
3. Demonstrate and Interpret working of Hyperledger Fabric, SDK composer tool
4. Demonstrate the supply chain.
5. Apply to various use cases from different domains

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	2	1	-	-	-	-	-	-	-	-	-	-
2	3	3	2	1	-	-	-	-	-	-	-	-	-	-
3	3	3	1	2	1	-	-	-	-	-	-	-	-	-
4	3	2	1	-	-	-	-	-	-	-	-	-	-	-
5	3	3	1	-	-	-	-	-	-	-	-	-	-	-

UNIT - I

Introduction: History: Digital Money to Distributed Ledgers - Design Primitives: Protocols, Security, Consensus, Permissions, Privacy-: Blockchain Architecture and Design-Basic crypto primitives: Hash, Signature-Hashchain to Blockchain-Basic consensus mechanisms

UNIT - II

Consensus: Requirements for the consensus protocols-Proof of Work (PoW)-Scalability aspects of Blockchain consensus protocols**:** Permissioned Blockchains-Design goals-Consensus protocols for Permissioned Blockchains

UNIT - III

Hyperledger Fabric: Decomposing the consensus process-Hyperledger fabric components-Chaincode Design and Implementation: Hyperledger Fabric II:-Beyond Chaincode: fabric SDK and Front End-Hyperledger composer tool

UNIT - IV

Use Case I: Blockchain in Financial Software and Systems (FSS): -Settlements, -KYC, -Capital markets-Insurance- **Use case II:** Blockchain in trade/supply chain: Provenance of goods, visibility, trade/supply chain finance, invoice management/discounting

UNIT - V

Use Case III: Blockchain for Government: Digital identity, land records and other kinds of record keeping between government entities, public distribution system / social welfare systems : Blockchain Cryptography : Privacy and Security on Blockchain

Text Books:

1. Mark Gates, "Blockchain: Ultimate guide to understanding blockchain, bitcoin, cryptocurrencies, smart contracts and the future of money", Wise Fox Publishing and Mark Gates, 2017.
2. Salman Baset, Luc Desrosiers, Nitin Gaur, Petr Novotny, Anthony O'Dowd, Venkatraman Ramakrishna, "Hands-On Blockchain with Hyperledger: Building decentralized applications with Hyperledger Fabric and Composer", 2018.
3. ArshdeepBahga, Vijay Madisetti, "Blockchain Applications: A Hands-On Approach", ArshdeepBahga, Vijay Madisetti publishers 2017.

Suggested Reading:

1. Andreas Antonopoulos, "Mastering Bitcoin: Unlocking Digital Cryptocurrencies", O'Reilly Media, Inc., 2014.
2. Melanie Swa, "Blockchain ",O'Reilly Media, 2014

E-Books :
1. Blockchain Applications- https://www.blockchain-books.com
2. Hyperledger Fabric - https://www.hyperledger.org/projects/fabric
3. Zero to Blockchain - An IBM Redbooks course, by Bob Dill, David Smits,2017 - https://www.redbooks.ibm.com/Redbooks.nsf/RedbookAbstracts/crse0401.html

Online Resources:
1. https://onlinecourses.nptel.ac.in/noc18_cs47/preview
2. https://www.udemy.com/blockchain-and-bitcoin-fundamentals/

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16MTO 04 QUANTUM COMPUTINGELECTIVE-VIII (OE2)

Instruction	3Hours per week
Duration of Semester End Examination	3Hours
Semester End Examination	70 Marks
CIE	30Marks
Credits	3

Course Objectives: The main objectives of this course are :

1. Translate fluently between the major mathematical representations and its quantum operations.
2. Implement basic quantum algorithms.
3. Explain quantum decoherence in systems for computation.
4. Discuss the physical basis of uniquely quantum phenomena.

Course Outcomes: On successful of this course **s**tudent will be able to:

1. Explain the working of a Quantum Computing Program, its architecture and program model.
2. Compute basic mathematical operations.
3. Develop quantum logic gate circuits.
4. Develop quantum algorithm.
5. Program quantum algorithm on major toolkits.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	-	-	-	-	-	-	-	-	-	1	1	-
2	2	3	-	-	-	-	-	-	-	-	-	1	1	-
3	3	2	-	-	-	-	-	-	-	-	-	1	1	-
4	2	2	-	-	-	-	-	-	-	-	-	1	1	-
5	2	2	-	-	-	-	-	-	-	-	-	1	1	-

UNIT – I

Introduction to Quantum Computing: Motivation for Studying Quantum Computing, Major players in the industry (IBM, Microsoft, Rigetti, D-Wave etc), Origin of Quantum Computing, Overview of major concepts in Quantum Commuting (Qubits and multi-qubits states, Bra-ket notation, Bloch Sphere representation, Quantum Superposition, Quantum Entanglement).

UNIT – II

Math Foundation for Quantum Computing: Matrix Algebra: Basis vectors and orthogonality, inner product and Hilbert spaces, matrices and tensors, unitary operators and projectors, Dirac notation, Eigen values and Eigen Vectors.

UNIT – III

Building Blocks for Quantum Program: Architecture of a Quantum Computing Platform, Details of q-bit system of information representation (Block Sphere, Multi-qubits States, Quantum superposition of qubits (valid and invalid superposition), Quantum Entanglement, Useful states from Quantum algorithmic perceptive e.g. Bell State.

UNIT – IV

Quantum Logic gates and Circuits: Quantum Logic gates and Circuit:Pauli, Hadamard, Phase shift, controlled gates, ising, Deutsch, Swap etc.), Programming model for a Quantum Computing program (Steps performed on classical computer, steps performed on Quantum Computer, Moving data between bits and qubits).

UNIT – V

Quantum Algorithms: Basic techniques exploited by quantum algorithms (Amplitude amplification, Quantum Fourier Transform, Phase Kick-back, Quantum Phase estimation, Quantum walks), Major Algorithms (Shor's Algorithm, Grover's Algorithm, Deutsch's Algorithm, Deutsch-Jozsa Algorithm), OSS Toolkits for implementing Quantum program (IBM quantum experience, Microsoft Q, Rigetti PyQuil (QPU/QVM)).

Text Books:

1. Michael A.Nielsen, "Quantum Computation and Quantum Information", Cambridge University Press.
2. David McMahon, "Quanturm Computing Explained", Wiley.

16MEO 02 ROBOTICSELECTIVE-VIII (OE2)

Instruction	3Hours per week
Duration of Semester End Examination	3Hours
Semester End Examination	70 Marks
CIE	30Marks
Credits	3

Course Objectives: The main objectives of this course are:
1. The configuration, work envelop and motion controls and applications
2. The kinematics and dynamics of robots.
3. Robot end effectors and their design.
4. Robot Programming Languages and Programming methods of robot.
5. Various Sensors and drives and their applications in robots

Course Outcomes: On successful of this course **s**tudent will be able to:
1. Equipped with the knowledge of robot anatomy, work volume and robot applications
2. Familiarized with the kinematic motions of robot and robot dynamics
3. Having good knowledge about robot end effectors and their design concepts
4. Equipped with the Programming methods & drives used in robots
5. Equipped with the principles of various Sensors and their applications in robots.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	2	3	2	3	3	3	3	1	3	3	2	3	1	1
CO 2	3	3	3	3	3	0	1	0	2	3	1	3	1	1
CO 3	3	3	3	3	3	0	1	0	2	3	1	3	2	2
CO 4	2	3	3	3	3	3	2	1	3	3	2	3	3	2
CO 5	3	3	3	3	3	3	3	1	3	3	2	3	3	2

UNIT-I

Introduction to Robotics: History and evolution of robots, basic configuration, degree of freedom, work envelope, motion control methods. Various applications in industry: material handling, loading & unloading, processing, welding & painting, assembly and inspection. Requirements and Specifications of Robots

UNIT-II

Rigid Motions and Homogeneous Transformations: Rotation matrix, Homogenous transformation matrix, Denavit-Hartenberg convention, Euler angles, RPY representation, Direct and inverse kinematics for industrial robots for position and orientation.

UNIT-III

Velocity Kinematics – The Manipulator Jacobian: Joint, End effector velocity, direct and inverse velocity analysis. **Trajectory Planning**, interpolation, cubic polynomial, linear segments with parabolic blending, static force and moment transformation, solvability, stiffness, singularities.

UNIT-IV

Robot Dynamics: Lagrangian formulation, link inertia tensor and manipulator inertia tensor. **Newton**-Euler formulation for RR & RP manipulators. **Control**: Individual joint, computed torque.

UNIT-V

End Effectors: Position and velocity measurement, **Sensors**: Proximity and range, tactile, force and torque, Drives for Robots: Electrical, Hydraulic and Pneumatic. **Robot Vision**: Introduction to technique, image acquisition and processing, introduction to robot programming languages.

Text Books:

1. Spong and Vidyasagar, "Robot Dynamics and Control", John Wile and Sons, 1990
2. R.K. Mittal, I.J. Nagrath, "Robotics and control", Tata Mcgraw-Hill Publishing Company Ltd. 2003
3. Groover, "Industrial Robotics", Mcgraw-Hill Publishing Company Ltd. 2003

Suggested Reading:

1. Asada and Slotine, "Robot analysis and Intelligence", Wiley Interscience, 1986
2. K.S. Fu Gon ZalezRC., lEEc.S.G., "Robotics, Control Sensing Vision and Intelligence", McGraw Hill, Int. Ed., 1987
3. Richard S. Paul, "Robot Manipulators: Mathematics, Programming, and Control", MIT Press

16MEO 04 INTELLECTUAL PROPERTY RIGHTS ELECTIVE-VIII (OE2)

Instruction	3Hours per week
Duration of Semester End Examination	3Hours
Semester End Examination	70 Marks
CIE	30Marks
Credits	3

Course Objectives: The main objectives of this course are:
1. Fundamental aspects of IP
2. Aspects of IPR acts.
3. Awareness of multi disciplinary audience
4. Awareness for innovation and its importance
5. The changes in IPR culture and techno-business aspects of IPR

Course Outcomes: On successful of this course student will be able to:
1. Will respect intellectual property of others
2. Learn the art of understanding IPR
3. Develop the capability of searching the stage of innovations.
4. Will be capable of filing a patent document independently.
5. Completely understand the techno-legal business angle of IPR and converting creativity into IPR and effectively protect it.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	-	-	-	-	3	-	1	-	-	-	2	-	-	-
2	-	-	-	-	3	-	1	-	-	-	2	-	-	-
3	-	-	-	-	3	-	1	-	-	-	2	-	-	-
4	-	-	-	-	3	-	1	-	-	-	2	-	-	-
5	-	-	-	-	3	-	1	-	-	-	2	-	-	-

UNIT-I

Overview of Intellectual Property: Introduction and the need for intellectual property right (IPR), IPR in India – Genesis and Development, IPR abroad, Some important examples of IPR. Importance of WTO, TRIPS agreement, International Conventions and PCT, **Patents:** Macro economic impact of the patent system, Patent and kind of inventions protected by a patent, Patent document, How to protect your inventions. Granting of patent, Rights of a patent, how extensive is patent protection. Why protect inventions by patents. Searching a patent, Drafting of a patent, Filing of a patent, the different layers of the international patent system, (national, regional and international options), compulsory licensing and licensers of right & revocation, Utility models, Differences between a utility model and a patent. Trade secrets and know-how agreements

UNIT-II

Industrial Designs: What is an industrial design. How can industrial designs be protected? What kind of protection is provided by industrial designs? How long does the protection last? Why protect industrial designs?

UNIT-III

Trademarks: What is a trademark, Rights of trademark? What kind of signs can be used as trademarks. Types of trademark, function does a trademark perform, How is a trademark protected? How is a trademark registered. How long is a registered trademark protected for? How extensive is trademark protection. What are well-known marks and how are they protected? Domain name and how does it relate to trademarks? Trademark infringement and passing off.

UNIT-IV

Copyright: What is copyright. What is covered by copyright. How long does copyright last? Why protect copyright? Related Rights: what are related rights. Distinction between related rights and copyright. Rights covered by copyright? Copy rights in computer programming.

UNIT-V

Enforcement of Intellectual Property Rights: Infringement of intellectual property rights Enforcement Measures Emerging issues in Intellectual property protection. Case studies of patents and IP Protection. **Unfair Competition:** What is unfair competition. Relationship between unfair competition and intellectual property laws.

Text Books:

1. Ajit Parulekar and Sarita D' Souza, "Indian Patents Law – Legal & Business Implications", Macmillan India ltd , 2006
2. B. L.Wadehra; "Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications", Universal law Publishing Pvt. Ltd., India 2000
3. P. Narayanan, "Law of Copyright and Industrial Designs", Eastern law House, Delhi 2010

Suggested Reading:

1. W.R1 Cronish, "Intellectual Property; Patents, copyright, Trad and Allied rights", Sweet & Maxwell, 1993.
2. Narayanan, "Intellectual Property Law", Eastern Law Edn., 1997.
3. Robin Jacob and Daniel Alexander, "A Guide Book to Intellectual Property Patents, Trademarks, Copy rights and designs", 4/e, Sweet, Maxwell.

16PYO 01 HISTORY OF SCIENCE AND TECHNOLOGY ELECTIVE-VIII (OE2)

Instruction	3Hours per week
Duration of Semester End Examination	3Hours
Semester End Examination	70 Marks
CIE	30Marks
Credits	3

Course Objectives: The main objectives of this course are:
1. Enable students to understand science as a socio-cultural product in specific socio-historical contexts.
2. Expose students to philosophical, historical and sociological perspectives to look at science as a practice deeply embedded in culture and society.
3. Inculcate the scientific culture and ethics in the development of technologies.

Course Outcomes: On successful of this course student will be able to:
1. Demonstrate knowledge of broad concepts in the history of science, technology ranging over time, space and cultures.
2. Recognize the values of a wide range of methodologies, conceptual approaches and the impact of competing narratives within the history of science, technology.
3. Identify, locate and analyze relevant primary and secondary sources in order to construct evidence-based arguments.
4. Think independently and critically, using appropriate methodologies and technologies to engage with problems in the history of science, technology.
5. Demonstrate academic rig our and a sensitivity to cultural and other diversity, and understanding of the ethical implications of historical and scientific enquiry within a global context.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	1	1	1	1	2	2	1	1	2	1	2		
2	3	1	2	1	2	2	2	1	2	2	2	2		
3	2	2	1	1	1	1	1	1	1	2	1	2	1	1
4	3	2	2	2	2	2	2	1	1	2	1	2	1	1
5	3	2	2	2	2	1	2	2	1	2	1	2	1	1

UNIT - I

Science - The Beginning (through 599 BC): The Stone Ages, Knowledge among hunter gatherers, Agricultural Revolution and other revolutions, Civilization, Major advances. **Science in Antiquity (600 BC - 529 AD):** Philosophy, a precursor to science, Hellenistic world and the Roman Empire, Other cultures of the period, major advances.

UNIT - II

Medieval Science (530 AD - 1452 AD): The decline of science in Europe , Science in China, Science and mathematics in India, Arab science, revival of science in Europe, technology revolution of the Middle ages, Major advances. **The Renaissance and the Scientific Revolution (1453 AD – 1659 AD):** Renaissance, Scientific Revolution, Technology, Major advances.

UNIT - III

Scientific Method: Measurement and Communication (1660 AD – 1734): European domination, The scientific method, Major advances. **The Industrial Revolution (1735 AD – 1819 AD):** Industrial Revolution, Rise of the engineer, Major Advances.

UNIT - IV

Science and Technology in the 19th Century (1820 AD – 1894 AD): philosophical basis of 19th-century science, Science and the public, Science and technology, Major advances. **Rise of Modern Science and Technology (1895 AD – 1945 AD):** The growth of 20thcentury science, New philosophies, Quantum reality, Energy sources, Electricity: a revolution in Technology, Major advances.

UNIT - V

Big Science and the Post-Industrial Society (1946 AD – 1972 AD): Big science, Specialization and changing categories, Technology changes society, Major advances. **The Information Age (1973 AD – 2015 AD):** Information and society, Globalization, The post-industrial society, Problems of the Information age, Major Advances

Text Books:
1. Bryan and Alexander Hellemans, “The History of Science and Technology”, Houghton Mifflin Company, 2004.
2. JD Bernal, “Science in History”, 4 volumes, Kindle Edition.

Suggested Readings:
1. “The 100 Most Influential Scientists of All Time”, Edited by Kara Rogers, Britannica Educational Publishing, 2010

2. Alberto Hernandez, "A Visual History of Science and Technology", The Rosen Publishing Group, 2016

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY(A)
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
(CBCS CURRICULUM)

OPEN ELECTIVE FOR OTHER PROGRAMME

S.NO.	SUBJECT CODE	SUBJECT NAME
1	16CSO 01	Python for Bioinformatics
2	16CSO 02	JAVA Programming and Bio-Java
3	16CSO 03	IOT and Applications
4	16CSO 04	Basics of Data Science using R
5	16CSO 05	Fundamentals of Virtual Reality
6	16CSO 06	Fundamentals of DBMS
7	16CSO 07	Basics of Cyber Security
8	16CSO 08	Open Source Technologies
9	16CSO 09	Basics of Artificial Intelligence
10	16CSO 10	Machine Learning Using Python

16CSO 01

PYTHON FOR BIOINFORMATICS
(Open Elective)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The main objectives of this course are:
1. Introduce Python with reference to bioinformatics.
2. Understanding of various algorithms useful for biological sequences.
3. Identification Python modules useful to analyze gene and Biological sequences

Course Outcomes: On Successful completion of this course, student will be able to
1. Understand the basics of Python Programming.
2. Develop applications using Python to solve problems.
3. Identify and use Python modules related to Biology.
4. Analyze biological and gene sequences using Python.
5. Understand advanced analysis techniques.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	1	1	-	-	-	-	-	-	-	1	1	1
2	2	3	2	2	1	-	-	-	-	-	-	1	2	2
3	2	2	2	1	2	1	-	-	-	-	-	1	2	1
4	1	2	2	2	2	2	1	-	-	-	-	1	2	1
5	-	3	2	1	1	1	-	-	-	-	-	-	1	2

UNIT - I

Introduction to Python: Basics of Python, Python IDEs, Running Python programs, types and operations, Functions, modules, classes, Exceptions.

UNIT - II

Object-Oriented Programming, Modules: Object Oriented Programming, Threads, process, synchronization, databases and persistence, NumPy, SciPy, Image manipulation, Akando and Dancer modules.

UNIT - III

Biological Sequence Analysis: Biopython: Parsing DNA data files, Sequence Analysis, Dynamic Programming, Hidden Markov Model, Genetic Algorithms, Multiple Sequence Alignment, gapped alignment.

UNIT - IV

Advanced Analysis Techniques: Trees, Text Mining, Clustering, Self-Organizing Map, Principal Component Analysis and Numerical Sequence Alignment.

UNIT - V

Expression Analysis: Gene expression array analysis, Spot finding and Measurement, Spreadsheet Arrays and Data Displays, Applications with expression Alignment.

Text Books:

1. Jason Kinser, “Python for Bioinformatics”, Jones & Bartlett Publishers, 2nd Edition, 2013.
2. Reema Thareja “Python Programming”, Oxford Press, 2017.

Suggested Reading:

1. Mark Lutz, “Learning Python”, 3rd edition, O’Reilly, 2007.
2. Alex Martelli, David Ascher, “Python cookbook”, O’Reilly, 2002.

Online Resources:
1. http://www.biopython.org

16CSO 02

` JAVA PROGRAMMING AND BIO-JAVA
(Open Elective)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Basics of any programming language.

Course Objectives: The main objectives of this course are:

1. To introduce the concepts of Object-Oriented programming.
2. Prepare the students to develop solutions using OOPs concepts.
3. Design and develop Biotechnology related solutions using Java and Java class libraries.

Course Outcomes: On Successful completion of this course, student will be able to

1. Understand fundamental concepts in object-oriented programming.
2. Design and develop computer based solutions to solve real world problems.
3. Handle file I/O and exceptions.
4. Create Windows, Containers, GUI components in Java.
5. Create GUI-based applications related to Biotechnology problems.

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1	-	-	1	1	-	-	-	-	1	1	-
2	2	2	3	2	1	1	1	-	-	-	-	1	2	1
3	2	2	2	1	2	-	-	-	-	-	-	1	1	1
4	2	2	1	1	1	-	-	-	-	-	-	1	1	1
5	2	2	3	1	2	-	-	-	-	-	-	2	2	2

UNIT - I

Java Essentials: Features of Java, OOPs concepts in Java, Elements of java program, Variables, and Literals, Data Types, variables and arrays, Operators, arrays Control structures: if, if-else, nested if, if-else-if, switch, while, do-while, for, break and continue statements.

UNIT - II

Classes and Objects: Introduction to classes and methods, typecasting, access specifiers and modifiers, modifiers, passing arguments, Constructors. Inheritance: Basics of inheritance, types of inheritance, polymorphism.

UNIT - III

Interfaces and Packages: Basics of interfaces, Packages, Exception handling: Types of exceptions and Errors, exception handling, Multithreading concepts. Files and I/O Streams: File Class, Streams, Byte Streams.

UNIT - IV

AWT and Applets: Applets, GUI, Window class hierarchy, Dialog Boxes,, Layout managers, Swing Component Classes, Event-Handling, AWT Graphics classes and Swing Controls.

UNIT - V

StrBio Lib: Molecular Biology Classes, Interfaces to Bioinformatics tools and Databases, General purpose tools, applications. Writing simple Java programs for Biotechnology related problems.

Text Books:

1. Sagayaraj, Denis, KArthik and Gajalaxmi, “Java Programming”, for Core and Adanced Learners”, University Press, Pvt. Ltd, 2018.
2. Johan-Marc Chandonia, “StrBioLib: a Java Library for Development of Custom Computations Structural Biology Applications”, BIO-INFO ALPPLICATIONS NOTE, Vol. 23, No. 15,2007, PP2018-2020 (https://academic.oup.com/bioinformatics/article-abstract/23/15/2018/203542)

Suggested Reading:

1. Herbert Schildt, “ The complete reference Java 2”, TMH
2. Internet World 60 minute Java by Ed Tittel

Online Resources:

1. https://www.tutorialspoint.com/java/index.htm

16CSO 03

IOT AND APPLICATIONS
(Open Elective)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Programming Basics.

Course Objectives: The main objectives of this course are:

1. Impart necessary and practical knowledge of components in Internet of Things.
2. Understand working of IoT Systems.
3. Develop skills required to build IoT based systems.

Course Outcomes: On Successful completion of this course, student will be able to

1. Understand Internet of Things and its hardware and software components.
2. Interface I/O devices, sensors & communication module.
3. Remotely monitor data and control devices.
4. Develop real time IoT based projects.
5. Advance towards research based IoT.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	1	1	-	-	-	-	-	-	-	-	1	1	1
2	3	2	2	-	1	-	-	-	1	-	1	1	1	1
3	3	3	2	1	1	-	-	-	-	-	1	1	1	1
4	2	2	2	-	1		-	-	1	-	1	1	1	1
5	2	2	1	2	-	-	-	-	-	-	-	1	1	1

UNIT – I

Introduction to IoT: Sensors, Types of sensors and Transducers, Actuators and Types of Actuators.

UNIT – II

Basics of Networking: Functional Components of IoT, IoT interdependencies, IoT Service oriented architecture, IoT categories, IoT gateways, IoT and associated technologies, Key technologies for IoT, IoT challenges.

UNIT – III

IoT Hardware Components: Computing (Arduino/Raspberry Pi), Communication, Sensors, Actuators, I/O interfaces, Programming API's (for Arduino/ Raspberry Pi).

UNIT – IV

IoT Application Development: Solution framework for IoT applications- Implementation of Device integration, Data acquisition and integration, Device data storage- Unstructured data storage on cloud/local server, Authentication, Authorization of devices

UNIT – V

IoT Systems and Applications: Smart Lighting, Weather Monitoring System, Weather Reporting Bot, Forest Fire Detection, Alcohol Detection System, Smart Parking Environment., Drip-irrigation, Biological water treatment system, Work flow Automation in Industries, Smart Intrusion Detection System, monitoring space risks and hazardous conditions in industrial regions like underground tanks, trap door margins.

Text Books:

1. Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press, 2017.
2. Jeeva Jose, "Internet of Things", Khanna Publishing House, Delhi, 2018.
3. Arshdeep Bahga and Vijay Madisetti, "Internet of Things: A Hands-on Approach", Universities Press, 2014.

Suggested Reading:

1. Dr. SRN Reddy, Rachit Tirnkral and Manasi Mishra, "Introduction to Internet of Things: A practical Approach", ETI Labs, 2018.
2. Adrian McEwen, "Designing the Internet of Things", Wiley, 2013.
3. Raj Kamal, "Internet of Things:Architecture and Design", McGraw Hill, 2017.
4. Cuno Pfister, "Getting Started with the Internet of Things", 0 Reilly Media, 2011.
5. O. Vermesan, P. Friess, "Internet of Things – Converging Technologies for Smart Environments and Integrated Ecosystems", River Publishers, Series in Communications, 2013.

Online Resources / Weblinks / NPTEL Courses:

1. Li Da Xu, Wu He, and Shancang Li, “Internet of Things in Industries: A Survey “, IEEE Transactions on Industrial Informatics, Vol. 10, No. 4, Nov. 2014.
2. Gotovtsev, Pavel M., and Andrey V. Dyakov. "Biotechnology and Internet of Things for green smart city application." 2016 IEEE 3rd World Forum on Internet of Things (WF-IoT). IEEE, 2016.
3. Yanjing, Sun, et al. "Research and design of agriculture informatization system based on IOT." Journal of Computer Research and Development 48 (2011): 316-331.
4. Somov, Andrey, et al. "Bacteria to power the smart sensor applications: Biofuel cell for low-power IoT devices." 2018 IEEE 4th World Forum on Internet of Things (WF-IoT). IEEE, 2018.
5. Han, Shuqing, et al. "Analysis of the frontier technology of agricultural IoT and its predication research." IOP Conference Series: Materials Science and Engineering. Vol. 231. No. 1. IOP Publishing, 2017.

16CSO 04

BASICS OF DATA SCIENCE USING R
(Open Elective)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Probability and Statistics, basics of programming languages.

Course Objectives: The main objectives of this course are:
1. Understand R programming language.
2. Explore the programming skills needed to use R tool for statistical analysis of Biological data.
3. Analyze biological data.

Course Outcomes: On Successful completion of this course, student will be able to
1. Understand the basics of R, various statistical measures, algorithms useful for data analysis.
2. Explore the programming skills needed to use R tool for biological data.
3. Analyze biological data using R tool.
4. Apply classification and clustering algorithms to biological data.
5. Identify and work with the technologies and resources related to bioinformatics.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	1	2	3	2	-	-	-	1	1	2	2	-
2	3	3	2	3	2	2	-	-	1	1	2	2	2	1
3	3	3	2	2	2	2	-	-	1	2	3	2	2	1
4	3	3	3	2	3	2	-	-	1	3	2	3	2	-
5	3	3	2	2	2	2	-	-	1	2	2	2	2	1

UNIT - I

Basics of R: Introduction, R features, setting up and exploring R environment, loading packages, types of data objects in R, working with R data objects, Controlling work space, importing files. **Programming with R:** Variables and assignment, operators, control structures, Functions-built-in, writing own functions, package creation.

UNIT - II

Data Analysis and Graphics: Data summary functions in R, Graphics technology in R, saving graphics, additional graphics packages. **Bayesian Data Analysis**: Need of Bayesian approach, Application of Bayes rule, Priors, Likelyhood functions, evaluating the posterior, Applications of Bayesial Statistics in Bioinformatics. **Stochastic Modeling**: Stochastic process and Markov Processes, Classification of Stochastic processes, modeling a DNA sequence with Markov Chain, Characteristics of Markov Chain.

UNIT - III

MCMC using Brugs: ABO blood type example. Gibbs sampling. **Statistical Inference:** Sampling distributions, Parameter estimation, interval estimation, bootstrapping, R packages for bootstrapping. **Hypothesis Testing**: Package ctest, Binomial test, comparing variances, Wilcoxon tests, Chi-Square test, Fisher's Exact tests, Likelihood Ratio tests.

UNIT - IV

ANOVA and Regression: ANOVA table, perforating ANOVA using R, graphical analysis of ANOVA comparison, Regression: Correlations, linear regression model, fitting and testing of regression model, generalization of the model. **Working with Multivariate Data:** Multivariate data, sample statistics, display of multivariate data, outliers and principal components. Classification of discriminate analysis- classification with two population and more than two populations, cross validation classification trees.

UNIT - V

Clustering methods: measures of dissimilarities, K-means clustering, K-Medoid clustering, Hierarchical clustering-Agglomerate and divisive. **R Packages:** Bio-conductor and Seqin R.

Data Technologies: R for Data manipulation, example, Database technologies, Bioinformatics resources on the WWW.

Text Books:

1. Kim Seefeld, Ernest Linder, “Statistics using R with Biological examples”, 2007 (https://cran.r-project.org/doc/contrib/Seefeld_StatsRBio.pdf).
2. Robert Gentleman, “R Programming for Bioinformatics”, 1st Edition, CRC Press, 2008.

Suggested Reading:

1. Arvil Cohhlan “A Little Book of R for Bioinformatics”, Release 1.0, CC ver 3.0

Online Resources:

1. https://epdf.tips/r-programming-for-bioinformatics.html
2. https://epdf.tips/r-programming-for-bioinformatics.htmlhttps://www.cyclismo.org/tutorial/R/objectOriented.html
3. https://www.w3schools.in/r/object-oriented/

16CSO 05

FUNDAMENTALS OF VIRTUAL REALITY
(Open Elective)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The main objectives of this course are:

1. To introduce hardware and software components of virtual reality.
2. To provide knowledge about geometry of virtual worlds.
3. To understand visual physiology, perception and audio in VR.
4. To study the applications of VR in various domains like military and robotics.

Course Outcomes: On Successful completion of this course, student will be able to:

1. Define Virtual Reality and acquire knowledge of virtual worlds.
2. Apply modeling techniques to model real world scenarios.
3. Study human factors for developing interfaces.
4. Evaluate virtual reality systems.
5. Address the issues and challenges in virtual reality.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	-	-	-	-	-	-	-	-	-	-	1	1	1
2	2	2	2	2	2	1	-	-	-	-	-	-	1	1
3	1	1	1	2	2	2	1	-	-	-	-	1	1	1
4	2	2	2	2	2	-	-	-	-	--	-	-	1	1
5	1	1	1	1	1	2	2	2	-	-	-	1	1	1

UNIT - I

Introduction: The three I's of virtual reality, commercial VR technology and the five classic components of a VR system. **Input Devices:** Trackers, Navigation and Gesture Interfaces: Three-dimensional position trackers, navigation and manipulation, interfaces and gesture interfaces. **Output Devices:** Graphics displays, sound displays and haptic feedback.

UNIT - II

Geometry of Virtual Worlds: Geometric modeling, Transforming models, Matrix algebra and 2D rotations, 3D rotations and yaw, pitch, and roll, Axis-angle representations, Quaternions, Converting and multiplying rotations, Homogeneous transforms, The chain of viewing transforms, Eye transforms, Canonical view transform , Viewport transform.

UNIT - III

Light and Optics : Three interpretations of light, Refraction, Simple lenses, Diopters, Imaging properties of lenses, Lens aberrations, Optical system of eyes. **Visual Physiology:** Photoreceptors, Sufficient resolution for VR, Light intensity, Eye movements, Eye movement issues for VR, Neuroscience of vision, **Visual Perception:** Depth perception, Motion perception, Frame rates and displays.

UNIT - IV

Tracking Systems : Overview, Orientation tracking, Tilt drift correction, Yaw drift correction, Tracking with a camera, Perspective n-point problem, Filtering, Lighthouse approach, **Visual Rendering:** Overview, Shading models, Rasterization, Pixel shading, VR-specific problems, Distortion shading, Post-rendering image warp.

UNIT – V

Audio: Physics and physiology, Auditory perception, Auditory localization, Rendering, Spatialization and display, Combining other senses, **Interfaces:** overview, Locomotion, Manipulation, System control, Social interaction, Evaluation of VR Systems, **Applications:** Medical, Military, Robotics, issues and challenges in virtual reality.

Text Books:

1. John Vince, "Virtual Reality Systems", Pearson Education Asia, 2007
2. Anad R., "Augmented and Virtual Reality", Khanna Publishing House, Delhi.

Suggested Reading:

1. George Mather, "Foundations of Sensation and Perception:Psychology", Press; 2 edition, 2009.
2. Peter Shirley, Michael Ashikhmin, and Steve Marschner, "Fundamentals of Computer Graphics", A K Peters/CRC Press; 3 edition, 2009.

Online Resources:

1. http://msl.cs.uiuc.edu/vr/

16CSO 06

FUNDAMENTALS OF DBMS
(Open Elective)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: File Structures.

Course Objectives: The main objectives of this course are:
1. To learn data models, conceptualize and depict a database system using E-R diagram.
2. To understand the internal storage structures in a physical DB design.
3. To know the fundamental concepts of transaction processing techniques.

Course Outcomes: On Successful completion of this course, student will be able to:
1. Understand the find fundamental components of the DBMS.
2. Design the database schema and develop E-R model.
3. Devise queries using relational algebra and SQL.
4. Apply normalization techniques and solve problems using various Indexing techniques.
5. Understand transaction processing, Concurrency control and recovery techniques.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	2	1	-	-	--	-	-	-	-	-	1	2
2	3	3	3	1	-	-	-	-	-	-	-	-	1	2
3	2	2	3	1	-	-	-	-	-	--	-	-	1	2
4	1	3	2	2	-	-	-	-	-	-	-	-	1	2
5	3	1	2	1	-	2	-	1	-	-	-	-	1	2

UNIT - I

Introduction: Database System Applications, Purpose of Database Systems, View of Data, Database Languages, Database Users and Administrators Database System Architecture, Application Architectures. **Database Design and E-R Model:** Basic concepts, Constraints, E-R Diagrams, E-R Design Issues, Extended E-R Features, Specialization and Generalization.

UNIT - II

Relational Model: Structure of Relational Databases, Database Schema, Keys, Relational Algebra, Fundamental Operations. **Structured Query Language:** Overviews, SQL Data Types, SQL Queries, Data Manipulation Language Set Operations, Aggregate Functions, Data Definition Language, Integrity Constraints, Null Values, Views, Join Expression. Index Definition in SQL.

UNIT - III

Relational Database Design: Undesirable Properties in Relational Database Design, Functional Dependencies, Trivial and Nontrivial Dependencies, Closure of Set of Functional Dependencies, Closure of Set of Attributes, Irreducible Set of Functional Dependencies, Normalization – 1NF, 2NF, and 3NF, Dependency Preservation, BCNF, Comparison of BCNF and 3NF.

UNIT - IV

Indexing: Basic concepts, Dense and Sparse Indices, Secondary Indices, Tree-Structured Indexing, Indexed Sequential Access Method (ISAM), B+ Tree Index Files. **Transaction Management:** Transaction Concept – ACID Properties, States of Transaction, Implementation of Atomicity and Durability, Serializability, Recoverability.

UNIT - V

Concurrency Control: Lock-Based Protocols, Timestamp-Based Protocols, Validation-Based Protocols, Deadlocks Handling: Deadlock Prevention, Deadlock Detection and Recovery, **Recovery System:** Failure Classification, Storage Structure, Recovery and Atomicity, Log-Based Recovery, Recovery with Concurrent Transactions.

Text Books:

1. Abraham Silberschatz, Henry F Korth, S Sudarshan, “Database System Concepts”, Sixth Edition, McGraw-Hill International Edition, 2011.
2. Date CJ, Kannan A, Swamynathan S, “An Introduction to Database Systems”, Eight Edition, Pearson Education, 2006.

Suggested Reading:

1. Raghu Ramakrishnan, Johnnes Gehrke, “Database Management Systems”, Third Edition, McGraw Hill, 2003.
2. Ramez Elmasri, Durvasul VLN Somayazulu, Shamkant B Navathe, Shyam K Gupta, “Fundamentals of Database Systems”, Fourth Edition, Pearson Education,2006.

16CSO 07

BASICS OF CYBER SECURITY
(Open Elective)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Operating System, Computer Network, Cryptography.

Course Objectives: The main objectives of this course are:

1. To Identify and present indicators that a cybercrime has occurred and understand methods and tools used in cybercrimes.
2. To collect, Process, Analyze and Present Computer Forensics Evidence.
3. To understand the legal perspectives and Organizational implications of Cyber Security

Course Outcomes: On Successful completion of this course, student will be able to

1. Discuss different types of cybercrimes and analyze legal frameworks to deal with these cybercrimes.
2. Describe Tools used in cybercrimes and laws governing cyberspace.
3. Analyze and resolve cyber security issues.
4. Recognize the importance of digital evidence in prosecution.
5. Analyze the commercial activities in the event of significant information security incidents in the Organization.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	1	2	1	3	1	1	1	-	-	2	-	1
2	3	2	2	3	3	2	1	2	2	1	-	2	-	2
3	2	3	1	3	3	3	1	2	3	2	2	3	-	1
4	2	2	1	3	3	3	1	2	3	2	1	2	-	1
5	2	3	2	3	3	2	1	2	3	2	2	3	-	1

UNIT - I

Introduction to Cyber Crime: Cyber Crime: Definition and Origins of the Word, Cyber crime and Information Security, Classification of Cyber Crimes, Cyber Crime: The Legal Perspective, Cyber Crime: An Indian Perspective, A Global Perspective of Cyber Crime.

UNIT - II

Cyber Offenses: Introduction, How Criminals plan the Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector.

Tools and Methods Used in Cybercrime: Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horse and Backdoors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Overflow.

UNIT - III

Cyber Security: The Legal Perspectives**:** Cyber Crime and the Legal Landscape around the World, Need of Cyber laws: the Indian Context, The Indian IT Act, Challenges to Indian Law and Cyber Crime Scenario in India, Digital Signatures and the Indian IT Act, Cyber Crime and Punishment, Cyber Law, Technology and Students: The Indian Scenario.

UNIT - IV

Understanding Cyber Forensics: Introduction ,Digital Forensics Science, Need for Computer Forensics, Cyber Forensics and Digital Evidence, Forensics Analysis of Email, Digital Forensics Life Cycle, Chain of Custody Concept, Network Forensics, Approaching a Cyber Forensics Investigation, Challenges in Computer Forensics.

UNIT - V

Cyber Security: Organizational Implications: Introduction, Cost of Cybercrimes and IPR issues, Web threats for Organizations, Security and Privacy Implications, Social media marketing: Security Risks and Perils for Organizations, Social Computing and the associated challenges for Organizations.

Text Books:

1. Sunit Belpre and Nina Godbole, Cyber Security: Understanding Cyber Crimes, Computer Forensics And Legal Perspectives, Wiley India Pvt.Ltd, 2011.
2. Kevin Mandia, Chris Prosise, Incident Response and computer forensics, Tata McGraw Hill, 2006.

Suggested Reading:

1. Alfred Basta, Nadine Basta, Mary Brown, Ravinder Kumar, “Cyber Security and Cyber Laws”, Paperback – 2018.
2. Mark F Grady, Fransesco Parisi, “The Law and Economics of Cyber Security”, Cambridge university press, 2006.

Online Resources:

1. https://www.edx.org/learn/cybersecurity
2. https://www.coursera.org/courses?query=cyber%20security
3. https://swayam.gov.in/course/4002-cyber-law

16CSO 08

OPEN SOURCE TECHNOLOGIES
(Open Elective)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The main objectives of this course are:
1. Familiarity with Open Source Technologies.
2. Examples of OSS Projects, Advantages of Open Source.
3. Understand the principles, methodologies of OSS.
4. Understand the policies, licensing procedures and ethics of OSS.

Course Outcomes: On Successful completion of this course, student will be able to
1. Differentiate between Open Source and Proprietary software and Licensing.
2. Recognize the applications, benefits and features of Open Source Technologies.
3. Understand and demonstrate Version Control System along with its commands.
4. Gain knowledge to start, manage open source projects.
5. Understand and practice the Open Source Ethics.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	1	2	2	2	-	-	-	2	1	1	1	3
2	2	2	3	3	2	2	1	1	1	1	2	2	1	3
3	3	3	3	3	3	3	1	-	2	2	3	1	2	3
4	3	3	3	2	3	3	2	2	2	3	2	3	1	3
5	3	3	2	2	2	2	2	3	1	2	2	2	1	3

UNIT – I

Introduction to Open Source: Open Source, need of Open Source, Open Source Principles, Open Source Standards Requirements for Software, OSS success, Free Software, Examples, Licensing, Free Software Vs. Proprietary Software, Public Domain software, History of free software, Proprietary Vs Open Source Licensing Model, use of Open Source Software.

UNIT – II

Fault Tolerant Design: **Principles and Open Source Methodology-** History, Open Source Initiatives, Open Standards Principles, Methodologies, Philosophy, Software freedom, Open Source Software Development, Licenses, Copyright vs. Copyleft, Patents, zero marginal cost, income-generation Opportunities, Internationalization.

UNIT – III

Case Studies: Apache, BSD, Linux, Mozilla Firefox, Wikipedia, Git, GNU CC, Libre Office.

UNIT – IV

Open Source Project: Starting and Maintaining an Open Source Project, Open Source Hardware, Open Source Design, Open Source Teaching (OST), Open Source Media, What Is A License, How to create your own Licenses. Important FOSS Licenses (Apache, BSD, PL, LGPL), copyrights and copy lefts, Patent.

UNIT – V

Open Source Ethics- Open Source Vs. Closed Source, Open Source Government, Ethics of Open Source, Social and Financial Impact of Open Source Technology, Shared Software, Shared Source, Open Source as a Business Strategy.

Text Books:

1. Kailash Vadera, Bjhavesh Gandhi "Open Source Technology", University Science Press, 1st Edition, 2009.
2. Fadi P. Deek and James A. M. McHugh, "Open Source Technology and Policy", Cambridge University Press.

Suggested Reading:

1. Wale Soyinka, "Linux Administration- A beginner's Guide", Tata McGraw Hills.
2. Andrew M. St. Laurent, "Understanding Open Source and Free Software Licensing", O'Reilly Media.
3. Dan Woods, Gautam Guliani, "Open Source for the Enterprise", O'Reilly Media.
4. Bernard Golden, "Succeeding with Open Source", Addison-Wesley Professional.
5. Clay Shirky and Michael Cusumano, "Perspectives on Free and Open Source Software", MIT press.

16CSO 09

BASICS OF ARTIFICIAL INTELLIGENCE
(Open Elective)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Basic Mathematics.

Course Objectives: The main objectives of this course are:

1. Provide a strong foundation of fundamental concepts in Artificial Intelligence.
2. Discuss the various paradigms involved in solving an AI problems which involve perception, reasoning and learning
3. Apply the AI concepts to build an expert system to solve the real-world problems.

Course Outcomes: On Successful completion of this course, student will be able to

1. Differentiate between a rudimentary Problem and an AI problem, it's Characteristics and problem-solving Techniques.
2. Compare and contrast the various knowledge representation schemes of AI.
3. Understand and analyze the various reasoning and planning techniques involved in solving AI problems.
4. Understand the different learning techniques.
5. Apply the AI techniques to solve the real-world problems.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	1	1	-	-	-	-	-	-	-	-	2	1
2	3	2	2	1		-	-	-	-	-		-	-	2
3	3	2	2	2	-	-	-	-	-	-	-	-	-	-
4	3	2	3	1	-	-	-	-	-	-	-	1	-	-
5	3	3	2	2	1	-	-	-	--	-	-	2	-	-

UNIT - I

Introduction: Definition, history, applications. **Problem Solving:** AI problems, AI Technique, Defining problem as a State-Space Search, Problem Characteristics. Heuristic Search Techniques: Generate–and–test, Hill Climbing, Constraint Satisfaction.

UNIT - II

Knowledge Representation (Logic): Representing facts in logic, proposition logic, predicate logic, resolution and unification. **Knowledge Representation (Structured):** Declarative representation, Semantic nets, procedural representation, frames.

UNIT - III

Reasoning: Probability and Bayes theorem, Certainty factors and Rule based systems, Bayesian Networks, Dempster-Shafer Theory. **Planning:** Components, goal stack planning, nonlinear planning, hierarchical planning.

UNIT - IV

Learning: Introduction, Rote learning, learning by taking advice, learning in problem solving and learning from examples: Decision tree. **Intelligent Agents:** Classification, Working of an agent, single agent and multi agent systems, multi agent application.

UNIT - V

Expert System: Representing and Using Domain Knowledge, Expert systems shells, Explanation, Knowledge Acquisition. **Perception and Action:** Real Time Search, Vision, Speech Recognition, ACTION: Navigation, Manipulation, Robot architectures.

Text Books:

1. Elaine Rich, Kevin Night, Shivashankar B Nair, "Artificial Intelligence", 3rd Edition, 2008
2. Russell Norvig, "Artificial Intelligence-Modern Approach", 3rd edition, 2010.

Suggested Reading:

1. Saroj Kaushik, "Artificial Intelligence", Cengage Learning India, 2012.
2. Nelson M. Mattos, "An Approach to Knowledge Base Management", Springer Berlin Heidelberg, 1991.

Online Resources:

1. http://nptel.ac.in/courses/106106126/
2. http://nptel.ac.in/courses/106105077/

16CSO 10

MACHINE LEARNING USING PYTHON
(Open Elective)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The main objectives of this course are:
1. Get an idea of Machine Learning algorithms to solve real world problems.
2. Study various machine learning algorithms.
3. Analyze data using machine learning techniques.

Course Outcomes: On Successful completion of this course, student will be able to
1. Understand the basics concepts of Machine Learning and Python.
2. Apply feature engineering techniques and visualization tools to the data.
3. Analyze the various types of data by using python based machine learning techniques.
4. Identify and evaluate various recommender systems.
5. Design solutions to real world problems using deep learning algorithms.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	-	-	-	1	-	-	1	1	1	-	1	2	1	2
2	2	1	1	-	1	1	1	1	1	1	-	1	2	1	2
3	2	3	1	1	2	-	-	1	2	2	1	2	2	2	2
4	2	2	1	1	2	-	-	1	1	1	1	2	2	2	2
5	2	2	2	1	2	1	1	2	2	2	1	2	3	2	3

UNIT - I

Introduction to Machine Learning: Introduction, Machine Learning process. **Introduction to Python**: Features, sources and installation of Python, IDEs, Basics of Python, Data Structures and loops.

UNIT - II

Feature Engineering: Introduction to Features and need of feature Engineering, Feature extraction and selection, Feature Engineering Methods, Feature Engineering with Python. **Data Visualization:** Various charts, histograms, plots.

UNIT - III

Regression: Simple and multiple regressions, Model assessment, various types of errors, errors, ridge regression, Lasso regression, non-parameter regression. **Classification:** Linear classification, logistic regression, Decision Trees, Random Forest, Naïve Bayes.

UNIT - IV

Unsupervised Learning: Clustering, K-Means clustering, Hierarchical clustering. **Text Analysis:** Basic text analysis with Python, regular expressions, NLP, text classification. **Time Series Analysis**: Date and time handling, window functions, correlation, time series forecasting.

UNIT - V

Neural Network and Deep Learning: Neural network- gradient descent, activation functions, parameter initialization, optimizer, loss function, deep learning, deep learning architecture, memory, deep learning framework. **Recommender System:** Recommendation engines, collaborative filtering.

Text Books:

1. Abhishek Vijavargia "Machine Learning using Python", BPB Publications, 1st Edition, 2018
2. Tom Mitchel "Machine Learning", Tata McGraWHill, 2017
3. Reema Thareja "Python Programming", Oxford Press, 2017.

Suggested Reading:

1. Yuxi Liu, "Python Machine Learning by Example", 2nd Edition, PACT, 2017

Online Resources:
1. https://www.guru99.com/machine-learning-tutorial.html
2. https://www.tutorialspoint.com/machine_learning_with_python/index.htm
3. https://www.tutorialspoint.com/python/
4. https://docs.python.org/3/tutorial/
5. https://www.geeksforgeeks.org/machine-learning/

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Scheme of Instruction and Syllabus of M. Tech (CSE) (With effect from 2019-20)

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (Autonomous)
Affiliated to Osmania University,
Hyderabad – 500 075, Telangana State

Institute Vision:

- To be a centre of Excellence in Technical Education and Research.

Institute Mission:

- To address the emerging needs through quality technical education and advanced research.

Department Vision:

- To become a center of excellence in the field of Computer Science and Engineering that produces innovative, skillful, socially responsible and ethical professionals.

Department Mission:

- To provide a curriculum that balances engineering fundamentals, modern technologies and research.
- To provide opportunities for solving real world problems.
- To provide opportunities for overall personal and social skill development.

M.Tech(CSE) Program Educational Objectives (PEO's)

1. Will be able to practice their profession with confidence and global competitiveness by making intellectual contributions.
2. Will pursue a life-long career of personal and professional growth with superior work ethics and character.
3. Will be engaged in research leading to innovations/products or become a successful entrepreneur.

M.Tech. (CSE) Program Outcomes (PO's)

At the end of the program, students will be able to:

1 Apply the principles of Computer Science and Engineering to the appropriate problems

2. Investigate, analyze and formulate solutions to the complex real world problems

3. Demonstrate the use of modern tools and techniques in the field of Computer Science

4. Work with multidisciplinary groups in a collaborative manner to develop sustainable inclusive technologies

5. Communicate effectively and develop self-confidence and life-long learning

6 Able to possess leadership, project management and financial skills with professional ethics

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (AUTONOMOUS)
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
M.TECH (CSE)
SCHEME OF INSTRUCTION & EXAMINATIONS

SEMESTER– I

S. No	Course Code	Title of the Course	Scheme of Instruction: Hours per Week			Duration of SEE in Hours	Scheme of Examination: Maximum Marks		Credits
			L	T	P/D		CIE	SEE	
THEORY									
1	19CSC 101	Mathematical Foundation of Computer Science	3	0	0	3	30	70	3
2	19CSC 102	Advanced Data Structures	3	0	0	3	30	70	3
3	19CSEXXX	Elective -I	3	0	0	3	30	70	3
4	19CSEXXX	Elective -II	3	0	0	3	30	70	3
5	19MEC 103	Research Methodology and IPR	2	0	0	2	20	50	2
6	19XXXXXX	Audit Courses-1	2	0	0	2		50	0
PRACTICAL									
7	19CSC 103	Laboratory 1 (Advanced Data Structures)	0	0	4	3	25	50	2
8	19CSEXXX	Laboratory 2 (Based on Elective-I,III)	0	0	4	3	25	50	2
		TOTAL	16	0	8	-	190	480	18

L: Lecture T: Tutorial D: Drawing P: Practical
CIE - Continuous Internal Evaluation SEE - Semester End Examination

ELECTIVE-I,III	
19CSE101	Machine Learning
19CSE102	Internet of Things
19CSE103	Introduction to Intelligent Systems
19CSE104	Data Preparation and Analysis
19CSE105	Secure Software Design & Enterprise Computing (SSDEC)
19CSE106	Computer Vision

ELECTIVE-II,IV,V	
19CSE113	Data Science & Big Data Analytics
19CSE114	Distributed Database Systems
19CSE115	Advanced Wireless and Mobile Networks
19CSE116	Human and Computer Interaction
19CSE117	GPU Computing
19CSE118	Digital Forensics
19CSE119	Mobile Applications and Services
19CSE120	Compiler for HPC
19CSE121	Open Source Technologies

ELECTIVE -I ,III LAB	
19CSE107	Machine Learning Lab
19CSE108	Internet of Things Lab
19CSE109	Introduction to Intelligent Systems Lab
19CSE110	Data Preparation and Analysis Lab
19CSE111	SSDE Lab
19CSE112	Computer Vision Lab

II-SEMESTER

SNO	Course Code	Title of the Course	Scheme of Instruction Hours per Week			Duration of SEE in Hours	Scheme of Examination Maximum Marks		Credits
			L	T	P		CIE	SEE	
THEORY									
1	19CSC 104	Advanced Algorithms	3	0	0	3	30	70	3
2	19CSC 105	Soft Computing	3	0	0	3	30	70	3
3	19CSEXXX	Elective -III	3	0	0	3	30	70	3
4	19CSEXXX	Elective -IV	3	0	0	3	30	70	3
5	19XXXXXX	Audit Course 2	2	0	0	2	-	50	0
PRACTICAL									
7	19CSC 106	Laboratory 3 (AA & Soft Computing)	-	-	4	3	25	50	2
8	19CSEXXX	Laboratory 4 (Based on Electives-III)	-	-	4	3	25	50	2
9	19CSC 107	Mini Projects with Seminar	-	-	4		50		2
		TOTAL	**14**	**0**	**12**	**-**	**220**	**430**	**18**

* Students be encouraged to go to Industrial Training/Internship for at least 2-3 months during semester break. **List of Audit Courses -1&2**

Code	Subjects
19EGA101	English for research paper writing
19CEA101	Disaster mitigation and management
19EEA101	Sanskrit for technical knowledge
19ECA101	Value education
19EGA102	Indian constitution & fundamental rights
19ITA101	Pedagogy studies
19EGA103	Stress Management by Yoga
19 EGA104	Personality Development through Life Enlightenment Skills.

III- SEMESTER

S.No	Course Code	Title of the Course	Scheme of Instruction Hours per Week			Duration of SEE in Hours	Scheme of Examination Maximum Marks		Credits
			L	T	P		CIE	SEE	
THEORY									
1	19CSEXXX	Elective V	3	0	0	3	30	70	3
2	19CSXXX	Open Elective	3	0	0	3	30	70	3
3	19CSC 108	Dissertation Phase – I	0	0	20		100		10
		TOTAL	**6**	**0**	**20**	**-**	**160**	**140**	**16**

ELECTIVE-V	
19CSE119	Mobile Applications and Services
19CSE120	Compiler for HPC
19CSE121	Open Source Technologies
NPTEL Courses**	Software Project Management
	Natural Language Processing
	Block Chain Architecture Design and Use cases
	Social Networks
	Virtual Reality

Open ELECTIVE-VI	
19CSO 101	Business Analytics
19MEO 101	Industrial Safety
19MEO 102	Introduction to Optimization Techniques
19CEO101	Cost Management of Engineering Projects
19MEO103	Composite Materials
19EEO101	Waste to Energy
19PYO 01	History of Science and Technology

****Students going for Internship / Industrial project, may complete these courses through NPTEL/ MOOCs**

IV - SEMESTER

S.No	Course Code	Title of the Course	Scheme of Instruction Hours per Week			Duration of SEE in Hours	Scheme of Examination Maximum Marks		Credits
			L	T	P		CIE	SEE	
THEORY									
1	19CSC 109	Dissertation Phase – II	0	0	32	3	100	100	16
		TOTAL	**0**	**0**	**32**	**-**	**100**	**100**	**16**

SEMESTER-I

19CSC 101

MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE

Instruction	3 hrs per week
Duration of End examination	3 hrs
Semester end examinations	70
CIE	30
Credits	3

Prerequisites: UG level Course in Discrete Mathematics.

Course Objectives:

1. Gain knowledge in discrete and continuous probability and its applications.
2. Use Graph theory for solving real world problems.
3. Solve problems using counting technique.

Course Outcomes: After completion of the course, students will be able to:

1. Understand the basic concepts of discrete and continuous probability.
2. Understand the methods of statistical inference, and their roles.
3. Apply graphs models in various applications
4. Apply various counting techniques in solving combinatorial problems.
5. Understand stochastic process and its applications.

UNIT 1:

Fundamentals: Probability mass, Density, Cumulative Distribution functions, Parametric families of distributions, Expected value, Variance, Conditional Expectation, Applications of the univariate and multivariate Central Limit Theorem, Probabilistic inequalities, Markov Chains.

UNIT 2:

Statistical Inference: Introduction, Parameter Estimation, Hypothesis Testing, Least squares curve fitting, The Coefficients of Determination Confidence Intervals in Linear Regression, Trend Detection and Slope Estimation, Correlation Analysis.

UNIT 3:

Graphs: Graphs and Graph Models, Special Types of Graphs, Applications of Graphs, Representing Graphs and Graph Isomorphism, Connectivity, Euler and

Hamilton Paths, Shortest Path Problems, Planar Graphs, Graph Coloring, Applications of Graph Colorings, Spanning Trees.

UNIT 4:

Counting: Basics of Counting, the Pigeon hole Principle, Permutations and Combinations, Enumerating Combinations and Permutations with Repetitions, Enumerating Permutations with Constrained Repetitions, Binomial Coefficients.

Advanced Counting Techniques: recurrence Relations, Solving Linear Recurrence Relations, Divide and Conquer Algorithms, Generating functions, Inclusion-Exclusion, Applications of Inclusion – Exclusion

UNIT 5:

Number theory and cryptography: Fundamental algorithms involving numbers, cryptography computations, information security algorithms and protocols. Computer Science and Engineering Applications: HMM, Routing algorithms, Bayes Theorem.

Text Books:

1. Kishor S. Trivedi, "Probability & Statistics with Reliability. Queuing, and Computer Science Applications", 2ndEdition, John Wiley and Sons Ltd.2016.
2. Kenneth H. Rosen, "Discrete Mathematics and its Applications with Combinatorics and Graph Theory", 7thEdition, McGraw Hill Education (India) Private Limited, 2011.
3. M.T Goodrich, R.Tomasia, "Algorithm design- Foundations, analysis", and Internet algorithms, John Wiley,2002 .

Reference Books:

1. D.S. Malik and M.K. Sen., "Discrete Mathematics, Theory and Applications", Revised Edition, Cengage Learning, 2012.
2. Thomas Koshy, "Discrete Mathematics with Applications", Elsevier Academic Press, 2012.
3. Douglas B. West, "Introduction to Graph Theory, 2ndEdition", PHI.2015.
4. Joe L. Mott, Abraham Kandel, Theodore P. Baker, "Discrete Mathematics for Computer Scientists & Mathematicians", 2nd Edition, Pearson Education, 1985.

Online Resources:

1. http://www.cs.yale.edu/homes/aspnes/classes/202/notes.pdf.

Professor and Head Department

19CSC 102

ADVANCED DATA STRUCTURES

Instruction	3 hrs per week
Duration of End examination	3 hrs
Semester end examinations	70
CIE	30
Credits	3

Prerequisites: Undergraduate Course in Data Structures.

Course Objectives:

1. Able to choose appropriate data structures, understand the ADT/ libraries, and use them to design algorithms for a specific problem.
2. Able to understand the necessary mathematical abstractions to solve problems.
3. Familiarity with advanced paradigms and data structure used to solve algorithmic problems.

Course Outcomes:

After completion of the course, students will be able to

1. Demonstrate Dictionaries and various hashing techniques.
2. Analyze and construct Skip Lists.
3. Develop and analyze algorithms for red-black trees, B-trees and Splay trees.
4. Develop algorithms for text processing applications.
5. Identify suitable data structures and develop algorithms for computational geometry problems.

UNIT 1:

Dictionaries: Definition, Dictionary Abstract Data Type, Implementation of Dictionaries; **Hashing**: Review of Hashing, Hash Function, Collision Resolution Techniques in Hashing, Separate Chaining, Open Addressing, Linear Probing, Quadratic Probing, Double Hashing, Rehashing, Extendible Hashing, Recent trends in hashing.

UNIT 2:

Skip Lists: Need for Randomizing Data Structures and Algorithms, Search and Update Operations on Skip Lists, Probabilistic Analysis of Skip Lists, Deterministic Skip Lists.

UNIT 3:

Trees: Binary Search Trees, AVL Trees, Red Black Trees, 2-3 Trees, B- Trees, Splay Trees.

UNIT 4:

Text Processing: String Operations, Brute-Force Pattern Matching, The Boyer Moore Algorithm, The Knuth-Morris-Pratt Algorithm, Standard Tries, Compressed Tries, Suffix Tries, The Huffman coding algorithm.

UNIT 5:

Computational Geometry: One Dimensional Range Searching, Two Dimensional Range Searching, Constructing a Priority Search Tree, Searching a Priority Search Tree, Priority Range Trees, Quad-trees, k-D Trees.

Text Books:

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in JAVA", 3rd Edition, Pearson,2004.
2. M T Goodrich and Roberto Tamassia, Algorithm Design, John Wiley, 2002.

Reference Books:

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++, 2ndEdition", Pearson, 2004.
2. Sartaj Sahni, "Data structures, Algorithms and Applications in Java", 2ndEdition, Universities Press,2005.

Online Resources:

1. https://www.cise.ufl.edu/~sahni/cop3530/presentations.htm.
2. http://www.nptelvideos.com/java
   java_video_LectureHours_tutorials.php

19CSE101

MACHINE LEARNING

Elective-I	
Instruction	3 hrs per week
Duration of End examination	3 hrs
Semester end examinations	70
CIE	30
Credits	3

Pre-requisites:
UG level course in probability, linear algebra and calculus. Any Programming experience is essential.

Course objectives:
1. Introduce students to state-of-the-art methods.
2. Expose to Modern programming tools for data analysis.
3. To study various sampling and classification problems

Course Outcomes: After completion of the course, students will be able to
1. Understand complexity of Machine Learning algorithms and their limitations, and also modern notions in data analysis oriented computing.
2. Apply common Machine Learning algorithms in practice and implementing their own
3. Design and implement machine learning solutions to classification, regression, and clustering problems;
4. Evaluate and interpret the results of the algorithms
5. Develop an appreciation for what is involved in learning from data.

UNIT 1:
Introduction: Learning, Types of Machine Learning.
Concept learning: Introduction, Version Spaces and the Candidate Elimination Algorithm.
Learning with Trees: Constructing Decision Trees, CART, Classification Example.

UNIT 2:
Linear Discriminants: The Perceptron, Linear Separability, Linear Regression Multilayer Perceptron (MLP): Going Forwards, Backwards, MLP in practices,

Deriving back Propagation SUPPORT Vector Machines: Optimal Separation, Kernels.

UNIT 3:

Clustering: Introduction, Similarity and Distance Measures, Outliers, Hierarchical Methods,Partitional Algorithms, Clustering Large Databases, Clustering with Categorical Attributes, Comparison.

UNIT 4:

Evolutionary Learning: Genetic Algorithms, Genetic Operators, Genetic Programming.

Ensemble learning: Boosting, Bagging, Dimensionality Reduction: Linear Discriminant Analysis, Principal Component Analysis.

UNIT 5:

Graphical Models: Bayesian networks, Approximate Inference, Making Bayesian Networks,Hidden Markov Models, The Forward Algorithm.. Reinforcement Learning - The Learning Task, Q Learning.

Text Books

1. Tom M. Mitchell, "Machine Learning", Mc Graw Hill, 1997
2. Stephen Marsland, Machine Learning - An Algorithmic Perspective, CRC Press, 2009.

Suggested Reading:

1. Margaret H Dunham, "Data Mining", Pearson Edition., 2003.
2. Galit Shmueli, Nitin R Patel, Peter C Bruce, "Data Mining for Business Intelligence", Wiley India Edition, 2007
3. Rajjan Shinghal, "Pattern Recognition", Oxford University Press, 2006.

Online resources

1. nptel https://nptel.ac.in/courses/106106139/.

19CSE102

INTERNET OF THINGS

Elective-I

Instruction	3 hrs per week
Duration of End examination	3 hrs
Semester end examinations	70
CIE	30
Credits	3

Pre-requisites: UG level Course in CAMP, Programming Basics.

Course Objectives:

1. Identify the vision and understand the basics of IoT.
2. To explore the use of Devices, Gateways in IoT and understand IoT protocols
3. To introduce Node MCU, Raspberry Pi platform and Explore Industrial Automation, and Commercial Building Automation in IoT.

Course Outcomes: After completion of the course, students will be able to

1. Understand an Overview of IoT
2. Use Devices and Gateways in Service Oriented Architecture.
3. Analyze the use of communication protocols in sensor networks.
4. Design Applications using Raspberry Pi.
5. Develop different IoT Automation systems.

UNIT 1:

Introduction to IoT: Sensors, Types of sensors and Transducers, Actuators and Types of Actuators.

Basics of Networking : IoT components, Functional Components of IoT, IoT interdependencies, IoT Service oriented architecture, IoT categories, IoT gateways, IoT and associated technologies, Key technologies for IoT, IoT challenges.

UNIT 2:

Communication Protocols:6LoWPAN, 6LoWPAN Routing Considerations, LOADng Routing, RPL Routing, RFID, Functionality-based IoT Protocol Organization: MQTT, SMQTT, CoAP, XMPP, AQMP, Zigbee,Wireless HART, Z-Wave, Bluetooth, NFC, RFID.

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UNIT 3:

Sensor Networks: Target Tracking, Wireless Multimedia Sensor Networks (WMSNs), Nano networks, Underwater Acoustic Sensor Networks, Opportunistic localization, WSN Coverage, Stationary Wireless Sensor Networks, Mobile Wireless Sensor Networks, Delay Tolerant Networks, UAV Networks, FANETs: Flying Ad Hoc Networks, VANETs, Machine-to-Machine Communications, Interoperability in IoT, Introduction to SDN: SDN for IoT , Recent advances in IoT.

UNIT 4:

Introduction to NodeMCU: NodeMCU pin diagram, Integration of Sensors and Actuators with NodeMCU.

Introduction to Raspberry Pi: About the board, Linux on Raspberry Pi, Raspberry Pi Interfaces, Programming Raspberry Pi with Python.

UNIT 5 :

IoT Systems : A Case Study.

Home Automation: Smart Lighting, Home Intrusion Detection , Smart Cities: Smart Parking Environment: Weather Monitoring System, Weather Reporting Bot, Air Pollution Monitoring, Forest Fire Detection, Agriculture: Smart Irrigation.

Text Books:

1. Raj and Anupama C. Raman,"The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press, 2017.
2. Jeeva Jose, "Internet of Things", Khanna Publishing House, Delhi, 2018.
3. Arshdeep Bahga and Vijay Madisetti, "Internet of Things: A Hands-on Approach", Universities Press, 2014.

Suggested Reading:

1. Dr. SRN Reddy, Rachit Tirnkral and Manasi Mishra, "Introduction to Internet of Things: A practical Approach", ETI Labs, 2018.
2. Adrian McEwen, "Designing the Internet of Things", Wiley, 2013.
3. Raj Kamal, "Internet of Things:Architecture and Design", McGraw Hill, 2017.
4. Cuno Pfister, "Getting Started with the Internet of Things", 0 Reilly Media, 2011.
5. O. Vermesan, P. Friess, "Internet of Things – Converging Technologies for Smart Environments and Integrated Ecosystems", River Publishers, Series in Communications, 2013.

Online Resources / Weblinks / NPTEL Courses:

1. Li Da Xu, Wu He, and Shancang Li, “Internet of Things in Industries: A Survey “, IEEE Transactions on Industrial Informatics, Vol. 10, No. 4, Nov. 2014.
2. T. Winter, P. Thubert, A. Brandt, J. Hui, R. Kelsey, P. Levis, K. Pister, R. Struik , JP. Vasseur, R. Alexander, “RPL: IPv6 Routing Protocol for LowPower and Lossy Networks”, IETF, Standards Track, Mar. 2012.
3. Z. Shelby , K. Hartke, C. Bormann, “The Constrained Application Protocol (CoAP)”,Internet Engineering Task Force (IETF), Standards Track, 2014.
4. L.Fenzel, “What’s The Difference Between IEEE 802.15.4 And ZigBee Wireless?”,Electronic Design (Online), Mar. 2013.
5. S. N. Das and S. Misra, “Information theoretic self-management of Wireless Sensor Networks”, Proceedings of NCC 2013.
6. F. Luo et al., “A Distributed Gateway Selection Algorithm for UAV Networks,” in IEEE Transactions on Emerging Topics in Computing, vol. 3, no. 1, pp. 22-33, March 2015.

19CSE103

INTRODUCTION TO INTELLIGENT SYSTEMS

Elective-I

Instruction	3 hrs per week
Duration of End examination	3 hrs
Semester end examinations	70
CIE	30
Credits	3

Pre-Requisites : UG level Course in Data Structures, Data Management. Probability and Statistics.

Course Objectives:
1. Understand the different learning techniques of AI systems.
2. Learn different knowledge representation techniques.
3. Developing systems to demonstrate intelligent behavior dealing with uncertainty.

Course Outcomes: After completion of course, students would be:
1. Understand knowledge of the fundamental principles of intelligent systems.
2. Select a search algorithm for different applications.
3. Understand the knowledge based systems.
4. Acquire knowledge in Uncertainity and Probabilistic reasoning approaches.
5. Apply different learning techniques to solve complex problems.

UNIT 1:

Introduction: History Intelligent Systems, Foundations of Artificial Intelligence, Sub areas of Al, Applications.

Problem Solving - State - Space Search and Control Strategies: Introduction, General Problem Solving Characteristics of problem, Exhaustive Searches, Heuristic Search Techniques, Iterative - Deepening A*, Constraint Satisfaction. Game Playing, Bounded Look - Ahead Strategy and use of Evaluation Functions, Alpha Beta Pruning.

UNIT 2:

Logic Concepts and Logic Programming: Introduction, Propositional Calculus Propositional Logic, Natural Deduction System, Axiomatic System, Semantic Tableau, A System in Propositional Logic, Resolution refutation in Propositional Logic, Predicate Logic, Logic Programming.

Knowledge Representation: Introduction, Approaches to knowledge Representation, Knowledge Representation using Semantic Network, Extended Semantic Networks for KR, Knowledge Representation using Frames.

UNIT 3:

Expert System and Applications: Introduction, Phases in Building Expert Systems Expert System Architecture, Expert Systems Vs Traditional Systems, Truth Maintenance Systems, Application of Expert Systems, List of Shells and tools. Uncertainty Measure - Probability Theory: Introduction, Probability Theory, Bayesian Belief Networks, Certainity Factor Theory, Dempster - Shafer Theory.

UNIT 4:

Machine - Learning Paradigms: Introduction, Machine learning System, Supervised and Unsupervised Learning, Inductive Learning, Learning Decision Trees, Deductive Learning, Clustering, Support Vector Machines.
Intelligent Agents: Agents vs Software programs, classification of agents, Multi-agent systems, Architecture of intelligent agents, Multi-agent application.

UNIT 5:

Advanced Knowledge Representation Techniques: Case Grammars, Semantic Web.
Natural Language Processing: Introduction, Sentence Analysis Phases, Grammars and Parsers, Types of Parsers, Semantic Analysis, Universal Networking Knowledge.

Text Books:

1. Saroj Kaushik, "Artificial Intelligence", Cengage Learning India, First Edition, 2011.
2. Russell, Norvig, "Artificial Intelligence: A Modern Approach", Pearson Education, 2nd Edition, 2004.
3. Rich, Knight, Nair , Artificial Intelligence, Tata McGraw Hill, 3rd Edition 2009.

Online Resources/Weblinks/NPTEL Course:

1. http://www.vssut.ac.in/lecture_notes/lecture1428643004.pdf.
2. http://www.cs.toronto.edu/~fbacchus/csc384/Lecture Hours/Lecture Hours.html.
3. https://nptel.ac.in/courses/106105077/.

19CSE104

DATA PREPARATION AND ANALYSIS
Elective-III

Instruction	3 hrs per week
Duration of End examination	3 hrs
Semester end examinations	70
CIE	30
Credits	3

Course Objective:
1. Prepare data analysis for industrial and scientific applications of data analytics.
2. Perform exploratory data analysis and develop meaningful data visualizations.
3. Learn how to prepare data sets for analysis by cleaning and reformatting.

Course Outcomes: After completion of course, students would be:
1. Understand the concepts of data gathering and preparation.
2. Ability to perform data cleaning techniques on data sets.
3. Analyze various data transformation and segmentation techniques.
4. Apply and various visualization techniques for analyzing the data.
5. Ability to solve correlations and connections, hierarchies and networks in business and scientific information using processing environment.

UNIT 1:
Data Gathering and Preparation:
Data formats, parsing and transformation, Scalability and real-time issues.

UNIT 2:
Data Cleaning: Consistency checking, Heterogeneous and missing data, Data Transformation and segmentation.

UNIT 3:
Exploratory Analysis: Descriptive and comparative statistics, Clustering and association, Hypothesis generation.

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UNIT 4:

Visualization:

Designing visualizations, Time series, Geolocated data, Correlations and connections, Hierarchies and networks, interactivity.

UNIT 5:

Statistical Significance, ANOVA, T-test, Building machine learning Regression models.

Text books:

1. Making sense of Data : "A practical Guide to Exploratory Data Analysis and Data Mining", by Glenn J. Myatt, 2007.
2. Trochim, W. M. K. "Data Preparation" Research Methods Knowledge Base 2nd Edition. Accessed 2/24/09.

References:

1. The visual display of quantitative information by edward tufte, 2001.
2. "Visualizing Data:" Exploring and Explaining Data with the Processing Environment,by Ben Fry, 2008
3. Exploratory data Mining and data cleaning,by Tamraparni dasu, 2003.

Online Resources/Weblinks/NPTEL Course:

1. https://www.safaribooksonline.com/library/view/visualizingdata/9780596514556/ch08.html.
2. https://www.scribd.com/document/54993779/Making-Sense-of-Dataa-Practical-Guide-to-Exploratory-Data-Analysis-and-Data-Mining.

19CSE105

SECURE SOFTWARE DESIGN AND ENTERPRISE COMPUTING
Elective-III

Instruction	3 hrs per week
Duration of End examination	3 hrs
Semester end examinations	70
CIE	30
Credits	3

Pre-Requisites : UG level course in Computer Programming, Software Engineering.

Course Objective:
1. To make students aware of various issues like weak random number generation, information leakage, poor usability, and weak or no encryption on data traffic
2. Techniques for successfully implementing and supporting network services on an enterprise scale and heterogeneous systems environment.
3. Methodologies and tools to design and develop secure software containing minimum vulnerabilities and flaws.

Course Outcome: After completion of course, students would be able to:
1. Understand various software vulnerabilities.
2. Software process vulnerabilities for an organization.
3. Monitor resources consumption in a software.
4. Interrelate security and software development process.
5. Apply security to Web and Mobile applications.

UNIT 1:
Secure Software Design
Identify software vulnerabilities and perform software security analysis, Master security programming practices, Master fundamental software security design concepts, Perform security testing and quality assurance.

UNIT 2:
Enterprise Application Development
Describe the nature and scope of enterprise software applications, Design distributed N-tier software application, Research technologies available for the presentation, business and data tiers of an enterprise software application,

Design and build a database using an enterprise database system, Develop components at the different tiers in an enterprise system, Design and develop a multi-tier solution to a problem using technologies used in enterprise system, Present software solution.

UNIT 3:

Enterprise Systems Administration

Design, implement and maintain a directory-based server infrastructure in a heterogeneous systems environment, Monitor server resource utilization for system reliability and availability, Install and administer network services (DNS/DHCP/Terminal Services/Clustering/Web/Email).

UNIT 4:

Obtain the ability to manage and troubleshoot a network running multiple services, Understand the requirements of an enterprise network and how to go about managing them.

UNIT 5:

Handle insecure exceptions and command/SQL injection, Defend web and mobile applications against attackers, software containing minimum vulnerabilities and flaws.

Text books / References:

1. Theodor Richardson, Charles N Thies, "Secure Software Design", Jones & Bartlett, 2012.
2. Kenneth R. van Wyk, Mark G. Graff, Dan S. Peters, Diana L. Burley, Enterprise Software Security, Addison Wesley, 2015 E book.

Online Resources/Web links/NPTEL Course:

1. https://www.coursera.org/specializations/secure-software-design.

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19CSE106

COMPUTER VISION
Elective-III

Instruction	3 hrs per week
Duration of End examination	3 hrs
Semester end examinations	70
CIE	30
Credits	3

Pre Requisites: UG level Course in Linear Algebra and Probability.

Course Objectives:

1. To understand the Fundamental Concepts Related To Multi-Dimensional Signal Processing.
2. To understand Feature Extraction algorithms.
3. To understand Visual Geometric Modeling and Stochastic Optimization.

Course Outcomes: After completion of the course, students will be able to

1. To develop algorithms and techniques to analyze and interpret the visible world around us.
2. To implement boundary tracking techniques.
3. To analyze Patterns in images
4. To apply in the field of Biometrics, Medical diagnosis, document processing, mining of visual content, to surveillance, advanced rendering etc.
5. To explore and contribute to research and further developments in the field of computer vision.

UNIT 1:

Image Formation and Description: Fundamental steps of image processing, the image model and Image acquisition, Sampling and quantization, Relationship between pixels. Sampling & Quantization, Elements of Digital Image Processing Systems.

Image Transforms: Digital Image Transforms - Fourier Transform, Extension to 2D.Properites of Fourier transformations.

UNIT 2:

Image Enhancements: Histogram Equalization, Image Smoothing, Image Sharpening, Edge Detection.

Segmentation: Active contours, Split and merge, Mean shift and mode finding, Normalized cuts.
Feature-based alignment: 2D and 3D feature-based alignment, Pose estimation.

UNIT 3:
Structure from motion: Triangulation, Two-frame structure from motion, Factorization, Bundle adjustment, constrained structure and motion
Dense motion estimation: Translational alignment, parametric motion, Spline-based motion, Optical flow, Layered motion.

UNIT 4:
Recognition: Object detection, Face recognition, Instance recognition, Category recognition, Context and scene understanding.

UNIT 5:
3D Reconstruction: Shape from X, Active range finding, Surface representations, Point-based representations, Volumetric representations, Model-based reconstruction.

Text Books:

1. R. C. Gonzalez and R. E. Woods "Digital Image Processing" Addison Wesley 2008.
2. Richard Szeliski "Computer Vision: Algorithms and Applications" Springer-Verlag London Limited 2011.

References

1. "Pattern Recognition: Statistical. Structural and Neural Approaches"; Robert J. Schallkoff; John Wiley and Sons; 1992.
2. "Computer Vision: A Modern Approach"; D. A. Forsyth and J. Ponce; Pearson Education; 2003.
3. "Multiple View geometry". R. Hartley and A. "Zisserman. 2002 Cambridge university Press".
4. Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, March 2004.
5. K. Fukunaga; "Introduction to Statistical Pattern Recognition", Second Edition, Academic Press, Morgan Kaufmann, 1990.

Online links

1 https://onlinecourses.nptel.ac.in/noc18_ee40.
2 CV online: http://homepages.inf.ed.ac.uk/rbf/CVonline.
3. Computer Vision Homepage: http://www2.cs.cmu.edu/afs/cs/project/cil/ftp/ html/vision.html.

19CSE113

DATA SCIENCE AND BIG DATA ANALYTICS
Elective-II

Instruction	3 hrs per week
Duration of End examination	3 hrs
Semester end examinations	70
CIE	30
Credits	3

Prerequisites: UG level Course in Database Management Systems.

Course Objectives:

1. Provide you with the knowledge and expertise to become a proficient data scientist.
2. Demonstrate an understanding of statistics and machine learning concepts that are vital for data science.
3. Critically evaluate data visualization based on their design and use for communicating stories from data.

Course Outcomes: After completion of the course, students will be able to

1. Understand and apply suitable algorithms for data science.
2. Compare various techniques and use appropriate methods for given dataset.
3. Design suitable models to extract and present useful information for the given data.
4. Understand and analyze data leakage problems in data.
5. Analyze various hypotheses for better understanding.

UNIT 1:
Introduction: Big Data and Data Science Hype, History of past and current, A Data Science Profile, Meta-Definition, Statistical Thinking, Exploratory Data Analysis, The Data Science Process.

UNIT 2:
Algorithms: Machine Learning Algorithms, Three Basic Algorithms
Spam Filters, Naive Bayes, and Wrangling: Learning by Example, Naive Bayes, Laplace Smoothing, Comparing Naive Bayes to KNN.

UNIT 3:
Logistic Regression: Thought Experiments, Classifiers, M6D Logistic Regression.

Extracting Meaning from Data: William Cukierski, The Kaggle Model, Ethical Implications of a Robo-Grader, Feature Selection, Google's Hybrid Approach to Social Research.

UNIT 4:
Data Visualization Techniques: Data Visualization History, Types of Visualization, Characteristics, Encoding schemes, Mapping variables to encodings, Visual encodings.
Data Leakage and Model Evaluation: Claudia's Data Scientist Profile, Data Mining Competitions, Characteristics of Good Modeler, Data Leakage, Avoid Leakage, Evaluating Mode.

UNIT 5:
Introduction to Big Data: Defining big data, 4 V's of big data, Big data types, Analytics, Examples obig data, Big data and Data Risk, Big data technologies, The benefits of big data, Crowd sourcing analytics. Architecture of Apache Hadoop HDFS, **No SQL Data Management:** Types of NOSQL data bases Benefits of NO SQL, **Map Reduce:** Introduction, Map reduce example, Job Tracker, Map .

Text Books:

1. Cathy O'Neil and Rachel Schutt, Doing Data Science, Straight Talk From The Frontline, O'Reilly, 2014.
2. "Big Data & Hadoop", V.K. Jain, Khanna Publishing House, 2017.

Reference Books:

1. Jure Leskovek, AnandRajaraman and Jeffrey Ullman. "Mining of Massive Datasets", v2.1, Cambridge UniversityPress, 2014.
2. Foster Provost and Tom Fawcett, Data Science for Business, What You Need to Know about Data Mining and Data-Analytic Thinking, O'Reilly, 2013.
3. Samir Madhavan, "Mastering Python for Data Science, Packt Publishing, 2015.
4. "Big Data Black Book, DT Editorial Services," Wiley India
5. "Data Science & Analytics", V.K. Jain, Khanna Publishing House Beginner's Guide for Data Analysis using R Programming, Jeeva Jose, ISBN: 978-93-86173454, 2018.
6. Montgomery, Douglas C. and George C. Runger, Applied statistics and probability for engineers. John Wiley & Sons, 6th edition, 2013.

Online Resources:

1. http://datasciencemasters.org.
2. http://learnds.com/
3. https://www.datascienceweekly.org

19CSE114

DISTRIBUTED DATABASE SYSTEMS
Elective-II

Instruction	3 hrs per week
Duration of End examination	3 hrs
Semester end examinations	70
CIE	30
Credits	3

Course Objectives:

1. Acquire insight into difference between the centralized databases and distributed databases.
2. Understand distributed DBMS architecture, query decomposition and data localization.
3. Learn the techniques of transaction management, distributed concurrency control, client/server architectures and distributed multi-DBMSs.

Course Outcomes: After completion of the course, students will be able to

1. Differentiate key concepts and techniques for centralized databases and distributed databases.
2. Analyze and design distributed database systems based on the principles of distributed indexing, query evaluation, data replication.
3. Implement storage, indexing, query evaluation and query optimization techniques.
4. Implement the concepts of transaction management, concurrency control, crash recovery, deadlocks and catalog management.
5. Apply suitable architecture for distributed databases and concepts of inter-operability of databases.

UNIT 1:

INTRODUCTION: Distributed data processing; what is a DDBS; Advantages and disadvantages of DDBS.

Problem areas; Overview of database and computer network concepts DISTRIBUTED DATABASE MANAGEMENT SYSTEM ARCHITECTURE Transparencies in a distributed DBMS; Distributed DBMS architecture; Global directory issues.

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UNIT 2:

DISTRIBUTED DATABASE DESIGN Alternative design strategies; Distributed design issues; Fragmentation; Data allocation SEMANTICS DATA CONTROL View management; Data security; Semantic Integrity Control

QUERY PROCESSING ISSUES Objectives of query processing; Characterization of query processors; Layers of query processing; Query decomposition; Localization of distributed data.

UNIT 3:

DISTRIBUTED QUERY OPTIMIZATION Factors governing query optimization; Centralized query optimization; Ordering of fragment queries; Distributed query optimization algorithms.

TRANSACTION MANAGEMENT The transaction concept; Goals of transaction management; Characteristics of transactions; Taxonomy of transaction models

CONCURRENCY CONTROL Concurrency control in centralized database systems; Concurrency control in DDBSs; Distributed concurrency control algorithms; Deadlock management.

UNIT 4:

RELIABILITY issues in DDBSs; Types of failures; Reliability techniques; Commit protocols; Recovery protocols.

UNIT 5:

PARALLEL DATABASE SYSTEMS: Parallel architectures; parallel query processing and optimization; load balancing

ADVANCED TOPICS: Mobile Databases, Distributed Object Management, Multi-databases.

References:

1. "Principles of Distributed Database Systems", M.T. Ozsu and P. Valduriez, Prentice-Hall, 1991.
2. "Distributed Database Systems", D. Bell and J. Grimson, Addison-Wesley, 1992.

19CSE115

ADVANCED WIRELESS AND MOBILE NETWORKS
Elective-II

Instruction	3 hrs per week
Duration of End examination	3 hrs
Semester end examinations	70
CIE	30
Credits	3

Pre-requisites: Undergraduate course in Computer Networks.

Course Objective:

1. Familiarity with the wireless/mobile market and the future needs and challenges.
2. Familiarity with key concepts of wireless networks, standards, technologies and their basic operations.
3. Learn how to design and analyze various medium accesses, evaluate MAC and network protocols using network simulation software tools.

Course Outcomes: After completion of course, students would be able to:

1. Demonstrate advanced knowledge of networking and wireless networking and understand various types of wireless networks, standards, operations and use cases.
2. Design WLAN, WPAN, WWAN, and Cellular based upon underlying propagation and performance analysis.
3. Demonstrate knowledge of protocols used in wireless networks and learn simulating wireless networks.
4. Design wireless networks exploring trade-offs between wire line and wireless links.
5. Develop mobile applications to solve some of the real world problems.

UNIT 1:

INTRODUCTION: Wireless Networking Trends, Key Wireless Physical Layer Concepts, Multiple Access Technologies -CDMA, FDMA, TDMA, Spread Spectrum technologies, Frequency reuse, Radio Propagation and Modelling, Challenges in Mobile Computing: Resource poorness, Bandwidth, energy etc.

WIRELESS LOCAL AREA NETWORKS:

IEEE 802.11 Wireless LANs Physical & MAC layer, 802.11 MAC Modes (DCF & PCF) IEEE 802.11 standards, Architecture & protocols, Infrastructure vs. Adhoc Modes.

UNIT 2:

WIRELESS CELLULAR NETWORKS: WLAN ,3G, 4G and 5G introduction, Mobile IPv4, Mobile IPv6, TCP over Wireless Networks, Cellular architecture, Frequency reuse, Channel assignment strategies, Handoff strategies, Interference and system capacity, Improving coverage and capacity in cellular systems, Spread spectrum Technologies.

UNIT 3:

WiMAX (Physical layer, Media access control, Mobility and Networking), IEEE 802.22 Wireless Regional Area Networks, IEEE 802.21 Media Independent Handover Overview WIRELESS SENSOR NETWORKS
Introduction, Application, Physical, MAC layer and Network Layer, Power Management.

UNIT 4:

WIRELESS PANs Bluetooth AND Zigbee, Introduction to Wireless Sensors. Tiny OS Overview.

UNIT 5:

SECURITY

Security in wireless Networks Vulnerabilities, Security techniques, Wi-Fi Security, QoS in wireless communication.

Text Books:

1. Schiller J., "Mobile Communications," Addison Wesley 2000
2. Stallings W., "Wireless Communications and Networks", Pearson Education 2005

References

1. Stojmenic Ivan, "Handbook of Wireless Networks and Mobile Computing", John Wiley and Sons Inc 2002
2. Yi Bing Lin and Imrich Chlamtac, "Wireless and Mobile Network Architectures", John Wiley and Sons Inc 2000
3. Pandya Raj, "Mobile and Personal Communications Systems and Services', PHI 20.

19CSE116

HUMAN AND COMPUTER INTERACTION
Elective-IV

Instruction	3 hrs per week
Duration of End examination	3 hrs
Semester end examinations	70
CIE	30
Credits	3

Course Objectives:

1. Learn the foundations of Human Computer Interaction
2. Be familiar with the design technologies for computer interaction and guidelines for web user interface
3. Learn the ecosystem and tools of mobile Human Computer interaction

Course Outcomes: After completion of the course, students will be able to

1. Understand the structure of models and theories of human computer interaction.
2. Understand the vision of a computer user.
3. Understand the recognition and remembrance limitations of a computer user.
4. Understand the mobile ecosystem and use the corresponding tools for mobile design.
5. Design an interactive web interface on the basis of models studied.

UNIT 1:

Foundations: The human, the computer, The Interaction, Paradigms

Introduction: Our perception is biased; our vision is optimized to see structure.

UNIT 2:

We Seek and Use Visual Structure, Our Color Vision is Limited, Our Peripheral Vision is Poor, Reading is Unnatural, Our Attention is Limited; Our Memory is Imperfect, Limits on Attention Shape Our Thought and Action.

UNIT 3:

Recognition is Easy, Recall is Hard, Problem Solving and Calculation are Hard, Many Factors Affect Learning, Human Decision Making is Rarely Rational.

UNIT 4:

Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile Design: Elements of Mobile Design, Tools.

UNIT 5:

Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow. Case Studies.

Text Books:

1. "Designing with the Mind in Mind – Simple Guide to Understanding", 2nd edition, Jeff Johnson, Elsevier Inc., 2010.
2. "Human Computer Interaction", 3rd edition, Alan Dix, Janet Finlay, Gregory D. Abowd, Russell Beale, Pearson Education Limited, 2004.
3. Brian Fling, “Mobile Design and Development”, First Edition , O Reilly Media Inc., 2009.
4. Bill Scott and Theresa Neil, “Designing Web Interfaces”, First Edition, O Reilly, 2009.

Suggested Reading:

1. "Designing the User Interface", 5th Edition, Ben Shneiderman, Catherine Plaisant, Maxine Cohen, Steven Jacobs, Pearson Education Limited, 2013.
2. "Mind Design II, 2nd Edition", Revised and enlarged edition, John Haugeland, The MIT Press, 1997.

Online Resources / Weblinks / NPTEL Courses:

1. https://nptel.ac.in/courses/106103115/
2. https://www.interaction-design.org/courses/human-computer-interaction?ad-set=human-computer-interactioncourse&gclid=EAIaIQobChMIkJu W09jM4QIVgTgrCh0PuwtXEAAYASAAEgLPhPD_BwE

19CSE117

GPU COMPUTING
Elective-IV

Instruction	3 hrs per week
Duration of End examination	3 hrs
Semester end examinations	70
CIE	30
Credits	3

Prerequisites: UG level Course in Computer Graphics, Animation, Computer Vision, C Language.

Course Objective:

1. To learn parallel programming with Graphics Processing Units (GPUs).
2. Understand and Identify key elements of computer graphics pipeline and GPU hardware.
3. Recognize the computing problems and implement optimization procedures that will benefit GPU computing.

Course Outcomes: After completion of the course, students will be able to

1. Gain basic knowledge of parallel programming.
2. Have an understanding of GPUs and the CUDA programming model
3. Understand the memory management and data transfer methodology in CUDA.
4. Be able to develop programs using GPUs for relevant real world problems.
5. Gain knowledge and acquire unique skills in multi-GPU processing and heterogeneous computing.

UNIT 1:

Introduction: History, Graphics Processors, Graphics Processing Units, GPGPUs. Clock speeds, CPU / GPU comparisons, Heterogeneity, Accelerators, Parallel Programming

CUDA: CUDA Open CL / Open ACC, Hello World, Computation Kernels, Launch parameters, Thread hierarchy, Warps /Wavefronts, Thread blocks / Workgroups, **Streams:** Streaming multiprocessors, 1D / 2D /3D thread mapping, Device properties, Simple Programs.

UNIT 2:

Memory: Memory hierarchy, DRAM / global, local / shared, private / local, textures, Constant Memory,

Pointers, Parameter Passing, Arrays and dynamic Memory, Multi-dimensional Arrays, Memory Allocation, Memory copying across devices,
Matrices: Programs with matrices, Performance evaluation with different memories.

UNIT 3:
Synchronization: Memory Consistency, Barriers (local versus global), Atomics, Memory fence.
Prefix sum, Reduction, Synchronization across CPU and GPU Programs for concurrent Data Structures such as Work-lists, Linked-lists.
Functions: Device functions, Host functions, Kernels ,functions, Using libraries(such as Thrust), developing libraries.

UNIT 4:
Debugging GPU Programs: Profiling, Profile tools, Performance aspects
Streams: Asynchronous processing, tasks, Task-dependence, Overlapped data transfers, Default Stream, Synchronization with streams.
Events: Event-based-Synchronization - Overlapping data transfer and kernel execution, pitfalls.

UNIT 5:
Advanced topics: Dynamic parallelism, Multi-GPU processing, Heterogeneous Processing.

Text Books:

1. "CUDA Programming: A Developer's Guide to Parallel Computing with GPUs", Shane Cook, Morgan Kaufman, 2012 (ISBN: 978-0124159334)
2. "Programming Massively Parallel Processors: A Hands-on Approach", David Kirk, Wen-meiHwu, Morgan Kaufman, 2010 (ISBN: 978-0123814722).

References:

1. "CUDA by Example: An Introduction to General Purpose GPU Programming; Jason Sanders, Edward Kandrot; Addison-Wesley; 2011 (ISBN 978-0-13-138768-3)
2. The CUDA Handbook: A Comprehensive Guide to GPU Programming"; Nicholas Wilt; Addison Wesley; 2013(ISBN: 978-0321809469)

Online Resources/Weblinks/NPTEL Course:

1. CUDA C Programming Guide NVIDIA's Parallel Forall Blog
2. https://devblogs.nvidia.com/calibrating-videos-vrworks-360-video
3. Mapping from GPU name to Compute Capability.

19CSE118

DIGITAL FORENSICS
Elective-IV

Instruction	3 hrs per week
Duration of End examination	3 hrs
Semester end examinations	70
CIE	30
Credits	3

Prerequisites: UG level Course in Operating Systems, Computer Networks.

Course Objective:

1. To provide basics of the rapidly changing and fascinating field of Digital forensics.
2. To collect, process, analyze and present computer forensic evidence.
3. To learn about network forensics, mobile forensics and Legal Aspects of Digital Forensics.

Course Outcomes: After completion of the course, students will be able to

1. Understand fundamentals of digital forensics.
2. Collect, process, analyze, and present computer forensic evidence.
3. Preserve digital evidence during forensic analysis.
4. Perform network investigations.
5. Understand mobile network investigations.

UNIT 1:

Digitalforensics fundamentals: Forensics science, digital forensics, Uses of Digital Forensics, The Digital Forensics Process, Use of Computer forensics in law Enforcement, Computer forensics assistance to Human resources/ employment proceeding, Computer forensics services, Benefits of professional forensics methodology.

UNIT 2:

Data recovery: Data recovery defined, Data backup and data recovery,the role of backup in data recovery, Data recovery solution, Hiding and Recovering Hidden Data.

Evidence collection and data seizure: Why collect evidence, Collection options, obstacles, Types of evidence, rules of evidence, Volatile evidence, general procedure, Collection and archiving, methods of collection, artifacts, Collection steps, controlling contamination: The chain of custody.

UNIT 3:

Duplication and preservation of digital evidence: Preserving the digital crime scene, Computer evidence processing steps, Legal aspects of collection and preserving Computer forensics evidence Computer image verification and authentication Special needs of evidential authentication, Practical consideration, implementation.

UNIT 4:

Computer Forensics Analysis- Discovery of electronic evidence, identification of data, reconstructing past events, Investigating Live Systems (Windows &Unix) .

Network forensics: Network Security Tools, NetworkAttacks, Network Evidence and Investigations.

UNIT 5:

Mobile forensics: Collecting and Handling Cell Phones as Evidence, Cell Phone Forensic Tools.

Legal Aspects of Digital Forensics: IT Act 2000, amendment of IT Act 2008.

Recent trends in mobile forensic technique and methods to search and seizure electronic evidence

Text Books:

1. John Vacca, "Computer Forensics: Computer Crime Scene Investigation", Laxmi Publications, First Edition 2015.
2. John Sammons, “The Basics of Digital Forensics”, The Primer for Getting Started in Digital Forensics, 2nd Edition, Syngress (2014).
3. Kevin Mandia, Chris Prosise, “Incident Response and computer forensics”, TataMcGrawHill, 2006.

Suggested Reading:

1. Marjie T. Britz, “Computer Forensics and Cyber Crime An Introduction”, 3rd Edition, Pearson Education 2013.
2. Cory Altheide, Harlan Carvey, “Digital Forensics with Open Source Tools”, Elsevier Publications, 2011.
3. Brian Carrier, “File System Forensic Analysis”, Pearson Education, 2005.

Web Resources:

1. https://www.cs.nmt.edu/~df/lectures.html
2. http://www.cyberforensics.in/
3. https://www.ncdrc.res.in/

19CSE119

MOBILE APPLICATIONS AND SERVICES
Elective-V

Instruction	3 hrs per week
Duration of End examination	3 hrs
Semester end examinations	70
CIE	30
Credits	3

Pre-Requisites: UG level Course in Wireless Communication and Mobile Computing.

Course Objectives:

1. This course presents the three main mobile platforms and their ecosystems, namely Android, iOS, and PhoneGap/WebOS.
2. It explores emerging technologies and tools used to design and implement feature-rich mobile applications for smart phones and tablets
3. It also take into account both the technical constraints relative to storage capacity, processing capacity, display screen, communication interfaces, and the user interface, context and profile.

Course Outcomes : After completion of the course, students will be able to

1. Identify the target platform and users and be able to define and sketch a mobile application
2. Develop database management system to retrieve data for mobile application.
3. Use Intent, Broadcast receivers and Internet services in Android App.
4. Understand the lifecycle of mobile application on Android platform.
5. Design and develop a mobile application in one of the platform.

UNIT 1:

Introduction: Introduction to Mobile Computing, Introduction to Android Development Environment, Factors in Developing Mobile Applications, Mobile Software Engineering, Frameworks and Tools, Generic UI Development Android User

UNIT 2:

More on UIs: Voice UIs and Mobile Apps, Text-to-Speech Techniques, Designing the Right UI, Multichannel and Multimodal UIs . Storing and Retrieving Data, Synchronization and Replication of Mobile Data, Getting the Model Right, Android Storing and Retrieving Data, Working with a Content Provider.

UNIT 3:

Communications via Network and the Web: State Machine, Correct Communications Model, Android Networking and Web, Telephony Deciding Scope of an App, Wireless Connectivity and Mobile Apps, Android Telephony Notifications and Alarms: Performance, Performance and Memory Management, Android Notifications and Alarms.

UNIT 4:

Putting It All Together: Packaging and Deploying, Performance Best Practices, Android Field Service App, Location Mobility and Location Based Services

UNIT 5:

Platforms and Additional Issues: Development Process, Architecture, Design, Technology Selection, Mobile App Development Hurdles, Testing, Security and Hacking, Active Transactions.

Text book:

1. Wei-Meng Lee, "Beginning Android 4 Application Development", 2012 by John Wiley & Sons.

References:

1. Jeff Mc Wherter, "Scott Gowell, PROFESSIONAL Mobile Application Development", Wrox, 1 edition, 2012.
2. James C Sheusi, Android Application Development for Java Programmers, Cengage Learning, 2013.

Weblinks:

1. https://nptel.ac.in/courses/106106147/6
2. https://nptel.ac.in/courses/106106156/30

Professor and Head Department

19CSE120

COMPILER FOR HPC
Elective-V

Instruction	3 hrs per week
Duration of End examination	3 hrs
Semester end examinations	70
CIE	30
Credits	3

Pre-Requisites :UG Level course in Data Structure, Compiler Design, Theory of Computation.

Course Objective:

1. To introduce the structure of compilers and high-performance compiler design to the field of Computer Science.
2. Analyze the basic steps involved in converting a source language to target code or target language.
3. Understands the concepts of cache coherence and parallel loops in compilers are included. Gain the knowledge to write a compiler program or can able to build a compiler.

Course Outcomes : After completion of the course, students will be able to

1. Identify the basic concepts needed for the development of a compiler structure of a compiler.
2. Analyze and understand Parallel loops, data dependency, exception handling and debugging in a compiler.
3. Understand the concepts involved in loop structuring and concurrency analysis.
4. Differentiate the various types of Machines, Message passing Machines
5. Explores recent trends in compilers for efficient compiler building.

UNIT 1:

High-Performance Systems, Structure of a Compiler, Programming Language Features, Languages for High Performance, Compiler transformation for high performance computing.

Data Dependence: Data Dependence in Loops, Data Dependence in Conditionals, Data Dependence in Parallel Loops, Program Dependence Graph.

UNIT 2:

Scalar Analysis with Factored Use-Def Chains: Constructing Factored Use-Def Chains, FUD Chains for Arrays, Induction Variables Using FUD Chains, Constant Propagation with FUD Chains, Data Dependence for Scalars. Data Dependence Analysis for Arrays. Array Region Analysis, Pointer Analysis, I/O Dependence, Procedure Calls,Inter-procedural Analysis.

UNIT 3:

Loop Restructuring: Simple Transformations, Loop Fusion, Loop Fission, Loop Reversal, Loop Interchanging, Loop Skewing, Linear Loop Transformations, Strip-Mining, Loop Tiling, Other Loop Transformations, and Inter-procedural Transformations.

Optimizing for Locality: Single Reference to Each Array, Multiple References, General Tiling, Fission and Fusion for Locality

UNIT 4:

Concurrency Analysis: Concurrency from Sequential Loops, Concurrency from Parallel Loops, Nested Loops, Round off Error, Exceptions and Debuggers. Vector Analysis: Vector Code, Vector Code from Sequential Loops, Vector Code from For all Loops, Nested Loops, Round off Error, Exceptions, and Debuggers, Multi-vector Computers.

UNIT 5:

Message-Passing Machines:, Remote Data Access, Automatic Data Layout, Multiple Array Assignments, Other Topics. Scalable Shared-Memory Machines: Global Cache Coherence, Local Cache Coherence, Latency Tolerant Machines. Recent trends in compiler design for high performance computing and message passing machines and scalable shared memory machine, Nvidiacuda parallel computing.

Text Books:

1. Michael Wolfe, "High-Performance Compilers for Parallel Computing", Pearson, 2007.
2. "Compiler transformation for High performance computing" –DAVID F. BACON, SUSAN L, 1994.

Online Resources/Weblinks/NPTEL Course:

1. www.springer.com/gp/book/9783540280095
2. www.chpc.utah.edu/documentation/software/compilers.php
3. https ://www.aspsys.com/solutions/software-solutions/hpc-compilers
4. https://link.springer.com/book/10.1007%2fBFboo17241.

Professor and Head Department

19CSE121

Open Source Technologies
Elective-V

Instruction	3 hrs per week
Duration of End examination	3 hrs
Semester end examinations	70
CIE	30
Credits	3

Course Objectives: The objectives of this course are:

1. Familiarity with Open Source Technologies
2. Study some FOSS Projects to under the principles, methodologies of FOSS.
3. Understand the policies, licensing procedures and ethics of FOSS.

Course Outcomes: On Successful completion of this course, student will be able to:

1. Differentiate between Open Source and Proprietary software and Licensing.
2. Recognize the applications, benefits and features of Open Source Technologies.
3. Understand and demonstrate Version Control System along with its commands.
4. Gain knowledge to start, manage open source projects.
5. Understand and practice the Open Source Ethics.

UNIT - I

Introduction to Open Source: Open Source, need and principles of OSS, Open Source Standards, Requirements for Software, OSS success, Free Software, Examples, Licensing, Free Vs. Proprietary Software, Public Domain software, History of free software, Proprietary Vs Open Source Licensing Model, use of Open Source Software.

UNIT – II

Fault Tolerant Design: Principles and Open Source Methodology- History, Open Source Initiatives, Open Standards Principles, Methodologies, Philosophy, Software freedom, Open Source Software Development, Licenses, Copyright vs. Copy left, Patents, zero marginal cost, income-generation Opportunities, Internationalization.

UNIT – III

Case Studies: Apache, BSD, Linux, Mozilla Firefox, Wikipedia, Git, GNU CC, LibreOffice**.**

UNIT – IV

Open Source Project: Starting and Maintaining an Open Source Project, Open Source Hardware, Open Source Design, Open Source Teaching (OST), Open Source Media

What Is A License, How to create your own Licenses, Important FOSS Licenses (Apache, BSD, PL, LGPL), copyrights and copy lefts, Patent.

UNIT – V

Open Source Ethics- Open Source Vs. Closed Source, Open Source Government, Ethics of Open Source, Social and Financial Impact of Open Source Technology, Shared Software, Shared Source, Open Source as a Business Strategy**.**

Text Books:

1. Kailash Vadera, Bhavyesh Gandhi "Open Source Technology", University Science Press, 1st Edition, 2009.
2. Fadi P. Deek and James A. M. McHugh, "Open Source Technology and Policy", Cambridge University Press, 2008.

Suggested Reading:

1. Wale Soyinka, "Linux Administration- A beginner's Guide", Tata McGraw Hills, 2015.
2. Andrew M. St. Laurent, "Understanding Open Source and Free Software Licensing", O'Reilly Media, 2004.
3. Dan Woods, Gautam Guliani, "Open Source for the Enterprise", O'Reilly Media.
4. Bernard Golden, "Succeeding with Open Source", Addison-Wesley Professional.
5. Clay Shirky and Michael Cusumano, "Perspectives on Free and Open Source Software", MIT press.

19CSE107

MACHINE LEARNING LAB
Elective-I

Instruction	4 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50
Continuous Internal Evaluation	25
Credits	2

Pre Requisites: UG level Course in Probability and Statistics, Proficiency in programming basics.

Course Objectives:

1. To implement the machine learning algorithms
2. Implement the machine learning concepts in any suitable language of choice.
3. To explore Deep learning technique and various feature extraction strategies.

Course outcomes: After completion of the course, students will be able

1. To apply knowledge of computing and mathematics to machine learning problems, models and algorithms.
2. To apply mathematical foundations, algorithmic principles, and computer science theory to the modeling and design of computer-based systems.
3. To design, implement, and evaluate an algorithm to meet desired needs; and
4. To design and develop principles in the construction of software systems of varying complexity.
5. To analyze a problem and identify the computing requirements appropriate for its solution;

Description (If any):

1. The programs can be implemented in either JAVA or Python.
2. For Problems 1 to 6 and 10, programs are to be developed without using the built-in classes or APIs of Java/Python.
3. Data sets can be taken from standard repositories (https://archive.ics.uci.edu/ml/datasets.html) or constructed by the students.

Lab Experiments:

1. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.

2. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
3. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
4. Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.
5. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
6. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
7. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.
8. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.
9. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
10. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.

Text Books

1. Tom M. Mitchell, "Machine Learning", India Edition, McGraw Hill Education 2013.
2. Herbert Schildt & Dale Skrien, "Java Fundamentals-A Comprehensive Introduction", 2013 Edition, Tata McGraw-Hill.
3. Herbert Schildt, "The Complete Reference Java", 7 Edition, Tata McGraw-Hill 2007.
4. ReemaThareja "Python Programming", Oxford Press, 2017.
5. Mike McGrath "Python in easy steps: Makes Programming Fun", Kindle Edition, 2017.

Web references:

1. http://www.cs.cmu.edu/~tom/mlbook-chapter-slides.html
2. http://www.cs.cmu.edu/afs/cs.cmu.edu/user/mitchell/ftp/mlbook.html

19CSE108

INTERNET OF THINGS LAB
Elective-I

Instruction	4 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50
Continuous Internal Evaluation	25
Credits	2

Pre-requisites: UG level Course in CAMP, Programming Basics.

Course Objectives:

1. Identify the vision and understand the basics of IoT.
2. Impart necessary and practical knowledge of components of Internet of Things.
3. Develop skills required to build real-time IoT based projects.

Course Outcomes: After completion of the course, students will be able to

1. Understand internet of Things and its hardware and software components.
2. Interface I/O devices, sensors & communication module.
3. Analyze the use of communication protocols in IoT.
4. Remotely monitor data and control devices.
5. Develop real time IoT based projects.

LIST OF PRACTICALS

1. Introduction of IoT equipments and perform necessary software installation.
2. Write a program to interface LED/Buzzer with Arduino and to turn ON LED for 1sec after every 2 seconds.
3. Write a program to interface Digital sensor PIR with Arduino and to turn ON LED when motion detected.
4. Write a program to interface DHT22 sensor with Arduino and display temperature and humidity readings.
5. Write a program to interface motor using relay with Raspberry Pi. Turn ON motor when the temperature is high.
6. Write a program to interface LCD with Raspberry Pi and print temperature and humidity readings on it.
7. Interface Bluetooth with Arduino/Raspberry Pi and write a program to send sensor data to smart phone using Bluetooth.
8. Write a program to interface flame/smoke sensor with Arduino / Raspberry Pi and give an alert message when flame/smoke is detected.
9. Install MySQL database on Raspberry Pi and perform basic SQL queries.

10. Write a program on Arduino/Raspberry Pi to publish temperature data to MQTT broker.
11. Write a program on Arduino/Raspberry Pi to subscribe to MQTT broker for temperature data and print it.
12. Write a program on Arduino/Raspberry Pi to upload temperature and humidity data local/cloud server.
13. Write a program on Arduino/Raspberry Pi to retrieve temperature and humidity data from local/cloud server.
14. Implement any case study using Arduino/Raspberry Pi.

Text Books:

1. Arshdeep Bahga and Vijay Madisetti, "Internet of Things: A Hands-on Approach", Universities Press, 2014.

Suggested Reading:

1. Dr. SRN Reddy, Rachit Tirnkral and Manasi Mishra, "Introduction to Internet of Things: A practical Approach", ETI Labs, 2018.
2. Adrian McEwen, "Designing the Internet of Things", Wiley, 2013.
3. Raj Kamal, "Internet of Things:Architecture and Design", McGraw Hill, 2017.
4. Cuno Pfister, "Getting Started with the Internet of Things", 0 Reilly Media, 2011.
5. O. Vermesan, P. Friess, "Internet of Things – Converging Technologies for Smart Environments and Integrated Ecosystems", River Publishers, Series in Communications, 2013.

Online Resources / Weblinks / NPTEL Courses:

1. Li Da Xu, Wu He, and Shancang Li, "Internet of Things in Industries: A Survey ", IEEE Transactions on Industrial Informatics, Vol. 10, No. 4, Nov. 2014.
2. T. Winter, P. Thubert, A. Brandt, J. Hui, R. Kelsey, P. Levis, K. Pister, R. Struik, JP. Vasseur, R. Alexander, "RPL: IPv6 Routing Protocol for LowPower and Lossy Networks", IETF, Standards Track, Mar. 2012.
3. Z. Shelby , K. Hartke, C. Bormann, "The Constrained Application Protocol (CoAP)",Internet Engineering Task Force (IETF), Standards Track, 2014.
4. L.Fenzel, "What's The Difference Between IEEE 802.15.4 And ZigBee Wireless?",Electronic Design (Online), Mar. 2013.
5. S. N. Das and S. Misra, "Information theoretic self-management of Wireless Sensor Networks", Proceedings of NCC 2013.
6. F. Luo et al., "A Distributed Gateway Selection Algorithm for UAV Networks," in IEEE Transactions on Emerging Topics in Computing, vol. 3, no. 1, pp. 22 -33, March 2015.

Professor and Head Department

19CSE109

INTRODUCTION TO INTELLIGENT SYSTEMS LAB
Elective-I

Instruction	4 hrs per week
Duration of End examination	3 hrs
Semester end examinations	50
CIE	25
Credits	2

Pre Requisites: UG level Course in Probability and Statistics ,Proficiency in programming basics.

Course Objectives:

1. Design and analyze various computing algorithms and techniques using Python/Scilab.
2. Able to apply different learning algorithms to solve real time problems.
3. Recognize the underlying mathematics and logic behind various AI techniques.

Course Outcomes: After completion of the course, students will be able to

1. Write programs in Python/Scilab language.
2. Recognize the underlying mathematics and logic behind various computing algorithms under AI system.
3. Apply variety of uncertain algorithms to solve problems of moderate complexity.
4. Describe and apply various techniques for logic programming and machine learning.
5. Acquire knowledge in game playing algorithms.

Lab Experiments:

1. Implement an 8-puzzle solver using Heuristic search technique.
2. Implement the Constraint Satisfaction problem using backtracking.
3. Implement a program for game search.
4. Build a bot to implement any game using easy AI library(ex.. tic-tac-toe, game of bones).
5. Implement a Bayesian network from a given data.
6. Infer the data from the Bayesian network.
7. Implement an application to classify data using Support Vector Machines.
8. Develop a NLP application to perform the following tasks.
   a. Tokenizing text data.

   b. Converting words to their base forms using stemming .
   c. Converting words to their base forms using lemmatization.
   d. Dividing text data into chunks.

9. Implement a case study on sentiment analysis.
10. Implementation of any case study using AI techniques.

Text Books:

1. Saroj Kaushik, "Artificial Intelligence", Cengage Learning India, First Edition, 2011.
2. Prateek Joshi, "Artificial Intelligence with Python:" A Comprehensive Guide to Building Intelligent Apps for Python Beginners and Developers, Packt publishing, January 2017.

Reference Books:

1. Prateek Joshi, Artificial Intelligence with Python – Heuristic Search [Video], PACKT, 2017.

Online Resources:

1. https://www.researchgate.net/file.PostFileLoader.html?id...assetKey
2. http://artint.info/AIPython/aipython.pdf.

19CSE110

DATA PREPARATION AND ANALYSIS LAB
Elective-III

Instruction	4 hrs per week
Duration of End examination	3 hrs
Semester end examinations	50
CIE	25
Credits	2

Course Objectives:
1. Intended to obtain hands-on experience using data analysis application.
2. Intended to provide practical exposure of clustering and association rules mining.
3. Apply a variety of different data exploration techniques like statistics and visualization methods.

Course Outcomes: After completion of the course, students will be able to
1. Apply pre-processing statistical methods for any given raw data.
2. Ability to perform heterogeneous, cleaning techniques to replace missing data.
3. Analyze various data transformation techniques on various data sets.
4. Apply and analyze the various clustering techniques.
5. Comprehend visualize the data related to in real world applications.

List of programs
Implement the following programs:
1. Load any one dataset and perform following activities
2. List all the categorical (or nominal) attributes and the real-valued attributes separately.
3. What attributes do you think might be crucial in building the any data set?
4. Apply the cleaning process for the dataset (Replace Missing values).
5. Do you really need to input so many attributes to get good results? May be only a few would do. For example, you could try just having some combination of attributes, the class attribute (naturally)). Try out some combinations. (You had removed two attributes from the data set. Remember to reload the arff data file to get all the attributes initially before you start selecting the ones you want.)
6. Implement the discretization on any data set.
7. Demonstrate performing clustering on data sets.
8. Perform data pre-processing tasks and demonstrate performing association rule mining on data sets.

9. Load the mlb dataset and write a program to: Explore how relationships can be instantly and powerfully conveyed through the spatial arrangement of data,visual elements such as icons and lines, and most significantly, the use of animation.
   a. Loading Text Data.
   b. Files Too Large for loadStrings( )
   c. Reading Files Progressively.
   d. Reading Files Asynchronously with a Thread.
   e. Parsing Large Files As They Are Acquired.
   f. Load Milk, Tea, and Coffee dataset and perform the following activities
   g. Write a program to Acquiring a table of data from a text file.
   h. Write a program to perform parsing the contents of the file into a usable data structure.
   i. Write a program to calculate the boundaries of the data to facilitate representation.
   j. Write a program to find a suitable representation and considering alternatives.
   k. Write a program to refine the representation with consideration for placement, type, line weight, and color.
10. Design an application by providing a means of interacting with the data so that the variables can be compared against one another or against the average of the whole data set.

Text Books:

1. Glenn J. Myatt, "Making sense of Data : A practical Guide to Exploratory Data Analysis and Data Mining", John Wiley & Sons, Inc,2007.
2. Ben Fry, "Visualizing Data: Exploring And Explaining Data With The Processing Environment", O'Reilly Media, Inc, 2007.

Reference Books:

1. Robert Wysocki, "Effective Project Management: " Traditional, Agile, Extreme, Sixth edition, Wiley India, rp2011.
2. Watts S. Humphrey "An Introduction to the Team Software Process", Pearson Education, 2000.
3. James R. Persse, Process Improvement essentials, O'Reilly, 2006.
4. Bob Hughes & Mike Cotterell, "Software Project Management", fourth Edition, TMH, 2006.
5. Andrew Stellman & Jennifer Greene, Applied Software Project Management, O'Reilly, 2006.

Online Resources:

1. https://www.safaribooksonline.com/library/view/visualizing- data/9780596514556/ch08.html.
2. https://www.scribd.com/document/54993779/Making-Sense-of-Data-a-Practical-Guide-to-Exploratory-Data-Analysis-and-Data-Mining.

19CSE111

SECURE SOFTWARE DESIGN AND ENTERPRISE COMPUTING LAB
Elective-III

Instruction	4 hrs per week
Duration of End examination	3 hrs
Semester end examinations	50
CIE	25
Credits	2

Pre-Requisites : UG level Course in Computer Programming, Software Engineering, JAVA, J2EE.

Course Objective:

1. To make students aware of various issues like weak random number generation, information leakage, poor usability, and weak or no encryption on data traffic
2. Techniques for successfully implementing and supporting network services on an enterprise scale and heterogeneous systems environment.
3. Methodologies and tools to design and develop secure software containing minimum vulnerabilities and flaws.

Course Outcomes: After completion of course, students would be able to:

1. Differentiate between various software vulnerabilities.
2. Software process vulnerabilities for an organization.
3. Monitor resources consumption in a software.
4. Interrelate security and software development process.
5. Analyse Enterprise Computing security issues.

List of Experiments

1. Study of multi-tier software environment.
2. Study of web servers / web browser and Tools for enterprise software Development and deployment.
3. Develop a package using JDBC
4. Develop a package using servlets / JSP.
5. Study of System threat attacks - Denial of Services.
6. Implementation of S-DES algorithm for data encryption .
7. Implementation of Asymmetric Encryption Scheme – RSA.
8. Study of Symmetric Encryption Scheme – RC4.
9. Study of Techniques uses for Web Based Password Capturing.
10. Study of Anti-Intrusion Technique – Honey Pot.

References Books

1. Paul J Perrone, Venkata S.R. Krishna R and Chayanti, "Building Java Enterprise
2. Systems with J2EE", Techmedia , New Delhi, 2000.
3. George Reese, " Database programming, with JDBC and Java" Second Edition,
4. O'Reiliy Publishers, New Delhi, 2000.

19CSE112

COMPUTER VISION LAB
Elective-III

Instruction	4 hrs per week
Duration of End examination	3 hrs
Semester end examinations	50
CIE	25
Credits	2

Course Objectives:

1. To Make students acquainted with practical aspects of computing with images.
2. To Improve quality of image by applying enhancement techniques.
3. To understand Feature Extraction algorithms.

Course Outcomes: After completion of the course, students will be able to:

1. Understand the basic image processing techniques.
2. Apply image enhancement techniques.
3. Detect edges using various kernels and transformations.
4. Apply histogram processing and convertion between various colour spaces.
5. Analyse datasets using classification and clustering.
6. Evaluate computer vision system for real world problems.

Description :

Use any tool like OpenCV/ Scilab/ python/R Programming etc.,

List of Programs

1. Familiarization of the tool used for computer vision.
2. Implement basic image operations
   a. Loading and displaying an image.
   b. Color formats
   c. Image enhancement.
3. Implement smoothing filters on an image using
   a. Gaussian filter
   b. Median filter
   c. Mean Filter
4. Demonstrate fourier Transformations.
5. Implement histogram calculation and equalization for the given image.
6. Implement morphological operations like dilation, erosion, opening and closing on the given image.

7. Implement edge detection on images using any two edge detection masks.
8. Detection of motion from structure .
9. Implement texture extraction of a given image.
10. **Case Study :** Object detection like recognizing pedestrians..
11. **Case Study :** Face recognition of an image using K-Means clustering.
12. **Case Study :** Dimensionality reduction using PCA for the given images.
13. **Case Study :** Demonstrate model based reconstruction using tensor flow.

Text Books:

1. Gary Bradski and Adrian Kaehler, "Learning OpenCV", O'Reilly Media, Inc., 1st Edition, 2008.
2. Talita Perciano and Alejandro C Frery, "Introduction to Image Processing Using R:" Learning by Examples, Springer, 1st Edition, 2013.
3. "Computer Vision: Algorithms and Applications" by Richard Szeliski; Springer-Verlag London Limited 2011.

Reference Books:

1. R C Gonzalez and R E woods, "Digital Image Processing", Addison Pearson, 3rd Edition, 2013.
2. David A.Forsyth and Jean Ponce, Computer Vision-A Modern Approach, PHI, 1st Edition, 2003.

Online Resources:

1. https://atoms.scilab.org/toolboxes/IPCV/1.1
2. https://docs.opencv.org/2.4/doc/tutorials/tutorials.html.

Professor and Head Department

19CSC 103

ADVANCED DATA STRUCTURES LAB

Instruction	4 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50
Continuous Internal Evaluation	25
Credits	2

Prerequisites: Undergraduate course on Data Structures.

Course Objectives:

1. Write and execute programs to solve problems using data structures such as arrays, linked lists, stacks, queues, trees, hash tables and search trees.
2. Learn to implement various text processing .
3. Learn to use appropriate data structures for real world problems.

Course Outcomes: After completion of the course, students will be able to:

1. Develop programs for various data structures for stacks, queues and skip lists.
2. Develop programs for various non-linear data structures for linked lists
3. Develop programs for various non-linear data structures for binary search tree
4. Develop programs for dictionaries.
5. Implement various text processing algorithms.

List of Programs:

1. Implement StackADT using an array.
2. Implement QueueADT using an array .
3. Implement StackADT using a singly linked list.
4. Implement QueueADT using a singly linked list.
5. Implement priority queue ADT.
6. Implement all the functions of a dictionary (ADT) using Linear Probing.
7. Implement all the functions of a dictionary (ADT) using Quadratic Probing.
8. Implement skip list data structure with the following operations.
9. Construct, Search, Update.
10. Implement a binary search data structure to perform the following operations.
11. Construct a binary search tree of elements.

12. Search for a key element in the above binary search tree.
13. Delete an element from the above binary search tree.
14. Implement KMP algorithm for pattern matching.
15. Implement Boyer-Moore algorithm for pattern matching

Text Books:

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in JAVA", 3rdEdition, Pearson,2004.
2. M T Goodrich and Roberto Tamassia, "Algorithm Design", John Wiley, 2002.

Reference Books:

1. S.Sahni, "Data structures, Algorithms and Applications in Java", 2ndEdition, Universities Press,2005.
2. A.Drozdek, "Data Structures and Algorithms in java", 3rd Edition, Cengage Learning,2008.
3. J.R.Hubbard, Data Structures with Java, 2ndEdition, Schaum's Outlines, TMH, 2007.

Professor and Head Department

19CSC 104

ADVANCED ALGORITHMS

Instruction	3 hrs per week
Duration of End examination	3 hrs
Semester end examinations	70
CIE	30
Credits	3

Pre-Requisites: UG level course in Algorithm Design and Analysis .

Course Objective:

1. Introduce advanced methods of choosing, designing and analyzing algorithms.
2. Familiarize with basic paradigms and data structures used to solve advanced algorithmic problems.
3. Understand different classes of problems concerning their computation difficulties.

Course Outcomes: After completion of course, students would be able to:

1. Understand the different problems solved by using algorithmic paradigms.
2. Apply the suitable data structure for solving a problem using various strategies
3. Differentiate the complexities of a problem solved in various approaches.
4. Design appropriate mathematical notation to solve a problem using algorithmic paradigms.
5. Develop solutions for real world problem.

UNIT 1:

Sorting: Review of various sorting algorithms, topological sorting

Graph: Definitions and Elementary Algorithms: Shortest path by BFS, shortest path in edge-weighted case (Dijkasra's), depth-first search and computation of strongly connected components, emphasis on correctness proof of the algorithm and time/space analysis, example of amortized analysis.

UNIT 2:

Matroids: Introduction to greedy paradigm, algorithm to compute a maximum weight maximal independent set. Application to MST.

Graph Matching: Algorithm to compute maximum matching. Characterization of maximum matching by augmenting paths, Edmond's Blossom algorithm to compute augmenting path.

UNIT 3:

Flow-Networks: Maxflow-mincut theorem, Ford-Fulkerson Method to compute maximum flow, Edmond-Karp maximum-flow algorithm.

Matrix Computations: Strassen's algorithm and introduction to divide and conquer paradigm, inverse of a triangular matrix, relation between the time complexities of basic matrix operations, LUP-decomposition.

UNIT 4:

Shortest Path in Graphs: Floyd-Warshall algorithm and introduction to dynamic programming paradigm-Optimal Binary Search Tree, 0/1 Knapsack Problem, Longest Common Subsequence, Matrix Chain Multiplication .

Modulo Representation of integers/polynomials: Chinese Remainder Theorem, Conversion between base-representation and modulo-representation. Extension to polynomials. Application: Interpolation problem.

UNIT 5:

Linear Programming: Geometry of the feasibility region and Simplex algorithm

NP-completeness: proof of NP-hardness and NP-completeness-Clique Problem, Vertex-Cover Problem, Subset-Sum Problem.

Approximation algorithms: Introduction, Vertex-Cover Problem

Text Books

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", 3rd Edition,The MIT Press, 2009.

Suggested Reading

1. Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman, "The Design and Analysis of Computer Algorithms", Pearson Addison-Wesley Publication, Originally published on 1974.
2. Jon Kleinberg, Eva Tardos, "Algorithm Design", Pearson Addison-Wesley Publication, 2009.

Online Resources/Weblinks/NPTEL Course:

1. https://nptel.ac.in/courses/106104019/

19CSC 105

SOFT COMPUTING

Instruction	3 hrs per week
Duration of End examination	3 hrs
Semester end examinations	70
CIE	30
Credits	3

Pre-Requisites : UG level course in Basic knowledge of mathematics.

Course Objective:

1. To introduce soft computing concepts and techniques and foster their abilities in designing appropriate technique for a given scenario.
2. To implement soft computing based solutions for real-world problems.
3. To give students knowledge of non-traditional technologies and fundamentals of artificial neural networks, fuzzy sets, fuzzy logic, genetic algorithms.

Course Outcomes: After completion of course, students would be able to:

1. Identify and describe soft computing techniques and their roles in building intelligent Machines.
2. Apply fuzzy logic and reasoning to handle uncertainty and solve various engineering problems.
3. Apply genetic algorithms to combinatorial optimization problems.
4. Evaluate and compare solutions by various soft computing approaches for a given problem.
5. Recognize the underlying mathematics and logic behind various soft computing algorithms.

UNIT 1:

Introduction: Evolution of Computing: Soft Computing Constituents, From Conventional AI to Computational Intelligence, Hard vs Soft computing.

UNIT 2:

Artificial Neural Networks: Fundamental concepts, Evolution of neural networks, Basic models of artificial neural network, Important terminologies of ANNs. McCulloch-Pitts neuron, Linearseparability, Hebb network.Supervised Learning Neural Networks:Perceptron networks, Adaptive linear neuron(Adaline), Multiple Adaptive linear neuron (Madaline), Back propagation network

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UNIT 3:

Unsupervised Learning Neural Networks: Kohonen self organizing networks, Adaptive resonance theory.

Associate Memory Networks: Bidirectional associative memory network, Hopfield networks.

UNIT 4:

Fuzzy logic: Fuzzy Sets, Operations on Fuzzy Sets, Fuzzy Relations, Membership Functions: Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems, Fuzzy Expert Systems, Fuzzy Decision Making.

UNIT 5:

Genetic algorithms: Introduction to Genetic Algorithms (GA), Applications of GA in Machine Learning :Simple genetic algorithm, General genetic algorithm, Classification of genetic algorithm, Machine Learning Approach to Knowledge Acquisition.

Text Books:

1. S.N. Sivanandam& S.N. Deepa, "Principles of soft computing", Wiley publications, 2nd Edition, 2008.
2. Jyh:Shing Roger Jang, Chuen:Tsai Sun, EijiMizutani, Neuro :Fuzzy and Soft Computing , Prentice:Hall of India, 2003.

Suggested Readings:

1. LiMin Fu, "Neural Networks in Computer Intelligence",McGraw-Hill edition, 1994.
2. Simon Haykins, "Neural Networks a Comprehensive Foundation", PHI, second edition
3. George J. Klir and Bo Yuan, Fuzzy Sets and Fuzzy Logic:Theory and Applications , Prentice Hall, 1995.
4. MATLAB Toolkit Manual.

Online Resources/Weblinks/NPTEL Course:

1. www.soukalfi.edu.sk/01_NeuroFuzzyApproach.pdf
2. https://drive.google.com/file/d 0B0z1VRAPGVkT2MyTXlwdE9XWXc/view?usp=sharing
3. https://github.com/rohanchikorde/Data-Sciencebooks/blob/master/python-machine-learning-2nd.pdf
4. http://www.myreaders.info/html/soft_computing.html

19CSC 106

ADVANCED ALGORITHM and SOFT COMPUTING LAB

Instruction	4 hrs per week
Duration of End examination	3 hrs
Semester end examinations	50
CIE	25
Credits	2

Pre-Requisites : UG level course in Design and analysis of algorithm Lab using any programming Language.

Course Objective:

1. Familiarize with efficient utilization of programming language constructs and strategies to solve real time problems.
2. Fundamentals of Neural Networks & Feed Forward Networks, Associative Memories & ART Neural Networks
3. Fuzzy Logic and Fuzzy Systems; Genetic Algorithms and its design.

Course Outcomes: After completion of course, students would be able to:

1. Understand and Analyze implementation of various advanced Algorithms.
2. Design and identifies the suitable algorithmic paradigm for any application.
3. Design and analyze various Neural Networks Architectures.
4. Implement fuzzy sets and Genetic Algorithms with its operators.
5. Apply soft computing strategies for various real time applications.

List of Experiments:

1. Implementation of Sorting- heap sort, quick sort, topological sort.
2. Implementation of Minimum Spanning Trees.
3. Implementation of Maximum Sub-Array Problem, Stassen's Matrix Multiplication
4. Implementation of Shortest Path Algorithms.
5. Implementation of Longest Common Subsequence.
6. Implementation of Matrix Chain Multiplication, Simplex Algorithm.
7. Implementation of Simple Neural Network (McCulloh-Pitts model) for realizing AND Operation and OR operation using Perceptron learning algorithm.
8. Implementation of XOR problem using MADALINE network.

9. Design and implementing the back Propagation algorithm for training a non-linear network.
10. Implementation of BAM network.
11. Implementation of KSOFM network for Clustering.
12. Implement the Genetic Algorithm for TSP.

Text Books:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", 3rd Edition, MIT Press., 2009.
2. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", 2nd Edition, Pearson, 2004.
3. S.N.Sivanandam, S.N.Deepa "Principles of Soft Computing" Second Edition, Wiley Publication 2016.
4. Satish Kumar, –"Neural Networks -A classroom approach"; Second Edition, TMH, 2017.

Online Resources/Weblinks/NPTEL Course:

1. http://www.nptelvideos.in/2012/11/data-structures-and-algorithms.html
2. https://www.geeksforgeeks.org/top-algorithms-and-data-structures-for-competitive-programming/
3. http://www.nptelvideos.com/java/java_video_Lecture Hours_tutorials.php
4. https://nptel.ac.in/courses/106104019/

Professor and Head Department

19MEC 103

RESEARCH METHODOLOGY AND IPR

Instruction	2 hrs per week
Duration of End examination	2 hrs
Semester end examinations	50
CIE	25
Credits	2

Course Objectives:
To make the students to
1. Motivate to choose research as career
2. Formulate the research problem, prepare the research design
3. Identify various sources for literature review and data collection report writing
4. Equip with good methods to analyze the collected data
5. Know about IPR copyrights.

Course Outcomes: At the end of the course, student will be able to
1. Define research problem, review and asses the quality of literature from various sources
2. Improve the style and format of writing a report for technical paper/ Journal report, understand and develop various research designs
3. Collect the data by various methods: observation, interview, questionnaires
4. Analyze problem by statistical techniques: ANOVA, F-test, Chi-square
5. Understand apply for patent and copyrights.

UNIT - I
Research Methodology: Objectives and Motivation of Research, Types of Research, research approaches, Significance of Research, Research Methods verses Methodology, Research Process, Criteria of Good Research, Problems Encountered by Researchers in India, Benefits to the society in general. Defining the Research Problem, Selection of Research Problem, Necessity of Defining the Problem.

UNIT - II
Literature Survey Report writing: Literature Survey: Importance and purpose of Literature Survey, Sources of Information, Assessment of Quality of Journals and Articles, Information through Internet. Report writing: Meaning of interpretation, layout of research report, Types of reports, Mechanics of writing a report.

Research Proposal Preparation: Writing a Research Proposal and Research Report, Writing Research Grant Proposal.

UNIT - III

Research Design: Meaning of Research Design, Need of Research Design, Feature of a Good Design, Important Concepts Related to Research Design, Different Research Designs, Basic Principles of Experimental Design, Developing a Research Plan, Steps in sample design, types of sample designs.

UNIT - IV

Data Collection and Analysis: Methods of data collection, importance of Parametric, non parametric test, testing of variance of two normal population, use of Chi-square, ANOVA, Ftest, z-test.

UNIT - V

Patents and Copyright: Patent: Macro economic impact of the patent system, Patent document, How to protect your inventions. Granting of patent, Rights of a patent, how extensive is patent protection. Copyright: What is copyright. What is covered by copyright. How long does copyright last? Why protect copyright? Related Rights: what are related rights? Enforcement of Intellectual Property Rights: Infringement of intellectual property rights, Case studies of patents and IP Protection.

Text Books:

1. C.R Kothari, "Research Methodology, Methods & Technique"; New Age International Publishers, 2004
2. R. Ganesan, "Research Methodology for Engineers", MJP Publishers, 2011
3. Y.P. Agarwal, "Statistical Methods: Concepts, Application and Computation", Sterling Publs., Pvt., Ltd., New Delhi, 2004

Suggested Reading:

1. Day R (2006) **How to Write and Publish a Scientific Paper,** Cambridge University Press.
2. **MLA Hand book for writers of Research Papers**, East West Press Pvt. Ltd, New Delhi, 7th Edition, 2008.
3. Lauri Rozakis, Schaum's, **Quick Guide to Writing Great Research Papers**, Tata McGraw Hills Pvt. Ltd, New Delhi, 2007.

Online Resources:

1. NPTEL: https://onlinecourses.nptel.ac.in/noc18_mg13/preview

19CE A101

DISASTER MITIGATION AND MANAGEMENT

(MTech Audit Course I/II Sem - Common to all branches)

Instruction	3 hrs per week
Duration of End examination	3 hrs
Semester end examinations	70
CIE	30
Credits	3

Course Objectives: To enable the student

1. To equip the students with the basic knowledge of hazards, disasters, risks and vulnerabilities including natural, climatic and human induced factors and associated impacts
2. To impart knowledge in students about the nature, causes, consequences and mitigation measures of the various natural disasters
3. To enable the students to understand risks, vulnerabilities and human errors associated with human induced disasters
4. To enable the students to understand and assimilate the impacts of any disaster on the affected area depending on its position/ location, environmental conditions, demographic, etc.
5. To equip the students with the knowledge of the chronological phases ina disaster management cycle and to create awareness about the disaster management framework and legislations in the context of national and global conventions

Course Outcomes: At the end of the course the student

1. Ability to analyze and critically examine existing programs in disaster management regarding vulnerability, risk and capacity at different levels.
2. Ability to understand and choose the appropriate activities and tools and set up priorities to build a coherent and adapted disaster management plan.
3. Ability to understand various mechanisms and consequences of human induced disasters for the participatory role of engineers in disaster management.
4. To understand the impact on various elements affected by the disaster and to suggest and apply appropriate measures for the same.
5. Develop an awareness of the chronological phases of disaster preparedness, response and relief operations for formulating effective

disaster management plans and ability to understand various participatory approaches/strategies and their application in disaster management

UNIT 1:

Introduction: Basic definitions- Hazard, Disaster, Vulnerability, Risk, Resilience, Mitigation, Management; classification of types of disaster- Natural and man-made; International Decade for natural disaster reduction (IDNDR); International strategy for disaster reduction (ISDR), National disaster management authority (NDMA).

UNIT 2:

Natural Disasters: Hydro meteorological disasters: Causes, Early warning systems- monitoring and management, structural and non-structural measures for floods, drought and Tropical cyclones; Geographical based disasters: Tsunami generation, causes, zoning, Early warning systems- monitoring and management, structural and non-structural mitigation measures for earthquakes, tsunami, landslides, avalanches and forest fires. Case studies related to various hydro meteorological and geographical based disasters.

UNIT 3:

Human induced hazards: Chemical disaster- Causes, impacts and mitigation measures for chemical accidents, Risks and control measures in a chemical industry, chemical disaster management; Case studies related to various chemical industrial hazards eg: Bhopal gas tragedy; Management of chemical terrorism disasters and biological disasters; Radiological Emergencies and case studies; Case studies related to major power break downs, fire accidents, traffic accidents, oil spills and stampedes, disasters due to double cellar construction in multi-storeyed buildings.

UNIT 4:

Disaster Impacts: Disaster impacts- environmental, physical, social, ecological, economical, political, etc.; health, psycho-social issues; demographic aspects-gender, age, special needs; hazard locations; global and national disaster trends; climate change and urban disasters.

UNIT 5:

Concept of Disaster Management: Disaster management cycle – its phases; prevention, mitigation, preparedness, relief and recovery; risk analysis, vulnerability and capacity assessment; Post-disaster environmental response-water, sanitation, food safety, waste management, disease control; Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR programs in India and the activities of National Disaster Management Authority.

Text Books:

1. Pradeep Sahni," Disaster Risk Reduction in South Asia", Prentice Hall, 2003.
2. B. K. Singh," Handbook of Disaster Management: techniques & Guidelines", Rajat Publication, 2008.

Suggested Reading:

1. Ministry of Home Affairs". Government of India, "National disaster management plan, Part I and II", Latest 2016.
2. K. K. Ghosh," Disaster Management", APH Publishing Corporation, 2006.
3. http://www.indiaenvironmentportal.org.in/files/file/disaster_management_india1.pdf
4. http://www.ndmindia.nic.in/ (National Disaster management in India, Ministry of Home Affairs)
5. Hazards, Disasters and your community: A booklet for students and the community, Ministry of home affairs, 2003.

19EEA101

SANSKRIT FOR TECHNICAL KNOWLEDGE

(MTech. Audit Course I/II Sem - Common to all branches)

Instruction	2 hrs per week
Duration of End examination	3 hrs
Semester end examinations	70
CIE	30
Credits	0

Course Objectives:

1. To get a working knowledge in illustrious Sanskrit, the scientific language in the world
2. To make the novice Learn the Sanskrit to develop the logic in mathematics, science & other subjects
3. To explore the huge knowledge from ancient Indian literature

Course Outcomes: After completion of this course, students will be able to:

1. Develop passion towards Sanskrit language
2. Decipher the latent engineering principles from Sanskrit literature.
3. Correlates the technological concepts with the ancient Sanskrit history.
4. Develop knowledge for the technological progress
5. Explore the avenue for research in engineering with aid of Sanskrit

UNIT 1:

Introduction to Sanskrit language: Sanskrit Alphabets-vowels-consonants-significance of Amarakosa-parts of speech-Morphology-creation of new words-significance of synonyms-sandhi-samasa-sutras-active and passive voice-Past/Present/Future Tense-syntax-Simple Sentences (elementary treatment only)

UNIT 2:

Role of Sanskrit in Basic sciences: Brahmagupthas lemmas (second degree indeterminate equations), sum of squares of n-terms of AP- sulba_sutram or baudhayana theorem (origination of pythogorous theorem)-value of pie-Madhava's sine and cosine theory (origination of Taylor's series).The measurement system-time-mass-length-temp, Matter elasticity-optics-speed of light (origination of michealson and morley theory).

UNIT 3:

Role of Sanskrit in Engineering-I (Civil, Mechanical, Electrical and Electronics Engineering):

Building construction-soil testing-mortar-town planning-Machine definition-crucible-furnace-air blower- Generation of electricity in a cell-magnetism-Solar system-Sun: The source of energy, the earth-Pingala chandasutram (origination of digital logic system)

UNIT 4:

Role of Sanskrit in Engineering-II (Computer Science Engineering & Information Technology): Computer languages and the Sanskrit languages-computer command words and the vedic command words-analogy of pramana in memamsa with operators in computer language-sanskrit analogy of physical sequence and logical sequence, programming.

UNIT 5:

Role of Sanskrit in Engineering-III (Bio-technology and Chemical Engineering):
Classification of plants-plants, the living-plants have senses-classification of living creatures

Chemical laboratory location and layout-equipment-distillation vessel-kosthi yanthram-

Text Books:

1. M Krishnamachariar, History of Classical Sanskrit Literature, TTD Press, 1937.
2. M.R. Kale, A Higher Sanskrit Grammar: For the Use of School and College Students, Motilal Banarsidass Publishers, ISBN-13: 978-8120801783, 2015.
3. Kapail Kapoor, Language, Linguistics and Literature: The Indian Perspective, ISBN-10: 8171880649, 1994.
4. Pride of India, Samskrita Bharati Publisher, ISBN: 81-87276-27-4, 2007
5. Shri Rama Verma, Vedas the source of ultimate science, Nag publishers, ISBN:81-7081-618-1, 2005.

19EC A101

VALUE EDUCATION

(MTech Audit Course I/II Sem - Common to all branches)

Instruction	2 hrs per week
Duration of End examination	2 hrs
Semester end examinations	50
CIE	—
Credits	Non credit

Course Objectives

This course aims to:

1. Understand the need and importance of Values for self-development and for National development.
2. Imbibe good human values and Morals
3. Cultivate individual and National character.

Course outcomes: After completion of the Course, Students will be able to:

1. Gain necessary Knowledge for self-development
2. Learn the importance of Human values and their application in day to day professional life.
3. Appreciate the need and importance of interpersonal skills for successful career and social life
4. Emphasize the role of personal and social responsibility of an individual for all-round growth.
5. Develop a perspective based on spiritual outlook and respect women, other religious practices, equality, non-violence and universal brotherhood.

UNIT 1:

Human Values, Ethics and Morals: Concept of Values, Indian concept of humanism, human values; Values for self-development, Social values, individual attitudes; Work ethics, moral and non- moral behaviour, standards and principles based on religion, culture and tradition.

UNIT 2:

Value Cultivation, and Self-management: Need and Importance of cultivation of values such as Sense-of Duty, Devotion to work, Self-reliance, Confidence, Concentration, Integrity & discipline, and Truthfulness.

Professor and Head Department
Department of Computer Science & Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075 (T.S.)

UNIT 3:

Spiritual outlook and social values: Personality and Behavior, Scientific attitude and Spiritual (soul) outlook; Cultivation of Social Values Such as Positive Thinking, Punctuality, Love & Kindness, Avoiding fault finding in others, Reduction of anger, forgiveness, Dignity of labour, True friendship, Universal brotherhood and religious tolerance.

UNIT 4:

Values in Holy Books: Self-management and Good health; and internal & external Cleanliness, Holy books versus Blind faith, Character and Competence, Equality, Nonviolence, Humility, Role of Women.

UNIT 5:

Dharma, Karma and Guna: Concept of soul; Science of Reincarnation, Character and Conduct, Concept of Dharma; Cause and Effect based Karma Theory; The qualities of Devine and Devilish; Satwic, Rajasic and Tamasic gunas.

Suggested reading

1. Chakroborty, S.K. "Values & Ethics for organizations Theory and practice", Oxford University Press, New Delhi, 1998.
2. Jaya Dayal Goyandaka, "Srimad Bhagavad Gita", with Sanskrit Text, Word meaning and Prose meaning, Gita Press, Gorakhpur, 2017.

Professor and Head Department
Gandipet, Hyderabad-500 075 (T.S.)

19EG A 102

INDIAN CONSTITUTION & FUNDAMENTAL RIGHTS

(MTech Audit Course I/II Sem - Common to all branches)

Instruction	2 hrs per week
Duration of End examination	2 hrs
Semester end examinations	50

Course Objectives:

The course will introduce the students to :

1. The history of Indian Constitution and its role in the Indian democracy.
2. Address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement. to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. Have knowledge of the various Organs of Governance and Local Administration.

Course Outcomes : After successful completion of the course he students will be able to :

1. Understand the making of the Indian Constitution and its features.
2. Understand the Rights of equality, the Right of freedom and the Right to constitutional remedies.
3. Have an insight into various Organs of Governance - composition and functions.
4. Understand powers and functions of Municipalities, Panchayats and Co-operative Societies.
5. Understand Electoral Process, special provisions.

UNIT 1:

History of making of the Indian constitutions - History, Drafting Committee (Composition & Working).

Philosophy of the Indian Constitution: Preamble, Salient Features.

UNIT 2:

Contours of Constitutional Rights and Duties - Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

UNIT 3:

Organs of Governance - Parliament : Composition, Qualifications, Powers and Functions

Union executives : President, Governor, Council of Ministers, Judiciary, appointment and transfer of judges, qualifications, powers and functions

UNIT 4:

Local Administration - District's Administration head: Role and importance. Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Panchayati Raj: Introduction, PRI: Zilla Panchayat, Elected Officials and their roles, CEO Zilla Panchayat: positions and role.

Block level: Organizational Hierarchy(Different departments) Village level: role of elected and appointed officials. Importance of grass root democracy.

UNIT 5:

Election commission: Election Commission: Role and functioning, Chief Election Commissioner and Election Commissioners, State Election Commission :Role and functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

Suggested Reading:

1. **The Constitution of India**, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar, **Framing of Indian Constitution**, 1st Edition, 2015.
3. M. P. Jain, **Indian Constitution Law**, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, **Introduction to the Constitution of India**, Lexis Nexis, 2015.

Online Resources:

1. http://www.nptel.ac.in/courses/103107084/Script.pdf

Professor and Head Department

Hyderabad-500 075 (T.S.)

19ITA101

PEDAGOGY STUDIES
(Audit Course-2)

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	50 Marks
Credits	0

Course Objectives:
1. To present the basic concepts of design and policies of pedagogy studies.
2. To provide understanding of the abilities and dispositions with regard to teaching techniques, curriculum design and assessment practices.
3. To familiarize various theories of learning and their connection to teaching practice.
4. To create awareness about the practices followed by DFID, other agencies and other researchers.
5. To provide understanding of critical evidence gaps that guides the professional development.

Course Outcomes: Upon completing this course, students will be able to:
1. Illustrate the pedagogical practices followed by teachers in developing countries both in formal and informal classrooms.
2. Examine the effectiveness of pedagogical practices.
3. Understand the concept, characteristics and types of educational research and perspectives of research.
4. Describe the role of classroom practices, curriculum and barriers to learning.
5. Understand Research gaps and learn the future directions.

UNIT-I
Introduction and Methodology: Aims and rationale, Policy background, Conceptual framework and terminology - Theories of learning, Curriculum, Teacher education - Conceptual framework, Research questions - Overview of methodology and Searching.

UNIT-II
Thematic Overview: Pedagogical practices followed by teachers in formal and informal classrooms in developing countries - Curriculum, Teacher education.

UNIT-III

Evidence on the Effectiveness of Pedagogical Practices: Methodology for the in depth stage: quality assessment of included studies - How can teacher education (curriculum and Practicum) and the school curriculum and guidance material best support effective pedagogy? - Theory of change - Strength and nature of the body of evidence for effective pedagogical practices - Pedagogic theory and pedagogical approaches - Teachers' attitudes and beliefs and pedagogic strategies.

UNIT-IV

Professional Development: alignment with classroom practices and follow up support - Support from the head teacher and the community – Curriculum and assessment - Barriers to learning: Limited resources and large class sizes.

UNIT-V

Research Gaps and Future Directions: Research design – Contexts – Pedagogy - Teacher education - Curriculum and assessment – Dissemination and research impact.

Text Books:

1. Ackers J, Hardman F, "Classroom Interaction in Kenyan Primary Schools, Compare", 31 (2): 245 – 261, 2001.
2. Agarwal M, "Curricular Reform in Schools: The importance of evaluation", Journal of Curriculum Studies, 36 (3): 361 – 379, 2004.

Suggested Reading:

1. Akyeampong K, "Teacher Training in Ghana – does it count? Multisite teacher education research project (MUSTER)", Country Report 1.London: DFID, 2003.
2. Akyeampong K, Lussier K, Pryor J, Westbrook J, "Improving teaching and learning of Basic Maths and Reading in Africa: Does teacher Preparation count?, International Journal Educational Development, 33 (3): 272- 282, 2013.
3. Alexander R J, "Culture and Pedagogy: International Comparisons in Primary Education", Oxford and Boston: Blackwell, 2001.
4. Chavan M, "Read India: A mass scale, rapid, 'learning to read' campaign", 2003.

Web Resources:

1. https://onlinecourses.nptel.ac.in/noc17_ge03/preview
2. www.pratham.org/images/resources%20working%20paper%202.pdf.

19EG A 103

STRESS MANAGEMENT BY YOGA

(**(MTech Audit Course I/II Sem -** Common to all branches)

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	50 Marks

Course Objectives

The Course will introduce the students to :

1. Creating awareness about different types of stress and the role of yoga in the management of stress.
2. Promotion of positive health and overall wellbeing (Physical, mental, emotional, social and spiritual).
3. Prevention of stress related health problems by yoga practice.

Course Outcomes : After successful completion of the course, the students will be able to :

1. To understand yoga and its benefits.
2. Enhance Physical strength and flexibility.
3. Learn to relax and focus.
4. Relieve physical and mental tension through asanas
5. Improve work performance and efficiency.

UNIT 1:

Meaning and definition of Yoga - Historical perspective of Yoga - Principles of Astanga Yoga by Patanjali.

UNIT 2:

Meaning and definition of Stress - Types of stress - Eustress and Distress. Anticipatory Anxiety and Intense Anxiety and depression. Meaning of Management- Stress Management.

UNIT 3:

Concept of Stress according to Yoga - Stress assessment methods - Role of Asana, Pranayama and Meditation in the management of stress.

UNIT 4:

Asanas- (5 Asanas in each posture) - Warm up - Standing Asanas - Sitting Asanas - Prone Asanas - Supine asanas - Surya Namaskar

UNIT 5:

Pranayama- Anulom and Vilom Pranayama - Nadishudhi Pranayama - Kapalabhati Pranayama - Bhramari Pranayama - Nadanusandhana Pranayama.

Meditation techniques: Om Meditation - Cyclic meditation : Instant Relaxation technique (QRT), Quick Relaxation Technique (QRT), Deep Relaxation Technique (DRT)

Suggested Reading:

1. "**Yogic Asanas for Group Training - Part-I**": Janardhan Swami Yogabhyasi Mandal, Nagpur, 2019.
2. "**Rajayoga or Conquering the Internal Nature**"by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata, 1998.
3. Nagendra H.R nad Nagaratna R, **Yoga Perspective in Stress Management**, Bangalore, Swami Vivekananda Yoga Prakashan, 2014.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc16_ge04/preview
2. https://freevideolectures.com/course/3539/indian-philosophy/11

19 EG A 104

PERSONALITY DEVELOPMENT THROUGH LIFE'S ENLIGHTENMENT SKILLS

(MTech. Audit Course I/II Sem - Common to all branches)

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	50 Marks

Course Objectives:

The course will introduce the students to :

1. To learn to achieve the highest goal happily.
2. To become a person with stable mind, pleasing personality and determination.
3. To awaken wisdom among themselves.

Course Outcomes: After successful completion of the course the students will be able to :

1. Develop their personality and achieve their highest goal of life.
2. Lead the nation and mankind to peace and prosperity.
3. To practice emotional self regulation.
4. Develop a positive approach to work and duties.
5. Develop a versatile personality.

UNIT 1:

Neetisatakam – Holistic development of personality - Verses 19, 20, 21, 22 (Wisdom) - Verses 29, 31, 32 (Pride and Heroism) - Verses 26,28,63,65 (Virtue)

UNIT 2:

Neetisatakam – Holistic development of personality (cont'd) - Verses 52, 53, 59 (dont's) - Verses 71,73,75 & 78 (do's) - Approach to day to day works and duties.

UNIT 3:

Introduction to Bhagavadgeetha for Personality Development - Shrimad Bhagawad Geeta: Chapter 2 – Verses 41, 47, 48 - Chapter 3 – Verses 13,21,27,35 - Chapter 6 – Verses 5,13,17,23,35 - Chapter 18 – Verses 45, 46, 48 Chapter – 6: Verses 5, 13, 17, 23, 35; Chapter – 18: Verses 45, 46, 48

UNIT 4:

Statements of basic knowledge - Shrimad BhagawadGeeta: Chapter 2- Verses 56, 62,68 - Chapter 12 – Verses 13, 14, 15, 16, 17, 18 - Personality of Role model from Shrimad Bhagawat Geeta.

UNIT 5:

Role of Bahgavadgeeta in the present scenario - Chapter 2 – Verses 17 - Chapter 3 – Verses 36, 37, 42 - Chapter 4 – Verses 18, 38, 39 - Chapter 18 – Verses 37, 38, 63.

Suggested Readings:

1. "**Srimad Bhagavad Gita"** by Swami Swarupananda Advaita Ashram (Publication Department), Kolkata, 2016.
2. Bhartrihari's **Three Satakam** (Niti-sringar-vairagya) by P.Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi , 2010.

Online Courses:

1. NTPEL: http://nptel.ac.in/downloads/109104115

Professor and Head Department

19CSO 101

BUSINESS ANALYTICS
(Open Elective)

Instruction	3 hrs per week
Duration of End examination	3 hrs
Semester end examinations	70
CIE	30
Credits	3

Course Objectives: The main objectives of this course are to:
1. Understanding the basic concepts of business analytics and applications
2. Study various business analytics methods including predictive, prescriptive and prescriptive analytics
3. Prepare the students to model business data using various data mining, decision making methods

Course Outcomes: After completion of the course, students will be able:
1. To understand the basic concepts of business analytics
2. Identify the application of business analytics and use tools to analyze business data
3. Become familiar with various metrics, measures used in business analytics
4. Illustrate various descriptive, predictive and prescriptive methods and techniques
5. Model the business data using various business analytical methods and techniques

UNIT 1:

Introduction to Business Analytics: Introduction to Business Analytics, need and science of data driven (DD) decision making, Descriptive, predictive, prescriptive analytics and techniques, Big data analytics, Web and Social media analytics, Machine Learning algorithms, framework for decision making, challenges in DD decision making and future.

UNIT 2:

Descriptive Analytics: Introduction, data types and scales, types of measurement scales, population and samples, measures of central tendency, percentile, decile and quadrille, measures of variation, measures of shape-skewness, data visualization.

UNIT 3:

Forecasting Techniques: Introduction, time-series data and components, forecasting accuracy, moving average method, single exponential smoothing, Holt's method, Holt-Winter model, Croston's forecasting method, regression model for forecasting, Auto regression models, auto-regressive moving process, ARIMA, Theil's coefficient

UNIT 4:

Decision Trees: CHAID, Classification and Regression tree, splitting criteria, Ensemble and method and random forest. Clustering: Distance and similarity measures used in clustering, Clustering algorithms, K-Means and Hierarchical algorithms, Prescriptive Analytics- Linear Programming(LP) and LP model building,

UNIT 5:

Six Sigma: Introduction, introduction, origin, 3-Sigma Vs Six-Sigma process, cost of poor quality, sigma score, industry applications, six sigma measures, DPMO, yield, sigma score, DMAIC methodology, Six Sigma toolbox.

Text Books:

1. U Dinesh Kumar, "Data Analytics", Wiley Publications, 1st Edition, 2017
2. Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, "Business analytics Principles, Concepts, and Applications with SAS", Associate Publishers, 2015

Suggested Reading:

1. S. Christian Albright, Wayne L. Winston, "Business Analytics - Data Analysis and Decision Making", 5th Edition, Cengage, 2015.

Web Resources:

1. https://onlinecourses.nptel.ac.in/noc18-mg11/preview
2. https://nptel.ac.in/courses/110105089/

Professor and Head Department

19MEO 101

INDUSTRIAL SAFETY

(Open Elective)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70
CIE	30
Credits	3

Course Objectives:

The students will be able to understand

1. Causes for industrial accidents and preventive steps to be taken.
2. Fundamental concepts of Maintenance Engineering.
3. About wear and corrosion along with preventive steps to be taken
4. The basic concepts and importance of fault tracing.
5. The steps involved in carrying out periodic and preventive maintenance of various equipments used in industry.

Course Outcomes: At the end of the course the students will be able to

1. Identify the causes for industrial accidents and suggest preventive measures.
2. Identify the basic tools and requirements of different maintenance procedures.
3. Apply different techniques to reduce and prevent Wear and corrosion in Industry.
4. Identify different types of faults present in various equipments like machine tools, IC Engines, boilers etc.
5. Apply periodic and preventive maintenance techniques as required for industrial equipments like motors, pumps and air compressors and machine tools etc

UNIT 1:

Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes, Fire prevention and firefighting, equipment and methods.

UNIT 2:

Fundamentals of Maintenance Engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

UNIT 3:

Wear and Corrosion and their Prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications of Screw down grease cup, Pressure grease gun, Splash lubrication, Gravity lubrication, Wick feed lubrication, Side feed lubrication, Ring lubrication, Definition of corrosion, principle and factors affecting the corrosion, Types of corrosion, corrosion prevention methods.

UNIT 4:

Fault Tracing: Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, any one machine tool, Pump, Air compressor, Internal combustion engine, Boiler, Electrical motors, Types of faults in machine tools and their general causes.

UNIT 5:

Periodic and Preventive Maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of Machine tools, Pumps, Air compressors, Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

Text Books:

1. H. P. Garg, "Maintenance Engineering", S. Chand and Company, 2012.
2. Audels, "Pump-hydraulic Compressors", Mcgraw Hill Publication, 2001.

Suggested Readings:

1. Higgins & Morrow, "Maintenance Engineering Handbook", Da Information Services, Copy Right 2002.
2. Winterkorn, Hans, "Foundation Engineering Handbook", Chapman & Hall London, Originally published 1975.

19MEO 102

INTRODUCTION TO OPTIMIZATION TECHNIQUES
(Open Elective)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70
CIE	30
Credits	3

Course Objectives:
The students will
1. Come to know the formulation of LPP models
2. Understand the Transportation and Assignment techniques
3. Come to know the procedure of Project Management along with CPM and PERT techniques
4. Understand the concepts of queuing theory and inventory models
5. Understand sequencing techniques

Course Outcomes: At the end of the course, student will be able to
1. Formulate a linear programming problems (LPP)
2. Build and solve Transportation Models and Assignment Models.
3. Apply project management techniques like CPM and PERT to plan and execute project successfully
4. Apply queing and inventory concepts in industrial applications
5. Apply sequencing models in industries

UNIT - I
Operations Research: Definition, scope, Models, Linear programming problems (LPP), Formulation, Graphical Method, and Simplex Method.

UNIT - II
Transportation Models: Finding an initial feasible solution - North West Corner Method, Least Cost Method, Vogel's Approximation Method, Finding the optimal solution, Special cases in Transportation problems - Unbalanced Transportation problem, Degeneracy in Transportation, Profit Maximization in Transportation.

UNIT - III
Project Management: Definition, Procedure and Objectives of Project Management, Differences between PERT and CPM, Rules for drawing Network

diagram, Scheduling the activities, Fulkerson's rule, Earliest and Latest times, Determination of ES and EF times in forward path, LS & LF times in backward path, Determination of critical path, duration of the project, Free float, Independent float and Total float.

UNIT - IV

Queuing Theory and Inventory: Kendols Notation, single server models, Inventory control - deterministic inventory models - Probabilistic inventory control models.

UNIT - V

Sequencing Models: Introduction, Objectives, General assumptions, processing 'n' jobs through two Machines, processing 'n' jobs through three machines.

Text Books:

1. H.A. Taha, "Operations Research, An Introduction", PHI, 2008
2. H.M. Wagner, "Principles of Operations Research", PHI, Delhi, 1982
3. J.C. Pant, "Introduction to Optimisation: Operations Research", Jain Brothers, Delhi, 2008

Suggested Reading:

1. Hitler Libermann, "Operations Research", McGraw Hill Pub. 2009
2. Pannerselvam, "Operations Research", Prentice Hall of India 2010
3. Harvey M Wagner, "Principles of Operations Research", Prentice Hall of India 2010

19CEO 101

COST MANAGEMENT OF ENGINEERING PROJECTS
(OPEN ELECTIVE)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70
CIE	30
Credits	3

Course Objectives:

1. To enable the students to understand the concepts of Project management.
2. To provide knowledge on concepts of Project Planning and scheduling.
3. To create an awareness on Project Monitoring and Cost Analysis
4. To provide adequate knowledge to the students on Recourse Management Costing-Variance Analysis
5. To train the students with the concepts of Budgetary Control for cost management and to provide basic platform on Quantitative techniques for cost management.

Course Outcomes: At the end of course students will able to

1. Acquire in-depth knowledge about the concepts of project management and understand the principles of project management.
2. Determine the critical path of a typical project using CPM and PERT techniques.
3. Prepare a work break down plan and perform linear scheduling using various methods.
4. Solve problems of resource scheduling and leveling using network diagrams.
5. Learn the concepts of budgetary control and apply quantitative techniques for optimizing project cost.

UNIT 1:

Project Management: Introduction to project managements, stakeholders, roles, responsibilities and functional relationships. Principles of project management, objectives and project management system. Project team, organization, roles, responsibilities. Concepts of project planning, monitoring, staffing, scheduling and controlling.

UNIT 2:

Project Planning and Scheduling: Introduction for project planning, defining activities and their interdependency, time and resource estimation. Work break down structure. Linear scheduling methods-bar charts, Line of Balance (LOB), their limitations. Principles, definitions of network-based scheduling methods: CPM, PERT. Network representation, network analysis-forward and backward passes.

UNIT 3:

Project Monitoring and Cost Analysis: introduction-Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making, Time cost tradeoff-Crashing project schedules, its impact on time on time, cost. Project direct and indirect costs.

UNIT 4:

Resources Management and Costing-Variance Analysis: Planning, Enterprise Resource Planning, Resource scheduling and levelling. Total Quality Management and Theory of constraints. Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis

Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector. Just-in-time approach, Material Requirement.

UNIT 5:

Budgetary Control: Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing.

Quantitative techniques for cost management: Linear Programming, PERT/CPM, Transportation Assignment problems, Simulation, Learning Curve Theory.

References:

1. Charles T Horngren "Cost Accounting A Managerial Emphasis", Pearson Education; 14 edition (2012),
2. Charles T. Horngren and George Foster, "Advanced Management Accounting" Prentice-Hall; 6th Revised edition (1 February 1987)
3. Robert S Kaplan Anthony A. Atkinson, "Management & Cost Accounting" , Pearson; 2 edition (18 October 1996)
4. K. K Chitkara, "Construction Project Management: Planning, scheduling and controlling", Tata McGraw-Hill Education. (2004).
5. Kumar Neeraj Jha "Construction Project Management Theory and Practice",Pearson Education India; 2 edition (2015)

Professor and Head Department

19MEO 103

COMPOSITE MATERIALS

(Open Elective)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70
CIE	30
Credits	3

Course Objectives:

To make the students to learn the

1. Composite materials and their constituents.
2. Classification of the reinforcements and evaluate the behavior of composites.
3. Fabrication methods of metal matrix composites.
4. Manufacturing of Polymer matrix composites.
5. Failure mechanisms in composite materials.

Course Outcomes: At the end of the course, student will be able to

1. Classify and characterize the composite materials.
2. Describe types of reinforcements and their properties.
3. Understand different fabrication methods of metal matrix composites.
4. Understand different fabrication methods of polymer matrix composites.
5. Decide the failure of composite materials.

UNIT 1:

Introduction: Definition – Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

UNIT 2:

Reinforcements: Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions.

UNIT 3:

Manufacturing of Metal Matrix Composites: Casting – Solid State diffusion technique, Cladding – Hot isostatic pressing. Properties and applications.

Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties and applications.

UNIT 4:

Manufacturing of Polymer Matrix Composites: Preparation of Moulding compounds and prepegs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications.

UNIT 5:

Strength: Lamina Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength;

Text Books:

1. R.W.Cahn – VCH , "Material Science and Technology", (Vol 13) Composites , West Germany, Sept. 1993.
2. WD Callister, Jr., Adapted by R. Balasubramaniam, "Materials Science and Engineering, An introduction"., John Wiley & Sons, NY, Indian edition, 2007.

Suggested Readings:

1. Ed-Lubin, "Hand Book of Composite Materials"
2. K.K.Chawla, "Composite Materials".
3. Deborah D.L. Chung, "Composite Materials Science and Applications"
4. Daniel Gay, Suong V. Hoa, and Stephen W. Tsai, "Composite Materials Design and Applications"

Professor and Head Department

19EEO 101

WASTE TO ENERGY

(Open Elective)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70
CIE	30
Credits	3

Course objectives:

1. To know the various forms of waste
2. To understand the processes of Biomass Pyrolysis.
3. To learn the technique of Biomass Combustion.

Course outcomes: After completion of this course, students will be able to:

1. Understand the concept of conservation of waste.
2. Identify the different forms of wastage.
3. Chose the best way for conservation to produce energy from waste
4. Explore the ways and means of combustion of biomass
5. Develop a healthy environment for the mankind

UNIT 1:

Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors

UNIT 2:

Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

UNIT 3:

Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

UNIT 4:

Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

UNIT 5:

Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

Text Books:

1. "Non Conventional Energy", Desai, Ashok V., Wiley Eastern Ltd., 1990.
2. "Biogas Technology - A Practical Hand Book" - Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.

Suggested Readings:

1. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.
2. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996.

19PYO 101

HISTORY OF SCIENCE AND TECHNOLOGY

(Open Elective)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70
CIE	30
Credits	3

Course Objectives: The main objectives of this course are:

1. Enable students to understand science as a socio-cultural product in specific socio-historical contexts.
2. Expose students to philosophical, historical and sociological perspectives to look at science as a practice deeply embedded in culture and society.
3. Inculcate the scientific culture and ethics in the development of technologies.

Course Outcomes: On successful of this course student will be able to:

1. Demonstrate knowledge of broad concepts in the history of science, technology ranging over time, space and cultures.
2. Recognize the values of a wide range of methodologies, conceptual approaches and the impact of competing narratives within the history of science, technology.
3. Identify, locate and analyze relevant primary and secondary sources in order to construct evidence-based arguments.
4. Think independently and critically, using appropriate methodologies and technologies to engage with problems in the history of science, technology.
5. Demonstrate academic rig our and a sensitivity to cultural and other diversity, and understanding of the ethical implications of historical and scientific enquiry within a global context.

UNIT - I

Science - The Beginning (through 599 BC): The Stone Ages, Knowledge among hunter gatherers, Agricultural Revolution and other revolutions, Civilization, Major advances. Science in Antiquity (600 BC - 529 AD): Philosophy, a precursor to science, Hellenistic world and the Roman Empire, Other cultures of the period, major advances.

UNIT - II

Medieval Science (530 AD - 1452 AD): The decline of science in Europe , Science in China, Science and mathematics in India, Arab science, revival of science in Europe, technology revolution of the Middle ages, Major advances. The Renaissance and the Scientific Revolution (1453 AD – 1659 AD): Renaissance, Scientific Revolution, Technology, Major advances.

UNIT - III

Scientific Method: Measurement and Communication (1660 AD – 1734): European domination, The scientific method, Major advances. The Industrial Revolution (1735 AD – 1819 AD): Industrial Revolution, Rise of the engineer, Major Advances.

UNIT - IV

Science and Technology in the 19th Century (1820 AD – 1894 AD): philosophical basis of 19th-century science, Science and the public, Science and technology, Major advances. Rise of **Modern Science and Technology (1895 AD – 1945 AD):** The growth of 20thcentury science, New philosophies, Quantum reality, Energy sources, Electricity: a revolution in technology, Major advances.

UNIT - V

Big Science and the Post-Industrial Society (1946 AD – 1972 AD): Big science, Specialization and changing categories, Technology changes society, Major advances.; **The Information Age (1973 AD – 2015 AD):**Information and society, Globalization, The post-industrial society, Problems of the Information age, Major Advances

Text Books:

1. Bryan and Alexander Hellemans, "The History of Science and Technology", Houghton Mifflin Company, 2004.
2. JD Bernal, "Science in History", 4 volumes, Kindle Edition.

Suggested Readings:

1. Kara Rogers, "The 100 Most Influential Scientists of All Time", Britannica Educational Publishing, 2010
2. Alberto Hernandez, "A Visual History of Science and Technology", The Rosen Publishing Group, 2016

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Department of Computer Science & Engineering
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19CSC 107

MINI PROJECT with SEMINAR

Instruction	4 Hours per week
CIE	50 Marks
Credits	2

Course Outcomes:

Students are able to

1. Formulate a specific problem and give solution.
2. Develop model/models either theoretical/practical/numerical form.
3. Solve, interpret/correlate the results and discussions.
4. Conclude the results obtained.
5. Write the documentation in standard format.

Guidelines:

- As part of the curriculum in II- semester of the programme each student shall do a mini project, generally comprising about three to four weeks of prior reading, twelve weeks of active research, and finally a presentation of their work for assessment.
- Each student will be allotted to a faculty supervisor for mentoring.
- Students are advised to select the mini project in such a way that they can demonstrate their competence in research techniques for the challenging issues/problems, and get an opportunity to contribute something more original.
- Mini projects shall have inter disciplinary/industry relevance.
- The students can select a mathematical modeling based/Experimental investigations or Numerical modeling.
- All the investigations are clearly stated and documented with the reasons/explanations.
- The mini-project shall contain a clear statement of the research objectives, background of work, literature review, techniques used, prospective deliverables, and detailed discussion on results, conclusions and references.

  Department committee: Supervisor and two faculty coordinators

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Department of Computer Science & Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075 (T.S.)

<table>
<tr><td colspan="3">Guidelines for awarding marks (CIE): Max. Marks: 50</td></tr>
<tr><th>Evaluation by</th><th>Max .Marks</th><th>Evaluation Ccriteria / Parameter</th></tr>
<tr><td rowspan="2">Supervisor</td><td>20</td><td>Progress and Review</td></tr>
<tr><td>05</td><td>Report</td></tr>
<tr><td rowspan="5">Department Committee</td><td>05</td><td>Relevance of the Topic</td></tr>
<tr><td>05</td><td>PPT Preparation</td></tr>
<tr><td>05</td><td>Presentation</td></tr>
<tr><td>05</td><td>Question and Answers</td></tr>
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19CSC 108

DISSERTATION PHASE- I

Instruction	20 Hours per week
CIE	100 Marks
Credits	10

Course Outcomes:

At the end of the course:

1. Students will be exposed to self-learning various topics.
2. Students will learn to survey the literature such as books, national/ international refereed
3. journals and contact resource persons for the selected topic of research.
4. Students will learn to write technical reports.
5. Students will develop oral and written communication skills to present.
6. Student will defend their work in front of technically qualified audience.

Guidelines:

- The Project work will preferably be a problem with research potential and should involve scientific research, design, generation/collection and analysis of data, determining solution and must preferably bring out the individual contribution.
- Seminar should be based on the area in which the candidate has undertaken the dissertation work.
- The CIE shall include reviews and the preparation of report consisting of a detailed problem statement and a literature review.
- The preliminary results (if available) of the problem may also be discussed in the report.
- The work has to be presented in front of the committee consists of Head, Chairperson-BoS, Supervisor and Project coordinator.
- The candidate has to be in regular contact with his supervisor and the topic of dissertation must be mutually decided by the guide and student.

Professor and Head Department

Guidelines for the award of Marks: Max. Marks: 100

Evaluation by	Max .Marks	Evaluation Criteria / Parameter
Supervisor	30	Project Status / Review(s)
	20	Report
Department Committee	10	Relevance of the Topic
	10	PPT Preparation(s)
	10	Presentation(s)
	10	Question and Answers
	10	Report Preparation

Note : Department committee has to assess the progress of the student for every two weeks.

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19CSC 109

DISSERTATION PHASE- II

Instruction	32 Hours per week
Duration of SEE	3
SEE	100 Marks
CIE	100 Marks
Credits	16

Course Outcomes:

At the end of the course:

1. Students will be able to use different experimental techniques and will be able to use different software/ computational/analytical tools.
2. Students will be able to design and develop an experimental set up/ equipment/test rig.
3. Students will be able to conduct tests on existing set ups/equipments and draw logical conclusions from the results after analyzing them.
4. Students will be able to either work in a research environment or in an industrial environment.
5. Students will be conversant with technical report writing and will be able to present and convince their topic of study to the engineering community.

Guidelines:

- It is a continuation of Project work started in semester III.
- The student has to submit the report in prescribed format and also present a seminar.
- The dissertation should be presented in standard format as provided by the department.
- The candidate has to prepare a detailed project report consisting of introduction of the problem, problem statement, literature review, objectives of the work, methodology (experimental set up or numerical details as the case may be) of solution and results and discussion.
- The report must bring out the conclusions of the work and future scope for the study. The work has to be presented in front of the examiners panel consisting of an approved external examiner, an internal examiner(HoD and BoS Chair Person) guide/co-guide.
- The candidate has to be in regular contact with his/her guide/co-guide.

Guidelines for awarding marks in CIE: Max. Marks: 100		
Evaluation by	**Max .Marks**	**Evaluation Criteria / Parameter**
Department Review Committee	05	Review 1
	10	Review 2
	10	Review 3
	15	Final presentation with the draft copy of the report reportstandard format
	10	Submission of the report in a standard format
Supervisor	10	Regularity and Punctuality
	10	Work Progress
	10	Quality of the work which may lead to publications
	10	Analytical / Programming / Experimental Skills Preparation
	10	Report preparation in a standard format

Guidelines for awarding marks in SEE: (Max. Marks: 100)Max. Marks: 100		
Evaluation by	**Max .Marks**	**Evaluation Criteria / Parameter**
External and Internal Examiner(s) together	20	Power Point Presentation
	40	Quality of thesis and evaluation
	20	Quality of the project • Innovations • Applications • Live Research Projects • Scope for future study • Application to society
	20	Viva-Voce

Professor and Head Department

18MT CO1

MATHEMATICS– I

(Common to all branches and except for Bio-Tech)

Instruction	3 L+1T Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation:	30 Marks
Credits	4

Course Objectives:

1. To solve linear system of equations using Matrix Methods.
2. To know the convergence of the Series.
3. To represent the function in series form.
4. To know the Partial Derivatives and use them to interpret the way a function of two variables behaves.
5. To learn Vector Differential Operator and its Physical interpretations on Scalars and vector functions.
6. To solve improper integrals.

Course Outcomes: On the successful completion of this course student shall be able to

1. Solve system of linear equations and identify the Eigen values and Eigen vectors in engineering problems.
2. Check the series convergence.
3. Find the evolutes of the given curves.
4. Expand and find extreme values of functions of two variables.
5. Understanding the significance of gradient, divergence and curl.
6. An ability to solve the problems and interpret in geometrical approach.

UNIT-I: Matrices:

Rank of the matrix, Echelon form, System of linear equations, Linearly dependence and independence of vectors, Eigenvalues, Eigenvectors, Properties of eigenvalues, Cayley-Hamilton theorem, Quadratic forms, Diagonalization of Matrices, Reduction of quadratic form to canonical form by linear transformation, Nature of quadratic forms.

UNIT-II: Sequences and Series:

Definition of Convergence of sequence and series. Tests for convergence of series: Comparison test, limit comparison test, D'Alembert ratio test, Raabe's test, Cauchy's n^{th} root test, logarithmic test, alternative series, absolute and conditional convergence.

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UNIT-III: Calculus:
Rolle's Theorem, Lagranges Mean value theorem, Cauchy's mean value theorem (without proofs). Curvature, radius of curvature, Evolutes and involutes ,
Fourier series, half range sine and cosine series

UNIT-IV: Multi variable Calculus (Differentiation):
Functions of two variables, Partial derivatives, Total differential and differentiability, Derivatives of composite and implicit functions (Chain rule), Change of variables, Jacobian, Higher order partial derivatives, Taylor's series of functions of two variables, Maximum and minimum values of functions two variables, Lagrange's multipliers method.

UNIT-V: VectorCalculus (Differentiation):
Scalar and vector fields, Gradient of a scalar field, Directional derivative, Divergence and Curl of a vector field, vector identities. Improper integrals: Beta and Gamma functions and their properties

Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill, New Delhi, 11th Reprint, 2010.

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18CY C01

CHEMISTRY

(Common to all Branches)

Instruction:	3L+1T Hours per Week
Duration of Semester End Examination:	3 Hours
Semester End Examination:	70 Marks
Continuous Internal Evaluation:	30 Marks
Credits:	4

Course Objectives

1. The aim of framing the syllabus is to impart intensive and extensive knowledge of the subject so that students can understand the role of chemistry in the field of engineering.
2. This syllabus helps at providing the necessary introduction of the inorganic chemistry principles and concepts of chemical bonding involved in a comprehensive manner understandable to the students aspiring to become practicing engineers.
3. Thermodynamic and Electrochemistry units give conceptual knowledge about spontaneous processes and how can they be harnessed for producing electrical energy and efficiency of systems.
4. To teach students the value of chemistry and to improve the research opportunities knowledge of stereochemistry and organic reactions is essential.
5. New materials lead to discovering of technologies in strategic areas like defense and space research for which an insight into nano and composite materials of modern chemistry is essential.

Course Outcomes

The concepts developed in this course will aid in quantification of several concepts in chemistry that have been introduced at the 10+2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications. Quantum theory is more than 100 years old and to understand phenomena at nanometer levels; one has to base the description of all chemical processes at molecular levels. The course will enable the student to:

1. Analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
2. Rationalize bulk properties and processes using thermodynamic considerations & Ionic Equilibria.
3. List major chemical reactions that are used in the synthesis of molecules.
4. Apply the various methods used in treatment of water for domestic and industrial use.

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5. Discuss the various Engineering materials & Drug synthesis & their applications.

UNIT-I Atomic and molecular structure:
Molecular Orbital theory - atomic and molecular orbitals.Linear combination of atomic orbitals (LCAO) method. Molecular orbitals of diatomic molecules. Energy level diagrams of diatomics (H_2, He_2^+,N_2, O_2, O_2^- , CO, NO). Pi- molecular orbitals of butadiene , benzene and their aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties.

UNIT-II Use of free energy in chemical equilibria and Ionic Equilibria:
Use of free energy in chemical equilibria : Thermodynamic functions: Internal energy, entropy and free energy. Significance of entropy and free energy(criteria of spontaneity).Free energy and emf (Gibbs Helmholtz equations and its applications). Cell potentials –electrochemical series.Nernst equation and its applications. Potentiometric Acid base & Redox Titrations.Numericals.
Ionic Equilibria: Solubility product, Determination of solubility product, Applications of solubility product- Determination of solubilities of sparingly soluble salts; Predicting precipitation reactions; Precipitation of an insoluble salt; Precipitation of soluble salts ; Inorganic analysis .Numericals.

UNIT- III Stereochemistry and Organic reactions
Stereochemistry: Representations of 3 dimensional structures , Symmetry and chirality, Stereoisomers - Configurational isomers (Geometrical&Optical isomers), Conformational isomers - Newman and sawhorse representations of n-butane ,enantiomers (lactic acid), diastereomers (Tartaric acid) , optical activity, absolute configurations , Sequence rules for R&S notation.
Organic reactions
Types of Organic reactions:
Substitution Reactions- Electrophilic substitution (Nitration of Benzene) ;Nucleophilic Substitution(S_N1& S_N2) ; Free Radical Substitution(Halogenation of Alkanes).

Additions Reactions:
Electrophilic Addition – Markonikoff's rule.
Nucleophilic Addition – (Addition of HCN to carbonyl compounds).
Free radical Addition - Anti Markonikoff's rule (Peroxide effect).
Eliminations-E_1 and E_2 (dehydrohalogenation of alkyl halides).
Oxidation with $KMno_4$, $K_2 Cr_2O_7$; **Reduction** with $LiAlH_4$,$NaBH_4$.
Cyclization (Diels - Alder reaction).

UNIT–IV Water Chemistry:
Hardness of water – Types, units of hardness, Disadvantages of hard water , Boiler troubles - scales & sludge formation , causes and effects , Softening of water by ion

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exchange method and Reverse Osmosis. Specifications of potable water & industrial water. Disinfection of water by Chlorination , Ozonisation & UV radiation.

UNIT-V Engineering Materials and Drugs:

Nano materials-Introduction to nano materials and general applications, basic chemical methods of preparation- Sol gel method. Carbon nanotubes and their applications.

Composite materials- Definition, types of composites, fibre reinforced, glass fibre reinforced and carbon fibre reinforced composites and applications.

Conducting polymers- Definition, classification and applications.

Drugs-Introduction,Synthesis and uses of Aspirin (analgesic), Paracetamol (Antipyretic), Atenolol (antihypertensive).

TEXT BOOKS

1. P.C. Jain and M. Jain, "Engineering Chemistry", Dhanpat Rai Publishing Company Ltd., New Delhi,16th edition (2015).
2. W.U. Mali, G.D.Tuli and R.D.Madan, "Selected topics in Inorganic Chemistry", S Chand & Company Ltd, New Delhi,reprint (2009).
3. R.T. Morrison, R.N. Boyd and S.K. Bhattacharjee, "Organic Chemistry", Pearson, Delhi, 7th edition(2011).
4. G.L. David Krupadanam, D. Vijaya Prasad, K. Varaprasad Rao, K.L.N. Reddy and C. Sudhakar, "Drugs", Universities Press (India) Limited, Hyderabad (2007).

SUGGESTED READINGS

1. B. H. Mahan, "University Chemistry", Narosa Publishing house, New Delhi, 3rd edition (2013).
2. B.R. Puri, L.R. Sharma and M.S. Pathania, "Principles of Physical Chemistry", S. Nagin Chand & CompanyLtd.,46th edition(2013).
3. T.W. Graham Solomons, C.B. Fryhle and S.A. Snyder, "Organic Chemistry", Wiley,12th edition (2017).
4. P.W. Atkins, J.D. Paula, "Physical Chemistry", Oxford, 8th edition (2006).

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18CE C01

ENGINEERING MECHANICS

Instruction:	3L+1T Hours per Week
Duration of Semester End Examination:	3 Hours
Semester End Examination:	70 Marks
Continuous Internal Evaluation:	30 Marks
Credits:	4

Course Objectives:

1. The objective of this course is to understand the resolution of forces and to obtain resultant of all force systems, to understand moment of a force and equilibrium conditions of static loads for smooth and frictional surface.
2. To obtain centroid, centre of gravity and moment of inertia for various regular and composite areas and bodies.
3. To understand the basic structural analysis, principles of virtual work and energy methods.
4. To know the basic concepts of dynamics and analysis as a particle and rigid bodies.
5. To understand the work energy principles, impulse momentum and their applications and to know the concept of simple harmonic motion and free vibration.

Course Outcomes: The students will be able to

1. Solve problems dealing with forces in plane and space force systems, draw free body diagrams to analyze various problems in equilibrium, for smooth and frictional surface.
2. Determine centroid and moment of inertia for elementary, composite areas and bodies.
3. Analyze simple trusses for forces in various members of a truss.
4. Solve problem in kinematics and kinetics of particles and rigid bodies.
5. Analyze body motion using work energy principles, impulse and momentum approach and able to apply the concepts of simple harmonic motion and free vibrations in dynamics.

Unit–I: Resolution, Resultant and Equilibrium of force system and Friction:
Concepts of force, System of forces, components of forces in a plane and in space systems.Resultant of force systems.Moment of forces and its applications.Couples and its applications. Equilibrium of Force systems. Free body diagrams, equation of equilibrium of coplanar and spatial force systems. Static indeterminacy. Types of friction, Laws of friction, application of friction to a single body & connecting systems, wedge friction.

Unit–II: Centroid, centre of gravity and moment of Inertia:
Centroid of simple figures from first principle, centroid of composite sections. Centre of gravity and its implications, Definition of Area moment of Inertia, Moment of inertia of plane section from first principles, Theorems of moment of inertia, moment of inertia of standard sections and composite sections, Mass moment of inertia of rectangular and circular plates, cylinder, cone & sphere.

Unit–III: Analysis of simple trusses, Virtual work and Energy methods:
Analysis of simple trusses using method of joints, methods of sections. Determine if a member is in tension or compression, zero force members. Virtual displacements, Principle of virtual work for particle and ideal system of rigid bodies, degrees of freedom.Conservative forces and potential energy, energy equation for equilibrium.

Unit–IV: Particle Dynamics:
Rectilinear and curvilinear translation using rectangular, normal and tangential components.Relative and constrained motion. Newton's 2nd Law, rectangular and path coordinates. Basic terms, general principles in dynamics, D'Alembert's principle and its application in plane motion and connected bodies.Instantaneous centre of rotation in plane motion and simple problems.

Unit–V: Work- Energy, Impulse-momentum and Mechanical Vibrations:
Equation of work energy for translation and fixed axis rotation, work energy principles applied to particle motion, connected systems. Introduction to linear impulse momentum, principle of conservation of linear momentum, Impact, direct and oblique. Introduction to vibration, free and forced vibrations, simple harmonic motion, simple pendulum and compound pendulum.

Text Books:

1. Reddy Vijaykumar K. and J. Suresh Kumar," Singer's Engineering Mechanics Statics and Dynamics", B. S. Publications 2011.
2. A. Nelson, "Engineering Mechanics", Tata McGraw Hill, New Delhi, 2010.

Suggested Reading:

1. Irving H. Shames, "Engineering Mechanics", 4th Edition, Prentice Hall, 2006.
2. F. P. Beer and E. R .Johnson, "Vector Mechanics for engineers, Vol. I - Statics, Vol. II - Dynamics",
   9th edition, Tata McGraw Hill, 2011.
3. R. C. Hibbeler, "Engineering Mechanics: Principles of Statics and Dynamics", Pearson Press, 2006.

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18ME C01

ENGINEERING GRAPHICS AND DESIGN

Instruction	1T+4D Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation:	30 Marks
Credits	3

Course Objectives:

1. to prepare to design a system, component, or process to meet desired needs within realistic constraints.
2. to prepare the student to communicate effectively.
3. to prepare the student to use the techniques, skills, and modern engineering tools necessary for engineering practice.
4. to get exposure to a CAD package.

Course Outcomes:

1. Introduction to engineering design and its place in society.
2. Exposure to the visual aspects of engineering design.
3. To become familiar with engineering graphics standards.
4. Exposure to solid modelling.
5. Exposure to computer-aided geometric design.
6. Exposure to creating working drawings.
7. Exposure to engineering communication.

Detailed contents

Traditional Engineering Graphics:
Principles of Engineering Graphics; Orthographic Projection; Descriptive Geometry; Drawing Principles; Isometric Projection; Surface Development; Perspective; Reading a Drawing; Sectional Views; Dimensioning & Tolerances; True Length, Angle; intersection, Shortest Distance.

Computer Graphics:
Engineering Graphics Software; -Spatial Transformations; Orthographic Projections; Model Viewing; Coordinate Systems; Multi-view Projection; Exploded Assembly; Model Viewing; Animation; Spatial Manipulation; Surface Modeling; Solid Modeling; Introduction to Building Information Modeling (BIM)

(Except the basic essential concepts, most of the teaching part can happen concurrently in the laboratory)

UNIT-1 Introduction to Engineering Drawing:
Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involute;

UNIT-2 Orthographic Projections:
Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes (without traces); Projections of planes inclined Planes;
Introduction to CAD package:
Listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids.

UNIT-3 Projections of Regular Solids:
Projection of Prism, Cylinder, Pyramid and Cone : Simple position, axis inclined to one of the reference plane only. Customization & CAD Drawing: consisting of set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerancing; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles;

UNIT-4 Sections and Sectional Views of Right Angular Solids:
Sections of solids in simple position Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids.
Annotations, layering & other functions:
applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation, Computer-aided design (CAD) software modeling of parts and assemblies. Parametric and non-parametric solid, surface, and wireframe models. Part editing and twodimensional documentation of models. Planar projection theory, including sketching of perspective, isometric, multi view, auxiliary, and section views. Spatial visualization exercises. Dimensioning guidelines, tolerancing techniques; dimensioning and scale multi views of dwelling;

UNIT-5 Isometric Projections:
Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Viceversa, Conventions;

Demonstration of a simple team design project:
Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; geometric dimensioning and tolerancing; Use of solid-modeling software for creating associative models at the component and assembly levels; (Examples of specific components to the branch of study may be included).

Text Books:

1. N.D.Bhatt, Elementary Engineering Drawing, Charotar Publishers,2012.
2. K.L.Narayana and P.K.Kannaiah, -Text Book of Engineering Drawing Scitech Publications, 2011.
3. Basanth Agrawal and C M Agrawal ¯Engineering Drawing 2e ¯, McGraw-Hill Education(India) Pvt.Ltd.

Suggested Reading:

1. Shaw M.B and Rana B.C., - Engineering drawing 'Pearson, 2ndedition, 2009.
2. K.Veenugopal,-Engineering Drawing and Graphics + AutoCAD' New Age International Pvt.Ltd, 2011.
3. Bhattacharya. B,-Engineering Graphics 'I. K. International Pvt.Ltd, 2009.

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18CS C01

Programming for Problem Solving
(Common to All Programs)

Instruction	3 Periods per week
Duration of Semester-End Examination	3 Hours
Semester-End Examination	70 Marks
Sessional	30 Marks
Credits	3

Course Objectives

1. Identification of computer components, Operating environments, IDEs
2. Understanding the steps in problem solving and formulation of algorithms to problems.
3. Develop programming skills as an means of implementing an algorithmic solution with appropriate control anddata structures.
4. Develop intuition to enable students to come up with creative approaches to problems.
5. Manipulation of text data using files.

Course Outcomes: At the end of the course, students will be able to:

1. Identify the computing environments.
2. Formulate solutions to problems and represent them using algorithms/ Flowcharts.
3. Choose proper control statements and data structures to implement the algorithms.
4. Trace the programs with test the program solution.
5. Decompose a problem into modules and use functions to implement the modules.
6. Develop applications using file I/O.

UNIT -I

Introduction to computers and Problem Solving: Components of a computer, Operating system, compilers, Program Development Environments, steps to solve problems, Algorithm, Flowchart / Pseudocode with examples.

Introduction to programming: Programming languages and generations, categorization of high level languages.

Introduction to C: Introduction, structure of C program, keywords, identifiers, Variables, constants, I/O statements, operators, precedence and associativity.

UNIT – II

Introduction to decision control statements: Selective, looping and nested statements.

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Functions: Introduction, uses of functions, Function definition, declaration, passing parameters to functions, recursion, scope of variables and storage classes.
Case study:

UNIT – III
Arrays: Introduction, declaration of arrays, accessing and storage of array elements, 1-dimensional array, Searching (linear and binary search algorithms) and sorting(selection and Buble) algorithms, 2-D arrays, matrix operations.
Strings: Introduction, strings representation, string operations with examples.
Case study:

UNIT – IV
Pointers: Understanding computer's memory, introduction to pointers, declaration pointer variables, pointer arithmetic, pointers and strings, array of pointers, function pointers, array of function pointers, dynamic memory allocation, advantages and drawbacks of pointers.

Structures: Structure definition, initialization and accessing the members of a structure, nested structures, structures and functions, self- referential structures, unions and enumerated data types.

UNIT-V
Files: Introduction to files, file operations, reading data from files, writing data to files, error handing during file operations.
Preprocessor Directives: Types of preprocessor directives, examples.

Suggested Reading:

1. A K Sharma "**Computer Fundamentals and Programming**", 2nd Edition, University Press, 2018.
2. PradeepDey and Manas Ghosh, "**Programming in C"**, Oxford Press, 2nd Edition, 2017.

References:

1. Byron Gottfried, Schaum's"**Outline of Programming with C**", McGraw-Hill.
2. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India.
3. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill.
4. ReemaTharaja "**Introduction to C Programming**", Second Edition, OXFORD Press,2015.
5. https://www.tutorialspoint.com/cprogramming/index.htm
6. https://onlinecourses.nptel.ac.in/noc18-cs10/preview

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18CS C02

Programming for Problem Solving
(Programming Lab – I)
(Common to All Programs)

Instruction	4 Periods per week
Duration of Semester-End Examination	3 Hours
Semester-End Examination	50 Marks
Sessional	25 Marks
Credits	2

Course Objectives

1. Setting up programming environment.
2. Develop Programming skills to solve problems.
3. Use of appropriate C programming constructs to implement algorithms.
4. Identification and rectification of coding errors in program.
5. Develop applications in a modular fashion.
6. Manage data using files.

Course Outcomes:

At the end of the course students will be able to:

1. Identify and setup program development environment.
2. Implement the algorithms using C programming language constructs.
3. Identify and rectify the syntax errors and debug program for semantic errors.
4. Analyze the results to evaluate the solutionsof the problems.
5. Solve problems in amodular approach using functions.
6. Implement file operations with simple text data.

Lab experiments

1. Familiarization with programming environment.
2. Simple computational problems using arithmetic expressions.
3. Problems involving if-then-else structures.
4. Iterative problems e.g., sum of series.
5. 1D Array manipulation.
6. 2D arrays and strings.
7. Matrix problems, String operations.
8. Simple functions.
9. Recursive functions.
10. Pointers and structures.
11. Dynamic memory allocation and error handling.
12. File handling:

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Design the experiments in such a way that the students will be able to end up the solution for a real world problem that uses most of the concepts of C programming language.

For example: A banking application where it uses the concepts of operators, control structures, switch case for menu, structures, functions, error handling, files etc.

Suggested Reading:

1. Pradeep Dey and Manas Ghosh, "**Programming in C"**, Oxford Press, 2nd Edition, 2017
2. ReemaTharaja "**Introduction to C Programming**", Second Edition, OXFORD Press,2015

References:

1. https://www.tutorialspoint.com/cprogramming/index.htm
2. https://www.w3resource.com/c-programming/programming-in-c.php
3. https://www.w3schools.in/c-tutorial/

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18CY C02

CHEMISTRY LAB
(Common to all branches)

Instruction:	3 Hours per Week
Duration of Semester End Examination:	3 Hours
Semester End Examination:	50 Marks
Continuous Internal Evaluation:	25 Marks
Credits:	1.5

Course Objectives
1. To impart fundamental knowledge in handling the equipment / glassware and chemicals in chemistry laboratory.
2. The student should be conversant with the principles of volumetric analysis and identification of organic functional groups.
3. To apply various instrumental methods to analyze the chemical compounds and to improve understanding of theoretical concepts.

Course Outcomes
The chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and engineering.
The students will learn to:
1. Estimate rate constants of reactions from concentration of reactants/ products as a function of time.
2. Measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water, etc
3. Synthesize a small drug molecule and Identify the organic compounds.
4. understand importance of analytical instrumentation for different chemical analysis.
5. Perform interdisciplinary research such that the findings benefit the common man.

Chemistry Lab
1. Estimation of temporary and permanent hardness of water using EDTA solution
2. Estimation of amount of chloride in water.
3. Determination of rate constant for the reaction of hydrolysis of methyl acetate.(first order)
4. Estimation of amount of HCl Conductometerically using NaOH solution.
5. Estimation of (a) amount of CH_3 COOH Conductometerically using NaOH solution. Estimation of (b) amount of HCl and CH_3 COOH present in the given mixture of acids Conductometerically using NaOH solution.

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6. Estimation of amount of HCl Potentiometrically using NaOH solution.
7. Estimation of amount of Fe^{+2} Potentiometrically using $KMnO_4$ solution.
8. Distribution of acetic acid between n-butanol and water.
9. Synthesis of drug - Aspirin.
10. Organic Chemistry- Identification of Functional groups - neutral group (carbonyl groups-acetaldehyde and acetone); acidic group(benzoic acid); basic group (aniline).
11. Determination of surface tension of organic solvents (ethanol, ethyl acetate).
12. Determination of Viscosity.

TEXT BOOKS

1. J. Mendham and Thomas ,"Vogel' s text book of quantitative chemical analysis", Pearson education Pvt.Ltd. New Delhi ,6th ed. 2002.

SUGGESTED READINGS

1. Dr. Subdharani , "Laboratory Manual on Engineering Chemistry", Dhanpat Rai Publishing, 2012.
2. S.S. Dara , "A Textbook on experiment and calculation in engineering Chemistry", S. Chand and Company, 9th revised edition, 2015.

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18MT CO3

MATHEMATICS– II

(Common to all Branches and except for Bio-Tech)

Instruction	3 L+1T Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation:	30 Marks
Credits	4

Course Objectives

1. To evaluate double and triple integrals of various functions and their significance.
2. To evaluate vector line, surface and volume integrals.
3. To know the relevant method to solve higher order differential equations.
4. To evaluate complex integration.
5. To evaluate real and definite integrals.
6. To know the methods to solve real life problems.

Course Outcomes: On the successful completion of this course student shall be able to

1. Find the areas, volumes and surface of solids revolution.
2. Use Greens, Gauss and Stoke's theorems to find the surface and volume integrals.
3. Able to solve solutions of differential equations with initial and boundary value problems.
4. Solve the problems on analytic functions, Cauchy's theorem and Cauchy's integral formula.
5. Real and complex integrals by using Cauchy's theorems.
6. Solve physical and engineering problems.

UNIT-I: Multivariable Calculus (Integration):

Applications of definite integrals to evaluate surface areas and volumes of revolutions. Double integrals, Change of order of integration, Triple integrals, Change of variables in integrals, Applications: areas and volumes, Centre of mass and Gravity (constant and variable densities).

UNIT-II: Vector Integral Calculus:

Line, Surface and Volume integrals, Green's theorem in a plane, Gauss's divergence theorem and Stoke's theorem (without proof).

First Order Ordinary Differential Equations: Exact first order differential equations, Integrating factors, Linear first order equations, Bernoulli's, Riccati's

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and Clairaut's differential equations ,Orthogonal trajectories of a given family of curves.

UNIT-III: Ordinary differential equations of higher orders:
Solutions of higher order linear equations with constants coefficients, Method of variation of parameters, solution of Euler-Cauchy equation. Ordinary point, singular point and regular singular point, Power Series solution. Legendre Polynomial of first kind (without proof), Rodrigues formula, Generating function, recurrence relations, orthogonality of Legendre polynomials, Bessel's function of first kind (without proof), recurrence relations and problems.

UNIT-IV:Complex Variables –I :
Differentiation, analytic functions, Cauchy-Riemann equations, harmonic functions, finding harmonic conjugate, elementary analytic functions (exponential, trigonometric, logarithm) and their properties; Conformal mappings, Mobius transformations and their properties. Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof).

UNIT-V: Complex Variables – II:
Liouville's theorem and Maximum-Modulus theorem (without proof); Taylor's series, Laurent's series, zeros of analytic functions, singularities, Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine. Improper real integrals with singular points on the upper half plane.

Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

Suggested Reading:

1. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
2. R.K. Jain, S.R.K. Iyengar, Advanced engineering mathematics Narosa Publications, 5th edition, 2016.
3. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.

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18PY C01

OPTICS AND SEMICONDUCTOR PHYSICS

(for CSE, ECE & IT)

Instruction:	3L+1T Hours per Week
Duration of Semester End Examination:	3 Hours
Semester End Examination:	70 Marks
Continuous Internal Evaluation:	30 Marks
Credits:	4

Course Objectives:

The objectives of the course is to make the student

1. Understands the fundamentals of wave nature of light.
2. Acquires knowledge of lasers.
3. Familiar with Quantum Mechanics.
4. Learns the fundamental concepts of solids.
5. Understands the basics of semiconductors.

Course Outcomes:

At the end of the course, the student will be able to

1. Demonstrate the wave nature of the light.
2. Describe the types of lasers and their applications.
3. Explain the importance of wave mechanics.
4. Demonstrate the importance of band theory of solids.
5. Identify the semiconductors for engineering applications.

UNIT-I : Wave optics:

Huygens' principle, superposition of waves and interference of light by wave front splitting and amplitude splitting; Young's double slit experiment, Newton's rings, Michelson interferometer. Farunhofer diffraction from a single slit and a circular aperture, the Rayleigh criterion for limit of resolution and its application to vision; Diffraction gratings and their resolving power.

UNIT- II : Lasers:

Einstein's theory of matter radiation interaction and A and B coefficients; amplification of light by population inversion, different types of lasers: gas lasers (He-Ne, CO2), solid-state lasers (ruby, Neodymium), dye lasers; Properties of laser beams: mono-chromaticity, coherence, directionality and brightness, laser speckles, applications of lasers in science, engineering and medicine.

UNIT- III : Wave nature of particles and the Schrodinger equation:

Introduction to Quantum mechanics, Wave nature of Particles, Time-dependent and timeindependent Schrodinger equation for wavefunction, Born interpretation,

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probability current, Expectation values, Free-particle wavefunction and wave-packets, Uncertainty principle.

UNIT – IV: Introduction to Solids:

Free electron theory of metals, Fermi level, density of states, Application to white dwarfs and neutron stars, Bloch's theorem for particles in a periodic potential, Kronig-Penney model, Scattering from a potential barrier and tunneling; related examples like alpha-decay, field-ionization and scanning tunneling microscope.

UNIT- V :Semiconductors:

Intrinsic and extrinsic semiconductors, Dependence of Fermi level on carrier-concentration and temperature (equilibrium carrier statistics), Carrier generation and recombination, Carrier transport: diffusion and drift, p-n junction, Metal-semiconductor junction (Ohmic and Schottky), Thermistor, Hall effect, LED, Solar cell.

TEXT BOOKS:

1. B.K. Pandey and S. Chaturvedi, *Engineering Physics*, Cengage Publications, 2012.
2. M.N. Avadhanulu and P.G. Kshirsagar, *A Text BookEngineering Physics*, S. Chand Publications, 2014.
3. M. Arumugam, *Materials Science*, Anuradha Publications, 2015.
4. S.L. Gupta and Sanjeev Gupta, *Modern Engineering Physics*, Dhanpat Rai Publications, 2011.

SUGGESTD READING:

1. R. Murugeshan and Kiruthiga Sivaprasath, *Modern Physics*, S. Chand Publications S. Chand Publications, 2014.
2. V. Rajendran, *Engineering Physics*, McGahill Education Publications, 2013.
3. P.K. Palanisamy, *Engineering Physics*, Scitech Publications, 2012.
4. V. Raghavan, *Materials Science and Engineering*, Prentice Hall India Learning Private Limited; 6th Revised edition, 2015.

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18ITC01

OBJECT ORIENTED PROGRAMMING THROUGH C++

Instruction	3L Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation:	30 Marks
Credits	3

Course Objectives:

1. To familiarise the syntax and semantics of the C++ programming language.
2. To learn the design of C++ classes for code reuse.
3. To present the concepts of overloading, inheritance and exception handling.
4. To introduce the concept of dynamic binding.
5. To present stream computation and generic classes.

Course Outcomes:

After successful completion of this course, student will be able to

1. Understand the difference between object oriented programming and procedural programming.
2. Identify apt OOPS concepts in designing and implementing a solution.
3. Design and implement solutions for computer problem solving
4. Ascertain exceptions in a problem and handle them.
5. Perform stream computation using files and generic programming using templates.
6. Develop robust programs using OOPS concepts to solve real world problems.

Course Prerequisites: Programming and Problem Solving (16CSC01).

UNIT-I:

Object-Oriented Paradigm- OOPS- A new Paradigm, Evolution of Programming Paradigms, Moving from C to C++ Data Types, Operators and Expressions, Control Flow, Strings Modular Programming with Functions- Function Components, Passing Data to Functions, Function Return Data Type, Parameter Passing, Return by Reference, Default Arguments, Inline Functions, Function Overloading, Function Templates, Functions with Variable Number of Arguments, Recursive Functions.

UNIT-II:

Classes and Objects: Class Specification, Class Objects, Accessing Class Members, Member Functions, Outside Member Functions as Inline, Accessing Member Functions within the Class, Data Hiding, Access Boundary of Objects Revisited, Empty Class, Pointers within a Class, Passing Objects as Arguments, Returning Objects from Functions, Friend Function and Friend Classes, Constant Parameters

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and Member Functions, Structures and Classes, Static Data Members and Member Functions.

Object Initialization and Clean-up: Constructors—Parameterised Constructors, Destructor, Order of Construction and Destruction, Constructors with Default Arguments, Nameless Objects, Dynamic Initialization Through Constructors, Constructors with Dynamic Operations, Copy Constructor, Constructor with Two Dimensional Arrays, Constant Objects and Constructor, Static Data Members with Constructors and Destructors.

Dynamic Objects: Pointers to Objects, Array of Objects, Array of Pointers to Objects, Pointers to Objects Members, this Pointer, Self – Referential Classes, Passing Objects Parameters.

UNIT-III:

Operator Overloading: Overloadable Operators, Unary Operator Overloading, Operator keyword, Operator Return Values, Nameless Temporary Objects, Limitations of Increment/ Decrement Operators, Binary Operator Overloading, Arithmetic Operators, Concatenation of Strings, Comparison Operators, Assignment Operators, New and Delete Operators, Conversion Between Objects and Basic types and Objects of different classes, Subscript and Assignment Operator overloading, Overloading with Friend Functions.

Inheritance: Derived Class Declaration, Forms of Inheritance, Constructors and Destructors in derived classes, Constructor invocation and data member initialization, Overloaded Member Functions, Types of Inheritances, Abstract classes and virtual base classes.

Exception Handling: Error Handling, Exception handling model, Exception handling constructs, Lists of exceptions, catch all exceptions, exceptions in: Constructors, Destructors, Operator overloaded functions, Inheritance Tree, Class Templates.

UNIT-IV:

Virtual Functions: Need for virtual functions, Pointer to derived class objects, definition of virtual functions, Array of pointers to base class objects, Pure virtual functions, Abstract classes, Virtual destructors, Dynamic Binding.

Streams Computation with Console: Introduction, Predefined console streams, Hierarchy of console streams, unformatted and formatted I/O operations, manipulators, stream operators with user defined classes.

UNIT-V:

Streams Computation with Files : Introduction, Hierarchy of File stream classes, opening and closing of files, file modes, file pointers and their manipulators, Sequential and Random access to a file, ASCII and Binary files, saving and retrieving of objects, fstream class, Random Access to a File, Error handling during file manipulation, Command line arguments.

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Generic Programming with Templates: Function template, Overloaded function templates, Nesting of function calls, Multiple arguments function template, user defined template arguments, Class templates, Inheritance of class templates, class template with overloaded operators.

Text Books:

1. K.R.Venugopal, RajkumarBuyya, "Mastering C++", 2/e, TMH, 2016.
2. Paul Deitel, Harvey Deitel, "How to Program C++", 9^{th} edition, Pearson, 2013.

Suggested Reading:

1. Bjarne Stronusstrup, "The C++ Programming Language", 4/e, Pearson, 2013.
2. Sourav Sahay, "Object Oriented Programming with C++", 2/e, Oxford University Press.

Web Resources:

1. https://www.tutorialspoint.com/cplusplus/
2. https://www.programiz.com/cpp-programming
3. https://www.class-central.com/tag/c++

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18EG C01

ENGLISH

(Common to all branches)

Instruction	2Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation:	20 Marks
Credits	2

Course Objectives:

1. To enable the students to understand the role and importance of communication and to develop their basic communication skills in English.
2. To equip the students with basics of writing correct sentences to coherent paragraphs.
3. To equip the students with techniques of writing a précis and an essay by using accurate grammar and appropriate vocabulary.
4. To train the students to describe, define and classify processes and to draft formal reports by adhering to the proper structure.
5. To develop the reading skills and reading comprehension techniques of the students.
6. To develop the students reading, writing, grammatical, lexical and communicative competence.

Course Outcomes:

1. The students will understand the nature, process and types of communication and will communicate effectively without barriers.
2. The students will write correct sentences and coherent paragraphs.
3. The students will know how to condense passages by writing précis and write essays by using accurate grammar and appropriate vocabulary.
4. The students will demonstrate advanced writing skills by drafting formal reports.
5. The students will apply their reading techniques and analyze reading comprehension passages.
6. The students will become effective communicators and will display their advanced skills of reading and writing and use correct grammar and appropriate vocabulary in all contexts.

UNIT-I Understanding Communication in English:

Introduction, nature and importance of communication.Process of communication. Basic types of communication - verbal and non-verbal. Barriers to communication. Intrapersonal and interpersonal communication. Johari Window.

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Vocabulary & Grammar: The concept of Word Formation. Importance of proper punctuation. Articles.

UNIT-II Developing Writing Skills I:

Types of sentences. Use of phrases and clauses in sentences. Cohesion and coherence. Paragraph writing. Organizing principles of paragraphs in documents.

Vocabulary & Grammar: Cohesive devices. Root words from foreign languages and their use in English. Prepositions.

UNIT-III Developing Writing Skills II:

Techniques for writing precisely. Précise Writing. Essay Writing.

Vocabulary and Grammar: Subject-verb agreement, Noun-pronoun agreement Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives. Redundancies, Clichés.

UNIT-IV Developing Writing Skills III:

Describing, Defining, Classifying, Providing examples or evidence. Writing introduction and conclusion.

Report writing – Importance, structure and elements of style of formal reports.

Vocabulary and Grammar: Misplaced modifiers. Synonyms, antonyms

UNIT-V Developing Reading Skills:

The reading process, purpose, different kinds of texts.Reading comprehension. Techniques of comprehension - skimming, scanning, drawing inferences and conclusions.

Vocabulary and Grammar : Words often Confused. Standard abbreviations

Text Books:

1. Language and Life: A Skills Approach, Board of Editors, Orient Black Swan, 2017.
2. Swan Michael, Practical English Usage. OUP. 1995.

Suggested Readings:

1. Wood F.T,Remedial English Grammar, Macmillan,2007.
2. Zinsser William,On Writing Well, Harper Resource Book, 2001.
3. Sanjay Kumar and Pushp Lata,Communication Skills.Oxford University Press, 2011.

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18PY C02

OPTICS AND SEMICONDUCTOR PHYSICS LABORATORY

(for CSE, ECE & IT)

Instruction:	3 Hours per Week
Duration of Semester End Examination:	3 Hours
Semester End Examination:	50 Marks
Continuous Internal Evaluation:	25 Marks
Credits:	1.5

Course Objectives:

The objectives of the course is to make the student

1. Apply theoretical physics knowledge in doing experiments.
2. Understand the behavior of the light experimentally.
3. Analyze the behavior of semiconductor materials and optoelectronic devices.

Course Outcomes:

At the end of the course, the student will be able to

1. Understand the concept of errors and find the ways to minimize the errors.
2. Demonstrate interference and diffraction phenomena experimentally.
3. Understand the applications of semiconductor materials.
4. Know the working of optoelectronic devices.
5. Use LCR circuits in different applications.

Experiments:

1. Error analysis - Estimation of errors in the determination of time period of a torsional pendulum.
2. Hall effect – Determination of Hall coefficient, carrier concentration & mobility of charge carriers of given semiconductor specimen.
3. Thermistor – Determination of temperature coefficient of resistance of given thermistor.
4. Solar cell - Study of I-V characteristics of given solar cell and calculation of fill factor, efficiency and series resistance.
5. P-N junction diode – Study of V-I characteristics and calculation of resistance of given diode in forward and reverse bias.
6. Energy gap – Determination of energy gap of given semiconductor.
7. Planck's constant – Determination of Planck's Constant using photo cell
8. I-V characteristics of LED.
9. Photodiode.
10. Laser – Determination of wavelength of given semiconductor red laser.
11. Newton's rings - Determination of wavelength of given monochromatic source.

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12. Diffraction grating – Determination of wavelengths of two yellow lines of mercury light
13. LCR circuit (Resonance)

SUGGESTED READING:

1. Engineering Physics Manual by Department of Physics, CBIT, 2016
2. S.K. Gupta, Engineering Physics Practical, Krishna's Educational Publishers, 2014
3. O.P. Singh, V. Kumar and R.P. Singh, Engineering Physics Practical Manual, Ram Prasad & Sons Publications, 2009
4. Indu Prakash, Ram Krishna and A.K. Jha, A Text Book of Practical Physics, Kitab Mahal Publications, 2012.

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18ITC02

OBJECT ORIENTED PROGRAMMING THROUGH C++LAB

Instruction	4 Hours per week
Duration of End Examination	2 Hours
Semester End Examination	35 Marks
Continuous Internal Evaluation:	15 Marks
Credits	1

Course Objectives:

1. To familiarise the syntax and semantics of the C++ programming language.
2. To facilitate students with the skills required to solve problems using object oriented concepts like Encapsulation, Inheritance, Overloading, etc.
3. To enhance problem solving and programming skills in C++ with extensive exercises.
4. To familiarize exceptional handling for dealing with exceptional test cases.
5. To impart the knowledge required to write code with good coding practices.

Course Outcomes:

After successful completion of this course, student will be able to

1. Understand the process of writing, compiling and executing programs in C++ .
2. Implement object oriented concepts in developing applications using C++.
3. Appropriately use the concepts of Inheritance and polymorphism.
4. Ascertain exceptions in a problem and handle them.
5. Understand stream I/O, Files and usage of the available classes to handle stream objects in C++.
6. Design and develop robust programs using OOPS concepts to solve real world problems.

Prerequisites:

Programming and Problem Solving (16CSC01).

List of Programs

Write C++ Programs to

1. Implement parameter passing techniques in functions.
2. Create Class, Objects and illustrate Static members in a class.
3. Illustrate function overloading, inline functions and friend functions.
4. Implement various types of Constructors and Destructor.
5. Implement method overloading, manipulation of strings, array of Pointers.
6. Overload Unary Operators and Binary Operators.
7. Illustrate types of inheritance and exception handling.

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8. Illustrate virtual functions, pointer to derived class objects, pure virtual functions, Abstract classes and virtual destructors.
9. Implement streams and perform operations on sequential access file and random access file.
10. Illustrate Function Templates and Class Templates.

Text Books:

1. K.R.Venugopal, Rajkumar Buyya, "Mastering C++", 2/e, TMH, 2016.
2. Paul Deitel, Harvey Deitel, "How to Program C++", 9/e, Pearson, 2013.

Suggested Reading:

1. Bjarne Strousstrup, "The C++ Programming Language", 4/e, Pearson, 2013.
2. Sourav Sahay, "Object Oriented Programming with C++", 2/e, Oxford University Press.

Web Resources:

1. https://www.tutorialspoint.com/cplusplus/
2. https://www.programiz.com/cpp-programming
3. https://www.class-central.com/tag/c++

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18ME C02

WORKSHOP/ MANUFACTURING PRACTICE

Instruction	1T+4P Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation:	25 Marks
Credits	3

Course Objectives:

1. Give a feel of Engineering Practices & develop holistic understanding of various Engineering materials and Manufacturing processes.
2. Develop skills of manufacturing, safety, precision, quality, intelligent effort, optimization, positive & team work attitude to get things right the first time.
3. To provide basic knowledge of Steel, Plastic, Composite and other materials for suitable applications.
4. Study of Principle and hands on practice on techniques of fabrication, welding, casting, manufacturing, metrology, and allied skills.
5. To advance important hard & pertinent soft skills, productivity, create skilled manpower which is cognizant of industrial workshop components and processes and can communicate their work in a technical, clear and effective way.
6. Engineering Skill development with regard to making components, system integration and assembly to form a useful device.

Course Outcomes – (Laboratory): Student will be able to

1. Fabricate components with their own hands.
2. Get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.
3. Assembling different components, student will be able to produce small mechanisms/devices of their interest.
4. Gain practical skills of carpentry, tinsmithy, fitting, house wiring
5. Gain knowledge of different Engineering Materials and Manufacturing Methods.
6. Understand trades and techniques used in Workshop and chooses the best material/ manufacturing process for the application.

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18EG C02

ENGLISH LAB

(Common to all branches)

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	35 Marks
Continuous Internal Evaluation:	15 Marks
Credits	1

Course Objectives:

1. To introduce students to phonetics and the different sounds in English.
2. To familiarize the students with the software and give them sufficient practice in correct pronunciation.
3. To enable students to speak English correctly with focus on stress and intonation.
4. The students will enhance their listening skills by practicing IELTS and TOEFL material.
5. To help students overcome their inhibitions while speaking in English and to build their confidence. The focus shall be on fluency rather than accuracy.
6. To help students to understand team work, role behavior and to develop their ability to discuss in groups and make oral presentations.

Course Outcomes:

1. The students will differentiate the speech sounds in English.
2. The students will interact with the software and understand the nuances of pronunciation in English.
3. The students will speak with the proper tone, intonation and rhythm and apply stress correctly.
4. The students will demonstrate their listening skills by analyzing the IELTS and TOEFL listening comprehension texts.
5. The students will speak with clarity and confidence.
6. The students will work in teams and discuss various topics and demonstrate their presentation skills through posters.

Exercises

1. **Introduction to English Phonetics**: Introduction to auditory, acoustic and articulatory phonetics, organs of speech: the respiratory, articulatory and phonatory systems.
2. **Sound system of English**: Phonetic sounds and phonemic sounds, introduction to international phonetic alphabet, classification and description of English phonemic sounds, minimal pairs. The syllable: types of syllables, consonant clusters.
3. **Word stress**: Primary stress, secondary stress, functional stress, rules of word stress.

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4. **Rhythm &Intonation** : Introduction to Rhythm and Intonation. Major patterns, intonation of English with the semantic implications.
5. **Listening skills** -practice with IELTS and TOEFL material.
6. **Situational dialogues and role play-** Dialogue writing, – Role behavior and role enactment.
7. **Group Discussions -** Dynamics of a group discussion, group discussion techniques, body language.
8. **Public speaking -** Speaking with confidence and clarity in different contexts on various issues.
9. **Poster presentation -** Theme, poster preparation, team work and presentation.

Suggested Reading

1. T Balasubramanian. A Textbook of English Phonetics for Indian Students, Macmillan, 2008.
2. J Sethi et al. A Practical Course in English Pronunciation (with CD), Prentice Hall India, 2005.
3. Priyadarshi Patnaik. Group Discussions and Interviews, Cambridge University Press Pvt. Ltd. 2011.
4. Aruna Koneru, Professional Speaking Skills, Oxford University Press, 2016.

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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY(A)
AICTE Model Curriculum (with effect from 2019-20)
B.E. (Information Technology)

Semester– III

S.No	Course Code	Title of the Course	Scheme of Instruction: Hours per Week		Scheme of Examination			Credits
			L/T	P/D	Duration of SEE in Hours	Maximum Marks: CIE	Maximum Marks: SEE	
THEORY								
1	18IT C04	Data Structures and Algorithms	3	-	3	30	70	3
2	18IT C05	Discrete Mathematics and Applications	3	-	3	30	70	3
3	18EC C34	Basic Electronics	3	-	3	30	70	3
4	18ME C09	Principles of Management	3	-	3	30	70	3
5	18EE C01	Basic Electrical Engineering	3/1	-	3	30	70	4
6	18CE M01	Environmental Science	2	-	2	-	50	Non-Credit
PRACTICALS								
7	18IT C06	Data Structures and Algorithms Lab	-	2	2	15	35	1
9	18IT C08	Mini Project – I	-	2	-	50	-	1
10	18EC C35	Basic Electronics Lab	-	2	2	15	35	1
11	18EG C03	Soft Skills	-	2	2	15	35	1
12	18EE C02	Basic Electrical Engineering Lab	-	2	2	15	35	1
		TOTAL	**17/1**	**10**	**-**	**260**	**540**	**21**

L: Lecture **T: Tutorial** **D: Drawing** **P: Practical**
CIE-Continuous Internal Evaluation **SEE-Semester End Examination**

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18IT C04

DATA STRUCTURES AND ALGORITHMS

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:
1. To introducerepresentation, specification, and applications of various linear and nonlinear data structures.
2. To familiarize with asymptotic analysis of iterative and recursive functions.
3. To acquaint with various pattern matching algorithms.
4. To present different sorting algorithms.
5. To introduce hashing and collision handling.

Course Outcomes: Upon completing this course, students will be able to:
1. Provide optimal solutions using linear and nonlinear data structures.
2. Analyse time complexity of both iterative and recursive functions.
3. Perform pattern matching.
4. Understand various sorting algorithms and their performance
5. Understand hash functions and collision handling.

UNIT–I

Using Arrays, Storing Game Entries in an Array, Two-Dimensional Arrays. Singly Linked Lists, Implementing a Singly Linked List, Insertion to the front of a Singly Linked List, Removal from the front of a Singly Linked List. Doubly Linked Lists, Insertion into a Doubly Linked List, Removal from a Doubly Linked List, Circularly Linked Lists, Reversing a Linked List. Recursion, Linear Recursion, Binary Recursion, Multiple Recursion, Analysis of Algorithms.

UNIT–II

Stacks, the Stack Abstract Data Type, the STL Stack, A C++ Stack Interface, A Simple Array-Based Stack Implementation, Implementing a Stack with a Generic Linked List, Reversing a Vector Using a Stack, Matching Parentheses and HTML Tags, Queues,the Queue Abstract Data Type, the STL Queue, a C++ Queue Interface, a Simple Array-Based Implementation, Implementing a Queue with a Circularly Linked List. Double-Ended Queues, the Deque Abstract Data Type, the STL Deque, Implementing a Deque with a Doubly Linked List.

Lists, Node-Based Operations and Iterators, the List Abstract Data Type, STL Lists, STL Containers and Iterators.

UNIT–III

General Trees, Tree Definitions and Properties, Binary Trees. The Binary Tree ADT, A C++ Binary Tree Interface, Properties of Binary Trees, a Linked Structure for Binary Trees, a Vector-Based Structure for Binary Trees, Traversals of a Binary Tree, Representing General Trees with Binary Trees.

Pattern Matching Algorithms: Brute Force, the Boyer-Moore Algorithm, the Knuth-Morris-Pratt Algorithm. Tries, Standard Tries, Compressed Tries, Suffix Tries.

UNIT–IV

Binary Search Trees, Searching, Update Operations, C++ Implementation of a Binary Search Tree, AVL Trees, Update Operations, the Priority Queue Abstract Data Type: The Priority Queue ADT.

Merge-Sort, Divide-and-Conquer, Merging Arrays and Lists, Quick-Sort: Performing quick sort on arrays and lists. Linear-Time Sorting: Bucket-Sort and Radix-Sort, Comparing Sorting Algorithms.

The STL priority queue class, Implementing a Priority Queue with a List, Selection-Sort and Insertion-Sort, Heaps, The Heap Data Structure. Complete Binary Trees and their representation, Implementing a Priority Queue with a Heap, Heap Sort, Bottom-Up Heap Construction.

UNIT–V

Hash Tables, Bucket Arrays, Hash Functions, Hash Codes, Compression functions, Collision-Handling Schemes, Load Factors and Rehashing. Graphs, the Graph ADT, Data Structures for Graphs, the Edge List Structure, The Adjacency List Structure, The Adjacency Matrix Structure, Graph Traversals, Depth-First Search, Breadth First Search, Directed Graphs, Traversing a Digraph, Minimum Spanning Trees, Kruskal's Algorithm, The Prim-Jarn´ýk Algorithm.

Text Books:

1. Michael T. Goodrich, Roberto Tamassia, David M. Mount, "Data Structure and Algorithms in C++", 2nd Edition, John Wiley, 2011.
2. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", 3rd Edition Addison-Wesley, 2007.

Suggested Reading:

1. Narasimha Karumanchi, "Data Structures and Algorithms Made Easy: Data Structures and Algorithmic Puzzles", CareerMonk Publications, 2016.
2. Narasimha Karumanchi, "Data Structures and Algorithms for GATE", CareerMonk Publications, 2011.
3. D. Samantha, "Classic Data Structures", Prentice Hall India, 2nd Edition, 2013.

Web Resources:

1. http://nptel.ac.in/courses/106102064/1
2. https://www.cs.usfca.edu/~galles/visualization/Algorithms.html
3. https://visualgo.net/en

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18IT C05

DISCRETE MATHEMATICS AND APPLICATIONS

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To introduce Propositional and Predicate Logic Concepts.
2. To gain knowledge in Counting, Permutations and Combinations.
3. To facilitate learningRecurrence relations and Generating Functions.
4. To acquire knowledge in group theory.
5. To familiarize with Graph and Tree concepts.

Course Outcomes: Upon completing this course, students will be able to:

1. Symbolize the given sentence using predicate logic and propositional logic.
2. Apply permutations and combinations to handle different types of objects.
3. Solve recurrence relations using Generating Functions.
4. Understand semi group, monoid group and abelian group.
5. Apply Graph and Tree concepts for basic problem solving.

UNIT-I

Logic – Sets and Functions: Logic, Propositional equivalences – Predicates and Quantifiers – Nested Quantifiers-Rules of Inference-Sets-Set Operations, Functions.

Integers: The Integers and Division, Integers and Algorithms, Applications of Number Theory.

UNIT–II

Mathematical Reasoning, Induction, and Recursion: Proof Strategy, Sequence and Summation, Mathematical Induction, Recursive Definitions and Structural Induction, Recursive Algorithms.

Counting: Basics of Counting, Pigeonhole Principle, Permutations and Combinations– Binomial Coefficients, Generalized Permutations and Combinations, Generating Permutations and Combinations.

UNIT–III

Advanced Counting Techniques: Recurrence Relations, Solving Linear Recurrence Relations, Divide and Conquer Algorithms and Recurrence Relations, Generating Functions, Inclusion–Exclusion, Application of Inclusion – Exclusion.

Relations: Relations & their Properties, N-ary Relations and Applications, Representing Relations, Closures of Relations, Equivalence Relations, Partial Orderings.

UNIT–IV

Algebraic Structures: Algebraic System - General Properties, semi groups, Monoids, Homomorphism, Groups, Residue arithmetic, group codes and their applications.

UNIT–V

Graphs: Graphs and Graph Models, Graph Terminology, Representing Graphs and Graph Isomorphism, Connectivity, Euler and Hamilton Paths, Shortest Path Problems, Planar Graphs, Graph Coloring.

Trees: Introduction to Trees, Application of Trees, Tree Traversal, Spanning Trees, Minimum Spanning Trees.

Text Books:

1. Kenneth H Rosen, "Discrete Mathematics and its applications", 6th Edition, McGraw Hill, 2006.
2. R.K. Bishit, H.S. Dhami, "Discrete Mathematics", Oxford University Press, 2015.

Suggested Reading:

1. J.P.Trembly, R.Manohar, "Discrete Mathematical Structure with Application to Computer Science", McGraw- Hill, 1997.
2. J. K. Sharma, "Discrete Mathematics", 2nd Edition, Macmillan, 2005.
3. Joel. Mott.Abraham Kandel, T.P.Baker, "Discrete Mathematics for Computer Scientist &Mathematicans", Prentice Hall.

Web Resources:

1. https://onlinecourses.nptel.ac.in/noc18_cs53/
2. https://www.coursera.org/learn/discrete-mathematics

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18EC C34

BASIC ELECTRONICS

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course aims to:

1. Describe semiconductor devices principle and to understand the characteristics of junction diode and transistors.
2. Understand working principles of Oscillators and Amplifiers.
3. Understand the working principle of the regulators and transducers.

Course Outcomes: Upon completion of this course, students will be able to:

1. Use semiconductor devices in making circuits like rectifiers, filters, regulators etc.
2. Design amplifier and oscillators
3. Compare various types of power amplifiers.
4. Analyze the principles and practices for instrument design to development the real world Problems.
5. Apply concepts of various electronic circuits.

Prerequisite: Knowledge about semiconductor physics and basic electrical engineering

UNIT-I

Semiconductor Theory: Energy levels, Intrinsic and Extrinsic Semiconductor, Mobility, Diffusion and Drift current, Hall effect, Law of mass action, Characteristics of P-N Junction diode, current equation, Parameters and Applications.

Rectifiers: Half wave and Full wave Rectifiers Bridge and center tapped with and without filters, Ripple factor, regulation and efficiency.

UNIT-II

Transistors: Bipolar and field effect transistors with their h-parameter equivalent circuits, Basic Amplifiers classification and their circuits (Qualitative treatment only).

Regulators and Inverters: Zener Diode**,** Breakdown mechanisms, Characteristics, Effect of Temperature, Application as voltage regulator.

UNIT-III

Feedback Amplifiers: Properties of Negative Feedback Amplifier, Types of Negative Feedback, Effect of negative feedback on Input impedance and Output impedance, Applications (Qualitative treatment only).

Oscillators: principle of oscillations, LC Type-Hartley, Colpitt and RC Type-Phase shift, Wien Bridge and Crystal Oscillator (Qualitative treatment only).

UNIT-IV

Operational Amplifiers: Basic Principle, Ideal and practical Characteristics and Applications-Summer, Integrator, Differentiator, Instrumentation Amplifier.

Power Amplifiers: Operation of Class A, Class B, Class AB and Class C power amplifiers.

UNIT-V

Data Acquisition systems: Study of transducers-LVDT, Strain gauge.

Photo Electric Devices and Industrial Devices: Photo diode, Photo Transistor, LED, LCD, SCR, UJT Construction and Characteristics and their applications only.

Display Systems: Constructional details of C.R.O and Applications.

Text Books:

1. Robert L. Boylestad, Louis Nashelsky, "Electronic Devices and Circuits Theory", Pearson Education, 9^{th}Edition, LPE, Reprinted, 2006.
2. Morris Mano, "Digital Design", Pearson Education, Asia 2002.

Suggested Reading:

1. Jacob Millman and C., Halkias, "Electronic Devices", McGraw Hill, 8^{th} Edition, Reprint1985.
2. Ramakanth A. Gayakwad, "Op-Amps and Linear Integrated Circuits", Prentice Hall of India, 3^{rd} Edition,1985.
3. W. D. Cooper, A. Helfric, "Electronic Instrumentation and Measurement Techniques", PHI, 4^{th} Edition,2010.

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18ME C09

PRINCIPLES OF MANAGEMENT

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: To make the students to

1. Understand basic fundamentals and insights of management
2. Understand the nature and purpose of planning
3. Gain the knowledge about the frame work of organizing
4. Understand the essence and significance of directing
5. Recognize the importance of controlling and its outcomes

Course Outcomes: At the end of the course, student will be able to understand

1. Identify and evaluate the principles of management
2. Demonstrate the ability to have an effective and realistic planning
3. Identify the nature and the type of organization
4. Apply the tools and techniques of directing
5. Explain and evaluate the necessity for controlling and further refinement of an organization.

UNIT–I

Management: Definition of management, science or art, manager vs entrepreneur; managerial roles and skills;. Evolution of management, Basic management theories by FW Taylor, Henry Fayol, Types of Business Organizations, sole proprietorship, partnership, company, public and private enterprises; Organization culture and environment; Current trends and issues inmanagement

UNIT–II

Planning: Nature and purpose of Planning, types of Planning, objectives, setting objectives, policies, Strategic Management, Planning Tools and Techniques, Planning plant location and layout, Decision making steps & processes.

UNIT–III

Organizing: Nature and purpose of Organizing, formal and informal organization, organization structure, types, line and staff authority, departmentalization, delegation of authority, centralization and decentralization, job design, human

resource management, HR planning, Recruitment selection, Training & Development, Performance Management, Career planning and Management

UNIT–IV

Directing: Individual and group behavior, motivation, motivation theories, motivational techniques, job satisfaction, job enrichment, leadership, types & theories of leadership, effective communication.

UNIT–V

Controlling: system and process of controlling, budgetary and non-budgetary control techniques, use of computers and IT in management control, productivity problems and management, control and performance, direct and preventive control, reporting.

Text Books:

1. S.P. Robins and M. Couiter, “Management”, 10th Edition,Prentice Hall India, 2009.
2. JAF Stoner, RE Freeman and DR Gilbert, “Management”, 6th Edition, Pearson Education,2004.

Suggested Reading:

1. P.C. Tripathy & P.N.Reddy, “Principles of Management”, Tata McGraw Hill, 1999.
2. Harold Koontz and Cyril O’Donnell “Principles of Management”, Tata McGraw Hill, 2017.

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18EE C 01

BASIC ELECTRICAL ENGINEERING

Instruction	3 L+1T Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	4

Course Objectives:

1. To understand the behavior of different circuit elements R,L & C, and the basic concepts of electrical circuit analysis.
2. To know the concepts of AC circuits, RMS value, Average value, Phasor analysis etc.
3. To understand the basic principle of operation of Transformer and DC machines.
4. To understand the basic principle of operation of DC machines and AC machines.
5. To know about different types of electrical wires and cables, domestic and industrial wiring.
6. To understand safety rules and methods of earthing.

Course Outcomes: At the end of the course, the student will be able to

1. Acquire the concepts of Kirchhoff's laws and network theorems and able to get the solution of simple dc circuits.
2. Obtain the steady state response of RLC circuits and also determine the different powers in AC circuits.
3. Acquire the concepts of principle of operation of Transformers and DC machines.
4. Acquire the concepts of principle of operation of DC machines and AC machines.
5. Acquire the knowledge of electrical wiring and cables and electrical safety precautions.
6. Recognize importance of earthing and methods of earthing and electrical installations.

UNIT–I

DC Circuits Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation, Superposition, Thevenin and Norton Theorems, Time-domain analysis of firstorder RL and RC circuits.

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UNIT–II

AC Circuits Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor, Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel). Three phase balanced circuits, voltage and current relations in star and delta connections.

UNIT–III

Transformers Construction, Working principle, EMF Equation, Ideal and Practical transformer, Equivalent circuit of Transformer, OC and SC tests on a transformer, Efficiency and Regulation, Auto transformer.

UNIT–IV

DC and AC Machines DC Generators: Construction, Principle of operation, EMF equation, Classification, Characteristics of shunt, series and compound generators. DC Motors: Classification, Torque equation, Characteristics, Efficiency, Speed Control of Series and Shunt Motors. Three - Phase Induction Motors: Construction, Principle of operation, Torque equation, torque-slip characteristics, Power stages, speed control of induction motors.

UNIT–V

Electrical Installations Electrical Wiring: Types of wires and cables, Electrical Safety precautions in handling electrical appliances, electric shock, first aid for electric shock, safety rules. Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Earthing, Elementary calculations for energy consumption.

Text Books:

1. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
2. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.

Suggested Reading:

1. D. P. Kothari & I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
2. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.
3. D.C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill,2009
4. P.V.Prasad, S.sivanagaraju, R.Prasad, "Basic Electrical and Electronics Engineering", Cengage Learning, 1st Edition, 2013.

18CE M 01

ENVIRONMENTAL SCIENCE

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	0 Marks
Credits	0

Course Objectives: To enable the student:

1. Identify environmental problems arising due to engineering and technological activities and the science behind those problems.
2. Become aware about the importance of eco system and biodiversity for maintaining ecological balance
3. To identify the importance of interlinking of food chain
4. Learn about various attributes of pollution management and waste management practices.
5. To make the students contribute for capacity building of nation for arresting and/or managing environmental disasters.

Course Outcomes: At the end of the course, the student should have learnt

1. To define environment, identify the natural resources and ecosystems and contribute for the conservation of bio-diversity.
2. To suggest suitable remedial measure for the problems of environmental pollution and contribute for the framing of legislation for protection of environment.
3. To relate the social issues and the environment and contribute for the sustainable development.
4. To follow the environmental ethics.
5. To contribute for the mitigation and management of environmental disasters.

UNIT–I

Environmental Studies: Definition, Scope and importance, need for public awareness.

Natural resources: Use and over utilization of Natural Resources - Water resources, Food resources, Forest resources, Mineral resources, Energy resources, Land resources.

UNIT–II

Ecosystems: Concept of an ecosystem, structure and function of an ecosystem, role of producers, consumers and decomposers, energy flow in an ecosystem,

food chains, food webs, ecological pyramids, Nutrient cycling, Bio-geo chemical cycles, Terrestrial and Aquatic ecosystems.

UNIT–III

Biodiversity: Genetic, species and ecosystem biodiversity, Bio-geographical classification of India, India as a Mega diversity nation. Values of biodiversity, hot-spots of biodiversity, threats to biodiversity, endangered and endemic species of India, methods of conservation of biodiversity.

UNIT–IV

Environmental Pollution: Cause, effects and control measures of air pollution, water pollution, marine pollution, soil pollution, noise pollution and Solid waste management, nuclear hazards

Environmental Legislations: Environment protection Act, Air, Water, Forest & Wild life Acts, issues involved in enforcement of environmental legislation, responsibilities of state and central pollution control boards

UNIT–V

Social issues and the environment: Water conservation methods: Rain water harvesting and watershed management, Environmental ethics, Sustainable development and Climate change: Global warming, Ozone layer depletion, forest fires, and Contemporary issues.

Text Books:

1. Y. Anjaneyulu, "Introduction to Environmental Science", B S Publications, 2004.
2. Suresh K. Dhameja, "Environmental Studies", S. K. Kataria& Sons, 2009.

Suggested Reading:

1. C. S. Rao," Environmental Pollution Control Engineering", Wiley, 1991.
2. S. S. Dara, "A Text Book of Environmental Chemistry & Pollution Control", S. Chand Limited, 2006.

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18IT C06

DATA STRUCTURES AND ALGORITHMS LAB

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Course Objectives:

1. To introduce linked lists and operations.
2. To present Stacks, Queues and their applications.
3. To familiarize pattern matching algorithms.
4. To introduce Sorting algorithms and Hashing.
5. To gain knowledge of trees, graphs and related algorithms.

Course Outcomes: Upon completing this course, students will be able to:

1. Implement linked lists.
2. Develop ADT necessary for solving problems based on Stacks and Queues.
3. Perform pattern matching.
4. Implement various Sorting Algorithms and Hashing.
5. Identify data structures suitable for providing optimal solutions to real world problems.

List of Programs

1. Define Single Linked List ADT and implement its operations.
2. Define Double Linked List ADT and implement its operations.
3. Implement Stack ADT and perform Infix to Postfix Conversion.
4. Perform evaluation of postfix expression using Stack ADT.
5. Implement Queues, Circular Queues and Deques using arrays and linked lists.
6. Define String ADT and implement Boyer Moore pattern matching algorithm.
7. Implement Tries.
8. Implement the following: Insertion Sort, Bubble Sort, Selection Sort, and Shell Sort.
9. Implement the following: Merge Sort, Quick Sort, Heap Sort, and Binary Search.
10. Construct a Binary Search Tree and implement Tree Traversal techniques.

11. Implement Hashing with chaining.
12. Implement Graph traversal techniques.

Text Books:

1. Narasimha Karumanchi, "Data Structures and Algorithms Made Easy: Data Structures and Algorithmic Puzzles", CareerMonk Publications, 2016.
2. Michael T. Goodrich, Roberto Tamassia, David M. Mount, "Data Structure and Algorithms in C++", 2nd Edition, John Wiley, 2011.

Suggested Reading:

1. Narasimha Karumanchi, "Coding Interview Questions", CareerMonk Publications, 3rd Edition, 2016
2. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", Addison-Wesley, 3rd Edition, 2007.
3. D. Samantha, "Classic Data Structures", Prentice Hall India, 2nd Edition, 2013.

Web Resources:

1. https://leetcode.com/
2. https://www.hackerearth.com/practice/data-structures/arrays/1-d/tutorial/
3. https://www.cs.usfca.edu/~galles/visualization/Algorithms.html

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18IT C08

MINI PROJECT – I

Instruction	2 Hours per week
Duration of SEE	-
SEE	-
CIE	50 Marks
Credits	1

Course Objectives:
1. To enable students learn by doing.
2. To develop capability to analyse and solve real world problems
3. To develop innovative ideas among the students

Course Outcomes: Students should be able to do the following:
1. To provide innovative solutions
2. To work in a team
3. To manage time and resources in the best possible manner

The Students are required to choose a topic for miniproject related to the courses of this semester. The student has to implement and present the project as per the given schedule. During the implementation of the project, Personnel Software Process (PSP) has to be followed. Report of the project work has to be submitted for evaluation.

Schedule

S.No	Description	Duration
1.	Problem Identification / Selection	2 weeks
2.	Preparation of Abstract	1 week
3.	Design, Implementation & Testing of the Project	7 weeks
4.	Documentation & Project Presentation	4 weeks

Guidelines for the Award of marks

S.No.	Description	Max. Marks
1.	Weekly Assesment	20
2.	PPT Preparation	05
3.	Presentation	10
4.	Question and Answers	05
5.	Report Preparation	10

Final MiniProject demonstration and PPT presentation is to be evaluated for the entire class together by all the faculty handling MiniProject for that class.

18ECC 35

BASIC ELECTRONICS LAB

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Course Objectives: This course aims to:
1. Learn about various electronic components and devices.
2. Study the transistor characteristics in different modes.
3. Learn about oscillators and amplifiers.

Course Outcomes: Upon completion of this course, students will be able to:
1. Familiarize on basic electronic components, devices and system.
2. Analyze the measurements of time period, amplitude and phase of different waveforms.
3. Design and analyze the behavior of the regulator and rectifier.
4. Develop various types of oscillators and power amplifiers
5. Design the various circuits using operational amplifiers.

Prerequisite: Knowledge about semiconductor physics and basic electrical engineering.

List of Experiments
1. Study of Electronic components.
2. Characteristics of Semiconductor diodes (Ge, Si and Zener).
3. CRO and its Applications.
4. Half, Full wave rectifiers with and without filters.
5. Voltage Regulator using zener diode.
6. Characteristics of BJT in CE Configuration.
7. Characteristics of FET in CS Configuration.
8. Amplifier with and without feedback.
9. RC Phase shift oscillator
10. Operational Amplifier and its applications.
11. Power Amplifiers Characteristics
12. Realization of Half and Full adder

Text Books:
1. Paul B. Zbar, Albert P. Malvino, Michael A. Miller, "Basic Electronics,a Text - Lab Manual", 7th Edition, TMH, 1994.
2. Paul B. Zbar, "Industrial Electronics, a Text - Lab Manual", 4th Edition, 2008.

18EG C03

SOFT SKILLS

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Course Objectives: The course will introduce the students to:

1. Imbibe an impressive personality, etiquette, professional ethics & values, effective time management & goal setting.
2. Understand the elements of professional update & upgrade through industry exposure in a mini-live project. Understand confidence building strategies and thereby to make effective presentations through PPTs.
3. Learn what constitutes proper grooming and etiquette in a professional environment. Acquire the necessary skills to make a smooth transition from campus to corporate.

Course Outcomes : After successful completion of the course the students will be able to:

1. Be assertive and set short term and long term goals. Also learn to manage time effectively and deal with stress.
2. Win in professional communication situations and participate in group discussions with confidence. Write abstracts.
3. Write effective resumes. Plan, prepare and face interviews confidently.
4. Adapt to corporate culture by being sensitive - personally and sensible - professionally. Draft an SOP.
5. Apply the soft skills learnt in the mini-live project, by collecting and analyzing data and making oral and written presentations on the same.

Exercise 1

Main Topics: Thinking Skills, Personality Development – Effective Time Management, setting realistic goals, self confidence and assertiveness, stress management, moral values.
Flipped Sessions: Personal Sensitivity & Professional Sensibility (Reading & Discussion)
Writing Input: Writing to Express - Drafting & Delivering a Speech (Free Writing Exercise)

Exercise 2

Main Topics: Advanced Group Discussion with Case studies: Dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and coherence.

Flipped Sessions: Importance of Professional Updating & Upgrading (Reading & Discussions)
Writing Input: Writing with Precision - Writing Abstracts

Exercise 3

Main Topics: Interview Skills – concept and process, pre-interview planning, opening strategies, answering strategies, mock interviews. Resume' writing – structure and presentation, planning, defining the career objective, projecting ones strengths and skills.
Flipped Sessions: Mock Interviews (Video Sessions & Practice)
Writing Input: Writing to Reflect - Resume Writing

Exercise 4

Main Topic: Corporate Culture – Grooming and etiquette, communication media, academic ethics and integrity
Flipped Sessions: Corporate Culture, Etiquette & Grooming (Video Sessions & Practice through Role-play)
Writing Input: Writing to Define - Writing an effective SOP.

Exercise 5

Main Topic: Mini Project – General/Technical. Research, developing a questionnaire, data collection, analysis, written report and project seminar. Elements & Structure of effective presentation. Presentation tools – Body language, Eye-contact, Props & PPT.
Flipped Sessions: Effective Presentations (Video & Writing Sessions, Practice through Emulation)
Writing Input: Writing to Record - Writing minutes of meeting.

Suggested Reading:

1. Madhavi Apte , "**A Course in English communication**", Prentice-Hall of India, 2007.
2. Dr. Shalini Verma, **"Body Language- Your Success Mantra**", S Chand, 2006.
3. Ramesh, Gopalswamy, and Mahadevan Ramesh, "**The ACE of Soft Skills",** New Delhi: Pearson, 2010.
4. Van Emden, Joan, and Lucinda Becker, "**Presentation Skills for Students**", New York: Palgrave Macmillan, 2004.

* Flipped Class-room: Students explore the concept first and then trainer explains it, students work on their own.

Web Resources:

1. https://www.goskills.com/Soft-Skills
2. https://www.trainerbubble.com
3. https://www.skillsconverged.com

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18EE C02

BASIC ELECTRICAL ENGINEERING LAB

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Course Objectives:

1. To acquire the knowledge of different types of electrical elements.
2. To verify the basic electrical circuit laws and theorems.
3. To determine the parameters and power factor of a coil.
4. To calculate the time and frequency responses of RLC circuits
5. To determine the characteristics of Transformers.
6. To determine the characteristics of dc and ac machines.

Course Outcomes: At the end of the course, the students are expected to

1. Get an exposure to common electrical components and their ratings.
2. Make electrical connections by wires of appropriate ratings.
3. Understand the circuit analysis techniques.
4. Determine the parameters of the given coil.
5. Understand the basic characteristics of transformer.
6. Understand the basic characteristics of dc and ac machines. List of Laboratory

Experiments/Demonstrations:

1. Demonstration of Measuring Instruments and Electrical Lab components
2. Verification of KCL and KVL.
3. Time response of RL and RC circuits.
4. Calculation of permittivity of a choke or coil by Wattmeter Method.
5. Verification of Thevenin's and Norton's theorems.
6. Turns ratio /voltage ratio verification of 1-Ph Transformers.
7. OC and SC tests on a given 1-Ph Transformer.
8. Observation of Excitation Phenomenon in Transformer.
9. Measurement of 3-Ph power in a balanced system (By 2- Wattmeter method).
10. Measurement of 3-Ph Energy by an Energy Meter (Demonstration of Principle).

11. Load test of DC Shunt motor.
12. Speed control of DC Shunt motor.
13. Load test of 3-Ph Induction motor.
14. Demonstration of LT Switchgear Equipment/Components.
15. Demonstration of cut - out section of Machines like DC Machine, Induction Machine etc.

Note: At least TEN experiments should be conducted in the semester.

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UNIT–II

Registers: Register with Parallel load, Shift Register, Counters. **Data Representation:** Data Types, Number Systems, Octal and Hexadecimal Numbers, Decimal Representation, Alphanumeric Representation, Complements: (r-1)'s Complement, r's Complement, Subtraction of Unsigned Numbers, Fixed–Point Representation, Floating –Point Representation, Other Binary Codes, Error Detection Codes.

UNIT–III

Central Processing Unit: General register Organization, Stack Organization: Register Stack, Memory Stack, Reverse Polish Notation, Instruction Formats: ThreeAddress Instructions, Two-Address Instructions, One-Address Instructions, Zero-Address Instructions, RISC Instructions, Addressing Modes, Data Transfer and Manipulation, Program Control, Reduced Instruction Set Computer (RISC): CISC Characteristics, RISC Characteristics.

UNIT–IV

Input-Output Organization: Peripheral Devices: ASCII AlphanumericCharacters, Input-output Interface: I/O Bus and Interface Modules, Asynchronous Data Transfer: Strobe Control, Handshaking, Asynchronous Communication Interface, First-In- First-Out Buffer, Modes of Transfer: Interrupt-Initiated I/O, Priority Interrupt: Daisy Chaining Priority, Parallel Priority Interrupt, Priority Encoder, Direct Memory Access (DMA): DMA Controller.

UNIT–V

Memory Organization: Memory Hierarchy, Main Memory: RAM and ROM Chips, Memory Address Map, Memory Connection to CPU, Auxiliary memory: Magnetic Disks, Magnetic Tapes, Associative Memory: Hardware Organization, Match Logic, Read and Write Operations, Cache Memory: Associative Mapping, Direct Mapping, Set-Associative Mapping, Virtual Memory: Address Space and Memory Space, Address Mapping using Pages, Associative Memory Page Table, Page Replacement.

Text Book:

1. M.Morris Mano, "Computer System Architecture", 3rd Edition, Pearson Education.

Suggested Reading:

1. Stephen Brown, ZvonkoVranesic, "Fundamentals of Digital Logic with VHDL design", 2nd Edition, McGraw Hill, 2009.

2. ZVI Kohavi, "Switching and Finite Automata Theory", 2nd Edition, Tata McGraw Hill, 1995.
3. William Stallings, "Computer Organization and Achitecture", 8th Edition,PHI.
4. Carl Hamachar, Vranesic, Zaky, "Computer Organization", 5th Edition, McGraw Hill.

Web Resources:

1. https://nptel.ac.in/courses/117106114Week1%20Slides1.1Introduction.pdf
2. https://ece.gmu.edu/coursewebpages/ECE/ECE545/F10/viewgraphs/ECE545_lecture1_digital_logic_review.ppt
3. http://www.nptelvideos.in/2012/11/computer-organization.html

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18IT C09

DATABASE MANAGEMENT SYSTEMS

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To introduce the fundamental concepts and the role of a database system in an organization.
2. To acquire knowledge on Data base design models, constraints and notations.
3. To familiarize with querying databases using SQL.
4. To acquaint with design and implementation issues of a database system.
5. To discuss the concepts of database security, concurrency and recoverability.

Course Outcomes: Upon completing this course, the students will be able to:

1. Understand the purpose of database systems and design any domain specific database using E-R model.
2. Design and implement a database using Relational data model, formulate Relational algebra expressions. Use SQL for efficient data retrieval queries.
3. Access databases from high level languages, define triggersand apply normalization.
4. Efficiently organize and manage data using indexing and hashing.
5. Understand the conceptsof database transactions, locking protocols, concurrency control, backup and recovery.

UNIT–I

Introduction: Database-System Applications, Purpose of Database Systems, View of Data, Database Languages, Relational Databases, Database Design, Data Storage and Querying, Transaction Management, Database Architecture, Data Mining and Information Retrieval Specialty Databases, Database Users and Administrators. **Database Design and the E-R Model:** Overview of the Design Process, the EntityRelationship Model, Constraints, Removing Redundant Attributes in Entity Sets, Entity-Relationship Diagrams, Reduction to Relational

Schemas, Entity-Relationship Design Issues, Extended E-R Features, Alternative Notations for Modeling Data.

UNIT–II

Introduction to the Relational Model: Structure of Relational Databases, Database Schema, Keys, Schema Diagrams, Relational Query Languages, Relational Operations. **Introduction to SQL:** Overview of the SQL Query Language, SQL Data Definition, Basic Structure of SQL Queries, Additional Basic Operations, Set Operations, Null Values, Aggregate Functions, Nested Sub queries, Modification of the Database. **Intermediate SQL:** Join Expressions, Views, Transactions, Integrity Constraints, SQL Data Types and Schemas, Authorization.

UNIT–III

Advanced SQL: Accessing SQL from a Programming Language, Functions and Procedures, Triggers, Recursive Queries, Advanced Aggregation Features. **Relational Database Design:** Features of Good Relational, Designs, Atomic Domains and First Normal Form, Decomposition using Functional Dependencies, Functional-Dependency Theory,Algorithms for Decomposition, Decomposition using Multivalued Dependencies.

UNIT–IV

Indexing and Hashing: Basic Concepts, Ordered Indices, B+ Tree Index Files, Multiple-Key Access, Static Hashing, Dynamic Hashing, Comparison of Ordered Indexing and Hashing, Bitmap Indices, Index Definition in SQL **Transactions:** Transaction Concept, a Simple Transaction Model, Transaction Atomicity and Durability, Transaction Isolation, Serializability, Transaction Isolation and Atomicity, Transaction Isolation Levels.

UNIT–V

Concurrency Control: Lock-Based Protocols, Deadlock Handling, Multiple Granularity, Timestamp-Based Protocols, Validation-Based Protocols, Multiversion Schemes, Snapshot Isolation, Insert Operations, Delete Operations and Predicate Reads. **Recovery System:** Failure Classification, Storage, Recovery and Atomicity, Recovery Algorithm, Buffer Management, Failure with Loss of Nonvolatile Storage, ARIES, Remote Backup Systems.

Text Book:

1. Abraham Silberschatz, Henry F Korth, S. Sudarshan, "Database System Concepts", 6th Edition, McGraw-Hill International Edition, 2010.

Suggested Reading:

1. RamezElmasri, Shamkant B. Navathe, "Fundamentals of Database System", 6^{th} Edition, Addison-Wesley, 2011.
2. Raghu Ramakrishnan,JohannesGehrke, "Database Management Systems", 3^{rd} Edition, McGraw-Hill International Edition, 2014
3. Rick F Vander Lans, "Introduction to SQL", 4^{th} Edition, Pearson Education, 2007.
4. Benjamin Rosenzweig, Elena Silvestrova, "Oracle PL/SQL by Example", 5^{th} Edition, Pearson Education, 2015.

Web Resources:

1. http://db-book.com/
2. https://www.tutorialspoint.com/dbms/
3. https://www.w3schools.in/dbms/
4. http://www.oracle-dba-online.com/sql/oracle_sql_tutorial.htm.
5. http://www.tutorialspoint.com/plsq

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18IT C10

JAVA PROGRAMMING

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	20 Marks
Credits	2

Course Objectives:

1. To familiarize with fundamentals of object-oriented programming paradigm.
2. To impart the knowledge of string handling, interfaces, packages and inner classes.
3. To acquaint with Exception handling mechanisms and Multithreading.
4. To gain knowledge on collection framework, stream classes.
5. To familiarize with event driven GUI and Database connectivity.

Course Outcomes: After successful completion of this course, student will be able to:

1. Understand object-oriented concepts.
2. Create Java applications using best OOP practices e.g. Inheritance, interfaces, packages, and inner classes.
3. Implement the concepts of Exception Handling and Multi threading.
4. Develop applications using Collections framework.
5. Design and Develop GUI applications with JDBC.

UNIT–I

Introduction to Java: Objects, Classes, structure a java program, difference betweenjdk and jre, Java Primitive Types, Basic Operators, Conditional and Logical statements.

Defining Classes: Adding Instance Fields and Methods, Constructors, Access Modifiers (Visibility Modes), Object Creation Examples, Method Overloading and Constructor Overloading, Use of static andfinalkeywords, Objects as parameters, Difference between local variable and instance field, importance of Object class.

UNIT–II

Inheritance, Interfaces and Packages in Java: Defining super / sub classes, Abstract classes, Method overriding, Interfacesand new features in latest version.

Packages: Defining, Creatingand Accessing a Package, importing packages.

Arrays,StringsinJava: Howtocreateanddefinearrays,Introductionto java.util. Array class, Difference between String &String Buffer classes, String Tokenizer class and Wrapperclassesandconversionbetween Objects and primitives, Autoboxing and unboxing

Inner classes in Java: Types of inner classes, Creating static / non-static inner classes, Local and anonymous innerclasses.

UNIT–III

Exception Handling in Java: What are exceptions, Error vs. Exception, usage of try, catch, throw throws and finally clauses, writing your own exception classes, Difference between checked vs. unchecked Exceptions.

Generics: Need of Generics concept, Generic classes, bounded types, Generic methods and interfaces.**Multithreading in Java:** The java Thread Model, How to create threads, Thread class in java, Thread priorities, Inter thread communication, Thread synchronization.

UNIT–IV

Collections: Overview of Java Collection Framework, Collection Interfaces – Collection, Set, List, Map, Commonly used Collectionclasses – ArrayList, LinkedList, HashSet, TreeSet, HashMap, TreeMap, legacy and class, Iteration over Collections – Iterator and ListIterator, Enumeration interfaces, differentiate Comparable and Comparator

File Handling: Stream classes, Reader and Writer classes, File and Directory class, How to read user input fromkeyboard. New Features in java 8 and 9

UNIT–V

GUI Design & Event Handling: Component, Container, Color,GUI Controls, Layout Managers, Introduction to Swings, Delegation Event Model, Event Classes, Source of Events, Event Listener Interfaces. Handlingbutton click, mouse and keyboard events, and Adapter classes. Writing GUI Based applications, Applets, life cycle of an Applet, Developing and running applets, passing parametersto applets.

Database Handling in Java: Java Database Connectivity (JDBC) using MySQL.

Text Books:

1. Herbert Schildt, "Java: The Complete Reference", 8th Edition, TataMcGraw Hill Publications, 2011.
2. Cay S. Horstmann, Gary Cornell,"Core Java, Volume I— Fundamentals", 8th Edition, Prentice Hall, 2008.

Suggested Reading:

1. Sachin Malhotra, Saurabh Choudhary, "Programming in Java", Oxford University Press, 2nd Edition, 2014.
2. C.ThomasWu, "An Introduction to Object-Oriented Programming with Java", TataMcGraw-Hill, 4th Edition, 2010.

Web Resources:

1. https://www.cse.iitb.ac.in/~nlp-ai/javalect_august2004.html
2. https://nptel.ac.in/courses/106106147/2
3. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-092-introduction-to-programming-in-java-january-iap-2010/lecture-notes/

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18IT C11

DESIGN AND ANALYSIS OF ALGORITHMS

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To analyze the performance of various algorithms.
2. To illustrate different paradigms of problem solving.
3. To learn about various algorithm design techniques and illustrates them using a number of well known problems and applications.
4. To familiarize graph traversal and search techniques.
5. To discuss NP hard and NP complete problems and their applications.

Course Outcomes: Upon completing this course, students will be able to:

1. Analyse best, average and worst case complexities of algorithms and choose appropriate data structure for designing algorithm.
2. Design solutions using Divide and Conquer, Greedy techniques.
3. Design algorithms using dynamic programming approach, apply various traversal and search techniques.
4. Design algorithms using backtracking, branch and bound techniques.
5. Identify P, NP, NP-Complete and NP-Hard classes to which an algorithm belongs and design a feasible solution.

UNIT-I

Introduction: Algorithm Specification, Performance analysis: Space Complexity, Time Complexity, Asymptotic Notation (O, Omega, Theta), Practical Complexities, Performance Measurement, **Elementary Data Structures:** Stacks and Queues, Trees, Dictionaries , Priority Queues, Sets and Disjoint Set Union.

UNIT-II

Divide and Conquer: The general method, Finding the Maximum and Minimum, Merge Sort, Quick Sort, Selection Sort, Strassen's Matrix Multiplication.
Greedy Method: The General Method, Knapsack Problem, Job Sequencing with Deadlines, Minimum Cost Spanning Trees, Optimal Storage on Tapes, Optimal Merge Patterns, Single Source Shortest Paths.

UNIT-III

Dynamic Programming: The General Method, Multistage graphs, All Pair Shortest Paths, Single Source Shortest Paths, Optimal Binary Search Trees, 0/1 Knapsack, Reliability Design, The Traveling Salesperson Problem.
Traversal and Search Techniques: Breadth First Search and Traversal, Depth First Search and Traversal, Connected Components and Spanning Trees, Bi-connected Components and DFS.

UNIT-IV

Backtracking: The General Method, 8-Queens Problem, Graph Colouring, Hamilton cycles, Knapsack Problem.
Branch and Bounds: The Method: Least Cost (LC) Search, The 15 puzzle, FIFO Branch and Bound, LC Branch and Bound, 0/1 Knapsack Problem, Traveling Salesperson Problem.

UNIT-V

NP-Hard and NP-Complete Problems: Basic Concepts: Non-Deterministic Algorithms, the Classes NP Hard and NP Complete. Cook's theorem, NP-Hard Graph Problems: Node Cover Decision Problem, Chromatic Number Decision Problem, Directed Hamiltonian Cycle, Traveling Salesperson Decision Problem, NP Hard Scheduling Problems: Job Shop Scheduling.

Text Books:

1. Ellis Horowitz, Sartaj Sahani, Sanguthevar Rajasekaran, "Fundamentals of Computer Algorithm, 2nd Edition", Universities Press, 2011.
2. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", 2nd Edition, Prentice Hall of India Private Limited, 2006.

Suggested Reading:

1. AnanyLevitin, "Introduction to the Design & Analysis of Algorithms", Pearson Education, 2003.
2. Aho, Hopcroft, Ullman, "The Design and Analysis of Computer Algorithm", Pearson Education, 2000.
3. Parag H.Dave, Himanshu B. Dave, "Design and Analysis of Algorithms", 2nd Edition, Pearson Education, 2014.

Web Resources:

1. http://nptel.ac.in/courses/ 106101060
2. http://nptel.ac.in/courses/106106131

18MT C09

PROBABILITY AND STATISTICS

Instruction	3 L+1T Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	4

Course Objectives:
1. Able to learn and Analysing data in Linear and Non-Linear form.
2. Able to fit the hypothetical data using probability distribution.
3. Understand the data using the testing of Hypothesis.
4. Able to Analysing time series data using trend analysis.
5. Able to formulate and get the solution of real world problem.

Course Outcomes: On successful completion of this course the students shall be able to
1. Use the principle of Least Squares approximating for estimating the value.
2. Use the basic probability for fitting the Random phenomenon.
3. Analysing data using different methods of hypothesis testing.
4. Use the Moving Averages Methods for trend analysis.
5. Analyse the random phenomena of real world data.

UNIT-I

Basic Statistics: Measures of Central Tendency, Measures of Dispersion, Skewness (SKP & SKB) for frequency distribution, Kurtosis, Curve fitting by the Method of Least Squares, Fitting of Straight lines, Second degree parabola and Growth curve ($y = ae^{bx}$, $y = ax^b$ and $y = ab^x$).

UNIT-II

Discrete Probability Distributions: Basic probability, Conditional probability, Bayes theorem, Random variable, Discrete random variable, continuous random variable, Properties of probability mass function, probability density function, Mathematical expectation variance, co-variance and properties, Poisson distribution, Poisson Distribution is a limiting form of Binomial Distribution), MGF, CGF, fitting of Poisson distribution.

UNIT-III

Continuous Probability Distribution and Bivariate Distribution: Continuous probability distribution-Normal distribution-Standard Normal random variable (MGF, Expectation, Variance, Properties of Normal Curve)-Areas under Normal curve-Exponential distribution (MGF, CGF, Expectation, Variance)-Uniform distribution (MGF, Expectation, Variance)-Bivariate data two dimensional Discrete random variable, continuous random variable, Marginal probability function, Properties of joint probability function-sum and differences.

UNIT-IV

Small Sample Test: Inferential statistics-Test of significance-Large sample test for single proportion, difference of proportions, single mean, difference of means and differences of standard deviations. Small sample test-test for single mean, differences of Means, test for ratio of variances, Chi-Square test for goodness of fit and independent of attributes.

UNIT-V

Time Series Analysis and ANOVA: One way classification-Assumptions for ANOVA Test-ANOVA for fixed effect model-Two way classification-ANOVA for fixed effect model-Components of Time series-Measurement of Trend-Method of semi Averages- Moving Averages Method (3 Years and 5 Years).

Text books:

1. S.C.Gupta, V.K.Kappoor, "Fundamentals of Mathematical Statistics", Sultan Chand and Sons, 2014.
2. S.C.Gupta, V.K.Kappoor, "Fundamentals of Applied Statistics", Sultan Chand and Sons, 2014.
3. Sheldon Ross, "A First Course in Probability", 9th Edition, Pearson publications, 2014.

Suggested Reading:

1. W. Feller, "An Introduction to Probability Theory and its Applications", Vol. 1, 3rd Edition, Wiley, 1968.

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18EG M01

INDIAN CONSTITUTION

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	50 Marks

Course Objectives: The course will introduce the students to:

1. The history of Indian Constitution and how it reflects the social, political and economic perspectives of the Indian society.
2. Address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indiannationalism.
3. Have knowledge of the various Organs of Governance and Local Administration.

Course Outcomes: After successful completion of the course the students will be able to :

1. Understand the making of the Indian Constitution and its features.
2. Have an insight into various Organs of Governance - composition and functions.
3. Understand powers and functions of Municipalities, Panchayats and Co-operativeSocieties.
4. Be aware of the Emergency Provisions in India.
5. Understand the Right To equality, the Right To freedom and the Right To Liberty.

UNIT-I

Constitution of India: Introduction and salient features, Constitutional history. Directive Principles of State Policy - Its importance and implementation.

UNIT-II

Union Government and its Administration: Structure of the Indian Union: Federalism, distribution of legislative and financial powers between the Union and the States.

Parliamentary form of government in India. President: role, power and position.

UNIT-III

Emergency Provisions in India: National emergency, President rule, Financial emergency

UNIT-IV

Local Self Government: District's Administration Head: Role and Importance.

Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation.

Panchayati Raj: Introduction, Zilla Panchayat, Elected officials and their roles, CEO Zilla Panchayat: Position and role. Block level: Organizational Hierarchy (Different departments). Village level: Role of Elected and officials.

UNIT-V

Scheme of The Fundamental Rights & Duties: Fundamental Duties - The legal status.

Scheme of The Fundamental Rights - To Equality, to certain Freedom Under Article 19, to Life And Personal Liberty Under Article 21.

Suggested Reading:

1. The Constitution of India, 1950 (Bare Act), GovernmentPublication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar, Framing of Indian Constitution, 1st Edition,2015.
3. M. P. Jain, Indian Constitution Law, 7th Edition, Lexis Nexis,2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis,2015.

Web Resource:

1. http://www.nptel.ac.in/courses/103107084/Script.pdf

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18IT C07

IT WORKSHOP

Instruction	2 Hours per week
Duration of SEE	-
SEE	-
CIE	50 Marks
Credits	1

Course Objectives:

1. To understand the basic components and peripherals of a computer.
2. To become familiar in configuring a system.
3. To impart the usage of productivity tools.
4. To acquire knowledge about the netiquette and plagiarism.
5. To get hands on experience in LATEX.

Course Outcomes: Upon successful completion of the course students will be able to:

1. Identify the basic components and peripherals of a computer.
2. Installation of Operating System and various Device Drivers.
3. Work on MS Office Packages.
4. Understand Net etiquette and Plagiarism tools.
5. Create documents using LATEX.

List of Experiments

1. System Assembling, Disassembling and identification of Parts / Peripherals.
2. **Operating System Installation** - Install Operating Systems like Windows, Linux along with necessary Device Drivers.
3. **MS-Office:Word** - Formatting, Page Borders, Reviewing, Equations, symbols. **Spread Sheet** - organize data, usage of formula, graphs, charts.**Power point** - features of power point, guidelines for preparing an effective presentation.
4. **Essentials:** Search Engines & Net etiquette, Plagiarism, Open source tools and other Utility Tools.
5. **LATEX** - basic formatting, handling equations and images.

Text Books:

1. K.L. James, "Computer Hardware, Installation, Interfacing, Troubleshooting and Maintenance", Eastern Economy Edition.

2. Gary B. Shelly, Misty E. Vermaat, Thomas J. Cashman, "Microsoft Office 2007: Introductory Concepts and Techniques", Windows XP Edition, 2007.
3. Leslie Lamport," LATEX- User's Guide and Reference manual", 2^{nd} Edition, Pearson, LPE.

Suggested Reading:

1. Scott. Mueller, "Scott Mueller's Upgrading and Repairing PCs", 18^{th} Edition, QUE, Pearson,2008.
2. Cheryl A Schmidt, "The Complete Computer upgrade and repair book", 3^{rd} Edition, Dreamtech.

Web Resources:

1. https://en.wikibooks.org/wiki/How_To_Assemble_A_Desktop_PC/Assembly
2. https://www.auburn.edu/citizenship/netiquette.html
3. https://tex.stackexchange.com/questions/79051/how-to-style-text-in-hyperref-url

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18IT C12

DATABASE MANAGEMENT SYSTEMS LAB

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Course Objectives:

1. To introduce the basic commands of SQL, functions and procedures.
2. To familiarize with query processing.
3. To impart knowledge on triggers and DML.
4. To introduce database security methods.
5. To familiarize with design and development of database applications.

Course Outcomes: Upon completion of this course, the students will be able to:

1. Design and implement database schemas by enforcing integrity constraints.
2. Use SQL for database administration, data manipulation and retrieval.
3. Write PL/SQL programs, define triggers and cursors for the databases.
4. Enforcesecurity features for database applications.
5. Design, Create Forms and Reports from multiple tables.

List of Programs

1. Creation of database (Exercising commands like DDL and DML) (Note: use constraints while creating tables).
2. Exercising simple to complex queries
   a. Queries (along with sub Queries) using ANY, ALL, IN, EXISTS, NOTEXISTS, UNION, INTERSECT Constraints.
   b. Queries using Aggregate functions (COUNT, SUM, AVG, MAX and MIN), GROUP BY, HAVING clause and Creation and dropping of Views.
   c. Exercising all types of Joins.
3. Demonstration of PL/SQL Blocks and Cursors.
4. Demonstration of Procedures and Functions.
5. Usage of Triggers (BEFORE and AFTER Triggers, Row and Statement level Triggers and INSTEAD OF Triggers).
6. Demonstrate Exception Handling by PL/SQL procedures for data validation.
7. Creating Password and Security features for applications.

8. Usage of File locking, table locking facilities in applications.
9. Creation of Forms and Generation of SQL reports.
10. Creation of full-fledged database application spreading over to 3 sessions

Text Books:

1. Rick F Vander Lans, "Introduction to SQL", 4th Edition, Pearson Education, 2007.
2. Benjamin Rosenzweig, Elena Silvestrova, "Oracle PL/SQL by Example", 5th Edition, Pearson Education, 2015.
3. Alan Beaulieu, "Learning SQL",2nd Edition,O'Reilly,2009.

Suggested Reading:

1. Albert Lulushi, "Oracle Forms Developer's Handbook", Pearson Education, 2006.

Web Resources:

1. http://www.oracle-dba-online.com/sql/oracle_sql_tutorial.htm
2. https://www.javatpoint.com/pl-sql-tutorial

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18IT C13

JAVA PROGRAMMING LAB

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Course Objectives:

1. To gain the fundamental programming knowledge of OOPs.
2. To use Exception handing mechanisms in application development.
3. To provide the knowledge of generics and Collections Framework.
4. To acquaint with GUI design and Event hanling using AWT andSwing.
5. To provide the knowledge of writing applications using JDBC.

Course Outcomes: After successful completion of this course, student will be able to:

1. Develop Java applications using the concepts of Inheritance, interfaces, packages and access controlspecifiers.
2. ImplementtheconceptsofExceptionHandling and Multithreading injavaApplications.
3. Read and write data using different Java I/Ostreams.
4. Develop applications using Collections framework.
5. Create GUI applications using AWT, Swing Packages withJDBC.

List of Programs

1. Program(s) to illustrate the concepts of constructor overloading, method overloading, static and final keywords usage.
2. Program(s) to illustrate the concepts of Inheritance, method overriding, super keyword usage, and Dynamic polymorphism.
3. Program(s) to illustrate concept of abstract class &interfaces.
4. Program(s) to demonstrate Stringhandling with String, StringBuffer and StringTokenizer classes.
5. Program(s) to demonstrate various types of inner classes, Packages creation and usage.
6. Program(s) to demonstrate concept of exception handling and user definedexceptions.
7. Program(s) to demonstrate concept of Multithreading and Thread synchronization.

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8. Program(s) using Generics, Collection framework classes and Interfaces.
9. Porograms(s) on Comparator and Comparableinterfaces to define customized sorting order on collection objects.
10. Program(s) to illustrate the usage of I/O streams.
11. Program(s) toillustrate GUI with different controls, eventhandling and applets.
12. Program to connect to a database using JDBC using various databases.

Text Books:

1. HerbertSchildt, "Java:The Complete Reference", 8th Edition,Tata McGraw Hill Publications,2011.
2. Cay S. Horstmann, Gary Cornell: "Core Java, Volume I—Fundamentals", 8th Edition, Prentice Hall, 2008.

Suggested Reading:

1. Sachin Malhotra, Saurabh Choudhary: "Programming in Java", Oxford University Press, 2nd Edition, 2014.
2. C. Thomas Wu, "Anintroduction to Object - Oriented Programming with Java", Tata Mc Graw- Hill Publishing company Ltd., 4th Edition, 2010.

Web Resources:

1. https://www.cse.iitb.ac.in/~nlp-ai/javalect_august2004.html
2. https://nptel.ac.in/courses/106106147/2
3. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-092-introduction-to-programming-in-java-january-iap-2010/lecture-notes/

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18IT C14

MINI PROJECT – II

Instruction	2 Hours per week
Duration of SEE	-
SEE	-
CIE	50 Marks
Credits	1

Course Objectives:

1. To enable students learn by doing.
2. To develop capability to analyse and solve real world problems
3. To develop innovative ideas among the students

Course Outcomes: Students should be able to do the following:

1. To provide innovative solutions
2. To work in a team
3. To manage time and resources in the best possible manner

The Students are required to choose a topic for miniproject related to the courses of this semester. The student has to implement and present the project as per the given schedule. During the implementation of the project, Personnel Software Process (PSP) has to be followed. Report of the project work has to be submitted for evaluation.

Schedule

S.No	Description	Duration
1.	Problem Identification / Selection	2 weeks
2.	Preparation of Abstract	1 week
3.	Design, Implementation & Testing of the Project	7 weeks
4.	Documentation & Project Presentation	4 weeks

Guidelines for the Award of marks

S.No.	Description	Max. Marks
1.	Weekly Assesment	20
2.	PPT Preparation	05
3.	Presentation	10
4.	Question and Answers	05
5.	Report Preparation	10

Final Mini Project demonstration and PPT presentation is to be evaluated for the entire class together by all the faculty handling MiniProject for that class.

16ITC16

PRINCIPLES OF OPERATING SYSTEMS

Instruction	3L Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

This course is introduced to

1. Learn various services provided by an operating system.
2. Learn, what a process is and how processes are synchronized and scheduled.
3. Learn different approaches of memory management.
4. Familiarizewith the structure and organization of the file system.
5. Familiarize with Protection and security aspects of operating systems.

Course Outcomes:

Upon successful completion of this course, student will be able to

1. Understand the services of an operating system, inter process communication and multithreaded programming.
2. Identify suitable process scheduling, deadlocks handling algorithms and solve process-synchronization problems.
3. Understand the organization of Main and Virtual memory in the operating system.
4. Understand File-System management.
5. Understand the Security problems, Threats and Protection mechanisms.
6. Choose an efficient algorithm based on different aspects for better performance of the system.

Prerequisites:

Computer Organization and Microprocessor (16ITC11), Programming and Problem Solving (16CSC01), Data Structures & Algorithms (16ITC02).

UNIT–I

Introduction: Definition of Operating System, Computer-System Organization, Computer-System Architecture, Operating-System Structure, Operating-System Operations, Process Management, Memory Management, Storage Management, Protection and Security Kernel Data Structures Computing Environments , Open-Source Operating Systems .

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Operating System Structures: Operating-System Services, User and Operating-System InterfaceSystem Calls, Types of System Calls, System Programs, Operating-System Design and Implementation, Operating-System Structure, System Boot.
Process: Process Concept, Process Scheduling, Operations on Processes, Interprocess Communication.
Threads: Overview, Multicore Programming, Multithreading Models, Threading Issues.

UNIT–II
Process Synchronization: Background, The Critical-Section Problem, Peterson's Solution, Synchronization Hardware, Mutex Locks, Semaphores, Classic Problems of Synchronization, Monitors.
CPU Scheduling: Basic Concepts, Scheduling Criteria, Scheduling Algorithms, Thread Scheduling, Multiple-Processor Scheduling, Algorithm Evaluation.
Deadlocks: System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.

UNIT–III
Memory: Background, Swapping, Contiguous Memory Allocation, Segmentation, Paging, Structure of the Page Table.
Virtual Memory: Background, Demand Paging, Copy-on-Write, Page Replacement, Allocation of Frames, Thrashing, Memory-Mapped Files, Allocating Kernel Memory.

UNIT–IV
Mass-Storage Structure: Overview of Mass-Storage Structure, Disk Structure, Disk Attachment, Disk Scheduling, Disk Management, Swap-Space Management
File-System Interface: File Concept, Access Methods, Directory and Disk Structure, File-System Mounting, File Sharing Protection.
File-System Implementation: File-System Structure, File-System Implementation, Directory Implementation, Allocation Methods, Free-Space Management, Efficiency and Performance.

UNIT–V
Protection: Goals of Protection, Principles of Protection, Domain of Protection Access Matrix, Implementation of the Access Matrix, Access Control, Revocation of Access Rights, Capability-Based Systems.

Security: The Security Problem, Program Threats, System and Network Threats, Cryptography as a Security Tool, User Authentication.

Text Book:

1. Abraham Silberschatz, Peter Galvin, Greg Gagne, "Operating System Concepts", Ninth Edition, John Wiley and sons publications, 2013.

Suggested Reading:

1. A.Tanenbaum, "Modern Operation Systems", Third Edition, Pearson Education, 2008.
2. William Stallings, "Operating Systems", Fifth Edition, Pearson Education, 2005.
3. Ida M.Flynn, "Understanding Operating Systems", Sixth Edition, Cengage, 2011.
4. D.M.Dhamdhere,"Operating systems a concept based approach", SecondEdition, McGraw-Hill, 2007.
5. Pramod Chandra P.Bhatt, "An Intoduction to Opearting Systems concepts and practice", Third Edition, PHI, 2014.

Web Resources:

1. http://nptel.ac.in/downloads/106108101/
2. http://www2.cs.uic.edu/~jbell/CourseNotes/OperatingSystems/
3. http://www.cs.kent.edu/~farrell/osf03/oldnotes/

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16ITC17

DATABASE SYSTEMS

Instruction	3L+1T Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	4

Course Objectives:

This course is introduced to

1. Familiarize with the fundamental concepts and the role of a database system in an organization.
2. Acquire knowledge on different issues in the design and implementation of a database system.
3. Learn how to write simple and moderately advanced database queries using SQL.
4. Learn logical database design and various database models.
5. Study the concepts of database security, concurrency and recoverability.

Course Outcomes:

Upon successful completion of this course, student will be able to

1. Understand the purpose of database systems and Design any domain specific database using E-R model by considering all the constraints and issues in the related domain.
2. Design and implement a database for any specified domain according to the well-known Relational data model and formulate Relational algebra expressions.
3. Use SQL for efficient data retrieval queries, advanced SQL concepts to access databases from programming languages and define various triggers to ensure the consistency of the databases.
4. Understand and apply normalization concepts in the design of a relational database.
5. Efficiently organize and manage data using indexing and hashing concepts to achieve good data retrieval performance.
6. Understand the concept of a database transaction and related database facilities, including concurrency control, backup and recovery, and data object locking and protocols.

Prerequisites:

Data Structuresand Algorithms (16ITC02), Java programming (16ITC10)

UNIT-I

Introduction: Database-System Applications, Purpose of Database Systems, View of Data, Database Languages, Relational Databases, Database Design, Data Storage and Querying, Transaction Management, Database Architecture, Data Mining and Information Retrieval Specialty Databases, Database Users and Administrators.

Database Design and the E-R Model: Overview of the Design Process, the Entity-Relationship Model, Constraints, Removing Redundant Attributes in Entity Sets, Entity-Relationship Diagrams, Reduction to Relational Schemas, Entity-Relationship Design Issues, Extended E-R Features, Alternative Notations for Modeling Data.

UNIT–II

Introduction to the Relational Model: Structure of Relational Databases, Database Schema, Keys, Schema Diagrams, Relational Query Languages, Relational Operations.

Introduction to SQL: Overview of the SQL Query Language, SQL Data Definition, Basic Structure of SQL Queries, Additional Basic Operations, Set Operations, Null Values, Aggregate Functions, Nested Sub queries, Modification of the Database.

Intermediate SQL: Join Expressions, Views, Transactions, Integrity Constraints, SQL Data Types and Schemas, Authorization.

UNIT–III

Advanced SQL: Accessing SQL from a Programming Language, Functions and Procedures, Triggers, Recursive Queries, Advanced Aggregation Features.

Relational Database Design: Features of Good Relational, Designs, Atomic Domains and First Normal Form, Decomposition using Functional Dependencies, Functional-Dependency Theory, Algorithms for Decomposition, Decomposition using Multivalued Dependencies.

UNIT-IV

Indexing and Hashing: Basic Concepts, Ordered Indices, B+ Tree Index Files, Multiple-Key Access, Static Hashing, Dynamic Hashing, Comparison of Ordered Indexing and Hashing, Bitmap Indices, Index Definition in SQL

Transactions: Transaction Concept, a Simple Transaction Model, Transaction Atomicity and Durability, Transaction Isolation, Serializability, Transaction Isolation and Atomicity, Transaction Isolation Levels.

UNIT–V

Concurrency Control: Lock-Based Protocols, Deadlock Handling, Multiple Granularity, Timestamp-Based Protocols, Validation-Based Protocols, Multiversion

Schemes, Snapshot Isolation, Insert Operations, Delete Operations and Predicate Reads.

Recovery System: Failure Classification, Storage, Recovery and Atomicity, Recovery Algorithm, Buffer Management, Failure with Loss of Nonvolatile Storage, ARIES, Remote Backup Systems.

Text Book:

1. Abraham Silberschatz, Henry F Korth, S. Sudarshan, "Database System Concepts", Sixth Edition, McGraw-Hill International Edition, 2010.

Suggested Reading:

1. C J Date, "An Introduction to Database Systems", Eighth Edition, Pearson Education, 2003.
2. RamezElmasri, Shamkant B. Navathe, "Fundamentals of Database System", Sixth Edition, Addison-Wesley, 2011.
3. Raghu Ramakrishnan,JohannesGehrke, "Database Management Systems", Third Edition, McGraw-Hill International Edition, 2014.
4. Patric O'Neil, Elizabeth O'Neil, "Database-principles, programming and performance", Second edition, Morgan Kaufmann Publishers, 2001.

Web Resources:

1. http://db-book.com/
2. https://www.tutorialspoint.com/dbms/
3. https://www.w3schools.in/dbms/
4. http://www.oracle-dba-online.com/sql/oracle_sql_tutorial.htm.
5. http://www.tutorialspoint.com/plsql/

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16ITC18

SOFTWARE ENGINEERING

Instruction	3LHours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

This course is introduced to

1. Describe the various software life cycle models.
2. Explain the importance of the software development process.
3. Acquaint the students with software requirements and SRS document.
4. Familiarize the students with different software architectural styles.
5. Explain the importance of software quality and review techniques.

Course Outcomes:

Upon successful completion of this course, the students should be able to

1. Understand the nature of software and definition of software engineering, agile software development and agile process models.
2. Recognize the minimum requirements for the development of application.
3. Develop a system, component, or process to meet desired needs of a customer, conduct tests using various testing methods to verify and validate the results.
4. Involve in developing, maintain, efficient, reliable and cost effective software solutions.
5. Understand the risks, formulate and implement software projects.
6. Use the techniques, skills, and modern engineering tools necessary for engineering practice.

Prerequisites:

Programming and Problem Solving (16CSC01), Design and analysis of algorithms (16ITC08).

UNIT-I

Software and Software Engineering: The Nature of Software, Software Engineering. The Software Process, Software Engineering Practice.

A Generic view of Process : Software Engineering -A Layered Technology, A Process frame work, Process Models-Waterfall model, spiral model, The Unified Process, Product and Process, Process Assessment and Improvement, The CMMI, Agility: Introduction to Agile development, Product development in Internet time, Agile Process models-Scrum, Extreme programming, Agile Vs Waterfall Model.

Understanding Requirements: Requirements Engineering, Establishing the Groundwork, Eliciting Requirements, Developing Use Cases, Building the Requirements Model, Negotiating Requirements, Validating Requirements.

Requirements Modelling: Requirements Analysis, Scenario-Based Modeling, Problem Analysis, Data Flow Diagrams, Software Requirement and specifications, Behavioural and non-behavioural requirements.

UNIT-II

Design Concepts: Design within the Context of Software Engineering, The Design Process, Design Concepts. Cohesion & Coupling, Object Oriented Design-Identifying Objects and classes, User Interface Design.

Architectural Design: Software Architecture, Architecture Styles-pipe and filter architecture, black board architecture , layered architecture.

Component level Design: Designing Class Based Components, Conducting Component-Level Design, Designing Traditional Components, Component-Based Development.

UNIT-III

Quality Concepts: Software Quality, Achieving Software Quality.

Review Techniques: Cost Impact of Software Defects.

Software Quality Assurance: Background Issues, Elements of Software Quality Assurance, SQA Tasks, Goals and Metrics, Formal Approaches to SQA, Statistical Software Quality Assurance, Software Reliability, The ISO 9000 Quality Standards, The SQA Plan.

UNIT-IV

Software Testing Strategies: A Strategic Approach to Software Testing, Strategic Issues, Validation Testing, System Testing, The Art of Debugging. Testing Tools – Rational functional tester, Testing Standards, Selenium software testing tool.

Testing Conventional Applications: Software Testing Fundamentals, Internal and External Views of Testing, White-Box Testing, Basis Path Testing, Control Structure Testing, Black–Box Testing, system testing, validation testing, beta testing, alpha testing, acceptance testing, regression testing,

Product Metrics: A Framework for Product Metrics, Size Metrics like LOC, Function points.

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UNIT-V

Estimation: Observations on Estimation, the Project Planning Process, Software Scope and Feasibility, Resources, Software Project Estimation.

Risk Management: Reactive versus Proactive Risk Strategies, Software Risks, Risk Identification, Risk Projection, Risk Refinement, Risk Mitigation, Monitoring, and Management, The RMMM Plan.

Text Books:

1. Roger S.Pressman, "Software Engineering: A Practitioners Approach", 7th edition, McGrawHill, 2009.
2. Jim Highsmith, "Agile Software Development Ecosystems", Addison-Wesley 2002, ISBN 0201760436, 2010.

Suggested Reading:

1. Carlo Ghezzi, Mehdi Jazayeri, Dino Mandrioli, "Fundamentals of Software Engineering", PHI, 2nd edition,2010.
2. Ali Behforoz and Frederic J.Hadson, "Software Engineering Fundamentals", Oxford End Press, 2010.
3. Pankaj Jalote, "An Integrated Approach to Software Engineering", 3rdedition, Narosa Publishing house, 2008.
4. James F.Peters, WitoldPedrycz, "Software Engineering-An engineering Approach", McGraw Hill, 2008.

Web Resources:

1. Software Engineering Sites: http://www.erg.abdn.ac.uk/users/brant/sre/soft-eng.html.
2. SE web - Software Engineering Education Home Page: http://tuvalu.cs.flinders.edu.au/seweb/se-ed/
3. ACM Classic Books Series: http://www.acm.org/classics/
4. Teaching Software Engineering - Lessons from MIT, by Hal Abelson and Philip Greenspun: http://philip.greenspun.com/teaching/teaching-software-engineering.
5. NASA Software Engineering Home Page:http://akao.larc.nasa.gov/dfc/swreng.html
6. Software Engineering Hotlist at Georgia Tech: http://www.cc.gatech.edu/computing/SW_Eng/hotlist.html
7. IEEE Guide to the Software Engineering Body of Knowledge: http://www.swebok.org/

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16ITC19

WEB TECHNOLOGY

Instruction	3L Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

This course is introduced to

1. Acquire knowledge about design and development of web pages.
2. Develop dynamic pages using Java Servlets and JSP.
3. Know about database connectivity and how it can be used in Web-based applications.
4. Describe the state of the art of frameworks.
5. ASP.NET, to tackle challenges that are simply out of reach on many other platforms.

Course Outcomes:

Upon successful completion of this course, student will be able to

1. Design responsive websites and validate web forms using JQuery.
2. Write a well-formed XML schemas and documents.
3. Develop dynamic web applications using Servlets and JSP.
4. Apply modern Framework techniques for web development to make applications maintainable.
5. Validate various types of controls.
6. Design and develop web applications using ASP.NET with Ajax based requests.

Prerequisites:

Java Programming (16ITC10)

UNIT-I

Introduction: Web Fundamentals, **HTML 5.0:** basic tags, Form controls, Layout Management, Graphics, Media, span and div tags.

Introduction to Cascading Style Sheets: CSS Selectors, CSS BOX Model, CSS Positioning, and CSS floating.

JQuery: Basics of JavaScript, JQuery syntax, Selectors, Events, JSON Fundamentals.

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UNIT-II

Introduction to XML: The Syntax of XML, XML Document Structure, Document Type Definitions, Name Space, XML Schemas, Displaying XML Documents with CSS, XSLT Style Sheets and XML Processors.

Web Services: Web Service Architecture, structure and contents of SOAP message, structure of WSDL, Information in UDDI registry, UDDI Registry API.

UNIT-III

Java Servlets: Overview of Java Servlet API, Servlet Implementation, Servlet Configuration, Servlet Exceptions, Servlet Life cycle, Request and Response methods, Approaches to Session tracking, Request dispatching.

JSP Basics: Introduction to JSP, Directives, Scripting Elements, Standard Actions.

Database Connections: Introduction to JDBC, Database Drivers, JDBC API, connecting to my SQL, connecting to oracle, working with No SQL databases.

UNIT-IV

Struts framework: MVC Design pattern, Introduction to the modern web application framework, Architecture and flow of execution, working with actions and interceptors, Building the view with Tags and Results in detail, OGNL and type conversion, exploring the validation framework, writing the custom validator and Struts application development.

UNIT-V

ASP.NET: .Net framework, Web Form fundamentals-Html server controls, HTML control classes, Application events,ASP.net Configuration, Basic Web Control classes, State management, Building better web form - Validation, rich controls, user controls and graphics, ADO.NET Fundamentals, ASP.NET with Ajax.

Text Books:

1. Robert W.Sebesta, "Programming with World Wide Web", Eighth Edition, Pearson Education, 2008.
2. John Pollak, "JQuery - A Beginners Guide", McGraw-Hill Education, 2014.
3. Gustavo Alonso ,"Web Services: Concepts, Architectures and Applications" Springer Science & Business Media, 2004
4. Phil Hanna, "The Complete Reference JSP", First Edition, Tata McGraw-Hill, 2003
5. Donald Brown, Chad Michael Davis, Scott Stanlick, "Struts 2 in Action",Manning Publications, 2008.
6. Matthew MacDonald, "Beginning ASP.NET 4.5 in C#", Illustrated, Apress, 2012.

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Suggested Reading:

1. James Webber, SavasParastatidis, Ivan Robinson," Restin Practice: HyperMedid and System Architecture", First Edition,O'REILLY,2010.
2. Deitel, Deitel, Goldberg, "Internet & World Wide Web How To Program", Third Edition, Pearson Education, 2010.
3. SubramanyamAllamraju, "Professional Java Server programming", J2EE 1.3 Edition, CeditBuest, Apress Publications

Web Resources:

1. https://msdn.microsoft.com/en-us/library/office/aa218647(v=office.11).aspx
2. https://sipb.mit.edu/iap/django/CCCDjango2010.pdf

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16ITC20

THEORY OF AUTOMATA

Instruction	3L+1T Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	4

Course Objectives:

This course is introduced to

1. Study abstract computing models namely Finite Automata, Pushdown Automata, and Turning Machines.
2. Learn various grammars, formal languages and their relationships.
3. Learn the relation between various grammars and recognizers for different formal languages.
4. Evaluate and explain the differences between different computational models, such as Turing machines, push-down automata, finite automata, etc.
5. Familiarize with decidability and undecidability of computational problems.

Course Outcomes:

Upon successful completion of this course, student will be able to

1. Understand formal machines, languages and design Deterministic, Nondeterministic Finite automata for acceptance of languages.
2. Build regular expressions and their equivalent finite automata for different languages.
3. Define context-free grammars for certain languages and check the ambiguity of the grammars.
4. Design pushdown automata for accepting languages.
5. DesignTuring machines for computational problems, distinguish between decidability and undecidability.

Prerequisites:

Discrete Structures and Applications (16ITC01) and Data Structures and Algorithms (16ITC02).

UNIT-IAutomata: Introduction to Finite Automata, the Central Concepts of Automata Theory: Alphabets, Strings, and Languages.

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Finite Automata: An Informal Picture Of Finite Automata: The Ground Rules, the Protocol, Enabling the Automata to Ignore Actions, the Entire System as an Automaton. Deterministic Finite Automata: Definition of a DFA, Simpler Notations for DFA's, Extending the Transition Function to Strings, The Language of a DFA, Nondeterministic Finite Automata: Definition of NFA, The Extended Transition Function, The Language of an NFA, Equivalence of NFA and DFA, An Application: Text Search, Finite Automata with Epsilon-Transitions: Use of €-transitions, The formal notation for an €- NFA, €-closure, Extended Transitions and Languages for €-NFA's, Eliminating €-transitions.

UNIT-II

Regular Expression and languages: Regular Expressions: The Operators of Regular Expressions, Building Regular Expressions. Finite Automata and Regular Expression: From DFAs to Regular Expressions, Converting DFA's to Regular Expressions by Eliminating States, Converting Regular Expressions to Automata, Applications of Regular Expressions, Algebraic Laws for Regular Expressions.

Properties of Regular Languages: Proving Languages not to be Regular: The pumping lemma for Regular Languages, Applications of Pumping Lemma, Closure Properties of Regular Languages, Decision Properties of Regular Languages: Testing Emptiness of Regular Languages, Testing Membership in a Regular Language. Equivalence and Minimization of Automata: Testing Equivalence of States, Testing Equivalence of Regular Languages, Minimization of DFA's.

UNIT-III

Context Free Grammars and Languages: Context-Free Grammars: Definition of Context Free Grammars, Derivations using a Grammar, Leftmost and Rightmost Derivation, The language of a Grammar, Parse Trees: Constructing Parse Trees, The Yield of a Parse Tree, Applications of CFGs, Ambiguity in Grammars and Languages: Ambiguous Grammars, Removing Ambiguity From Grammars, Leftmost Derivations as way to Express Ambiguity, Inherent Ambiguity.

Properties of Context Free Languages: Normal Forms for Context-Free Grammars: Eliminating Useless Symbols, Computing the Generating and Reachable Symbols, Eliminating Productions, Eliminating Unit Productions, Chomsky Normal Form, Greibachnormal form, Pumping Lemma for CFL's: Statement of the Pumping Lemma, Applications of Pumping Lemma for CFL's, Closure Properties of CFL's, Decision Properties of CFL's: Testing Emptiness of CFL's, Testing Membership in a CFL's.

UNIT-IV

Pushdown Automata: Definition of pushdown automaton: The Formal Definition of PDA, Graphical Notation for PDA's, Instantaneous Description of a PDA, The Language of a PDA: Acceptance by Final State, Acceptance by Empty Stack, From Empty Stack to Final State, From Final State to Empty Stack, Equivalence of PDA's

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and CFG's: From Grammars to PDA's, From PDA's to Grammars, Deterministic Pushdown Automata: Definition, Regular Languages and Deterministic PDA's, DPDA's to CFL's, DPDA's to Ambiguous Grammars.

UNIT-V

Introduction to Turing Machines: Problems that Computer Cannot Solve: The Turing Machine: Notation for the TM, Instantaneous Descriptions for TM's, Transitions Diagrams, The Language of a TM, Turing Machines and Halting, Programming Techniques for Turing Machines: Storage in the State, Multiple Tracks, Subroutines, Extensions to the Basic Turing Machine: Multitape Turing Machine, Equivalence of One-Tape and Multi-Tape TM's, Nondeterministic Turing Machines, Restricted Turing Machines: TM's with Sem infinite Tapes, Multistack Machines, Counter Machines. Turing Machine and Computers: Simulating a Computer by a TM.

Undecidability: A Language That Is Not Recursively Enumerable: Enumerating the Binary Strings, Codes for Turing Machines, The Diagonalization Language, An Undecidable problem that is RE: Recursive Languages, Compliments of Recursive and RE languages, The Universal Languages, Undecidablity of the Universal Language, Undecidable problems about Turing Machines: Reductions, TM's That Accept The Empty Language, Rice's Theorem and Properties of RE languages, Post's Correspondence Problem: Definition of PCP, The Modified PCP, Other Undecidable Problems.

Text Book:

1. John E. Hopcroft, Rajeev Motwani, Jeffery D Ullman, "Introduction to Automata Theory Languages and Computation", Third edition, Pearson Education, 2007.

Suggested Reading:

1. John C Martin. "Introduction to Language and Theory of Computation", 3rd edition, TMH, 2003.
2. Daniel Cohen, "Introduction to Computer Theory", 2nd edition, Wiley Publications, 2007.
3. Mishra K., Chandrasekaran N., "Theory of Computer Science (Automata, Languages and Computation)", 3rd edition, Prentice Hall of India 2008.
4. ShyamalendraKandar, "Introduction to Automata Theory, Formal Languages and Computation", Pearson, 2013.
5. Kamala Krithivasan, Rama R. "Introduction to Automata Theory, and Computation", Pearson 2009.

Web Resources:

1. http://nptel.ac.in/courses/106106049/
2. http://online.stanford.edu/course/automata-theory
3. https://www.tutorialspoint.com/automata_theory/

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16ITE01

PYTHON PROGRAMMING

(Elective - I)

Instruction	3L Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

This course is introduced to

1. Familiarize the fundamentals of Python programming
2. Learn how to use lists, tuples, and dictionaries in Python programs
3. Learn how to read and write files in Python
4. Impart usage of exception handling in Python
5. Familiarize data visualization

Course Outcomes:

Upon successful completion of this course, student will be able to

1. Understand basic data structures of python
2. Understand the concepts of file I/O
3. Understand exception handling in Python.
4. Develop proficiency in creating GUI based applications
5. Plot data using appropriate Python visualization libraries
6. Develop simple Python applications.

Prerequisites:

Programming and Problem Solving (16CSC01), Programming Laboratory (16CSC02)

UNIT-I

Introduction to Python Programming: Using Python, The IDLE Programming Environment, Input and Output Processing, Displaying Output with the Print Function, Comments, Variables, Reading Input from the Keyboard, Performing Calculations, More About Data Output: New line, Item Separator, Escape Characters, Formatting parameters.

Decision Structures and Boolean Logic: if, if-else, if-elif-else Statements, Nested Decision Structures, Comparing Strings, Logical Operators, Boolean Variables.

Repetition Structures: Introduction, while loop, for loop, Sentinels, Input Validation Loops, Nested Loops.

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UNIT-II

Functions: Introduction, Defining and Calling a Function, Designing a Program to Use Functions, Local Variables, Passing Arguments to Functions, Global Variables and Global Constants, Value-Returning Functions Generating Random Numbers, Writing Our Own Value-Returning Functions, The math Module, Random Module, Time Module and Storing Functions in Modules.

UNIT-III

Lists and Tuples: Sequences, Introduction to Lists, List slicing, Finding Items in Lists with the in Operator, List Methods and Useful Built-in Functions, Copying Lists, Processing Lists, Two-Dimensional Lists, Tuples.

Strings: Basic String Operations, String Slicing, Testing, Searching, and Manipulating Strings.

Dictionaries and Sets: Dictionaries, Sets, Serializing Objects.

Recursion: Introduction, Problem Solving with Recursion, Examples of Recursive Algorithms.

UNIT-IV

Python File Input-Output: Opening and closing file, various types of file modes, reading and writing to files, manipulating directories

Exception Handling: What is exception, various keywords to handle exception such try, catch, except, else, finally, raise.

Regular Expressions: Concept of regular expression, various types of regular expressions, using match function.

UNIT-V

GUI Programming: Graphical User Interfaces, Using the tkinter Module, Display text with Label Widgets, Organizing Widgets with Frames, Button Widgets and Info Dialog Boxes, Getting Input with Entry Widget, Using Labels as Output Fields, Radio Buttons, Check Buttons.

Introduction to plotting in Python – Basic Plots- Line and Scatter Plot, Histograms and plotting data contained in files.

Text Books:

1. Tony Gaddis, "Starting Out With Python", 3rd edition, Pearson, 2015.
2. Charles Dierbach, "Introduction to Computer Science using Python", Wiley, 2013.

Suggested Reading:

1. Kenneth A. Lambert, "Fundamentals of Python", Delmar Cengage Learning, 2013.
2. James Payne, "Beginning Python using Python 2.6 and Python 3", wrox programmer to programmer, 2010.

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3. Paul Gries, "Practical Programming: An Introduction to Computer Science using Python",3rd edition, 2016.
4. Clinton W. Brownley, "Foundations for Analytics with Python", 1st edition, O'Rielly Media, 2016.

Web Resources:

1. https://www.python.org/
2. https://www.coursera.org/learn/python
3. https://learnpythonthehardway.org/book/
4. https://www.coursera.org/specializations/python

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16ITE02

UNIX AND SHELL PROGRAMMING
(Elective - I)

Instruction	3L Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

This course is introduced to

1. Familiarize students with the UNIX environment and basic UNIX utilities
2. Learn File systems and File structures.
3. Impart skills required to write shell scripts.
4. Develop skills required to formulate regular expressions.
5. Familiarize students with the routine system administrative features and tools.

Course Outcomes:

Upon successful completion of this course, the students should be able to

1. Understand the UNIX architecture, basics of vi editor and UNIX utilities.
2. Implement various File processing commands, change file permissions and directory permissions.
3. Create and manage processes using the knowledge of process attributes process creation and process control mechanisms.
4. Construct simple and complex shell scripts to automate jobs and processes in UNIX environment.
5. Locate and replace patterns at specific locations using regular expressions
6. Demonstrate administrator privileges, super user basic commands to add, modify and delete users.

Prerequisites: Programming and Problem Solving (16CSC01), Programming Laboratory (16CSC02).

UNIT-I

Introduction to Unix: The UNIX Operating System, The UNIX Architecture, Features of UNIX, Internal and External Commands, Command Structure,

General-Purpose Utilities:cal, date, echo, printf, bc, script, mailx, passwd, who, uname, tty, sty,

The vi editor: vi Basics, Input Mode, Saving Text and Quitting, Navigation, Editing Text, Undoing Last Editing Instructions, Repeating the Last Command, Searching for a Pattern, Substitution.

UNIT-II

Handling Files: The File System, Parent Child Relationship, The HOME variable, pwd,cd, mkdir, rmdir, Absolute Pathnames, Relative Pathnames, The UNIX File System cat, cp, rm, mv, more, file, ls, wc, cmp, comm, diff,

Compressing and Archiving files: gzip and gunzip- Compressing and Decompressing files, tar- The Archival program, zip and unzip- Compressing and Archiving together.

File Attributes: ls options -l, -d,-lh,-la, File Ownership, File Permissions, chmod-Changing File permissions, Directory Permissions, Changing File ownership.

UNIT-III

The Shell: The Shells's interpretive Cycle, Shell Offerings, Pattern Matching, Escaping and quoting, Redirection, /dev/null and /dev/tty, Pipes, tee- Creating a tee, Command Substitution, Shell Variables.

The Process: Process Basics, ps- Process Status, System Processes (-e or –a), Mechanism of Process creation, Internal and External Commands, Process states and Zombies, Running jobs in Background, nice-Job Execution with low priority, Killing Processes with signals, Job Control, at and batch-Execute later, cron- Running jobs periodically, time-Timing Processes.

UNIT-IV

Simple Filters: pr-Paginating Files, head- Displaying the beginning of a File, tail-Displaying the end of a File, cut- Slitting a File vertically, paste-Pasting Files, sort-Ordering a File, uniq- Locate Repeated and Non-repeated Lines, tr- Translating Characters.

Filters using Regular Expressions: grep, Basic Regular Expressions, Extended Regular expressions, egrep, sed, Line Addressing, Using multiple instructions, Context Addressing, Writing Selected lines to a File, Text Editing, Substitution.

UNIT-V

Shell Programming: Shell scripts, read, Using Command Line Arguments, exit, The logical operators && and ||, Conditional execution- if, Using test and [ ] to evaluate expressions, case, expr, while, for, set and shift, trap, Debugging shell scripts with set–x.

System Administration: root, The administrator's privileges, Maintaining Security, User Management, Startup and Shutdown, Managing Disk Space, Device Files.

Text Book:

1. Sumitabha Das, "Unix Concepts and Applications", 4th Edition, TMH, 2006.

Suggested Reading:

1. Behrouz A. Forouzan, Richard F. Gilbery, "Unix and Shell Programming", 1st Edition, Cengage Learning India, 2003.

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2. Graham Glass, King Ables, "Unix for programmers and users", 3rd Edition, Pearson Education, 2009.
3. YashwanthKanitkar, "Unix Shell programming", 1st Edition, BPB Publishers, 2010.

Web Resources:

1. http://openclassroom.stanford.edu/MainFolder/CoursePage.php?course=PracticalUnix
2. https://www.shellscript.sh/
3. www.bash.academy/
4. http://linuxcommand.org/

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16ITE03

SCRIPTING LANGUAGES

(Elective - I)

Instruction	3L Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

This course is introduced to

1. Write scripts to extract meaningful summaries from partially structured text.
2. Prepare students to use Python to perform common scripting tasks.
3. Allow students to use scikit-image library to learn image processing algorithms.
4. Familiarize students with PHP for making dynamic and interactive web pages.
5. Improve VB Scripting Skills for writing desktop, web applications and automation of tasks.

Course Outcomes:

Upon successful completion of this course, the students should be able to

1. Use Perl language features in web application development
2. Master the fundamentals of writing Python scripts
3. Implement algorithms and techniques involved in Digital Image Processing using scikit-image package
4. Gain the PHP programming skills needed to successfully build interactive, data-driven websites.
5. Use Ajax technology to load new content without leaving the current page, creating a better, faster experience for webpages
6. Develop web, desktop and various automation tasks using Visual Basic Scripting (VB Script)

Prerequisites:

Programming and Problem Solving (16ITC01), Data structures and algorithms (16ITC02)

UNIT-I

PERL- Names and Values, Variables, Scalars, Arrays and its operations, Hashes, Regular expressions, string manipulation, File management, Command line arguments, sub routines, Packages, Modules.

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UNIT-II

Introduction to Python: Variables, Lists and Tuples, Introducing Functions , If statements, While Loops and Input, Basic Terminal Apps, Dictionaries, More Functions, Classes and OOPs, Exceptions.

UNIT-III

Simple Graphics and Image Processing using Python: "turtle" module; simple 2d drawing - colors, shapes; digital images, image file formats, image processing Simple image manipulations with 'image' module (convert to between, grey scale, blur, etc). Graphical user interfaces; event-driven programming paradigm; tkinter module, creating simple GUI; buttons, labels, entry fields, dialogs; widget attributes - sizes, fonts, colors layouts, nested frames.

UNIT-IV

Programming with PHP: PHP Basics, String Manipulation and regular expressions, Form handling, Adding dynamic Content, Managing Web sessions, Handling Date & Time in PHP, Sending email with PHP, Object Oriented Programming and PHP7, Exception handling, Accessing Databases using PHP, AJAX with PHP.

UNIT-V

VBScript: Introduction to VBScript, Declaring and Using Variables, Operators, Operator Precedence and Constants, Using Conditional Statements, Loops in VBScript, Using Procedures and Functions, Arrays, Date Functions, Working with Strings and Cookies, Working with Events, Working with Excel Objects, Working with Connection Objects, Working with Files, Error Handling

Text Books:

1. Randal L. Schwartz, Tom Phoenix, brianfoy, "Learning Perl", 5th Edition, O'Reilly Media, 2008.
2. Kenneth A. Lambert , "Fundamentals of Python First Programs", Cengage Learning, 2012.
3. Luke Welling, Laura Thomson, "PHP and MySQL Web Development", Pearson Education, 2017.
4. Kogent Solutions Inc, "Ajax Black Book", Dreamtech press, 2008.
5. Adrian Kingsley-Hughes, Kathie Kingsley-Hughes, Daniel Read, "VBScript – Programmers Reference", 3rd Edition, wiley publications, 2007.

Suggested Reading:

1. John ericsolem, "Programming Computer Vision with Python", First edition, O'Reilly Media, 2012
2. Thomas A Powel, "The Complete Reference: AJAX", 1st Edition, Tata McGraw Hill, 2008.

Web Resources:

1. https://docs.python.org/3/tutorial/
2. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-0001-introduction-to-computer-science-and-programming-in-python-fall-2016/
3. https://learn.perl.org/

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16ITC21

OPERATING SYSTEMS AND WEB TECHNOLOGY LAB

Instruction	3L Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	2

Course Objectives:

This course is introduced to

1. Familiarize with various system calls of LINUX
2. Learn processes synchronization and scheduling algorithms
3. Design and develop web pages using html5, CSS positioning, servlets and JDBC.
4. Learn and write a well-formed XML schemas and documents.
5. Learn MVC based web application development using Struts2 and ASP.NET.

Course Outcomes:

Upon successful completion of this course, the students should be able to

1. Create multiple processes and replace a process image using different system calls.
2. Understand Inter-process communication using shared memory, message passing and pipes.
3. Analyze and evaluate different algorithms for CPU scheduling.
4. Design various web based applications using HTML5,Jquery and CSS.
5. Use JDBC, JSP and Struts 2 framework, to build modem web applications.
6. Design web site using ASP.NET with Ajax based requests.

Prerequisites:

Programming Laboratory (16CSC02), Data Structures and Algorithms Lab (16ITC05), Java Programming Lab (16ITC13).

List of Programs

1. Demonstrate the following system calls:
   a) fork b) execvp c) stat d) setenv&getenv
2. Implement Echo Server using
   a) Pipes b) Shared memory c)Message queues

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3. Simulate the following CPU Scheduling Algorithm:
   a) FCFS b) SJF c) Round Robin
4. Implement Producer-Consumer Problem using
   a) Message passing b) Semaphores
5. Develop an e-commerce web site having the following specifications
   a) Use css for styling all the web controls.
   b) Use jquery for all form validations.
   c) All form submissions should be with AJAX only.
   d) Use menus in appropriate places.
6. Write a DTD and Schema for a library management system and give an XML example for each.
7. Build a java based dynamic working e-commerce website mentioned in question no.5 with database connections.
8. Develop a struts2 framework based "registration and login" application making use of validator framework.
9. Design and develop a simple web based application for "online quiz management" using ASP.NET.
10. Write an application to demonstrate data management using ADO.NET.

Text Books:

1. W. Richard Stevens, "Unix Network Programming", Volume 2, 2nd edition, Pearson Education, 2015.
2. Robert W.Sebesta, "Programming with World Wide Web", Eighth Edition, Pearson Education, 2008.
3. John Pollak, "JQuery - A Beginners Guide", McGraw-Hill Education, 2014.
4. Phil Hanna, "The Complete Reference JSP", First Edition, Tata McGraw-Hill, 2003.
5. Matthew MacDonald, "Beginning ASP.NET 4.5 in C#", Illustrated, Apress, 2012.

Suggested Reading:

1. Silberschatz, Galvin, and Gagne,"Operating System Concepts", 8thEdition,Wiley Publication.
2. Andrew S. Tanenbaum, "Modern Operating Systems", 3rd Edition, GOAL Series.
3. James Webber, SavasParastatidis, Ivan Robinson,"Rest in Practice: HyperMedid and System Architecture", First Edition,O'REILLY,2010.

4. Deitel, Deitel, Goldberg, “Internet & World Wide Web How To Program”, Third Edition, Pearson Education, 2010.
5. SubramanyamAllamraju, “Professional Java Server programming”, J2EE 1.3 Edition, CeditBuest, Apress Publications.

Web Resources:

1. http://www.tutorialspoint.com/unix/
2. https://msdn.microsoft.com/en-us/library/office/aa218647(v=office.11).aspx

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16ITC22

DATABASE SYSTEMS LAB

Instruction	3L Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	2

Course objectives:

This course is introduced to

1. Present the concepts and techniques relating to query processing.
2. Design and develop database for an application.
3. Learn the basic commands, SQL functions and the significance of triggers.
4. Learn how to manipulate a database using SQL.
5. Familiarize with the various methods of database security.

Course outcomes:

Upon successful completion of this course, the students should be able to:

1. Design and implement database schemas by enforcing integrity constraints for a given problem domain.
2. Use SQL for database administration(to create tables, indexes, and views) and data manipulation.
3. Write efficient data retrieval queriesusing relational set operators and advanced SQL Join operators.
4. Do PL/SQL programming and define various triggers and cursors for the databases.
5. Create Security features and facilities for the database applications.
6. Design, create, and test data entry forms and detailed reports that require access to data in multiple tables.

Prerequisites:

Programming and Problem Solving (16CSC01)

List of Programs

1. Creation of database (Exercising commands like DDL and DML) (Note: use constraints while creating tables).
2. Exercising simple to complex queries.

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a. Queries (along with sub Queries) using ANY, ALL, IN, EXISTS, NOTEXISTS, UNION, INTERSECT Constraints.
b. Queries using Aggregate functions (COUNT, SUM, AVG, MAX and MIN), GROUP BY, HAVING clause and Creation and dropping of Views.
c. Exercising all types of Joins.

3. Demonstration of PL/SQL Blocks and Cursors.
4. Demonstration of Procedures and Functions.
5. Usage of Triggers (Programs using BEFORE and AFTER Triggers, Row and Statement level Triggers and INSTEAD OF Triggers).
5. Demonstrate Exception Handling by PL/SQL procedures for data validation.
6. Creating Password and Security features for applications.
7. Usage of File locking table locking, facilities in applications.
8. Creation of Forms and Generation of SQL reports.
9. Creation of full-fledged database application spreading over to 3 sessions.

Note:-The creation of sample database for the purpose of the experiments is to be pre-decided by the instructor.

Text Book:

1. Rick F Vander Lans, "Introduction to SQL", Fourth edition, Pearson Education, 2007.

Suggested Reading:

1. Benjamin Rosenzweig, Elena Silvestrova, "Oracle PL/SQL by Example", Fifth Edition, Pearson Education, 2015.
2. Albert Lulushi, "Oracle Forms Developer's Handbook", Pearson Education, 2006.

Web Resources:

1. http://www.oracle-dba-online.com/sql/oracle_sql_tutorial.htm.
2. https://www.javatpoint.com/sql-tutorial
3. https://www.tutorialspoint.com/sql/
4. http://www.tutorialspoint.com/plsql/
5. https://www.javatpoint.com/pl-sql-tutorial

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16ITC23

MINI PROJECT - III

Instruction	2 Hours per week
Duration of End Examination	-
Semester End Examination	-
CIE	50 Marks
Credits	1

Course Objectives:

1. To enable students learn by doing.
2. To develop capability to analyse and solve real world problems.
3. To develop innovative ideas among the students.

Course Outcomes:

Students should be able to do the following:

1. To provide innovative solutions.
2. To work in a team.
3. To manage time and resources in the best possible manner.

The Students are required to implement one of the projects from project exercise given in the suggested readings of the theory subjects of the current semester / as suggested by the respective course faculty of that semester. During the implementation of the project, Personnel Software Process (PSP) has to be followed. Report of the project work has to be submitted for evaluation.

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16ITC24

COMPUTER NETWORKS AND SOCKET PROGRAMMING

Instruction	3L+1T Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	4

Course Objectives:

This course is introduced to

1. Familiarize students with basics of Socket based Client/Server programming.
2. Provide state-of-the-art knowledge on Network Layer issues including Routing, Addressing, Congestion Control and Quality of Service.
3. Give an overview of how Networks differ and how they can be interconnected.
4. Introduce IP based transport protocols TCP and UDP.
5. Give an insight into the working principles of popular Internet Applications including Email and Domain Name System.
6. Provide a solid understanding of main issues related to network security and the relevant cryptographic techniques.

Course Outcomes:

Upon successful completion of this course, student will be able to

1. Enumerate functions of each layer in the OSI and TCP/IP reference models and build Client/Server applications using the understanding of Socket System calls.
2. Solve problems related to Addressing, Routing and Congestion in computer networks.
3. Understand Internetwork Routing issues and Interoperability among heterogeneous networks.
4. Analyze the functions and performance of Internet Transport Protocols TCP and UDP.
5. Understand the operating principles of Domain Name System and Electronic Mail.
6. Comprehend various network security threats and cryptographic algorithms.

Prerequisites:

Data Communications (16ITC09), Programming and Problem Solving (16CSC01).

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UNIT-I

Introduction: Uses of Computer Networks, ISO/OSI and TCP/IP Reference Models, Comparison of the OSI and TCP/IP Reference Models.

Socket programming: Socket address, Elementary socket system calls, Advanced socket system calls, Reserved ports, Socket options, Asynchronous I/O, Out-of-Band data, Internet Super Server, Daemon Processes.

UNIT-II

Network Layer Design Issues: Store and Forward Packet switching, Services, Implementation of Connectionless Service and Connection-Oriented Service, Comparison of Virtual circuits and Datagram subnets.

Routing Algorithms: The Optimality principle, Shortest path routing, Flooding, Distance vector Routing, Link state Routing, Hierarchical Routing, Broadcast and Multicast routings,

Congestion control algorithms: Approaches, Traffic-Aware Routing, Admission Control, Traffic Throttling, Load Shedding,

Quality of Service: Application Requirements, Traffic shaping Packet Scheduling, Integrated and Differentiated Services.

UNIT-III

Internetworking: How networks differ, How networks can be Connected, Tunneling, Internetwork routing, Packet Fragmentation,

The Network Layer in the Internet: The IPv4 protocol, IP addresses, Subnets, Classless Inter Domain Routing, Classful and Special Addressing, Network Address Translation, IP version 6, Label Switching and MPLS, OSPF, BGP.

UNIT-IV

Transport Layer: Transport service primitives, Addressing, Connection Establishment, Connection Release, Error Control and Flow control, Multiplexing and Crash recovery.

Internet Transport Protocols (TCP and UDP): Introduction to UDP, Remote Procedure Call (RPC), Real-Time Transport Protocols, The TCP service model, The TCP protocol, The TCP Segment Header, TCP Connection Establishment, TCP Connection Release, TCP Connection Management Modeling, TCP Sliding Window, TCP Timer management, TCP Congestion Control, Performance issues.

UNIT-V

Application Layer: The Domain Name System- DNS Name Space, Domain Resource Records, Name Servers, Electronic Mail-Architecture and Services, The User Agent, Message Transfer, SMTP and Extensions, Final Delivery,

Network Security: Introduction to Cryptography, Substitution Ciphers, Transposition Ciphers, Symmetric Key Algorithms-The Data Encryption Standard (DES), Triple DES, Public Key Algorithm:RSA Algorithm, Digital Signatures:

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Symmetric-Key Signatures, Public-Key Signatures, Message Digests, Authentication Protocols.

Text Books:

1. Andrew S. Tanenbaum, David J. Wetherall, "Computer Networks", 5th Edition, Pearson Education, 2014.
2. W. Richard Stevens, Unix Network Programming, Prentice Hall/Pearson Education, 2009.

Suggested Reading:

1. Chwan-Hwa (John) Wu, J. David Irwin, Introduction to Computer Networks and Cyber Security, CRC Press, 2013.
2. James F. Kurose and Keith W. Ross, Computer Networking: A Top-Down Approach Featuring the Internet, 5th Edition, Addison-Wesley, 2012.

Web Resources:

1. http://www.nptelvideos.in/2012/11/computer-networks.html
2. beej.us/guide/bgnet/output/print/bgnet_A4.pdf

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16ITC25

DATA WAREHOUSING AND DATA MINING

Instruction	3LHours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

This course is introduced to

1. Familiarise the concepts of Data Warehouse and Data Mining techniques.
2. Examine the types of the data to be mined and apply preprocessing methods on raw data.
3. Present different frequent pattern discovery methods.
4. Describe various classification and clustering techniques.
5. Minecomplex data types.

Course Outcomes:

Upon successful completion of this course, the students should be able to

1. Understand requirements of data warehousing and data mining to the decision support level of organizations.
2. Apply Pre-Processing techniques on various data formats to make it suitable for data mining algorithms.
3. Generate Association rules for the data.
4. Build models for Classification, prediction, and clustering.
5. Evaluate the performance of various data mining algorithms.
6. Understand mining of complex data.

Prerequisites:

Database Systems (16ITC17), Database Lab (IT 317).

UNIT-I

Introduction: What is Data mining? What kinds of data can be mined? What kinds of pattern can be mined? Major issues in data mining.

Getting to know your data: Data Objects and Attribute Types, Basic Statistical Descriptions of Data, Measuring Data Similarity and Dissimilarity.

Data Preprocessing: An Overview, Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization.

UNIT-II

Data Warehousing and Online Analytical Processing Data Warehouse: Basic Concepts, Data Warehouse Modeling: Data Cube and OLAP, Data Warehouse Design

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and Usage: A Business Analysis Framework for Data Warehouse Design, Data Warehouse Design Process, Data Warehouse Usage for Information Processing, Data Warehouse Implementation.
Mining Frequent Patterns, Associations and correlations: Basic Concepts, Frequent Item Set Mining Methods, Interesting patterns, Pattern Evaluation Methods.
Advanced Pattern Mining: Pattern Mining in Multilevel and multidimensional space.

UNIT-III
Classification: Basic Concepts, Decision Tree Induction, Bayes Classification Methods, Rule-Based Classification, Model Evaluation and Selection, Techniques to Improve Classification Accuracy: Introducing Ensemble Methods, Bagging, Boosting, Random Forests, Improving Classification Accuracy of Class-Imbalanced Data. **Classification: Advanced Methods** Bayesian Belief Networks, Classification by Back propagation, Support Vector Machines, Lazy Learners (or Learning from Your Neighbors), Other Classification Methods.

UNIT-IV
Cluster Analysis: Basic Concepts and Methods: Cluster Analysis, Partitioning Methods, Hierarchical Methods: Agglomerative versus Divisive Hierarchical Clustering, Distance Measures in Algorithmic Methods, DBSCAN, Evaluation of Clustering.

UNIT-V
Outlier Detection: Outliers and Outlier Analysis, Outlier Detection Methods, Statistical Approaches, Proximity-Based Approaches
Data Mining Trends and Research Frontiers: Mining Complex Data Types: Mining Sequence Data: Mining Other Kinds of Data, Data Mining Applications, Data Mining and Society, Data Mining Trends.

Text Book:
1. Han J, Kamber M, Jian P "Data Mining: Concepts and Techniques", Third Edition, Elsevier, 2012.

Suggested Reading:
1. Pang-Ning Tan, Michael Steinback, Vipin Kumar, "Introduction to Data Mining", Pearson Education, 2008.
2. M. Humphires, M.Hawkins, M.Dy,"Data Warehousing: Architecture and Implementation", Pearson Education, 2009.
3. Anahory, Murray, "Data Warehousing in the Real World", Pearson Education, 2008.
4. Kargupta, Joshi, etc., "Data Mining: Next Generation Challenges and Future Directions", Prentice Hall of India Pvt. Ltd, 2007.

Web Resources:
1. https://www.kdnuggets.com/
2. http://archive.ics.uci.edu/ml/index.php

16ITC26

ARTIFICIAL INTELLIGENCE

Instruction	3L Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

This course is introduced to

1. Learn problem solving techniques.
2. Familiarize with knowledge representation and logical reasoning techniques used in Artificial Intelligence.
3. Learn probabilistic reasoning models on uncertain data.
4. Design machine learning and neural network systems.
5. Learnsyntax and semantics of the natural language.

Course Outcomes:

Upon successful completion of this course, student will be able to

1. Solve problems using Exhaustive and Heuristic Search Techniques.
2. Apply inference methods in propositional logic to prove statements.
3. Apply probabilistic reasoning models on uncertain data.
4. Apply classification and clustering techniques on data sets.
5. Understand the working of neural networks to store and process information
6. Understand syntax and semantics of the language and knowledge representations.

Prerequisites:

Discrete Structures and Applications (16ITC01), Fundamentals of Data Science (16ITC12).

UNIT-I

Introduction – The Foundations of AI, History of AI.

Intelligent agents – Agents and Environments, Good Behavior: The Concept of Rationality, The Nature of Environments, The Structure of Agents.

Solving problems by searching – Problem Solving Agents, Example Problems, Searching for Solutions, Uninformed Search Strategies, Informed Search Strategies, Heuristic Functions.

Adversarial search – Games, Optimal decisions in games, Alpha-Beta Pruning.
Constraint Satisfaction Problems- Defining constraint satisfaction Problems.

UNIT-II
Logic Concepts and Logic Programming: Introduction, Propositional Calculus, Propositional Logic, Natural Deduction System, Axiomatic System, Semantic Tableau System in Propositional Logic, Resolution Refutation in Propositional Logic, Predicate Logic, Logic Programming.

Knowledge Representation: Introduction, Approaches to Knowledge Representation, Knowledge Representation using Semantic Network, Extended Semantic Networks for KR, Knowledge Representation using Frames.

UNIT-III
Quantifying Uncertainty- Acting under Uncertainty, Basic Probability Notation, Inference Using Full Joint Distributions, Independence, Bayes' Rule and its Use.
Probabilistic Reasoning - Representing Knowledge in an Uncertain Domain, The Semantics of Bayesian Networks, Efficient Representation of Conditional Distributions, Exact Inference in Bayesian Networks.

Probabilistic Reasoning over Time-Time and Uncertainty, Inference in Temporal Models, Hidden Markov Models, Kalman Filters.

UNIT-IV
Learning from Examples- Forms of Learning, Supervised Learning, Learning Decision Trees, Evaluating and Choosing the Best Hypothesis, The Theory of Learning, Regression and Classification with Linear Models, Artificial Neural Networks, Nonparametric Models, Support Vector Machines.
Learning Probabilistic Models- Statistical Learning, Learning with Complete Data.
Learning with Hidden Variables: The EM Algorithm

UNIT-V
Natural Language Processing-Language Models, Text Classification, Information Retrieval, Information Extraction.
Natural Language for Communication-Phrase Structure Grammars, Syntactic Analysis, Augmented Grammars and Semantic Interpretation.

Text Books:

1. Russell, Norvig, "Artificial intelligence - A Modern Approach", Pearson Education, Third Edition, 2015.
2. Saroj Kaushik, "Artificial Intelligence", Cengage Learning, 2011.

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Suggested Reading:

1. Nilsson, N., “Artificial Intelligence: A New Synthesis”, San Francisco, Morgan Kaufmann, 1998.
2. Rich, Knight, Nair: “Artificial intelligence”, Tata McGraw Hill, Third Edition, 2009.
3. Tom M. Mitchell, “Machine Learning”, McGraw Hill, 1997.
4. Kulkarni, Parag, Joshi, Prachi ,”Artificial Intelligence : Building Intelligent Systems”, PHI, 2015.
5. Peter Jackson, “Introduction to Expert Systems”, Third Edition, Pearson Addison Wesley, 1998.

Web Resources:

1. http://www.nptel.ac.in/courses/106105077/
2. https://www.coursera.org/specializations/machine-learning

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16ITC27

PRINCIPLES OF COMPILER DESIGN

Instruction	3L+1T Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	4

Course Objectives:

This course is introduced to

1. Learn various phases of Compiler Design.
2. Design scanner and Parsers.
3. Develop Intermediate code and generate code for target machine.
4. Familiarize with machine dependent and machine independent optimization techniques.
5. Present the role of a symbol table and error recovery strategies.

Course Outcomes:

Upon successful completion of this course, the students should be able to

1. Understand various phases in the design of compiler.
2. Generate a lexical analyser.
3. Design top-down and bottom-up parsers.
4. Develop Syntax Directed Translation scheme and Generate Intermediate code for a language.
5. Develop algorithms to generate code for a target machine.
6. Understand Data flow Analysis and Apply the optimization techniques.

Prerequisites:

Programming and Problem Solving (16CSC01), Data Structures and Algorithms (16ITC02),
Theory of Automata (16ITC20).

UNIT-I

Introduction: Programs related to compilers, Translation process, Major data structures, Other issues in compiler structure, Boot strapping and porting.

Lexical analysis: The role of Lexical Analyzer, Input Buffering, Specification of Tokens, Recognition of Tokens, The Lexical-Analyzer Generator Lex.

UNIT-II

Syntax Analysis: Introduction, Context-Free Grammars, Writing a Grammar, Top-Down parsing, Bottom-Up parsing, Introduction to LR Parsing, More powerful LR parsers, Using Ambiguous Grammars, Parser Generators.

UNIT-III

Syntax Directed Translation: Syntax Directed Definitions, Evaluation Orders for SDDs, Applications of Syntax Directed Translation.

Intermediate code generation: Variants of Syntax Trees, Three-Address Code, Types and Declarations, Translation of Expressions, Type Checking, Control Flow.

UNIT-IV

Runtime Environments: Storage Organization, Stack Allocation of Space, Access to Non local Data on the Stack, Heap Management, Introduction to Garbage Collection.

Code Generation : Issues in the Design of a Code Generator, The Target Language, Addresses in the Target Code, Basic Blocks and Flow Graphs, Optimization of Basic Blocks, Peephole Optimization, Register Allocation and Assignment.

UNIT-V

Machine Independent Optimizations: The Principal Sources of Optimizations, Introduction to data flow analysis, Foundation of data flow analysis.

Text Books:

1. Alfred V Aho, Monica S Lam, Ravi Sethi, Jeffrey D Ullman ,"Compilers: Principles, Techniques &Tools", Pearson Education, Second Edition, 2014.
2. Kenneth C Louden, "Compiler Construction: Principles and Practice", Cengage Learning.

Suggested Reading:

1. Keith D Cooper & Linda Torczon, "Engineering a Compiler", Morgan Kafman, Second Edition.
2. Dick Grune, Kees van Reeuwijk, Henri E. Bal , Ceriel J.H. Jacobs, Koen Langendoen ," Modern Compiler Design", Springer, Second Edition.

Web Resources:

1. http://nptel.ac.in/courses/106108113

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Input Methods: The User Dialogue, Logical Classification of Input Devices, Input Functions, Interactive Picture Construction Techniques.

UNIT-III

2-D Geometrical transforms: Translation, scaling, rotation, reflection and shear transformations, matrix representations and homogeneous coordinates, composite transforms, transformations between coordinate systems.

2-D Viewing: The viewing pipeline, viewing coordinate reference frame, window to view-port coordinate transformation, viewing functions, Cohen-Sutherland and Liang-Barsky line clipping algorithms, Sutherland –Hodgeman polygon clipping algorithm.

UNIT-IV

3-D Object representation: Polygon surfaces, quadric surfaces, spline representation, Hermite curve, Bezier curve and B-spline curves, Bezier and B-spline surfaces, CSG, Octrees, BSP Trees.

3-D Geometric transformations: Translation, rotation, scaling, reflection and shear transformations, composite transformations, 3-D viewing: Viewing pipeline, viewing coordinates, projections, view volume and general projection transforms.

UNIT-V

Visible surface detection methods: Classification, back-face detection, depth-buffer, scan-line, depth sorting, BSP-tree methods, area sub-division and octree methods.

Computer animation: Design of animation sequence, general computer animation functions, raster animation, computer animation languages, key frame systems, motion specifications.

Text Books:

1. Donald Hearn and M. Pauline Baker, "Computer Graphics C version", Second Edition, Pearson Education.
2. "Computer Graphics Principles & practice", second edition in C, Foley, VanDam, Feiner and Hughes, Pearson Education.

Suggested Reading:

1. "Computer Graphics" Second edition, Zhigandxiang, Roy Plastock, Schaum's outlines, Tata Mc- Graw hill edition.
2. Procedural elements for Computer Graphics, David F Rogers, Tata Mc Graw hill, 2nd edition.
3. "Principles of Interactive Computer Graphics", Neuman and Sproul, TMH.
4. Principles of Computer Graphics, ShaliniGovil, Pai, 2005, Springer.
5. Computer Graphics, Steven Harrington, TMH.

Web Resources:

1. http://nptel.iitm.ac.in/courses/Webcourse-contents/IITDelhi/Computer%20Graphics/csmain.html

Indexed Files of Data Objects- Indexing: A Simple Index for Entry-Sequenced File, Template Classes in C++, Object-Oriented support for Indexed, Entry-Sequenced Files of Data Objects, Indexes That Are Too Large to Hold in Memory, Indexing to Provide Access by Multiple Keys, Retrieval Using Combinations of Secondary Keys, Improving the Secondary Index Structure: Inverted Lists, Selective Indexes, Binding.

UNIT-III

Multilevel Indexing and B-Trees: Introduction: The Invention of the B-Tree, Statement of the Problem, Indexing with Binary Search Trees, Multi-level Indexing, A Better Approach to Tree Indexes, B-Trees: Working up from the Bottom, Example of Creating a B-Tree, An Object-Oriented Representation of B-Trees, B-Tree Methods Search, Insert, and Others, B-Tree Nomenclature, Formal Definition of B-Tree Properties, Worst-case Search Depth, Deletion, Merging, and Redistribution, Redistribution during Insertion: A Way to Improve Storage Utilization, B* Trees, Buffering of Pages: Virtual B-Trees, Variable-length Records and Keys.

UNIT-IV

Indexed Sequential File Access and B+ Trees : Indexed Sequential Access, Maintaining a Sequence Set, Adding a Simple Index to the Sequence Set, The Content of the Index: Separators Instead of Keys, The Simple Prefix B+ Tree, Simple Prefix B+ Tree Maintenance, Index Set Block Size, Internal Structure of Index Set Blocks: A Variable-order B-Tree, Loading a Simple Prefix B+ Tree, B+ Trees, B-Trees, B+ Trees, and Simple Prefix B+ Trees in Perspective.

Hashing: Introduction, A Simple Hashing Algorithm, Hashing Functions and Record Distributions, How Much Extra Memory Should Be Used, Collision Resolution by Progressive Overflow, Storing More Than One Record per Address: Buckets, Making Deletions, Other Collision Resolution Techniques, Patterns of Record Access.

UNIT-V

Extendible Hashing: Introduction, How Extendible Hashing Works, Implementation, Deletion, Extendible Hashing Performance, Alternative Approaches, Multi list and Inverted Files, Sorting of Large Files,

External sorting: Secondary storage algorithms.

Text Book:

1. Michael j. Folk, Greg Riccardi, Bill Zoellick; *File Structures: An Object Oriented Approach with C++*, 3/e Pearson Publishers.

Suggested Reading:

1. Horowitz, E., and Sahni.S: Fundamentals of Data structures. Computer Science Press, 1978.
2. Wirth, Nicolaus: Algorithms + Data structures = Programs. Prentice-Hall International, 1975.
3. Knuth, D.: The Art of Computer Programming, Vols. 1-2. Addison-Wesley, 1970-80.

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16ITE06

OBJECT ORIENTED SYSTEM DEVELOPMENT USING UML

(Elective-II)

Instruction	3LHours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

This course is introduced to:

1. Acquaint the student with the precise vocabulary and powerful notation used in Unified modeling language.
2. Describe the basic structural modeling concepts in UML.
3. Familiarize students with architectural modeling.
4. Explain the concepts of Unified software development process.
5. Acquaint the students with UML notations and discuss several case studies.

Course Outcomes:

Upon successful completion of this course, student will be able to

1. Understand the precise vocabulary and powerful notation used in Unified modeling language.
2. Provide comprehensive introduction to basic structural modeling in UML.
3. Develop the component and deployment diagrams in architectural modeling.
4. Understand the Unified software development process and apply to UML models.
5. Involve in analysis and design of UML models for various case studies.
6. Relate the applications of Unified process in UML modeling.

Prerequisites:

Object Oriented Programming (16ITC03), Software engineering (16ITC26)

UNIT-I

UML Introduction: Why we Model, Introducing the UML, Elements of UML. Basic Structural Modeling: Classes, Relationships, Common Mechanisms, Diagrams, Class Diagrams.

Advanced Structural Modeling: Advanced Classes, Advanced Relationships, Interfaces, Types and Roles, Packages, Instances, Object Diagrams, Components, Case studies on class diagrams.

UNIT-II

Basic BehavioralModeling: Interactions, Use Cases, Use Case Diagrams, Interaction diagrams, Activity diagrams, Case studies on Use Case diagrams, Interaction diagrams.

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Advanced BehavioralModeling: Events and Signals-types of events-internal and external events, State Machines, Processes and Threads, Time and space, State Chart Diagrams, Case studies on State chart diagrams.

UNIT-III

Architectural Modeling: Artifacts, Deployment , Collaborations, Patterns and Frame-works, Artifact Diagrams, Deployment Diagrams, components of deployment diagrams-nodes and links, common modeling techniques for deployment diagrams-modeling a fully distributed system, modeling embedded systems, modeling client-server systems, Systems and Models- subsystems, trace relationships, Case studies on Deployment diagrams.

UNIT-IV

Unified Software Development Process: The Unified Process, phases in unified software development process-inception, elaboration, construction and transition, The Four P's-people, project, product, process, A Use-Case Driven Process-Importance of Use case modeling, An Architecture-Centric Processes, base lining the architecture, An Iterative and Incremental Process-a generic iteration, advantages of iterative and incremental process.

UNIT-V

Core Workflows: Requirements Capture, Capturing Requirements as Use Cases, Analysis-role of analysis in software life cycle, artifacts, workers and activities in analysis workflow, Design-workers, artifacts and activities in design workflow, Implementation-role of implementation in software life cycle, Test, testing artifacts-test case, test plan, test procedure.

Text Books:

1. Grady Booch, James Rumbaugh, Ivor Jacobson, "The Unified Modeling Language-User Guide (Covering UML 2.0)", Third Edition, Pearson Education, India, 2010.
2. Ivor Jacobson, Grady Booch, James Rumbaugh, "The Unified Software Development Process", second edition ,Pearson Education, India, 2008.

Suggested Reading:

1. Martin Fowler, Kendall Scott "UML Distilled: A Brief Guide to the Standard Object Modeling Language" Addison Wesley, Fourth Edition, 2011.
2. Hans van Vliet "Software Engineering Principles and Practice", Second Edition, 2010.

Web Resources:

1. IBM Rational http://www-306.ibm.com/software/rational/uml/
2. Practical UML - A Hands-On Introduction for Developers http://www.togethersoft.com/services/practical_guides/umlonlinecourse/
3. http://www-inst.eecs.berkeley.edu/~cs169/

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16ITE07

DIGITAL IMAGE PROCESSING

(Elective-III)

Instruction	3LHours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To learn the fundamental concepts and applications of digital image processing.
2. To learn the image processing concepts: intensity transformations, spatial filtering, smoothing and sharpening in both spatial and frequency domains, image restoration and reconstruction.
3. To learn the image analysis concepts: morphological image processing, image segmentation, image representation and description, and object recognition.
4. To understand colour image processing techniques.
5. To learn various image compression methods.

Course Outcomes:

Upon successful completion of the course, student will be able to

1. Explain the fundamental concepts and discuss the applications of digital image processing.
2. Explain intensity transformations, spatial filtering, smoothing and sharpening in both spatial and frequency domains, image restoration and reconstruction.
3. Demonstrate the image analysis concepts like morphological image processing, image segmentation, image representation and description, and object recognition.
4. Illustrate colour image processing techniques.
5. Distinguish and describe various image compression methods.

Prerequisites:

Engineering Mathematics- I (16MTCO1)

UNIT-I

Basics: Introduction, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Elements of visual perception, Image Sampling

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and Quantization - Basic Concepts in Sampling and Quantization, Representing Digital Images, Spatial and Intensity Resolution;

Some Basic Relationships between Pixels - Neighbours of a Pixel, Adjacency, Connectivity, Regions, and Boundaries, Distance Measures
Intensity Transformations: Some Basic Intensity Transformation Functions, Image Negatives, Log Transformations, Power-Law (Gamma) Transformations, Piecewise-Linear Transformation Functions, Histogram Processing - Histogram Equalization, Histogram Matching (Specification), Local Histogram Processing.

UNIT- II

Spatial Filtering: Fundamentals of Spatial Filtering, The Mechanics of Spatial Filtering, Spatial Correlation and Convolution, Smoothing Spatial Filters - Smoothing Linear Filters, Order-Statistic (Nonlinear) Filters; Sharpening Spatial Filters – Foundation, Using the Second Derivative for Image Sharpening—The Laplacian, Unsharp Masking and Highboost Filtering.

Filtering in the Frequency Domain: The 2-D Discrete Fourier Transform and its inverse, Some Properties of the 2-D Discrete Fourier Transform - Relationships Between Spatial and Frequency Intervals, Translation and Rotation, Periodicity, Symmetry Properties, Fourier Spectrum and Phase Angle, The 2-D Convolution Theorem.

The Basics of Filtering in the Frequency Domain - Frequency Domain Filtering Fundamentals Correspondence Between Filtering in the Spatial and Frequency Domains, Image Smoothing Using Frequency Domain Filters, Ideal Low pass Filters, Butterworth Low pass Filters, Gaussian Low pass Filters, Image Sharpening Using Frequency Domain Filters - Ideal High pass Filters, Butterworth High pass Filters, Gaussian High pass Filters, The Laplacian in the Frequency Domain, Unsharp Masking, Highboost Filtering.

UNIT- III

Image Restoration and Reconstruction: A Model of the Image Degradation/ Restoration Process, Noise Models - Spatial and Frequency Properties of Noise, Some Important Noise Probability Density Functions, Periodic Noise, Estimation of Noise Parameters, Restoration in the Presence of Noise Only—Spatial Filtering, Mean Filters, Order-Statistic Filters, Adaptive Filters; Periodic Noise Reduction by Frequency Domain Filtering – Band reject Filters, Band pass Filters; Estimating the Degradation Function - Estimation by Image Observation, Estimation by Experimentation, Estimation by Modelling; Inverse Filtering; Minimum Mean Square Error (Wiener) Filtering; Constrained Least Squares Filtering.

Morphological Image Processing: Preliminaries, Erosion and Dilation, Opening and Closing.

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UNIT- IV

Image Segmentation:Fundamentals, detection of isolated points, line detection, basic edge detection, edge linking and boundary detection; thresholding – foundation, basic global thresholding, optimum global thresholding using otsu's method; region-based segmentation - region growing, region splitting and merging; segmentation using morphological watersheds - background, dam construction, watershed segmentation algorithm.

Representation and Description: Representation-Boundary (Border) Following, Chain Codes, Polygonal Approximations Using Minimum-Perimeter Polygons, Signatures, Boundary Descriptors - Some Simple Descriptors, Shape Numbers, Fourier Descriptors, Statistical Moments, Regional Descriptors - Some Simple Descriptors, Topological Descriptors, Texture.

Object Recognition: Patterns and Pattern Classes, Recognition Based on Decision-Theoretic Methods – Matching, Optimum Statistical Classifiers, Neural Networks.

UNIT-V

Colour Image Processing: Colour Fundamentals; Colour Models - RGB Colour Model, CMY and CMYK Colour Models, The HSI Colour Model; Pseudo colour Image Processing - Intensity Slicing, Intensity to Colour Transformations; Basics of Full-Colour Image Processing - Colour Transformations, Colour Edge Detection
Image Compression: Fundamentals-Coding Redundancy, Spatial and Temporal Redundancy, Irrelevant Information, Measuring Image Information, Fidelity Criteria, Image Compression Models - Image Formats, Containers, and Compression Standards; Some Basic Compression Methods - Huffman Coding, Arithmetic Coding, LZW Coding, Block Transform Coding.

Text Book:

1. Rafael C Gonzalez and Richard E Woods, "Digital Image Processing", Pearson Education, Third Edition.

Suggested Reading:

1. Vipula Singh, "Digital Image Processing with MatLab and lab View", Elsevier.
2. Thomas B. Moeslund, "Introduction to Video and Image Processing: Building Real Systems and Applications", Springer, 2012.
3. Milan Sonka, Vaclav Halvac and Roger Boyle, "Image Processing, Analysis, and Machine Vision", Second Edition, Thomson Learning Publishers.
4. Kenneth R.Castleman, "Digital Image Processing", Pearson Education, 2006.

16ITE08

INFORMATION RETRIEVAL SYSTEMS

(Elective – III)

Instruction	3LHours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

This course is introduced to

1. To familiarize the different Information Retrieval models.
2. To understand how to write query languages and evaluation.
3. To build index and perform compression on the data.
4. To familiarize pattern matching algorithms.
5. To learn parallel and distributes models.

Course Outcomes:

Upon successful completion of this course, student will be able to

1. Understand different Information Retrieval models.
2. Understand the query language to retrieve the data.
3. Analyse and improve the retrieval results.
4. Understands the operations on the text data and builds index of the data.
5. Apply different pattern matching algorithms on text data.
6. Understand parallel and distributed Information Retrieval models.

Prerequisites:

Database Systems (16ITC17), Data Warehousing and Data Mining (16ITC25).

UNIT-I

Introduction: Basic concepts, Past present and Future of IRS, Retrieval Process. Modeling: Introduction, A Taxonomy of IR Models, Retrieval: Adhoc and Filterig, A formal characterization of IR Models, Classic IR, Set Theoretic Models, Algebraic Models, Probabilistic Models.

UNIT-II

Structured Text Retrieval Models, Models for Browsing.
Retrieval Evaluation: Introduction, Reference Collections.
Query languages: Introduction, Keyword-based querying, pattern Matching, Structural Queries, Query Protocols.

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UNIT-III

Query operations: Introduction, User Relevance Feedback, Automatic Local Analysis, Automatic Global Analysis.

Text and Multimedia Languages and Properties: Introduction, Meta Data, Text, Markup Languages, Multimedia.

UNIT-IV

Text operations: Introduction, Document Preprocessing, Document Clustering, Text Compression, Comparing Text Compression Techniques Indexing: Introduction, Inverted Files, Other Indices for Text Searching, Boolean Queries.

UNIT-V

Searching: Sequential Searching, Pattern Matching, Structural Queries, Compression Parallel and Distributed IR: Introduction, Parallel IR, Distributed IR.

Text book:

1. Ricardo, Baeza-yates, BerthierRibeiro-Neto, "Modern Information Retrieval" Pearson Education, 2008.

Suggested Reading:

1. Christopher D. Manning and PrabhakarRaghavan and HinrichSchütze, "Introduction to
2. Information Retrieval", Cambridge University Press, 2009.
3. David A. Grossman, OphirFrieder, "Information Retrieval - Algorithms and Heuristics", Springer, 2nd Edition (Distributed by Universities Press), 2004.
4. Gerald Kowalski, "Information Retrieval Systems: Theory and Implementation", Springer.
5. William B. Frakes, Ricardo Baeza- Yates, "Information Retrieval – Data Structures & Algorithms", Pearson Education, 2008.

Web Resources:

1. https://class.coursera.org/nlp/lecture
2. http://www.dcs.gla.ac.uk/Keith/Preface.html

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16ITE09

E-COMMERCE
(Elective-III)

Instruction	3LHours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

This course is introduced to

1. Analyze features of existing e-commerce businesses, and propose future directions or innovations for specific businesses.
2. To understand the role of multimedia in E-Commerce and security issues of E-Commerce.
3. Discuss electronic commerce and the stakeholders and their capabilities and limitations in the strategic convergence of technology and business.
4. Identify advantages and disadvantages of technology choices such as merchant server software and electronic payment options.
5. To understand the Emerging tools for Resource search and discovery.

Course Outcomes:

Upon successful completion of this course, student will be able to

1. Able to implement e-commerce in business applications.
2. To make effective use of multimedia in E-commerce applications.
3. To resolve security issues in Electronic Payment Systems.
4. Able to describe the Document infrastructure for E-commerce and advertisement in Market.
5. To make use of emerging tools in Resource search and discovery.
6. Be aware of global perspectives (needs, rules/regulations, and specifications).

UNIT-I

Introduction: Electronic commerce and Physical Commerce, different type of ecommerce, some e-commerce scenario, Advantages of e-commerce.

Basic technologies of Ecommerce: Client side Programming, Server Side Programming, Database connectivity, session tracking techniques.

UNIT-II

Internet Payment System: Characteristics of payment system, SET Protocol for creditcard payment, E-cash, E-check, Micropayment system.

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E-commerce strategies: Strategies for marketing, Sales and Promotions, Strategies forPurchasing and support activities, Strategies for Web Auctions, Virtual Communities,and web portals.

UNIT -III

E-Business -Introduction: E-Business vs E-commerce,, Characteristics of e-Business, e-Business role and their challenges, e-business Requirements, impacts of e-business.

E-business strategies: Strategic positioning, Levels of e-business strategies, Strategicplanning process, Strategic alignment, the consequences of e-Business, Success factorsfor implementation of e-business strategies. Business models, Business process and collaborations.

UNIT-IV

Advance technologies of E-commerce: Mobile Agent, WAP, XML, Data Mining, RichInternet Application, Web 2.0, REST Web Services, Web Mashup, Working of SearchEngines, Internet Security.

UNIT- V

Integration of Application: Approaches to Middleware, RPC and RMI, EnterpriseApplication Integration, e-business Integration, loosely Coupled e-Business solutions forintegration, Service Oriented Architecture, EAI and web Services, WS-security.

Text Books:

1. E-Commerce Fundamentals and application (Henry Chan) Wiley publication.
2. Electronic Commerce (Gary Schneider) Thomson Course technology.
3. E-Business Organizational and technical foundation (Michael P) Wiley Publication.

Suggested Reading:

1. E- Commerce Strategies, Technology and applications (David) Tata McGraw-Hill.
2. Introduction to E-commerce (Jeffrey) Tata- McGraw-Hill.
3. E-Business and Commerce- Strategic Thinking and Practice (Brahm) biztantra.

Web Resources:

1. http://www.w3schools.com/xml/default.asp
2. http://www.tizag.com/xmlTutorial/
3. https://www.practicalecommerce.com/

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16ITC28

NETWORK PROGRAMMING LAB

Instruction	3LHours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	2

Course Objectives:

This course is introduced to

1. Familiarize students with client/server architecture in application development.
2. Provide understanding of elementary socket system calls, advanced socket system calls.
3. Expose students to the usage of TCP and UDP based sockets.
4. Provide knowledge of network routing algorithms and application layer protocols.
5. Cryptographic principles and encryption algorithms.

Course Outcomes:

Upon successful completion of this course, student will be able to

1. Use elementary socket system calls and develop distributed applications.
2. Model and evaluate performance of networking systems.
3. Implement the Routing algorithms.
4. Develop and implement next generation protocols required for emerging applications.
5. Understand the operating principles of Electronic Mail (SMTP), HTTP.
6. Comprehend various network security threats and implement the cryptographic algorithms.

Prerequisites:

Programming and Problem Solving (16CSC01), Java Programming (16ITC10).

List of Programs

1. Understanding and using of commands like ifconfig, netstat, ping, arp, telnet, ftp, finger, traceroute, whoisetc. Usage of elementary socket system calls (socket(), bind(), listen(), accept(), connect(), send(), recv(), sendto(), recvfrom()).
2. Implementation of Connection oriented concurrent service (TCP).
3. Implementation of Connectionless Iterative time service (UDP).
4. Implementation of Select system call.
5. Implementation of getsockopt(), setsockopt() system calls.

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6. Implementation of getpeername() system call.
7. Implementation of remote command execution using socket system calls.
8. Implementation of Distance Vector Routing Algorithm.
9. Implementation of HTTP.
10. Implementation of RSA algorithm.
11. Develop an Internet Mail Application.
12. Multimedia file transmission using FTP.

Note: Implement programs 2 to 7 in C and 8 to 12 in JAVA.

Text Book:

1. W. Richard Stevens, "Unix Network Programming", Prentice Hall, Pearson Education, 2009.

Suggested Reading:

1. Douglas E.Comer, "Hands-on Networking with Internet Technologies", Pearson Education.
2. James Kurose and Keith Ross. Computer Networking: A Top-Down Approach Featuring the Internet.

Web Resources:

1. https://in.udacity.com/course/computer-networking—ud436
2. https://www.mooc-list.com/course/learn-socket-programming-tutorial-c-scratch-eduonix.

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16ITC29

DATA MINING LAB

Instruction	3LHours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	2

Course Objectives:

This course is introduced to

1. Weka tool and R-Tool for data mining.
2. Present various pre-processing techniques.
3. Familiarise with data visualization.
4. Acquaint various features available in weka for mining interesting patterns.
5. Present various mining techniques to analyse the data in R - Tool.

Course Outcomes:

Upon successful completion of this course, student will be able to

1. Describe the data using various visualisation techniques.
2. Identify and apply necessary pre-processing techniques on raw data.
3. Generate interesting patterns using appropriate data mining techniques.
4. Perform pattern evaluation.
5. Visualise the knowledge mined.
6. Build a data mining system for a given application.

Prerequisites:

Database Systems (16ITC17)

List of Programs

I. Introduction to data mining using Weka and R-Tool.

II. Experiment the following in Weka Tool.

1. Perform the following Preprocessing operations:
   - i. Attribute selection
   - ii. Handling missing values
   - iii. Discretisation
   - iv. Converting nominal attributes to binary attributes
   - v. Normalisation
   - vi. Standardisation
   - vii. Outlier detection and elimination.

2. Generate Association Rules using Apriori and FP Growth algorithms.
3. Build the following classifiers and check their efficiency:
   i. Decision Tree
   ii. Naïve Bayes
   iii. Bagging
   iv. AdaBoost
   v. Random forest
   vi. K-NN
4. Apply the following clustering algorithms on datasets and visualise the clusters
   i. K-Means
   ii. Hierarchical
   iii. DBSCAN
5. Build Linear Regression model.

III. Experiment the following in R-Tool:
1. Data Import/Export
2. Data Exploration and Visualization
3. Association Rule Mining
4. Regression and Classification
5. Data Clustering
6. Text Mining with R: Twitter Data Analysis
7. Time Series Analysis and Mining

(Note: Wherever necessary interpret the results and measure the performance)

Text Books:

1. Ian H.Witten, EibeFank, Mark A Hall, "Data Mining Practical Machine Learning Tools and Techniques", Third edition, 2011.
2. Pawel Cichosz, "Data Mining Algorithms: Explained Using R", Wiley (2015).

Suggested Reading:

1. Han J, Kamber M, Jian P "Data Mining: Concepts and Techniques", Third Edition, Elsevier, 2012.
2. Yanchang Zhao, "R and Data mining: Examples and Case Studies", First Edition, Elsevier 2012.

Web Resources:

1. https://www.cs.waikato.ac.nz/ml/weka/
2. http://www.rdatamining.com/
3. http://illimine.cs.uiuc.edu/
4. https://www.kdnuggets.com/
5. http://archive.ics.uci.edu/ml/index.php

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16ITC30

MINI PROJECT – IV

Instruction	2 Hours per week
Duration of End Examination	-
Semester End Examination	-
CIE	50 Marks
Credits	1

Course Objectives:

1. To enable students learn by doing.
2. To develop capability to analyze and solve real world problems.
3. To develop innovative ideas among the students.

Course Outcomes:

Students should be able to do the following:

1. To provide innovative solutions.
2. To work in a team.
3. To manage time and resources in the best possible manner.

The Students are required to implement one of the projects from project exercise given in the suggested readings of the theory subjects of the current semester / as suggested by the respective course faculty of that semester. During the implementation of the project, Personnel Software Process (PSP) has to be followed. Report of the project work has to be submitted for evaluation.

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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY(A)
Choice Based Credit System (with effect from 2019-20)
B.E. (Information Technology)

Semester– VII

S.No	Course Code	Title of the Course	Scheme of Instruction		Scheme of Examination			Credits
			Hours per Week		Duration of SEE in Hours	Maximum Marks		
			L/T	P/D		CIE	SEE	
THEORY								
1	16IT C31	Embedded Systems and Internet of Things	3	-	3	30	70	3
2	16IT C32	Distributed Systems	3	-	3	30	70	3
3	16IT C33	Information Security	3	-	3	30	70	3
4	16IT C34	Big Data Analytics	3	-	3	30	70	3
5		Elective -IV	3	-	3	30	70	3
6		Elective -V	3	-	3	30	70	3
PRACTICALS								
7	16IT C35	Big Data Analytics Lab	-	3	3	25	50	2
8	16IT C36	Embedded Systems and IoT Lab	-	3	3	25	50	2
9	16IT C37	Project Seminar	-	3	-	50	-	2
		TOTAL	18	9	-	280	520	24

L: Lecture T: Tutorial D: Drawing P: Practical
CIE-Continuous Internal Evaluation SEE-Semester End Examination

Elective-IV

S.No.	Subject Code	Subject Name
1.	16IT E10	Human Computer Interaction
2.	16IT E11	Soft Computing
3.	16IT E12	VLSI Technology

Elective -V

S.No.	Subject Code	Subject Name
1.	16IT E13	Natural Language Processing
2.	16IT E14	Mobile Computing
3.	16IT E15	Business Intelligence

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16ITC 31

EMBEDDED SYSTEMS AND INTERNET OF THINGS

Instruction	3L Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course is introduced to
1. Explore theoretical aspects of the design and development of an embedded system.
2. Provide an overview of basic concepts, structure and development of embedded systems using 8051.
3. Familiarize students with programming using 8051 and advanced processors.
4. Facilitate the Internet of Things, building blocks of IoT and the real world applications
5. Acuire knowledge of Raspberry Pi device, its interfaces and Django Framework.
6. Comprehend on domain specific applications of IoT.

Course Outcomes: After successful completion of this course, student will be able to
1. Acquire knowledge and skill in development of embedded systems.
2. Design and develop embedded systems using 8051.
3. Demonstrate real-time and advanced processor concepts.
4. Describe the role of things and Internet in IoT and determine the IoT levels for designing an IoT system.
5. Learn design methodology for IoT system design.
6. Describe about the Raspberry Pi board and interfacing sensors with Rasberry Pi and work with python based web application framework called Django.

Course Prerequisites: Digital Electronics and Logic Design (16ITC04), Computer Organization (16ITC11)

UNIT-I

Embedded Computing: Introduction, Complex Systems and Microprocessor, Embedded System Design Process. The 8051 Architecture: Introduction, 8051

Micro controller Hardware, Input/output Ports and Circuits, External Memory, Counter and Timers, Serial data Input/Output, Interrupts.

UNIT-II

Programming using 8051: Data Transfer and Logical Instructions, Arithmetic Operations, Decimal Arithmetic, Jump and Call Instructions, Applications: Interfacing with Keyboards, Displays, D/A and A/D Conversions, Multiple Interrupts, Introduction to advanced architectures: ARM and SHARC Processor and memory organization, Bus protocols, 12C bus and CAN bus.

UNIT-III

Introduction: Introduction to Internet of Things- Definitions & Characteristics of IoT, Physical Design of IoT-Things in IoT, IoT Protocols, Logical Design of IoT-IoT Functional Blocks, IoT Communication Models, IoT Communication APIs, IoT Enabling Technologies-Wireless Sensor Networks, Cloud Computing, Big Data Analytics, Communication Protocols, Embedded Systems, IoT Levels& Deployment Templates.

UNIT-IV

IoT Platforms Design Methodology: Introduction, IoT Design Methodology Steps-Purpose and Requirements Specification, Process Specification, Domain Model Specification, Information Model Specification, Service Specifications, IoT Level Specification, Functional View Specification, Operational View Specification, Device and Component Integration, Application Development, Case Study on IoT System for Weather Monitoring. IoT Physical Devices and End Points: Basic building blocks of an IoT device, Raspberry Pi About the board, Raspberry Pi interfaces-Serial, SPI, I2C. Python Web Application Framework: Django Framework-Roles of Model, Template and View.

UNIT-V

Domain Specific IOTs: Various types of IoT Applications in Home Automation-smart lighting, Smart appliance, smoke and gas detectors, Cities, Environment, Energy, Retail, Logistics Agriculture, Industry, Health & Life Style-Wearable Electronics. IoT and M2M – Introduction, M2M, Differences between IoT and M2M, Software Defined Networking, Network Function Virtualization.

Text Books:

1. Wayne Wolf, "Computers as Components", 1st Edition, Academic press, 2001.
2. Kenneth J.Ayala, "The 8051 Microcontroller", 3rd Edition, Thomson, 2014.

3. Arshdeep Bahga, Vijay Madisetti, "Internet of Things: A Hands-on Approach", Universities Press, 2014.

Suggested Reading:

1. Raj Kamal, "Embedded Systems", 2nd Edition, McGraw Hill, 2015.
2. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, StamatisKarnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014.

Web Resources:

1. https://nptel.ac.in/noc/individual_course.php?id=noc17-cs05
2. www.win.tue.nl/~qingzhiliu/courses/IoT-Msc-2017/Slides/IoT-04-Architecture.pdf

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16IT C32

DISTRIBUTED SYSTEMS

Instruction	3L Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course is introduced to

1. Present the basic concepts and principles of distributed systems.
2. Deal with the architectures and models of distributed systems.
3. Familiarize with concepts of processes, threads and various communication methods.
4. Familiarize with concepts of naming, directory services and synchronization in distributed environment.
5. Impart knowledge on the principles of consistency, replication and fault tolerance in distributed systems.
6. Provide understanding of various distributed object based systems.

Course Outcomes: Upon successful completion of the course, student will be able to

1. Describe the various models and architectures of distributed systems.
2. Illustrate use of threads in distributed systems.
3. Comprehend the distributed communication mechanisms.
4. Describe various naming and synchronization mechanism in distributed systems.
5. Analyse consistency, replication and fault tolerance in distributed systems.
6. Compare and contrast various distributed object-based systems.

Course Prerequisites:

Principles of Operating Systems (16ITC16), Computer Networks & Socket Programming (16ITC24)

UNIT – I

Introduction: Definition of A Distributed System; Goals- Making Resources Accessible, Distribution Transparency, Openness, Scalability; Types of Distributed Systems- Distributed Computing Systems, Distributed Information Systems, Distributed Pervasive Systems.

Architectures: Architectural Styles, System Architectures- Centralized Architectures, Decentralized Architectures, Hybrid Architectures; Architectures versus Middleware-Interceptors, General Approaches to Adaptive Software.

UNIT – II

Processes: Threads - Introduction to Threads, Threads in Distributed Systems; Virtualization - The Role of Virtualization In Distributed Systems, Architectures of Virtual Machines; Clients- Networked User Interfaces, Client-Side Software for Distribution Transparency; Servers- General Design Issues, Server Clusters, Managing Server Clusters; Code Migration- Approaches to Code Migration, Migration and Local Resources, Migration in Heterogeneous Systems.

Communication: Fundamentals- Layered Protocols, Types of Communication; Remote Procedure Call- Basic RPC Operation, Parameter Passing, Asynchronous RPC; Message-Oriented Communication- Message Oriented Transient Communication, Message Oriented Persistent Communication; Stream-Oriented Communication- Support for Continuous Media, Streams and Quality of Service, Stream Synchronization; Multicast Communication- Application-Level Multicasting, Gossip-Based Data Dissemination.

UNIT–II

Naming: Names, Identifiers, and Addresses; Flat Naming- Simple Solutions, Home-Based Approaches, Distributed Hash Tables, Hierarchical Approaches; Structured Naming- Name Spaces, Name Resolution, the Implementation of a Name Space; Attribute-based Naming- Directory Services, Hierarchical Implementations: LDAP, Decentralized Implementations.

Synchronization: Clock Synchronization- Physical Clocks, Global Positioning System, Clock Synchronization Algorithms; Logical Clocks- Lamport's Logical Clocks, Vector Clocks; Mutual Exclusion-Overview, A Centralized Algorithm, A Decentralized Algorithm, A Distributed Algorithm, A Token Ring Algorithm, A Comparison of the Four Algorithms; Global Positioning of Nodes; Election Algorithms- Traditional Election Algorithms, Elections in Wireless Environments, Elections in Large Scale Systems.

UNIT – IV

Consistency And Replication: Introduction- Reasons for Replication, Replication as Scaling Technique; Data-Centric Consistency Models- Continuous Consistency, Consistent Ordering of Operations; Client-Centric Consistency Models- Eventual Consistency, Monotonic Reads, Monotonic Writes, Read your Writes, Writes Follow Reads; Replica Management- Replica-Server Placement, Content Replication and Placement, Content Distribution; Consistency Protocols- Continuous Consistency, Primary-Based Protocols, Replicated-Write

Protocols, A Cache-Coherence Protocols, Implementing Client-Centric Consistency.

Fault Tolerance: Introduction To Fault Tolerance-Basic Concepts, Failure Models, Failure Masking by Redundancy; Process Resilience- Design Issues, Failure Masking and Replication, Agreement in Faulty Systems, Failure Detection; Reliable Client-Server Communication- Point-To-Point Communication, RPC Semantics in The Presence Of Failures; Reliable Group Communication- Basic Reliable-Multicasting Schemes, Scalability in Reliable Multicasting, Atomic Multicast; Distributed Commit-Two-Phase Commit, Three-Phase Commit; Recovery- Introduction, Checkpointing, Message Logging, Recovery-Oriented Computing.

UNIT – V

Distributed Object-Based Systems: Architecture- Distributed Objects, Example: Enterprise Java Beans, Example- Globe Distributed Shared Objects; Processes- Object Servers, Example: The Ice Runtime System; Communication- Binding a Client to an Object, Static versus Dynamic Remote Method Invocations, Parameter Passing, Example: Java RMI, Object-Based Messaging; Naming- CORBA Object References, Globe Object References; Synchronization, Consistency and Replication- Entry Consistency, Replicated Invocations; Fault Tolerance- Example: Fault-Tolerant CORBA, Example: Fault-Tolerant Java; Security- Example: GLOBE, Security for Remote Objects.

Text Books:

1. Andrew S. Tanenbaum and Van Steen “Distributed Systems: Principles and Paradigms”, PHI, 2nd Edition, 2014.
2. Colouris G., Dollimore Jean and Kindberg Tim, “Distributed Systems Concepts and Design”, Pearson education, 5th Edition, 2012.

Suggested Reading:

1. Sunitha Mahajan, Seema Shah, “Distributed Computing”, Oxford University Press, 2nd Edition, 2013.
2. S.Ghosh, Chapman & Hall/CRC, “Distributed Systems”, Taylor & Francis Group, 2010.
3. Ajay D. Kshemakalyani, MukeshSinghal, “Distributed Computing, Principles, Algorithms and Systems”, Cambridge, 2010.

Web Resource:

1. https://nptel.ac.in/courses/106106168/

16IT C33

INFORMATION SECURITY

Instruction	3L Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course is introduced to

1. Provide basic concepts of Information security and threats its associated attacks.
2. Deal with legal, ethical, professional issues and the role of risk management.
3. Impart knowledge about Information security planning and technology.
4. Facilitate learning of cryptographic algorithms.
5. Acquaint with physical access and oversight of environmental controls.
6. Provide how security policy affects the ongoing technical and administrative evaluation.

Course Outcomes: Upon successful completion of this course, student will be able to:

1. Identify threats that cause harm to assets.
2. Implement laws, ethics that avoids violations in security.
3. Understand security planning and technology.
4. Implement cryptography algorithms to provide security.
5. Understand security issues and the corresponding solutions.
6. Implement information security,employment policies and practices.

Course Prerequisites: Data Communications (16IT C09)

UNIT – I

Introduction to Information Security: History of Information Security, What Is Security,CNSS security model,Components of an Information System, Balancing Information Security and Access, Approaches to Information Security Implementation, Security in the Systems Life Cycle, Security Professionals and the Organization.

Need for Security: Business needs, Threats and Attacks, Compromises to Intellectual Property, Deviations in Quality of Service, Espionage or Trespass, Forces of Nature, Human Error or Failure, Information Extortion, Sabotage or Vandalism, Software Attacks, Technical Hardware Failure or Errors,Technical Software Failure or Errors, Technological Obsolescence, Theft.

UNIT – II

Legal, Ethical and Professional Issues in Information Security: Introduction, Law and Ethics in Information Security, Relevant U.S Laws, International Laws and Legal Bodies,Ethics and Information Security, Codes of Ethics at Professional Organization, Key U.S.Federal Agencies.

Risk management: An Overview of Risk Management, Risk Identification, Risk assessment, Risk Control, Quantatitive versus Qualitative Risk Management Practices, Recommended Risk Control Practices.

UNIT – III

Planning for Security: Introduction, Information Security Planning and Governance, Information Security Policy, Standards and Practices, the Information Security Blue Print, Security Education, Training and Awareness Program, Continuity Strategies.

Security Technology: Introduction, Access Control, Firewalls, Intrusion detection and prevention systems, Honey pots,Honey nets, Padded Cell Systems, Scanning and Analysis Tools.

UNIT – IV

Cryptography: Introduction, Foundations of Cryptology, Cipher methods, cryptographic Algorithms Cryptographic Tools, Protocols for Secure Communications.

Physical Security: Introduction,Physical Access Controls,Fire Security and Safety,Failure of Supporting Utilities and Structural Collapse, Interception of Data,Securing Mobile and Portable Systems,Special Considerations for Physical Security

UNIT – V

Implementing Information Security: Introduction, Information Security Project Management, TechnicalAspects of Implementation, Non technical Aspects of Implementation, Information Systems Security Certification and Accreditation.

Security and Personnel: Introduction,Positioning and Staffing Security Function, Employment Policies and Practices, Security Considerations for Temporary Employees, Consultants and Other Workers, Internal Control Strategies, Privacy and the Security of Personnel Data

Information security Maintenance: Introduction, Security Management Maintenance Models, Digital Forensics.

Text Books:

1. Michael E. Whitman, Hebert J Mattord, “Principles of Information Security”, 5th Edition, Cengage Learning, 2014.
2. Thomas R Peltier, Justing Peltier, JohnBlackley, “Information Security Fundamentals”, Auerbacj Publications, 2010.
3. William Stallings “Cryptography and Network Security Principles and Practice”, 6th Edition, Pearson, 2014.

Suggested Reading:

1. Dr.V.K.Jain,”Cryptography and Network Security”, 1st Edition, Khanna Book publishing, 2013.
2. Marks Merkow, Jim Breithaupt, “Information Security: Principle and Practices”, 2nd Edition, Pearson Education, 2014.

Web Resources:

1. https://www.sans.org/security-resources/
2. https://nptel.ac.in/courses/106106129/

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16IT C34

BIG DATA ANALYTICS

Instruction	3L Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course is introduced to

1. To explain the importance of big data, role of Hadoop framework in analyzing large datasets.
2. To gain knowledge of writing mapper and reducer for a given problem.
3. To provide the concepts of NoSQL databases and the working mechanisms of MongoDB.
4. To familiarize writing queries in Pig and Hive to process big data.
5. To discuss the concept and writing applications using Spark
6. To acquaint with Scala Programming constructs

Course Outcomes: Upon successful completion of the course, student will be able to

1. Understand processing large datasets in Hadoop framework.
2. Develop applications using MapReduce framework to solve real world problems.
3. Develop data models using MongoDB.
4. Develop scripts using Pig to process large datasets and understand querying using hive from a data warehouse.
5. Understand the fundamentals of the Spark and expertise in using Resilient Distributed Datasets (RDD) for creating applications in Spark.
6. Develop functional programs using Scala.

Course Prerequisites: Java Programming (16ITC10), Python Programming (16ITE01)

UNIT – I

Introduction to Big Data: Importance of Big Data, when to considerBig Data as a solution, Big Data use cases: IT for IT Log Analytics, the Fraud Detection Pattern, and Social Media Pattern.
The Hadoop Distributed Files system: The Design of HDFS, HDFS Concepts, Blocks, Name nodes and Data nodes, Block Caching, HDFS Federation, HDFS

High Availability, The Command-Line Interface, Basic File system Operations, Hadoop File systems, Interfaces, The Java Interface, Reading Data from a Hadoop URL, Reading Data Using the File System API, Writing Data, Directories, Querying the File system, Deleting Data, Data Flow, Anatomy of a File Read, Anatomy of a File Write.

UNIT – II

MapReduce: What is Map reduce, Architecture of map reduce.**How MapReduce Works**: Anatomy of a MapReduce Job Run, Job Submission, Job Initialization, Task Assignment, Task Execution, Progress and Status Updates, Job Completion, Failures, Task Failure, Application Master Failure, Node Manager Failure, Resource Manager Failure, Shuffle and Sort, The Map Side, The Reduce Side, MapReduce Types and Formats: MapReduce Types, The Default MapReduce Job, Input Formats,Input Splits and Records, Text Input, Output Formats, Text Output.
Developing MapReduce Applications on contemporary problems.

UNIT – III

No SQL Databases: Review of traditional Databases, Need for NoSQL Databases, Columnar Databases, Failover and reliability principles, CAP Theorem, Differences between SQL and NoSQL databases.
Working mechanisms of Mongo DB: Overview, Advantages, Environment, Data Modeling, Create Database, Drop Database, Create collection, Drop collection, Data types, Insert, Query, Update and Delete operations, Limiting and Sorting records, Indexing, Aggregation.

UNIT – IV

Pig: Installing and Running Pig, an Example, Generating Examples, Comparison with Databases, Pig Latin, User-Defined Functions, Data Processing Operators, Pig in Practice.
Hive: Installing Hive, The Hive Shell, An Example, Running Hive, Comparison with Traditional Databases, HiveQL, Tables, Querying Data, User-Defined Functions, Writing a User Defined Functions, Writing a User Defined Aggregate Function.

UNIT – V

Spark: Importance of Spark Framework, Components of the Spark unified stack, Batch and Real-Time Analytics with Apache Spark, Resilient Distributed Dataset (RDD), SCALA (Object Oriented and Functional Programming)**Scala**: Scala Environment Set up, Downloading and installing Spark standalone, Functional Programming, Collections.

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Text Books:

1. Tom White, “Hadoop: The Definitive Guide”, 4th Edition, O’Reilly Media Inc, 2015.
2. Tanmay Deshpande, “Hadoop Real-World Solutions Cookbook”, 2nd Edition, Packt Publishing, 2016.

Suggested Reading:

1. Thilinagunarathne,”Hadoop MapReduce v2 Cookbook”, 2ndEdition, Packet Publishing, 2015.
2. Chuck Lam, Mark Davis, AjitGaddam, “Hadoop in Action”, Manning Publications Company, 2016.
3. Alan Gates, “Programming Pig”, O’Reilly Media Inc, 2011.

Web Resources:

1. http://www.planetcassandra.org/what-is-nosql
2. http://www.iitr.ac.in/media/facspace/patelfec/16Bit/index.html
3. https://class.coursera.org/datasci-001/lecture
4. http://bigdatauniversity.com

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16IT E10

HUMAN COMPUTER INTERACTION

(Elective - IV)

Instruction	3L Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course objectives: This Course is introduced to

1. Present the characteristics of graphical and web user interface, design and system menus.
2. Facilitate learning of different kinds of windows, device based and screen based controls.
3. Familiarize with feedback, internationalization, color, graphics, images and icons.
4. Impart knowledge about prototype modelling for an interactive product.
5. Impart knowledge about the structure and the representational dynamics of the cognitive system interacting with the computer.
6. Discuss interaction design and evaluation framework.

Course Outcomes: Upon successful completion of the course, student will be able to

1. Comprehend the characteristics of Graphical and web user interface, design and system menus.
2. Choose proper kinds of windows, device based and screen based controls.
3. Understand feedback, internationalization, color, graphics, images and icons.
4. Describe prototype modelling methods.
5. Demonstrate an understanding of principles, and theories influencing human computer interaction.
6. Understand the role of text, sound and touch in interaction design.

Course Prerequisites: IT Workshop (18ITC08)

UNIT – I

The Importance of the User Interface: Defining the User Interface, The Importance of Good Design, **Characteristics of Graphical and Web User Interfaces:** The

Graphical User Interface, The Web User Interface: Characteristics of a Web Interface, **Principles of User Interface Design:** General Principles.

The User Interface Design Process: Obstacles and Pitfalls in the Development Path, Usability, the Design Team, **Know Your User or Client:** Understanding How People Interact with Computers, Important Human Characteristics in Design, Human Considerations in Design, Human Interaction Speeds, Methods for Gaining an Understanding of Users, **Understand the Principles of Good Screen Design:** Human Considerations in Screen Design, **Develop System Menus and Navigation Schemes:** Structures of Menus, Functions of Menus, Content of Menus, Formatting of Menus, Phrasing the Menu, Selecting Menu Choices, Kinds of Graphical Menus

UNIT – II

Select the Proper Kinds of Windows: Window Characteristics, Components of a Window, Window Presentation Styles, Types of Windows, Window Management, Organizing Window Functions, Window Operations, **Select the Proper Device-Based Controls:** Characteristics of Device-Based Controls, **Choose the**

Proper Screen-Based Controls: Operable Controls, Text Entry/Read-Only Controls, Combination Entry/Selection Controls, Other Operable Controls, Presentation Controls, Selecting the Proper Controls, **Write Clear Text and Messages.**

UNIT – III

Provide Effective Feedback, Guidance and Assistance, Provide Effective Internationalization and Accessibility, Create Meaningful Graphics, Icons and Images, Choose the Proper Colors, Organize and Layout Windows and Pages.

UNIT – IV

Interaction Design – Introduction, Goals of Interaction Design, Heuristics and Usability principles, **Conceptualizing interaction:** Problem Space, conceptual models, interface metaphors, paradigms. **Understanding Users**: cognition, Conceptual frame works for cognition, **Collaboration and Communication:** Social mechanisms, Conceptual frameworks.

UNIT – V

Understanding how interfaces affect users: Affective aspects, Expressive interfaces, User frustration, Agents, **Process of Interaction Design:** What is interaction design about? Life cycle models, **Design, prototyping and Construction:** Prototyping and construction, Conceptual Design, Physical Design, **Introducing Evaluation:** Introduction, What, Why and when to evaluate, **Evaluation Framework, Testing and modeling users.**

Text Books:

1. Wilbert O. Galitz, "The essential guide to User Interface Design", Wiley Dreamtech, 2002.
2. Sharp, Rogers, Preece, "Interaction Design", 2nd Edition, John Wiley, 2008
3. Steven Heim, "The Resonant Interface: HCI Foundations for Interaction Design", Addison-Wesley, 2007.

Suggested Reading:

1. J. Preece, Y. Rogers, and H. Sharp, "Interaction Design: Beyond Human-Computer Interaction", Wiley & Sons, 2nd Edition, 2007.
2. Ben Shneiderman,Catherine Plaisant, "Designing the User Interface: Strategies for Effective Human-Computer Interaction", 5th Edition, Addison-Wesley, 2009.

Web Resources:

1. http://openclassroom.stanford.edu/MainFolder CoursePage.php?course=HCI
2. http://hcibib.org/hci-sites/history
3. http://www.hcirn.com/tutor/index.php

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a FET, Modeling small MOSFET, scaling. MOSFET as switches, pass characteristics, logic gates using CMOS, Bubble pushing, XOR and XNOR gates, AOI and OAI logic gates, transmission gates. TG based 2-to-1 MUX, XOR, XNOR, OR circuits.

UNIT – II

Physical structure of CMOS ICs, IC layers, layers used to create a MOSFET, Top and side view of MOSFETs, Silicon patterning or layouts for series and parallel connected FETs. Layouts of NOT gate, transmission gate, non-inverting buffer, NAND2, NOR2, Complex logic gate, 4 input AOI gate. Stick diagram representations. Layouts of Basic Structure: nwells, active area definition, design of n+, p + regions, masks for the n-FET, active contact cross section and mask set, metal1 line with active contact, poly contact: cross section and layout, Vias and higher level metals, Latchup prevention.

UNIT – III

Fabrication of CMOS ICs, CMOS process flow, Design rules: minimum space width, minimum spacing, surround, extension, cell concepts and cell based design, logic gates as basic cells, creation of new cell using basic gates. DC characteristics of the CMOS inverter symmetrical inverter, layouts, Inverter switching characteristics, RC switch model equivalent for the CMOS inverter, rise time and fall time calculation.

UNIT – IV

Pseudo n-MOS, tri-state inverter circuits, clocked CMOS, charge leakage, Dynamic CMOS logic circuits, pre-charge and evaluation charge sharing, Domino logic, Dual rail logic networks, differential Cascade Voltage Switch Logic (CVSL) AND/NAND, OR/NOR gates, The SRAM, 6T SRAM cell design parameters, writing to an SRAM, SRAM arrays, Dynamic RAMs: 1T RAM cell, charge leakage and refresh in a DRAM cell, ROM array using pseudo n-MOS circuitry, floating gate MOSFET, effect of charge storage on the floating gate.

UNIT – V

VLSI Design flow, structural gate level modeling, gate primitives, gate delays, switch level modeling, behavioural and RTL operators, timing controls, blocking and non blocking assignments, conditional statements, Data flow modeling and RTL, Arithmetic circuits; half adder, full adder, ripple carry adders, carry look ahead adders, High speed adders, multipliers. Interconnect modeling; Interconnect resistance and capacitance sheet resistance Rs,single and multiple rung ladder circuits, cross talk, floor planning and routing, clocking, Testing of VLSI circuits.

Text Books:

1. John P. Uyemura, “Introduction to VLSI circuits and Systems”, John Wiley & Sons, 2002.
2. Douglas A. Pucknell, Kamran Eshraghian, “Basic VLSI Design” 3rd Edition, PHI, 2000.

Suggested Reading:

1. John P. Uyemura, “Chip design for submicron VLSI: CMOS layout and simulation” IE, Cengage learning, 2006.
2. Jan M. Rabey and others “Digital Integrated Circuits A design perspective”, Pearson Education, 2003.
3. Kamran Eshraghian, Douglas A. Pucknell, and Sholeh Eshraghian, “Essentials of VLSI circuits and systems”, PHI, 2011.

Web Resources:

1. http://www.chwa.com.tw/fea/4kCgy2008610090733 2008610090733LF0RE2KZBA.pdf
2. http://nptel.ac.in/courses/117101058/downloads/Lec-2.pdf
3. https://slideplayer.com/slide/7713916/

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16IT E13

NATURAL LANGUAGE PROCESSING

(Elective -V)

Instruction	3L Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course introduces

1. Theoretical concepts of language processing that shows how to explore interesting bodies of text.
2. Fundamental topics in language processing that include tagging, classification, and information extractionusing tiny Python programs.
3. Formal grammar to describe the structure of an unlimited set of sentences.
4. Methods to parse a sentence, recognize its syntactic structure and construct representations of meaning.
5. Effective management of linguistic data.
6. Design of existing corpora, the typical workflow forcreating a corpus and the life cycle of a corpus.

Course Outcomes: Upon successful completion of this course, student will be able to

1. Comprehend the concept of natural language processing, its challenges and applications.
2. Demonstrate skills in natural language processing using the Python programming language and the Natural Language Toolkit (NLTK) open source library.
3. Extract information from unstructured text, either to guess the topic or identify "named entities".
4. Analyze linguistic structure in text, including parsing and semantic analysis.
5. Access popular linguistic databases, including WordNet and treebanks.
6. Integrate techniques drawn from fields as diverse as linguistics and artificial intelligence.

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Course Prerequisites: Python Programming (16ITE01)

UNIT– I

Language Processing: Computing with Language- Texts and Words, A Closer Look at Python: Texts as Lists of Words, Computing with Language- Simple Statistics, Automatic Natural Language Understanding, **Accessing Text Corpora and Lexical Resources**: Accessing Text Corpora, Conditional Frequency Distributions, Lexical Resources, Word Net

UNIT– II

Processing Raw Text: Strings- Text Processing at the Lowest Level, Text Processing with Unicode, Regular Expressions for Detecting Word Patterns, Useful Applications of Regular Expressions, Normalizing Text, Regular Expressions for Tokenizing Text, Segmentation, Formatting: From Lists to Strings

Categorizing and Tagging Words: Mapping Words to Properties Using Python Dictionaries, Automatic Tagging, N-Gram Tagging, Transformation-Based Tagging

UNIT– III

Learning to Classify Text: Supervised Classification, Evaluation, Modeling Linguistic Patterns, **Extracting Information from Text**: Information, Chunking, Developing and Evaluating Chunkers Recursion in Linguistic Structure .

UNIT— IV

Analyzing Sentence Structure: Context-Free Grammar, Parsing with Context-Free Grammar,Dependencies and Dependency Grammar, Grammar Development

Building Feature-Based Grammars: Grammatical Features,Processing Feature Structures,Extending a Feature-Based Grammar

UNIT– V

Analyzing the Meaning of Sentences: Natural Language Understanding, Propositional Logic, First-Order Logic, the Semantics of English Sentences.

Managing Linguistic Data: Corpus Structure: A Case Study, the Life Cycle of a Corpus, Acquiring Data.

Text Book:

1. Steven Bird, Evan Klein, Edward Loper, "Natural Language Processing with Python", O'Reilly Media, Inc., 2009.

Medium Access Control: Motivation for a specialized MAC: Hidden and Exposed terminals. Near and Far terminals; SDMA, FDMA, TDMA: Fixed TDM, Classical Aloha, Slotted Aloha, Carrier sense multiple access, Demand assigned multiple access, PRMA packet reservation multiple access, Reservation TDMA, Multiple access with collision avoidance, Polling, Inhibit sense multiple access; CDMA: Spread Aloha multiple access.

UNIT–II

Mobile Devices And Systems-Features of Mobile Smart Phones,Digital Music Players, Hand-held Pocket Computers, Operating Systems of Hand-held Devices and their features, Smart Systems- Smart cards, Smart labels, RFID, Smart Tokens, Sensors and Actuators, Set-top Boxes,Limitations of Mobile Devices,Automotive Systems.

GSM: Mobile services, System architecture, Localization, Call Handling, Handover, Security, New data services, Features of HSPA 3G Network, HSPA+, Long Term Evolution (LTE), WiMax and 4G LTE Advanced and WiMax 802.16m Networks.

UNIT–III

Mobile Network Layer: Mobile IP: Goals, assumptions and requirements, Entities and Terminology, IP packet delivery, Agent advertisement and discovery, Registration, Tunneling and Encapsulation, Optimizations, Reverse tunneling, Ipv6; Dynamic host configuration protocol.

UNIT–V

Mobile Transport Layer : Traditional TCP: Congestion control, Slow start, Fast retransmit/fast recovery, Implications on mobility; Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit/fast recovery, Transmission/timeout freezing, Selective retransmission, Transaction oriented TCP.

UNIT–V

Databases and Mobile Computing: Data Hoarding Techniques, Data Caching-Cache Invalidation Mechanisms, Data Cache Maintenance and Web Cache Maintenance in Mobile Environments, Power-aware Mobile Computing, Context-aware Computing.

Data Dissemination: Communication Asymmetry, Classification of Data Delivery mechanisms: Push-based mechanisms, Pull-based mechanisms, Hybrid mechanisms.

Data Synchronization: Synchronization in Mobile Computing Systems, Usage Models for Synchronization, Domain-dependent Specific rules for Data Synchronization, Personal Information Manager (PIM), Synchronization and Conflict resolution strategies, Synchronizer.

Text Books:

1. Jochen, M Schiller, “Mobile Communications”, 2^{nd} Edition Pearson Education, India, 2012.
2. Raj Kamal, “Mobile Computing”, 2^{nd} Edition, Oxford University Press, 2013.

Suggested Reading:

1. Reza B, “Mobile Computing Principles”, Cambridge University press, 2005.
2. Frank Adelstein, S.K.S. Gupta, Golden G. Richard III, Loren Schwiebert, “Fundamentals of Mobile and Pervasive Computing”, McGraw-Hill Professional Publication.
3. KurnkumGarg, “Mobile Computing”, Pearson Education, 2010.
4. K. Pahlavan, P. Krishnamurthy, “Principles of Wireless Networks”, Prentice Hall.
5. D.P. Agrawal, Q.A. Zeng, “Introduction to Wireless and Mobile Systems”, Thomson Brooks/Cole.

Web Resource:

1. https://onlinecourses.nptel.ac.in/noc16_cs13/preview

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16IT E15

BUSINESS INTELLIGENCE
(Elective -V)

Instruction	3L Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course is introduced to

1. Focus on designing and building a business intelligent system.
2. Acquaint with advanced database techniques.
3. Acquire and understand mathematical concepts to develop data centric decision models.
4. Design and develop data Warehouse using Various Schema and Dimensional modelling.
5. Design data architectures.
6. Familiarize with differentreport generating techniques.

Course Outcomes: After successful completion of this course, student will be able to

1. Gain knowledge in the theory, principles and applications of business intelligent system.
2. Design and implement OLTP, OLAP and Warehouse concepts.
3. Design a data model and use relevant techniques for data analysis
4. Use Analytics concepts like data mining, Exploratory and statistical techniques for predictive analysis in Business Intelligence.
5. Represent different data Architectures.
6. Build Business Intelligence reports.

Course Prerequisites: Database Systems (16ITC17), Data Warehousing and Data Mining (16ITC25)

UNIT–I

Business Intelligence And Its Impact : Introduction, Information Pyramid – Data, Information, Knowledge, What is Business Intelligence,Factors Driving Business Intelligence,Business Intelligence And Related Technologies, Business Intelligence in Contemporary Organizations,Obstacles To Business Intelligence.

UNIT–II

Business Intelligence Capabilities: Four Synergic Capabilities, Organizational Memory,Information Integration, Insight Creation,Presentation.
Technologies Enabling Organizational Memory: Data Warehouse: ER Modeling,

Dimensional Modeling, Designing Enterprise Architecture, Knowledge Repositories.

UNIT–III

Representation of Data in Data Warehouse: Dimensional Modelling:The STAR and SNOWFLAKE schema, Pros & Cons of the STAR/SNOWFLAKE Schema.
Technologies Enabling Presentation: Online Analytical Processing(OLAP), Online Transaction Processing(OLTP), OLAP Versus OLTP, Impact Of Business Intelligence On Corporate Performance,
The Central Repository – Meta data, Information Consumption User Interfaces – Desktop Vs. Web Vs. Mobile, Open Architecture, Scalability, Performance in BI – In Memory Analytics.

UNIT–-V

BI Project Life cycle: Typical BI Project Life cycle, Requirements Gathering & Analysis – Functional & Non Functional Requirements, Reports & Dashboards Design – Mock-up and Story boarding, testing in a BI Project, BI Project Deployment, and Post Production Support.

UNIT–V

Introduction to Enterprise Class: BI Tool First Level of Abstraction of the Data Warehouse in Micro Strategy, **Building the Schema Objects** – Attributes, Facts, Transformation & Hierarchies, **Building Reusable Application Objects** – Metrics, Filters, Prompts, Five Styles of BI, Building Reports – Grids & Graphs, Report Manipulation over the Web – Pivoting, Sorting, Drilling, Exporting etc., Setting up Report Distribution, Report Project.

Text Books:

1. Sabherwal R. and Becerra-Fernandez I., “Business Intelligence”, Wiley.
2. R. Sharda, D. Delen, E. Turban, “Business Intelligence and Analytics: Systems for Decision Support”, 10th Edition, Pearson/Prentice Hall.

Suggested Reading:

1. Kimball R., Ross M., “The Kimball Group Reader: Relentlessly Practical Tools for Data Warehousing and Business Intelligence”, Wiley and Sons, 2010.
2. Carlo Vercellis, “Business Intelligence: Data Mining and Optimization for Decision Making”, Wiley Publications, 2009.
3. Jim Mazzullo,”SAP R/3 for Everyone”, Pearson, 2007.

Web Resources:

1. http://www.teradatamagazine.com/v13n01/Features/A-Better-Data-Plan/ (accessed September 2013).
2. https://www.youtube.com results?search_query=Business+Analytic+and+intelligence
3. https://www.youtube.com results?search_query=Business+Analytic+and+intelligence+IIT

16IT C35

BIG DATA ANALYTICS LAB

Instruction	3P Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	2

Course Objectives: This course is introduced to

1. Provide the knowledge to setup a Hadoop Cluster.
2. Impart knowledge to develop programs using MapReduce.
3. Discuss Pig, PigLatin and HiveQL to process big data.
4. Familiarize with NoSQL databases.
5. Presentlatest big data frameworks and applications using Spark and Scala.
6. IntegrateHadoop with R (RHadoop) to process and visualize.

Course Outcomes: Upon successful completion of this course, student will be able to

1. Understand Hadoop working environment.
2. Work with big data applications in multi node clusters.
3. Apply big data and echo system techniques for real world problems.
4. Write scripts using Pig to solve real world problems.
5. Write queries using Hive to analyze the datasets
6. Understand spark working environment.

Course Prerequisites: Java Programming (16ITC10), Python Programming (16ITE01)

List of Programs

1. Understanding and using basic HDFS commands
2. Word count application using Mapper Reducer on single node cluster
3. Analysis of Weather Dataset on Multi node Cluster using Hadoop
4. Real world case studies on Map Reduce applications
5. Working with files in Hadoop file system: Reading, Writing and Copying
6. Writing User Defined Functions/Eval functions for filtering unwanted data in Pig
7. Working with Hive QL

8. Writing User Defined Functions in Hive
9. Understanding the processing of large dataset on Spark framework.
10. Integrating Hadoop with other data analytic framework like R

Text Books:

1. Tom White, “Hadoop: The Definitive Guide”, 4th Edition, O’Reilly Inc, 2015.
2. Tanmay Deshpande, “Hadoop Real-World Solutions Cookbook”, 2nd Edition, Packt Publishing, 2016.

Suggested Reading:

1. Edward Capriolo, Dean Wampler, and Jason Rutherglen, “Programming Hive”, O’Reilly Inc, 2012.
2. VigneshPrajapati, “Big data Analytics with R and Hadoop”, Packt Publishing, 2013.

Web Resources:

1. https://parthgoelblog.wordpress.com/tag/hadoop-installation
2. http://www.iitr.ac.in/media/facspace/patelfec/16Bit/index.html
3. https://class.coursera.org/datasci-001/lecture
4. http://bigdatauniversity.com

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16IT C36

EMBEDDED SYSTEMS AND IOT LAB

Instruction	3P Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	2

Course Objectives: This course is introduced to

1. Familiarize withinterfacing LEDs and switches using 8051 Microcontroller.
2. Aquaint with interface controls using 8051.
3. Explore design and development of an embedded system
4. Know the interfacing programs using Python.
5. Understand the applications using Raspberry Pi3.
6. Provide necessary knowledge to develop working code for real-world IoT applications.

Course Outcomes: Upon successful completion of this course, student will be able to

1. Possess the passion for acquiring programming skills in using different tools.
2. Able to design and develop embedded systems (hardware, peripherals and firmware).
3. Write code for different forms of interfacing devices.
4. Develop python programs that run on Raspberry Pi3
5. Interface Sensors and Actuators with Raspberry Pi3
6. Develop simple IoT systems using Raspberry Pi3 device and appropriate sensors and Django Framework.

Course Prerequisites: Microprocessors (16ITC11) and Python Programming (16ITE01).

List of Experiments

A. Use of 8-bit and 32-bit Microcontrollers, (such as 8051 Microcontroller, ARM2148 / ARM2378, LPC 2141/42/44/46/48) and C compiler (Keil, Ride etc.) to:
   1. Interface Input-Output and other units such as: Relays, LEDs, LCDs, Switches, Keypads, Stepper Motors, and ADCs.

   2. Develop Control Applications such as: Temperature Controller, Elevator Controller, Traffic Controller

B. Internet of Things (IoT) Experiments

Following are some of the programs that a student should be able to write and test on Raspberry Pi

1. Switching LED on/off from Raspberry Pi Console.
2. Interfacing an LED and Switch with Raspberry Pi.
3. Interfacing a Light Sensor with Raspberry Pi.
4. Interfacing Rain Sensing Automatic Wiper System.
5. Interfacing to identify accident and send alert messages.
6. Interfacing smoke sensor to give alert message to fire department.
7. Implementation of Traffic Light System based on density, to decrease congestion.
8. Design and develop IoT Solar Power Monitoring System.
9. Design and develop Patient health monitoring system.
10. Implementation of Home Automation System using WiFi Module.

Text Books:

1. Kenneth J.Ayala, “The 8051 Microcontroller”, 3rd Edition, Thomson, 2014.
2. ArshdeepBahga, Vijay Madisetti, “Internet of Things: A Hands-on Approach”, Universities Press, 2014.

Suggested Reading:

1. Raj Kamal, “Embedded Systems”, 2nd Edition, McGraw Hill, 2015.
2. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, “From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence”, 1stEdition, Academic Press, 2014.
3. Francis daCosta, “Rethinking the Internet of Things: A Scalable Approach to Connecting Everything”, 1st Edition, Apress Publications, 2013.

Web Resources:

1. https://www.edgefx.in/8051-microcontroller-architecture/
2. http://www.circuitbasics.com/raspberry-pi-ds18b20-temperature-sensor-tutorial/
3. https://raspberrypihq.com/making-a-led-blink-using-the-raspberry-pi-and-python/

UNIT– I

Industrial Designs: What is an industrial design. How can industrial designs be protected? What kind of protection is provided by industrial designs? How long does the protection last? Why protect industrial designs?

UNIT– III

Trademarks: What is a trademark, Rights of trademark? What kind of signs can be used as trademarks. Types of trademark, function does a trademark perform, How is a trademark protected? How is a trademark registered. How long is a registered trademark protected for? How extensive is trademark protection. What are well-known marks and how are they protected? Domain name and how does it relate to trademarks? Trademark infringement and passing off.

UNIT– IV

Copyright: What is copyright. What is covered by copyright. How long does copyright last? Why protect copyright? Related Rights: what are related rights.Distinction between related rights and copyright. Rights covered by copyright? Copy rights in computer programming.

UNIT– V

Enforcement of Intellectual Property Rights: Infringement of intellectual property rights Enforcement Measures Emerging issues in Intellectual property protection. Case studies of patents and IP Protection.

Unfair Competition: What is unfair competition.Relationship between unfair competition and intellectual property laws.

Text Books:

1. Ajit Parulekar and Sarita D' Souza, "Indian Patents Law – Legal & Business Implications", Macmillan India ltd , 2006.
2. B. L.Wadehra; "Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications", Universal law Publishing Pvt. Ltd., India 2000.
3. P. Narayanan, "Law of Copyright and Industrial Designs", Eastern law House, Delhi 2010.

Suggested Reading:

1. W.R1 Cronish, "Intellectual Property; Patents, copyright, Trad and Allied rights", Sweet & Maxwell, 1993.
2. P. Narayanan, "Intellectual Property Law", Eastern Law Edition, 1997.
3. Robin Jacob and Daniel Alexander, "A Guide Book to Intellectual Property Patents, Trademarks, Copy rights and designs", 4^{th} Edition, Sweet, Maxwell.

16ME O06

RESEARCH METHODOLOGIES

(Open Elective - I)

Instruction	3L Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To make the students to formulate the research problem
2. To identify various sources for literature review and data collection.
3. To prepare the research design
4. To equip the students with good methods to analyze the collected data
5. To explain how to interpret the results and report writing

Course Outcomes: At the end of the course, the students are able to

1. Define research problem
2. Review and asses the quality of literature from various sources.
3. Understand and develop various research designs.
4. Analyze problem by statistical techniques: ANOVA, F-test, Chi-square
5. Improve the style and format of writing a report for technical paper/ Journal report

UNIT– I

Research Methodology: Objectives and Motivation of Research, Types of Research- Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, Conceptual vs. Empirical, Research Approaches, Significance of Research, Research Methods verses Methodology, Research process, Criteria of Good Research, Problems Encountered by Researchers in India, Technique involved in defining a problem.

UNIT—I

Literature Survey: Importance of Literature Survey, Sources of Information-primary, secondary, tertiary, Assessment of Quality of Journals and Articles, Information through Internet.

UNIT– III

Research Design: Meaning of Research Design, Need of Research Design, Feature of a Good Design Important Concepts Related to Research Design, Different Research Designs, Basic Principles of Experimental Design, Steps in sample design

UNIT-IV

Data Collection: Collection of primary data, Secondary data, Measures of central tendency-mean, mode, median, Measures of dispersion- Range, Mean deviation, Standard deviation, Measures of asymmetry (skewness), Important parametric tests -z, t, F, Chi-Square, ANOVA significance

UNIT-V

Research Report Writing: Format of the Research report, Synopsis, Dissertation, Thesis its Differentiation, References/Bibliography/Webliography, Technical paper writing/Journal report writing, making presentation, Use of visual aids. Research Proposal Preparation- Writing a Research Proposal and Research Report, Writing Research Grant Proposal.

Text Books:

1. C.R Kothari, "Research Methodology, Methods & Technique", New Age International Publishers, 2004.
2. R. Ganesan, "Research Methodology for Engineers", MJP Publishers, 2011.

Suggested Reading:

1. Vijay Upagade and Aravind Shende, "Research Methodology", S. Chand & Company Ltd., New Delhi, 2009.
2. G. Nageswara Rao, "Research Methodology and Quantitative methods", BS Publications, Hyderabad, 2012.
3. Ratan Khananabis and Suvasis Saha, "Research Methodology", Universities Press, Hyderabad, 2015.

16ME O07

INTRODUCTION TO OPERATIONS RESEARCH

(Open Elective - I)

Instruction	3L Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. Students will come to know the formulation of LPP models.
2. Students will understand the Algorithms of Graphical and Simplex Methods.
3. Students will understand the Transportation and Assignment techniques.
4. Students will come to know the procedure of Project Management along with CPM and PERT techniques.
5. Students will understand the concepts of sequencing.

Course Outcomes: At the end of the course, the students were able to

1. Formulate a managerial decision problem into a mathematical model.
2. Apply transportation problems in manufacturing industries.
3. Build and solve assignment models.
4. Apply project management techniques like CPM and PERT to plan and execute project successfully.
5. Apply sequencing concepts in industry applications.

UNIT–I

Introduction: Definition and Scope of Operations Research.

Linear Programming: Introduction, Formulation of linear programming problems, graphical method of solving LP problem, simplex method

UNIT–II

Transportation Models: Finding an initial feasible solution - North West Corner Method, Least Cost Method, Vogel's Approximation Method, Finding the optimal solution, Unbalanced Transportation problem, Degeneracy in Transportation,

UNIT–II

Assignment Techniques: Introduction, Hungarian technique of Assignment techniques, unbalanced problems, problems with restrictions, Maximization in Assignment problems.

UNIT-IV

Project Management: Definition, Procedure and Objectives of Project Management, Differences between PERT and CPM, Rules for drawing Network diagram, Scheduling the activities, Fulkerson's rule, Earliest and Latest times, Determination of critical path, duration of the project

UNIT-V

Sequencing Models: Introduction, General assumptions, processing 'n' jobs through two machines, processing 'n' jobs through three machines.

Text Books:

1. Hamdy, A. Taha, "Operations Research-An Introduction", Prentice Hall of India Pvt. Ltd., 6th Edition, 1997.
2. S.D. Sharma, "Operations Research", Kedarnath, Ramnath & Co., Meerut, 2009.
3. V.K. Kapoor, "Operations Research", S. Chand Publishers, New Delhi, 2004.

Suggested Reading:

1. Harvey M. Wagner, "Principles of Operations Research", 2nd Edition, Prentice Hall of India Ltd., 1980.
2. R. Paneer Selvam, "Operations Research", Second Edition, PHI Learning Pvt. Ltd., New Delhi, 2008
3. Nita H. Shah, Ravi M. Gor, Hardik Soni, "Operations Research", PHI Learning Private Limited, 2013

16ME O01

ENTREPRENEURSHIP

(Open Elective - II)

Instruction	3L Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: Student will understand

1. The environment of industry and related opportunities and challenges
2. Concept and procedure of idea generation
3. Elements of business plan and its procedure
4. Project management and its techniques
5. Behavioral issues and Time management

Course Outcomes: After completing this course, students will be able to:

1. Identify opportunities and deciding nature of industry
2. Brainstorm ideas for new and innovative products or services
3. Analyze the feasibility of a new business plan and preparation of Business plan
4. Use project management techniques like PERT and CPM
5. Analyze behavioural aspects and use time management matrix

UNIT–I

Indian Industrial Environment: Competence, Opportunities and Challenges, Entrepreneurship and Economic growth, Small Scale Industry in India, Objectives, Linkage among small, medium and heavy industries, Types of enterprises, Corporate Social Responsibility.

UNIT–II

Identification and Characteristics of Entrepreneurs: First generation entrepreneurs, environmental influence and women entrepreneurs, Conception and evaluation of ideas and their sources, Selection of Technology, Collaborative interaction for Technology development.

UNIT–III

Business Plan: Introduction, Elements of Business Plan and its salient features, Technical Analysis, Profitability and Financial Analysis, Marketing Analysis, Feasibility studies, Executive Summary.

Commission, National and State Commission of Women/Children/Minority/SC/ST

UNIT–II

A Right to Development: Socio-Economic and Cultural Effects of Globalization, Right to Education, Transparency in Governance and Right to Information, Consumer Protection act.

UNIT–IV

Environment Rights Such as Right to Clean Environment and Public Safety: Issues of Industrial Pollution, Prevention, and Rehabilitation, Safety aspects of New Technologies such as Chemical and Nuclear Technologies, Issues of Waste Disposal, Protection of Environment.

UNIT–V

Role of Advocacy Groups: (a) Professional bodies: Press, media role of Lawyers – Legal Aid., (b) Educational Institutions (c) Role of Corporate Sector (d) N.G.Os

Text Books:

1. Mr. Ishay, "The history of Human rights", Orient Longman, New Delhi, 2004.
2. S.N. Chaudhary, "Human Rights and Poverty in India: Theoretical Issues", Delhi: Concepts, 2005.
3. Anuradha Kumar, "Encyclopedia of Human Rights Development of under Privilege", New Delhi: Sarup, 2002.

Suggested Reading:

1. Venket Iyer, (ed.), Democracy, "Human Rights and the Rule of Law: Essays in Honour of Nani Palkhivala", New Delhi: Butterworth's, 2000.
2. R.J. Cook and C.G. Ngwena (ed.), "Health and Human Rights", OUP, Clarendon, 2007.
3. UNESCO, "Ethics of Science and Technology: Explorations of the Frontiers of Science and Ethics", OUP, Clarendon, 2006.

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16CE O02

DISASTER MITIGATION AND MANAGEMENT

(Open Elective - II)

Instruction	3L Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: To enable the student

1. To equip the students with the basic knowledge of hazards, disasters, risks and vulnerabilities including natural, climatic and human induced factors and associated impacts
2. To impart knowledge in students about the nature, causes, consequences and mitigation measures of the various natural disasters
3. To enable the students to understand risks, vulnerabilities and human errors associated with human induced disasters
4. To enable the students to understand and assimilate the impacts of any disaster on the affected area depending on its position/ location, environmental conditions, demographic, etc.
5. To equip the students with the knowledge of the chronological phases ina disaster management cycle and to create awareness about the disaster management framework and legislations in the context of national and global conventions

Course Outcomes: After successful completion of the course, student will be able to

1. Ability to analyse and critically examine existing programs in disaster management regarding vulnerability, risk and capacity at different levels
2. Ability to understand and choose the appropriate activities and tools and set up priorities to build a coherent and adapted disaster management plan
3. Ability to understand various mechanisms and consequences of human induced disasters for the participatory role of engineers in disaster management
4. To understand the impact on various elements affected by the disaster and to suggest and apply measures for the same

5. Develop an awareness of the chronological phases of disaster preparedness, response and relief operations for formulating effective disaster management plans and ability to understand various participatory approaches/strategies and their application in disaster management

UNIT-I

Introduction: Basic definitions- Hazard, Disaster, Vulnerability, Risk, Resilience, Mitigation, Management; classification of types of disaster- Natural and man-made; International Decade for natural disaster reduction (IDNDR); International strategy for disaster reduction (ISDR), National disaster management authority (NDMA).

UNIT-II

Natural Disasters: Hydro meteorological disasters: Causes, Early warning systems- monitoring and management, structural and non-structural measures for floods, drought and Tropical cyclones; Geographical based disasters: Tsunami generation, causes, zoning, Early warning systems- monitoring and management, structural and non-structural mitigation measures for earthquakes, tsunami, landslides, avalanches and forest fires. Case studies related to various hydro meteorological and geographical based disasters.

UNIT-III

Human induced hazards: Chemical disaster- Causes, impacts and mitigation measures for chemical accidents, Risks and control measures in a chemical industry, chemical disaster management; Case studies related to various chemical industrial hazards eg: Bhopal gas tragedy; Management of chemical terrorism disasters and biological disasters; Radiological Emergencies and case studies; Case studies related to major power break downs, fire accidents, traffic accidents, oil spills and stampedes, disasters due to double cellar construction in multi-storeyed buildings.

UNIT-IV

Disaster Impacts: Disaster impacts- environmental, physical, social, ecological, economical, political, etc.; health, psycho-social issues; demographic aspects-gender, age, special needs; hazard locations; global and national disaster trends; climate change and urban disasters.

UNIT-V

Concept of Disaster Management: Disaster management cycle – its phases; prevention, mitigation, preparedness, relief and recovery; risk analysis,

vulnerability and capacity assessment; Post-disaster environmental response-water, sanitation, food safety, waste management, disease control; Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR programmes in India and the activities of National Disaster Management Authority.

Text Books:

1. Pradeep Sahni,” Disaster Risk Reduction in South Asia”, Prentice Hall, 2003.
2. B. K. Singh,” Handbook of Disaster Management: techniques & Guidelines”, Rajat Publication, 2008.

Suggested Reading:

1. Ministry of Home Affairs”. Government of India, “National disaster management plan, Part I and II”,
2. K. K. Ghosh,” Disaster Management”, APH Publishing Corporation, 2006.
3. Hazards, Disasters and your community: A booklet for students and the community, Ministry of home affairs.

Web Resources:

1. http://www.indiaenvironmentportal.org.in/files/filedisaster_management_india1.pdf
2. http://www.ndmindia.nic.in/ (National Disaster management in India, Ministry of Home Affairs)

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Text Book:

1. Suneetha, Uma Bhrugubanda, DuggiralaVasanta, Rama Melkote,VasudhaNagaraj, AsmaRasheed, GoguShyamala, DeepaSreenivas and Susie Tharu "Towards a World of Equals: A Bilingual Textbook on Gender" published by Telugu Akademi, Hyderabad, Telangana State, 2015.

Suggested Reading:

1. Menon, Nivedita. Seeing like a Feminist. New Delhi: Zubaan-Penguin Books, 2012.

Web Resources:

1. Abdulali Sohaila. "I Fought For My Life…and Won." http://www.thealternative.in/lifestyle/i-fought-for-my-lifeand-won-sohaila-abdulal/
2. https://aifs.gov.au/publications/gender-equality-and-violence-against-women/introduction
3. https://theconversation.com/achieving-gender-equality-in-india

Note: Since it is an Interdisciplinary Course, Resource Persons can be drawn from the fields of English Literature or Sociology or Political Science or any other qualified faculty who has expertise in this field from engineering departments.

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16IT C38

SEMINAR

Instruction	3Hours per week
CIE	50 Marks
Credits	2

The goal of a seminar is to introduce students to critical reading, understanding, summarizing, explaining and preparing report on state of the art topics in a broad area of his/her specialization. Seminar topics may be chosen by the students with advice from the faculty members and the student shall read further relevant articles in the domain.

The seminar must be clearly structured and the power point presentation shall include following aspects:

1. Introduction to the field
2. Literature survey
3. Consolidation of available information
4. Summaryand Conclusions
5. References

Each student is required to:

1. Submit a one page synopsis of the seminar talk for display on the notice board.
2. Deliver the seminar for a maximum duration of 30 minutes, where the presentation should be for 20 minutes in PowerPoint, followed by Question and Answers session for 10 minutes.
3. Submit the detailed report of the seminar in spiral bound in a précised format as suggested by the department.

Seminars are to be scheduled from 3rd week to the last week of the semester and any change in schedule shall be discouraged.

For the award of sessional marks students are judged by three (3) faculty members and are based on oral and written presentations as well as their involvement in the discussions during the oral presentation.

Note: Topic of the seminar shall preferably be from any peer reviewed recent journal publications.

Guidelines for awarding marks		
Sl No.	Description	Max Marks
1.	Contents and relevance	10
2.	Presentation skills	10
3.	Preparation of PPT slides	05
4.	Questions and answers	05
5.	Report in a prescribed format	20

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16IT C39

PROJECT

Instruction	6 Hours per week
CIE	50 Marks
SEE	100 Marks
Credits	6

The object of Project is to enable the student extend further the investigative study, either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry. This is expected to provide a good training for the student(s) in R&D work and technical leadership. The assignment to normally include:

1. In depth study of the topic assigned
2. Review and finalization of the Approach to the Problem relating to the assigned topic
3. Preparing an Action Plan for conducting the investigation, including team work
4. Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed
5. Final development of product/process, testing, results, conclusions and future directions
6. Preparing a paper for Conference presentation/ Publication in Journals, if possible
7. Preparing a Dissertation in the standard format for being evaluated by the Department
8. Final Seminar presentation before Departmental Committee

Guidelines for the award of marks in CIE: (Max. Marks: 50)

Evaluation by	**Max .Marks**	**Evaluation Criteria / Parameter**
Department Review Committee	05	Review 1
	08	Review 2
	12	Submission
Supervisor	05	Regularity and Punctuality
	05	Work Progress
	05	Quality of the work which may lead to publications
	05	Report Preparation
	05	Analytical / Programming / Experimental Skills

UNIT–II

Inheritance: super and subclasses,Member access rules ,super keyword**,** Method overriding, Dynamic method dispatch , Abstract classes, using final with inheritance , Introduction to Object class.

Packages: Defining, Creating and Accessing a Package, Understanding CLASSPATH, importing packages.

Interfaces : Defining and implementing interfaces, Nested Interfaces.

Strings Handling: String & StringBuffer classes, StringTokenizer class and Wrapper classes and conversion between Objects and primitives.

Inner classes in Java: Types of inner classes, Creating static / non-static inner classes, Local and anonymous inner classes.

UNIT–III

Exception Handling in Java: what areExceptions? Exception types**,** Usage of try, catch, throw, throws and finally clauses, writing your own exception classes.

Multithreading in Java: The java Thread Model, How to create threads, Thread class in java, Thread priorities, Thread synchronization.

Generics: What are Generics? Generic classes, bounded types, Generic methods and interfaces.

UNIT–IV

Collections Framework: Overview of Collection Framework, Commonly used Collection classes – ArrayList, LinkedList, HashSet, LinkedHashSet, TreeSet, Collection Interfaces –Collection, List, Set, SortedSet, Accessing a collection via an Iteration,Storing user-defined classes in collections, Map Interfaces and Classes, Using a comparator. Legacy classes – Vector, Hashtable, The Enumeration interface.

Input/Output : How to read user input (from keyboard) using scanner class,Stream classes, InputStream, OutputStream, FileInputStream, FileOutputStream, Reader and Writer, FileReader, FileWriter cl asses. File class.

UNIT–V

GUI Design and Event Handling: Component, Container, window, Frame classes. Working with Frame window GUI Controls, Layout Managers, Introduction to Swings, Delegation Event Model, Event Classes, Source of Events, Event Listener Interfaces, Handling button click events, Adapter classes.Writing GUI Based applications.

Database Handling in Java: Java Database Connectivity (JDBC) using MySQL.

Text Books:

1. Herbert Schildt, “Java: The Complete Reference”, 8^{th} Edition, Tata McGraw Hill Publications, 2011.
2. Cay S. Horstmann, Gary Cornell, “Core Java, Volume I, Fundamentals”, 8^{th} Edition, Prentice Hall, 2008.

Suggested Reading:

1. Sachin Malhotra & Saurabh Choudhary, “Programming in Java”, 2^{nd} Edition, Oxford University Press, 2014.
2. C. Thomas Wu, “An introduction to Object-oriented programming with Java”, 4^{th} Edition, Tata McGraw-Hill Publishing company Ltd., 2010.
3. Kathy Sierra, Bert Bates, “Head First Java: A Brain-Friendly Guide” 2^{nd} Edition, O’Reilly,2005

Web Resources:

1. https://www.cse.iitb.ac.in/~nlp-ai/javalect_august2004.html.
2. http://nptel.ac.in/courses/106106147/
3. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-092-introduction-to-programming-in-java-january-iap-2010/lecture-notes/

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2. Francis da Costa, “Rethinking the Internet of Things: A Scalable Approach to Connecting Everything”, 1st Edition, Apress Publications, 2013.
3. Daniel Minoli, “Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications”, Willy Publications.

Web Resources:

1. The Internet of Things - Article
   https://dl.acm.org/citation.cfm?id=1862541
2. Internet of Things - Tutorial
3. http://archive.eurescom.eu/~pub/about-eurescoiem
   message_2009_02/Eurescom_message_02_2009.pdf
4. Publications on The Internet of Things.
   http://www.itu.int/osg/spu/publications/internetofthings
   InternetofThings_summary.pdf

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16IT C37

PROJECT SEMINAR

Instruction	3P Hours per week
CIE	50 Marks
Credits	2

The objective of 'Project Seminar' is to enable the student take up investigative study in the broad field of Engineering / Technology, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on an individual basis or two/three students in a group, under the guidance of a supervisor. This is expected to provide a good initiation for the student(s) towards R&D. The work shall include:

1. Survey and study of published literature on the assigned topic;
2. Working out a preliminary Approach to the Problem relating to the assigned topic;
3. Conducting preliminary Analysis/Modelling/Simulation/Experiment/ Design/Feasibility;
4. Preparing a Written Report on the Study conducted for Presentation to the Department;
5. Final Seminar, as oral Presentation before a departmental Committee.

Guidelines for the award of Marks:

Max. Marks: 50

Evaluation by	Max .Marks	Evaluation Criteria / Parameter
Supervisor	20	Project Status / Review
	5	Report
Department Committee	5	Relevance of the Topic
	5	PPT Preparation
	5	Presentation
	5	Question and Answers
	5	Report Preparation

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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY(A)
Choice Based Credit System (with effect from 2019-20)
B.E. (Information Technology)

Semester– VIII

S.No	Course Code	Title of the Course	Scheme of Instruction: Hours per Week L/T	P/D	Scheme of Examination: Duration of SEE in Hours	Maximum Marks CIE	SEE	Credits
THEORY								
1		Elective-VI	3	-	3	30	70	3
2		Open Elective-I	3	-	3	30	70	3
3		Open Elective-II	3	-	3	30	70	3
4	16ITC 38	Seminar	3	-	-	50	-	2
5	16ITC 39	Project	-	6	Viva-Voce	50	100	6
		TOTAL	12	6	-	190	310	17

L: Lecture T: Tutorial D: Drawing P: Practical
CIE-Continuous Internal Evaluation SEE-Semester End Examination

Elective-VI

S.No.	Subject Code	Subject Name
1.	16ITE 16	Virtual Reality
2.	16ITE 17	Social Media Analytics
3.	16ITE 18	Cloud Computing

Open Elective-I

S.No.	Subject Code	Subject Name
1.	16MEO 02	Robotics
2.	16MEO 04	Intellectual Property Rights
3.	16MEO 06	Research Methodologies
4.	16MEO 07	Introduction to Operations Research

Open Elective-II

S.No.	Subject Code	Subject Name
1.	16MEO 01	Entrepreneurship
2.	16MEO 03	Human Rights and Legislature Procedures
3.	16CEO 02	Disaster Mitigation and Management
4.	16EGO 02	Gender Sensitization

16IT E17

SOCIAL MEDIA ANALYTICS

(Elective -VI)

Instruction	3L Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course is introduced to

1. Present basics of Social media mining and challenges in mining social media data.
2. Discuss graph essentials, network essentials and network models for social media mining.
3. Deal with the process of detecting, analyzing communities and Information diffusion in the context of Social media analytics.
4. Impart knowledge about mining essentials and importance of influence and homophily.
5. Discuss recommendation systems in the context of social media.
6. Present the working of prediction systems.

Course Outcomes: Upon completing this course, students will be able to:

1. Understand and analyze the challenges posed by social media data.
2. Represent social media using a suitable network model.
3. Perform community analysis and analyze herd behavior.
4. Model, measure and distinguish between influence and homophily.
5. Understand and build recommendation systems.
6. Understand how a prediction system works.

UNIT– I

Introduction: Social Media Mining, New Challenges for Mining.
Graph Essentials: Graph Basics, Graph Representation, Types of Graphs, Connectivity in Graphs, Special Graphs, Graph Algorithms,
Network Measures: Centrality, Transitivity and Reciprocity, Balance and Status, Similarity, Network Models: Properties of Real-World Networks, Random Graphs, Small-World Model, Preferential Attachment Model.

UNIT– II

Community Analysis: Community Detection, Community Evolution, Community Evaluation, Information**Diffusion in Social Media:** Herd Behaviour, Information Cascades, Diffusion of Innovations, Epidemics.

UNIT– III

Data Mining Essentials: Data, Data Preprocessing, Data Mining Algorithms, Supervised Learning, Unsupervised Learning,
Influence and Homophily: Measuring Assortativity, Influence, Homophily, Distinguishing Influence and Homophily.

UNIT– V

Recommendation in Social Media: Challenges, Classical Recommendation Algorithms, Recommendation Using Social Context, Evaluating Recommendations, Behavior Analytics: Individual Behavior, Collective Behavior.

UNIT– V

Prediction: Predicting the future, Prediction of learning, Predicting elections, Predicting Box offices, Predicting Stock market, Closing predictions.

Text Books:

1. Zafarani R., Abbasi M.A., Liu H, “Social Media Mining: An Introduction”, Cambridge University Press, 2014.
2. Lutz Finger, Soumitra Dutta, “Ask, Measure, Learn: Using Social Media Analytics to Understand and Influence Customer Behavior”, O’Reilly Media, 2014.

Suggested Reading:

1. David Easley and Jon Kleinberg, “Networks, Crowds and Markets”, Cambridge University Press, 2010
2. Bing Liu, “Sentiment Analysis: mining opinions, sentiments, and emotions”, Cambridge University Press, 2015.
3. Matthew A. Russell, “Mining the Social Web: Analyzing Data from Facebook, Twitter, LinkedIn, and Other Social Media Sites”, O’Reilly Media 2011.

Web Resources:

1. http://www.kdd.org/kdd2015/tutorial.html
2. http://thinktostart.com/category/social-media/
   http://blogs.iit.edu/iit_web/social-media-2/social-media-whats-your-strategy/4

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16EG O02

GENDER SENSITIZATION
(Open Elective - II)

Instruction	3L Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course will introduce the students to:

1. To develop students' sensibility with regard to issues of gender in contemporaryIndia.
2. To provide a critical perspective on the socialization of men and women.
3. To expose the students to debates on the politics and economics of work. To help students reflect critically on gender violence.

Course Outcomes : After successful completion of the course the students will be able to:

1. Develop a better understanding of important issues related to what gender is in contemporary India.
2. Be sensitized to basic dimensions of the biological, sociological, psychological and legal aspects of gender. This will be achieved through discussion of materials derived fromresearch, facts, everyday life, literature, and film.
3. Attain a finer grasp of how gender discrimination works in our society and how to counter it. Students will acquire insight into the gendered division of labour and its relation to politics and economics.
4. Understand what constitutes sexual harassment and domestic violence and be made aware of New forums of Justice.
5. Draw solutions as to how men and women, students and professionals can be better equipped to work and live together as equals.

UNIT – I

Understanding Gender:

Gender: Why Should We Study It? (*Towards a World of Equals*: Unit -1)

Socialization: Making Women, Making Men (*Towards a World of Equals*: Unit -2)

Introduction.Preparing for Womanhood.Growing up Male.First lessons in Caste. Different Masculinities.

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UNIT – II

Gender And Biology:

Missing Women: Sex Selection and Its Consequences (*Towards a World of Equals*: Unit -4)

Declining Sex Ratio.Demographic Consequences.

Gender Spectrum: Beyond the Binary (*Towards a World of Equals*: Unit -10)

Two or Many?Struggles with Discrimination.

UNIT–III

Gender andLabour:

Housework: the Invisible Labour (*Towards a World of Equals*: Unit -3)

"My Mother doesn't Work." "Share the Load."

Women's Work: Its Politics and Economics (*Towards a World of Equals*: Unit -7)

Fact and Fiction.Unrecognized and Unaccounted work. Additional Reading: Wages and
Conditions of Work.

UNIT– V

Issues Of Violence

Sexual Harassment: Say No! (*Towards a World of Equals*: Unit -6)

Sexual Harassment, not Eve-teasing- Coping with Everyday Harassment- Further Reading:
"*Chupulu*".

Domestic Violence: Speaking Out (*Towards a World of Equals*: Unit -8)

Is Home a Safe Place? -When Women Unite [Film]. Rebuilding Lives. Additional Reading:
New Forums for Justice.

Thinking about Sexual Violence (*Towards a World of Equals*: Unit -11)

Blaming the Victim-"I Fought for my Life…." - Additional Reading: The Caste Face of
Violence.

UNIT–V

Gender: Co - Existence

Just Relationships: Being Together as Equals (*Towards a World of Equals*: Unit -12)

Mary Kom and Onler. Love and Acid just do not Mix. Love Letters. Mothers and Fathers.

Additional Reading: Rosa Parks-The Brave Heart.

19MT C101

COMPUTATIONAL NUMBER THEORY

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To familiarize with linear congruences and Chinese remainder theorem.
2. To know Fermat's little theorem, and Euler's extension of it.
3. To deal with applications of Fermat and Euler theorems.
4. To facilitate learning of relevance of number theory to coding theory.
5. To introduce basics of cryptography.

Course Outcomes: Upon completing this course, students will be able to:

1. Apply number theory concepts to cryptography.
2. Solve some of the divisor problems.
3. Understand the importance of Euler's phi function in RSA crypto system.
4. Appreciate the importance of larger primes in coding theory.
5. Apply the theory of congruences to derive some of powerful theorems in number theory.

UNIT-I

Divisibility and Primes : Division Algorithm, Euclid's algorithm for the greatest common divisor, Linear Diophantine equations, Prime numbers, fundamental theorem of arithmetic, infinitude of primes. Distribution of primes, twin primes, Goldbach conjecture, Fermat and Mersenne primes, Primality testing and factorization.

UNIT–II

Congruences, Congruences with a Prime-Power Modulus : Modular arithmetic, Linear congruences, Simultaneous linear congruences, Chinese Remainder Theorem, An extension of Chinese Remainder Theorem (with non-coprime moduli), Arithmetic modulo p, Fermat's little theorem, Wilson's theorem, Pseudo-primes and Carmichael numbers, Solving congruences modulo prime powers.

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UNIT–III

Euler's Function and RSA Cryptosystem, Units Modulo an Integer: Definition of Euler function, examples and properties, Multiplicative property of Euler's function, RSA cryptography, The group of units modulo an integer, primitive roots, Existence of primitive roots.

UNIT-IV

Quadratic Residues and Quadratic Forms: Quadratic residues, Legendre symbol, Euler's criterion, Gauss lemma, law of quadratic reciprocity, Quadratic residues for prime-power moduli and arbitrary moduli.

UNIT-V

Binary quadratic forms, equivalent forms, Discriminant, principal forms, positive definite forms, indefinite forms, Representation of a number by a form-examples, Reduction of Positive definite forms, reduced forms, Number of proper representations, automorph, class number.

Text Book:

1. G.A. Jones, J.M. Jones, "Elementary Number Theory", Springer UTM, 2007.

Suggested Reading:

1. Niven, H.S. Zuckerman & H.L. Montgomery, "Introduction to the Theory of Numbers", Wiley, 2000.
2. D. Burton, "Elementary Number Theory", McGraw-Hill, 2005.

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19IT C101

CRYPTOGRAPHY AND NETWORK SECURITY

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To provide fundamental concepts of computer security and cryptography.
2. To impart knowledge on symmetric and Asymmetric key cryptography algorithms.
3. To familiarize with Hash functions and digital signatures for Data Integrity.
4. To deal with key management and IP Security.
5. To facilitate learning on Transport and Electronic mail security.

Course Outcomes: Upon completing this course, students will be able to:

1. Understand Security Requirements for various organizations.
2. Implement symmetric and asymmetric cryptography algorithms.
3. Describe Hash functions and digital signatures for Data Integrity.
4. Learn various aspects of key management and IP Security.
5. Identify Security Protocols and methods to provide solutions for a specific Security Problem.

UNIT-I

Introduction: Computer Security Concepts, The OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms, A Model for Network Security.

Classical Encryption Techniques: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Rotor Machines, Steganography.

Block Ciphers and the Data Encryption Standard: Block Cipher Principles, The Data Encryption Standard (DES), A DES Example, The Strength of DES, Differential and Linear Cryptanalysis and Block Cipher Design Principles.

UNIT-II

Advanced Encryption Standard: AES Structure, AES Transformation Functions, AES Key Expansion, An AES Example.

Public Key Cryptography and RSA: Principles of Public-Key Cryptosystems, The RSA Algorithm.
Other Public-Key Cryptosystems: Diffie- Hellman Key Exchange, ElGamal Cryptographic System, Elliptical Curve Cryptography.

UNIT-III
Cryptographic Hash Functions: Applications of Cryptographic Hash Functions, Two Simple Hash Functions, Requirements and Security, Hash Functions Based on Cipher Block Chaining, Secure Hash Algorithm and SHA-3.
Message Authentication Codes Message Authentication Requirements, Message Authentication Functions, Requirements for Message Authentication Codes, Security of MACs, MACs Based on Hash Functions: HMAC **Digital Signatures**: Digital Signatures Properties and Requirements, Digital Signature Standard.

UNIT-IV
Key Management and Distribution: Symmetric Key Distribution Using Symmetric Encryption, Symmetric Key Distribution Using Asymmetric Encryption, Distribution of Public Keys, X.509 Certificates, Public Key Infrastructure.
IP Security: IP Security Overview, IP Security Policy, Encapsulating Security Payload, Combining Security Associations, Internet Key Exchange.

UNIT-V
Transport –Level Security: Web Security Considerations, Secure Socket Layer and Transport Layer Security, Transport Layer Security, HTTPS, Secure Shell.
Electronic Mail Security: Pretty Good Privacy, S/MIME, Domain Key Identified Mail.
User Authentication: Remote User-Authentication Principles, Kerberos, Federated Identity Management.

Text Books:

1. William Stallings, "Cryptography and Network Security Principles and Practice", Sixth Edition, Pearson, 2014.
2. Dr.V.K.Jain, "Cryptography and Network Security", First Edition, Khanna Book Publishing, 2013.

Suggested Reading:

1. Behrouz A Forouzan, "Cryptography and Network Security", TMH, 2010.

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2. Atul Kahate, "Cryptography and Network Security", Tata McGraw Hill 2003.
3. V.K Pachghare, "Cryptography and Information Security", Second Edition, PHI Learning 2015.

Web Resources:

1. https://nptel.ac.in/courses/106105162/
2. https://swayam.gov.in/courses/4955-cryptography

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19IT C102

ADHOC AND SENSOR NETWORKS

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To introduce principles and protocols of cellular networks, WLANs and PANs.
2. To provide knowledge about routing and transport layer protocols over wireless networks.
3. To familiarise with characteristics, applications and routing protocols for MANETs.
4. To facilitate learning of TCP over adhoc networks and QoS issues in MANETs.
5. To impart knowledge about architecture of wireless sensor networks, MAC layer support and routing protocols for MANETs.

Course Outcomes: Upon completing this course, students will be able to:

1. Understand the operating principles of cellular networks, wireless LANs and PANs.
2. Illustrate routing and transport layer protocols over wireless networks.
3. Comprehend characteristics, applications and routing protocols for MANETs.
4. Analyse TCP and QoS solutions for adhoc networks.
5. Describe the architecture of wireless sensor networks, MAC layer support and routing protocols in MANETs.

UNIT-I

Introduction: Issues in Mobile computing, Overview of wireless telephony: Cellular concept, GSM, System Architecture, Protocols, Connection Establishment, Frequency Allocation, Routing, Handover, Security, GPRS, **Wireless LAN:** IEEE 802.11 Standard, Architecture, services, HIPERLAN, Ad-hoc Network, Blue Tooth.

UNIT-II

Mobile IP: Goals, assumptions and requirements, Entities and terminology, IP packet delivery, Agent discovery, Registration, Tunnelling and encapsulation,

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Optimizations, Reverse tunnelling, IPv6, IP micro-mobility support, Dynamic host configuration protocol, **TCP over Wireless Networks:** Indirect TCP, Snooping TCP, Mobile TCP, Fast Retransmit /Fast Recovery, Transmission/ Timeout Freezing, Selective Retransmission, Transaction Oriented TCP,**WAP**: WAP Architecture, WDP, WTLS, WTP, WSP, WML, WML Script, WAE, WTA.

UNIT-III

Introduction to Ad-hoc Networks: Characteristics of MANETs, Applications of MANETs and challenges of MANET, **Routing in MANETs:** Topology based routing protocols-Proactive routing, reactive routing, hybrid routing, Position based routing protocols, Signal stability based routing, Power Aware Routing, Associativity based routing, QoS based routing, **Broadcasting, Multicasting and Geocasting**: Broadcast storm- Broadcasting in a MANET, Flooding generated broadcast storm, rebroadcasting schemes, Issues in providing multicast in a MANET, Multicast Routing protocols, Geocast routing protocols.

UNIT-IV

TCP over Ad-Hoc: TCP protocol overview: TCP basics, Header format, congestion control, Round trip time estimation, TCP and MANETs: Effect of partitions on TCP, Impact of lower layers on TCP, TCP Solutions for Ad hoc networks: Mobility related, Fairness related solutions

QoS Issues in Ad-hoc Networks: QoS parameters in Ad-hoc networks, Issues and challenges in providing QoS in Ad-hoc Wireless networks, Classification of QoS solutions, MAC layer and Network Layer solutions.

UNIT-V

Basics of Sensors and Applications: Introduction, applications, Empirical energy consumption, Sensing and communication range, localization scheme, clustering of sensor nodes, Architecture of wireless sensor networks, Network life time, physical layer, MAC layer, Design Issues, MAC protocols, The sensor-MAC, Routing layer- Directed diffusion, Sequential assignment routing, Minimum cost forwarding algorithm, Energy aware routing, coherent and non-coherent processing.

Text Books:

1. Carlos de Morais Cordeiro, Dharma Prakash Agrawal, “AdHoc and Sensor Networks: Theory and Applications”, Second Edition, World Scientific Publishers, 2011.
2. Jochen Schiller, “Mobile Communications”, Second Edition, Prentice Hall of India, Pearson Education, 2014.

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Suggested Reading:

1. William Stallings, "Wireless Communications and Networks", Second Edition, Prentice Hall of India, Pearson Education, 2004.
2. Uwe Hansmann, Lothar Merk, Martin S. Nicklons, Thomas Stober, "Principles of Mobile Computing", Springer, New York, 2003.
3. Prasant Mohapatra, Srikanth Krishnamurthy, "Ad-Hoc Networks Technologies and Protocols", Springer, Springer International Edition, 2009.
4. Kazem Sohraby, Daniel Minoli, Taieb Znati, "Wireless Sensor Networks", John Wiley & Sons, Inc., Publication, 2007.

Web Resource:

1. https://nptel.ac.in/courses/106105160/1

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19ME C103

RESEARCH METHODOLOGY AND IPR

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	25 Marks
Credits	2

Course Objectives: To make the students to

1. Motivate to choose research as career
2. Formulate the research problem, prepare the research design
3. Identify various sources for literature review and data collection report writing
4. Equip with good methods to analyze the collected data
5. Know about IPR copyrights

Course Outcomes: At the end of the course, student will be able to

1. Define research problem, review and asses the quality of literature from various sources
2. Improve the style and format of writing a report for technical paper/ Journal report, understand and develop various research designs
3. Collect the data by various methods: observation, interview, questionnaires
4. Analyze problem by statistical techniques: ANOVA, F-test, Chi-square
5. Understand apply for patent and copyrights

UNIT-I

Research Methodology: Research Methodology: Objectives and Motivation of Research, Types of Research, research approaches, Significance of Research, Research Methods verses Methodology, Research Process, Criteria of Good Research, Problems Encountered by Researchers in India, Benefits to the society in general. Defining the Research Problem: Selection of Research Problem, Necessity of Defining the Problem

UNIT-II

Literature Survey Report writing: Literature Survey: Importance and purpose of Literature Survey, Sources of Information, Assessment of Quality of Journals and Articles, Information through Internet. Report writing: Meaning of interpretation, layout of research report, Types of reports, Mechanics of writing

a report. Research Proposal Preparation: Writing a Research Proposal and Research Report, Writing Research Grant Proposal

UNIT-III

Research Design: Research Design: Meaning of Research Design, Need of Research Design, Feature of a Good Design, Important Concepts Related to Research Design, Different Research Designs, Basic Principles of Experimental Design, Developing a Research Plan, Steps in sample design, types of sample designs.

UNIT-IV

Data Collection and Analysis: Data Collection: Methods of data collection, importance of Parametric, non parametric test, testing of variance of two normal population, use of Chi-square, ANOVA, Ftest, z-test

UNIT-V

Patents and Copyright: Patent: Macro economic impact of the patent system, Patent document, How to protect your inventions. Granting of patent, Rights of a patent, how extensive is patent protection. Copyright: What is copyright. What is covered by copyright. How long does copyright last? Why protect copyright? Related Rights: what are related rights? Enforcement of Intellectual Property Rights: Infringement of intellectual property rights, Case studies of patents and IP Protection

Text Books:

1. C.R Kothari, "Research Methodology, Methods & Technique"; New Age International Publishers, 2004
2. R. Ganesan, "Research Methodology for Engineers", MJP Publishers, 2011
3. Y.P. Agarwal, "Statistical Methods: Concepts, Application and Computation", Sterling Publs., Pvt., Ltd., New Delhi, 2004

Suggested Reading:

1. Ajit Parulekar and Sarita D' Souza, "Indian Patents Law – Legal & Business Implications"; Macmillan India ltd , 2006
2. B. L.Wadehra; "Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications"; Universal law Publishing Pvt. Ltd., India 2000.
3. P. Narayanan; "Law of Copyright and Industrial Designs"; Eastern law House, Delhi 2010.

19IT E101

BIOMETRIC SECURITY

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To introduce concepts and methodologies for biometric recognition.
2. To familiarize biometrics, biometric equipment and standards applied to security.
3. To facilitate learning about major forms of automated personal identification systems, with emphasis on fingerprint, face and iris recognition.
4. To acquaint with biometric computing knowledge and methods.
5. To deal with basic biometrics systems using case studies.

Course Outcomes: Upon completing this course, students will be able to:

1. Demonstrate the knowledge of physical, biological science and engineering principles underlying the biometric systems.
2. Understand biometric systems at the component level.
3. Identify issues associated with the design and implementation of biometric systems.
4. Describe multi biometric systems.
5. Understand the role of biometrics in ensuring security.

UNIT-I

Introduction: Person Recognition, Biometric Systems, Biometric Functionalities, Biometric System Errors, the Design Cycle of Biometric Systems, Applications, Security and Privacy Issues.

UNIT-II

Fingerprint Recognition: Introduction, Friction Ridge Pattern, Fingerprint Acquisition, Feature Extraction, Matching, Fingerprint Indexing, Fingerprint Synthesis, Palmprint.

UNIT-III

Face Recognition: Introduction, Image Acquisition, Face Detection, Feature Extraction and Matching.

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Iris Recognition: Introduction, Design of an Iris Recognition System, Image Acquisition, Iris Segmentation, Iris Normalization, Iris Encoding and Matching, Iris Quality, Performance Evaluation.

UNIT-IV

Multibiometrics: Introduction, Sources of Multiple Evidence, Acquisition and Processing Architecture, Fusion Levels.

UNIT-V

Security of Biometric Systems: Introduction, Adversary Attacks, Attacks at the User Interface, Attacks on Biometric Processing, Attacks on the Template Database.

Text Book:

1. Anil K. Jain, Arun A. Ross, Karthik Nandakumar, "Introduction to Biometrics", Springer, 2011.

Suggested Reading:

1. James Wayman, Anil Jain, Davide Maltoni, Dario Maio (Eds) "Biometric Systems Technology, Design and Performance Evaluation", Springer-Verlag London Limited, 2005.
2. Julian Ashbourn, "Guide to Biometrics for Large-Scale Systems Technological, Operational and User-Related Factors", Springer-Verlag London Limited, 2011.
3. Charles A. Shoniregun, Stephen Crosier, "Securing Biometrics Applications", Springer, 2008.

Web Resources:

1. https://nptel.ac.in/courses/106104119/
2. https://www.coursera.org/lecture/usable-security/biometric-authentication

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19IT E106

ETHICAL HACKING

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To introduce the concepts of Ethical Hacking and legal issues surrounding hacking.
2. To provide deeper insight into the penetration testing tools and techniques.
3. To impart knowledge on vulnerability analysis and reverse engineering.
4. To familiarise with browser exploits and Windows memory protection.
5. To provide insight into setting trap for catching malware and tools used for malware analysis.

Course Outcomes: Upon completing this course, students will be able to:

1. Understand the Cyber Laws and the impact of hacking.
2. Demonstrate how to prepare and conduct a physical penetration.
3. Understand ethics behind hacking and vulnerability disclosure.
4. Exploit the vulnerabilities related to computer system and networks using state of the art tools and technologies.
5. Understand the core concepts related to malware, hardware and software vulnerabilities and their causes.

UNIT-I

Introduction to Ethical Disclosure: Ethics of Ethical Hacking, Ethical Hacking and the legal system, Proper and Ethical Disclosure.

UNIT-II

Penetration Testing and Tools: Using Metasploit, Using BackTrack Linux Distribution, Managing a Penetration Test.

UNIT-III

Vulnerability Analysis: Passive Analysis, Advanced Static Analysis with IDA Pro, Advanced Reverse Engineering.

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UNIT-IV

Client-side browser exploits, Exploiting Windows Access Control Model for Local Elevation Privilege, Intelligent Fuzzing with Sulley, From Vulnerability to Exploit.

UNIT-V

Malware Analysis: Collecting Malware and Initial Analysis, Hacking Malware.

Text book:

1. Shon Harris, Allen Harper, Chris Eagle, Jonathan Ness, “Gray Hat Hacking: The Ethical Hackers’ Handbook”, 3rd Edition, TMH.

Suggested Reading:

1. Jon Erickson, “Hacking: The Art of Exploitation”, Second Edition, SPD.
2. Sagar Rahalkar, “Metasploit for Beginners”, 2017.

Web Resource:

1. iDefense SysAnalyzer: labs.idefense.com/software/malcode.php

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19IT E113

DATA SCIENCE

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:
1. To introduce the fundamentals of Python.
2. To familiarise with Numpy, Pandas and various file formats.
3. To facilitate learning of data pre-processing and data visualisation.
4. To introduce data analysis and inferential statistics.
5. To impart knowledge on regression and ensemble methods.

Course Outcomes: Upon completing this course, students will be able to:
1. Understand programming in Python.
2. Work with packages Numpy, Pandas and various file formats.
3. Apply pre-processing on raw data.
4. Visualise data and understand inferential statistics.
5. Apply machine learning algorithms for data analysis.

UNIT-I

The Way of the Program, Variables, Expressions and Statements, Functions, Conditionals and Recursion, Functions, Iteration, Strings, Lists, Dictionaries, Tuples.

UNIT-II

NumPy Basics: Arrays and Vectorized Computation, Getting Started with Pandas, Data Loading, Storage, and File Formats.

UNIT-III

Data Cleaning and Preparation, Data Wrangling: Join, Combine, and Reshape, Making Sense of Data through Advanced Visualization, Data Aggregation and Group Operations.

UNIT-IV

Data Analysis Examples: Gov Data from Bitly, MovieLens Dataset, Food Database, Election Commission Database, Inferential Statistics, Uncovering Machine Learning.

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UNIT-V

Performing Predictions with Linear Regression, Pushing Boundaries with Ensemble Models, Applying Segmentation with k-means Clustering.

Text Books:

1. Allen B. Downey, "Think Python How to Think Like a Computer Scientist", Second Edition, O'Reilly, 2016.
2. William McKinney, "Python for Data Analysis Data Wrangling with Pandas, NumPy and IPython", Second Edition, O'Reilly Media, 2017.
3. Samir Madhavan, "Mastering Python for Data Science", Packt Publishing, 2015.

Suggested Reading:

1. Joel Grus, "Data Science from Scratch-First Principles with Python", O'Reilly Media, 2015
2. John V. Guttag, "Introduction to Computation and Programming Using Python– with Application to Understanding Data", Second Edition, The MIT Press, 2016.
3. Alberto Boschetti, Luca Massaron, "Python Data Science Essentials: A Practitioner's Guide Covering Essential Data Science Principles, Tools, and Techniques", Third Edition, 2018.

Web Resources:

1. https://www.kaggle.com
2. https://www.dataschool.io/
3. https://www.linkedin.com/in/randylaosat

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19IT C104

CRYPTOGRAPHY AND NETWORK SECURITY LAB

Instruction	4 Hours per week
CIE	50 Marks
Credits	2

Course Objectives:

1. To introduce the fundamental concepts of computer security and cryptography.
2. To facilitate learning on Symmetric Key Algorithms.
3. To impart the knowledge of Asymmetric Cryptography Algorithms.
4. To introduce digital signatures and its applications.
5. To familiarise with hash functions for Data Integrity.

Course Outcomes: Upon completing this course, students will be able to:

1. Apply basic cryptographic techniques.
2. Generate cipher text using Symmetric Key Algorithms.
3. Implement Use Asymmetric Key Cryptography Algorithms.
4. Generate Digital Signatures using standard algorithms.
5. Implement hash functions to ensure Data Integrity.

List of Programs

1. Implement Caesar cipher
2. Implement Mono Alphabetic Cipher
3. Implement Vigenere cipher (Polyalphabetic substitution)
4. Implement Hill cipher.
5. Implement S-DES algorithm for data encryption
6. Implement RSAAsymmetric (public key and private key)-Encryption-Encryption key (e, n) & (d, n)
7. Implement Diffie-Hellman Key Exchange Protocol.
8. Generate Digital Signature using Hash Code.
9. Study of MD5 Hash function and implement the hash code using MD5.
10. Study of SHA-5 hash function and implement the hash code using SHA-5.

Text Books:

1. William Stallings, "Cryptography and Network Security Principles and Practice", Sixth Edition, Pearson, 2014.

2. Dr.V.K.Jain, “Cryptography and Network Security”, First Edition ,Khanna Book publishing New Delhi 2013.

Suggested Reading:

1. Behrouz A Forouzan, “Cryptography and Network Security”, Tata McGraw Hill, 2010.
2. Atul Kahate, “Cryptography and Network Security”, Tata McGraw Hill, 2003.
3. V.K Pachghare, “Cryptography and Information Security”, Second Edition, PHI Learning 2015.

Web Resources:

1. https://nptel.ac.in/courses/106105162/
2. https://swayam.gov.in/courses/4955-cryptography

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19IT E119

DATA SCIENCE LAB

Instruction	4 Hours per week
CIE	50 Marks
Credits	2

Course Objectives:

1. To introduce data structures in Python.
2. To familiarise with different kinds of data and file formats.
3. To gain knowledge on data preprocessing and data visualization.
4. To acquaint with supervised and unsupervised learning algorithms.
5. To explore various case studies.

Course Outcomes: Upon completing this course, students will be able to:

1. Identify appropriate data structures for storing and processing the data.
2. Work with multiple kinds of data and various file formats.
3. Preprocess raw data and visualize the data.
4. Apply supervised and unsupervised algorithms.
5. Provide solutions to real world problems using machine learning algorithms.

List of Programs

1. Demonstrate the usage of Python data structures.
2. Explore various kinds of data like time series, text, etc.
3. Perform file handling operations in Python for various file formats.
4. Apply various preprocessing techniques on any two datasets.
5. Visualise data using packages matplotlib, seaborn, etc., and provide your inference.
6. Build Classifiers and perform prediction.
7. Demonstrate various Clustering Techniques.
8. Predict if a loan will get approved or not.
9. Predict the price of a house (Boston Housing Dataset).
10. Classify text documents according to their labels.

Text Books:

1. Allen B. Downey, "Think Python How to Think Like a Computer Scientist", Second Edition, O'Reilly, 2016.
2. William McKinney, "Python for Data Analysis Data Wrangling with Pandas, NumPy and IPython", Second Edition, O'Reilly Media, 2017.

3. Samir Madhavan, “Mastering Python for Data Science”, Packt Publishing, 2015.

Suggested Reading:

1. Joel Grus, “Data Science from Scratch-First Principles with Python”, O’Reilly Media, 2015.
2. Rachel Schutt, Cathy O’Neil, “Doing Data Science, Straight Talk from the Frontline”, O’Reilly, 2014.

Datasets:

1. https://www.kaggle.com/datasets
2. https://www.csie.ntu.edu.tw/~cjlin/libsvmtools/datasets/multilabel.html#siam-competition2007
3. https://archive.ics.uci.edu/ml/index.php

Web Resources:

1. https://www.analyticsvidhya.com/blog/2018/05/24-ultimate-data-science-projects-to-boost-your-knowledge-and-skills/
2. https://www.learndatasci.com/tutorials/data-science-statistics-using-python/
3. https://www.kaggle.com/getting-started
4. https://www.datacamp.com/community/tutorials

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19IT C106

MINI PROJECT with SEMINAR

Instruction	4 Hours per week
CIE	50 Marks
Credits	2

Course Outcomes: Upon completing this course, students will be able to:

1. Formulate a specific problem and give solution.
2. Develop model/models either theoretical/practical/numerical form.
3. Solve, interpret/correlate the results and discussions.
4. Conclude the results obtained.
5. Write the documentation in standard format.

Guidelines:

- As part of the curriculum in the II- semester of the programme each students shall do a mini project, generally comprising about three to four weeks of prior reading, twelve weeks of active research, and finally a presentation of their work for assessment.
- Each student will be allotted to a faculty supervisor for mentoring.
- Mini projects should present students with an accessible challenge on which to demonstrate competence in research techniques, plus the opportunity to contribute something more original.
- Mini projects shall have inter disciplinary/ industry relevance.
- The students can select a mathematical modeling based/Experimental investigations or Numerical modeling.
- All the investigations are clearly stated and documented with the reasons/explanations.
- The mini-project shall contain a clear statement of the research objectives, background of the work, literature review, techniques used, prospective deliverables, detailed discussion on results, conclusions and references.

Department committee: Supervisor and two faculty coordinators

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Guidelines for awarding marks (CIE):		Max. Marks: 50
Evaluation by	**Max .Marks**	**Evaluation Criteria / Parameter**
Supervisor	20	Progress and Review
	05	Report
Department Committee	05	Relevance of the Topic
	05	PPT Preparation
	05	Presentation
	05	Question and Answers
	05	Report Preparation

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19IT C107

DISSERTATION PHASE-I

Instruction	20 Hours per week
CIE	100 Marks
Credits	10

Course Outcomes: At the end of the course:

1. Students will be exposed to self-learning various topics.
2. Students will learn to survey the literature such as books, national/ international refereed journals and contact resource persons for the selected topic of research.
3. Students will learn to write technical reports.
4. Students will develop oral and written communication skills to present.
5. Student will defend their work in front of technically qualified audience.

Guidelines:

- The Project work will preferably be a problem with research potential and should involve scientific research, design, generation/collection and analysis of data, determining solution and must preferably bring out the individual contribution.
- Seminar should be based on the area in which the candidate has undertaken the dissertation work.
- The CIE shall include reviews and the preparation of report consisting of a detailed problem statement and a literature review.
- The preliminary results (if available) of the problem may also be discussed in the report.
- The work has to be presented in front of the committee consists of Head, Chairperson-BoS, Supervisor and Project coordinator.
- The candidate has to be in regular contact with his supervisor and the topic of dissertation must be mutually decided by the guide and student.

Guidelines for the award of Marks:		Max. Marks: 100
Evaluation by	**Max .Marks**	**Evaluation Criteria / Parameter**
Supervisor	30	Project Status / Review(s)
	20	Report
Department Committee	10	Relevance of the Topic
	10	PPT Preparation(s)
	10	Presentation(s)
	10	Question and Answers
	10	Report Preparation

Note : Department committee has to assess the progress of the student for every two weeks.

19IT C108

DISSERTATION PHASE- II

Instruction	32 Hours per week
Duration of SEE	Viva
SEE	100 Marks
CIE	100 Marks
Credits	16

Course Outcomes: At the end of the course:

1. Students will be able to use different experimental techniques and will be able to use different software/ computational/analytical tools.
2. Students will be able to design and develop an experimental set up/ equipment/test rig.
3. Students will be able to conduct tests on existing set ups/equipments and draw logical conclusions from the results after analyzing them.
4. Students will be able to either work in a research environment or in an industrial environment.
5. Students will be conversant with technical report writing and will be able to present and convince their topic of study to the engineering community.

Guidelines:

- It is a continuation of Project work started in semester III.
- The student has to submit the report in prescribed format and also present a seminar.
- The dissertation should be presented in standard format as provided by the department.
- The candidate has to prepare a detailed project report consisting of introduction of the problem, problem statement, literature review, objectives of the work, methodology (experimental set up or numerical details as the case may be) of solution and results and discussion.
- The report must bring out the conclusions of the work and future scope for the study. The work has to be presented in front of the examiners panel consisting of an approved external examiner, an internal examiner (HoD and BoS Chair Person) guide/co-guide.
- The candidate has to be in regular contact with his/her guide/co-guide.

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Guidelines for awarding marks in CIE:		**Max. Marks: 100**
Evaluation by	**Max. Marks**	**Evaluation Criteria / Parameter**
Department Review Committee	05	Review 1
	10	Review 2
	10	Review 3
	15	Final presentation with the draft copy of the report in standard format
	10	Submission of the report in a standard format
Supervisor	10	Regularity and Punctuality
	10	Work Progress
	10	Quality of the work which may lead to publications
	10	Analytical / Programming / Experimental Skills Preparation
	10	Report preparation in a standard format

Guidelines for awarding marks in SEE: (Max. Marks: 100)Max. Marks: 100

Evaluation by	**Max. Marks**	**Evaluation Criteria / Parameter**
External and Internal Examiner(s) together	20	Power Point Presentation
	40	Quality of thesis and evaluation
	20	Quality of the project • Innovations • Applications • Live Research Projects • Scope for future study • Application to society
	20	Viva-Voce

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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)
B.E (EEE)
SEMESTER – I

S.No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
	THEORY								
1	18MT C01	Mathematics - I	3	1	-	3	30	70	4
2	18PY C04	Waves, Optics and Introduction To Quantum Mechanics	3	1	-	3	30	70	4
3	18CS C01	Programming for Problem Solving	3	-	-	3	30	70	3
4	18EG C01	English	2	-	-	2	20	50	2
	PRACTICALS								
5	18PY C07	Waves and Optics Laboratory	-	-	3	3	25	50	1.5
6	18CS C02	Programming and Problem Solving Lab	-	-	4	3	25	50	2
7	18ME C02	Workshop/ Manufacturing Practice	1	-	4	3	25	50	3
8	18EG C02	English Lab	-	-	2	2	15	35	1
		Total	**12**	**02**	**13**	**-**	**200**	**445**	**20.5**

L: Lecture T: Tutorial D: Drawing P: Practical
CIE - Continuous Internal Evaluation SEE - Semester End Examination

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18MT CO1

MATHEMATICS– I

(Common to all branches and except for Bio-Tech)

Instruction	3 L+1T Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation:	30 Marks
Credits	4

Course Objectives:

1. To solve linear system of equations using Matrix Methods.
2. To know the convergence of the Series.
3. To represent the function in series form.
4. To know the Partial Derivatives and use them to interpret the way a function of two variables behaves.
5. To learn Vector Differential Operator and its Physical interpretations on Scalars and vector functions.
6. To solve improper integrals.

Course Outcomes: On the successful completion of this course student shall be able to

1. Solve system of linear equations and identify the Eigen values and Eigen vectors in engineering problems.
2. Check the series convergence.
3. Find the evolutes of the given curves.
4. Expand and find extreme values of functions of two variables.
5. Understanding the significance of gradient, divergence and curl.
6. An ability to solve the problems and interpret in geometrical approach.

UNIT-I: Matrices:

Rank of the matrix, Echelon form, System of linear equations, Linearly dependence and independence of vectors, Eigenvalues, Eigenvectors, Properties of eigenvalues, Cayley-Hamilton theorem, Quadratic forms, Diagonalization of Matrices, Reduction of quadratic form to canonical form by linear transformation, Nature of quadratic forms.

UNIT-II: Sequences and Series:

Definition of Convergence of sequence and series. Tests for convergence of series: comparison test, limit comparison test, D'Alembert ratio test, Raabe's test, Cauchy's n^{th} root test, logarithmic test, alternative series, absolute and conditional convergence.

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UNIT- III: Calculus:
Rolle's Theorem, Lagranges Mean value theorem, Cauchy's mean value theorem (without proofs). Curvature, radius of curvature, Evolutes and involutes , Fourier series, half range sine and cosine series

UNIT-IV: Multivariable Calculus (Differentiation):
Functions of two variables, Partial derivatives, Total differential and differentiability, Derivatives of composite and implicit functions (Chain rule), Change of variables, Jacobian, Higher order partial derivatives, Taylor's series of functions of two variables, Maximum and minimum values of functions two variables, Lagrange's multipliers method.

UNIT-V: Vector Calculus (Differentiation):
Scalar and vector fields, Gradient of a scalar field, Directional derivative, Divergence and Curl of a vector field, vector identities. Improper integrals: Beta and Gamma functions and their properties.

Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. B.V. Ramana, Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.

Suggested Reading:

1. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
2. R.K. Jain, S.R.K. Iyengar, Advanced engineering mathematics Narosa Publications, 5th edition, 2016.
3. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/ Cole, 2005.

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18PY C04

WAVES, OPTICS AND INTRODUCTION TO QUANTUM MECHANICS
(for EEE only)

Instruction:	3L+1T Hours per Week
Duration of Semester End Examination:	3 Hours
Semester End Examination:	70 Marks
Continuous Internal Evaluation:	30 Marks
Credits:	4

Course Objectives:
The objectives of the course is to make the student
1. Understands the fundamentals of oscillations.
2. Learns the basic concepts of wave nature of light.
3. Acquires knowledge of lasers and fibre optics.
4. Familiar with Quantum Mechanics.
5. Learns the fundamentals of solids and semiconductors.

Course Outcomes:
At the end of the course, the student will be able to
1. Describe the types of oscillations and analyze them.
2. Demonstrate the wave nature of the light.
3. Describe the types of lasers and optical fibres and their applications.
4. Demonstrate the important concepts of Quantum Mechanics.
5. Identify the electronic materials for engineering applications.

UNIT -I: Waves:
Mechanical and electrical simple harmonic oscillators, damped harmonic oscillator, forced mechanical and electrical oscillators, impedance, steady state motion of forced damped harmonic oscillator.

UNIT-II: Wave Optics:
Huygens' principle, superposition of waves and interference of light by wavefront splitting and amplitude splitting; Young's double slit experiment, Newton's rings, Michelson interferometer, Mach Zehnder interferometer. Fraunhofer diffraction from a single slit and a circular aperture, the Rayleigh criterion for limit of resolution and its application to vision; Diffraction gratings and their resolving power.

UNIT-III:
Lasers: Einstein's theory of matter radiation interaction and A and B coefficients; amplification of light by population inversion, different types of lasers: gas lasers (He-Ne, CO_2), solid-state lasers (ruby, Neodymium), dye lasers; Properties of laser beams: mono-chromaticity.

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Fibre Optics: Introduction, optical fibre as a dielectric wave guide: total internal reflection, numerical aperture and various fibre parameters, losses associated with optical fibres, step and graded index fibres, pulse dispersion, application of optical fibres.

UNIT- IV

Introduction to Quantum Mechanics: Wave nature of Particles, Time-dependent and time-independent Schrodinger equation for wave function, Born interpretation, probability current, Expectation values, Free-particle wave function and wave-packets, Uncertainty principle.

Solution of Wave Equation: Solution of stationary-state Schrodinger equation for one dimensional problems–particle in a box, particle in attractive delta-function potential, square-well potential.

UNIT-V: Introduction to Solids and Semiconductors:

Free electron theory of metals, Fermi level, Bloch's theorem for particles in a periodic potential, Kronig-Penney model and origin of energy bands. Types of electronic materials: metals, semiconductors, and insulators. Intrinsic and extrinsic semiconductors, Dependence of Fermi level on carrier-concentration and temperature (equilibrium carrier statistics), Carrier generation and recombination, Carrier transport: diffusion and drift, p -n junction.

TEXT BOOKS:

1. B.K. Pandey and S. Chaturvedi, *Engineering Physics*, Cengage Publications, 2012.
2. M.N. Avadhanulu and P.G. Kshirsagar, *A Text BookEngineering Physics*, S. Chand Publications, 2014.
3. M. Arumugam, *Materials Science*, Anuradha Publications, 2015.
4. S.L. Gupta and Sanjeev Gupta, *Modern Engineering Physics*, Dhanpat Rai Publications, 2011.

SUGGESTD READING:

1. R. Murugeshan and Kiruthiga Sivaprasath, *Modern Physics*, S. Chand Publications S. Chand Publi., 2014.
2. V. Rajendran, *Engineering Physics*, McGahill Education Publications, 2013.
3. P.K. Palanisamy, *Engineering Physics*, Scitech Publications, 2012.
4. V. Raghavan, *Materials Science and Engineering*, Prentice Hall India Learning Private Limited; 6th Revised edition, 2015.

18CS C01

Programming for Problem Solving
(Common to All Programs)

Instruction	3 Periods per week
Duration of Semester-End Examination	3 Hours
Semester-End Examination	70 Marks
Sessional	30 Marks
Credits	3

Course Objectives

1. Identification of computer components, Operating environments, IDEs.
2. Understanding the steps in problem solving and formulation of algorithms to problems.
3. Develop programming skills as an means of implementing an algorithmic solution with appropriate control anddata structures.
4. Develop intuition to enable students to come up with creative approaches to problems.
5. Manipulation of text data using files.

Course Outcomes: At the end of the course, students will be able to:

1. Identify the computing environments.
2. Formulate solutions to problems and represent them using algorithms/ Flowcharts.
3. Choose proper control statements and data structures to implement the algorithms.
4. Trace the programs with test the program solution
5. Decompose a problem into modules and use functions to implement the modules.
6. Develop applications using file I/O.

UNIT -I

Introduction to computers and Problem Solving: Components of a computer, Operating system, compilers, Program Development Environments, steps to solve problems, Algorithm, Flowchart / Pseudocode with examples.

Introduction to programming: Programming languages and generations, categorization of high level languages.

Introduction to C: Introduction, structure of C program, keywords, identifiers, Variables, constants, I/O statements, operators, precedence and associativity.

UNIT – II

Introduction to decision control statements: Selective, looping and nested statements.

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Functions: Introduction, uses of functions, Function definition, declaration, passing parameters to functions, recursion, scope of variables and storage classes.

Case study:

UNIT – III

Arrays: Introduction, declaration of arrays, accessing and storage of array elements, 1-dimensional array, Searching (linear and binary search algorithms) and sorting(selection and Buble) algorithms, 2-D arrays, matrix operations.

Strings: Introduction, stringsrepresentation, string operations with examples.

Case study:

UNIT – IV

Pointers: Understanding computer's memory, introduction to pointers, declaration pointer variables, pointer arithmetic, pointers and strings, array of pointers, function pointers, array of function pointers, dynamic memory allocation, advantages and drawbacks of pointers

Structures: Structure definition, initialization and accessing the members of a structure, nested structures, structures and functions, self- referential structures, unions and enumerated data types.

UNIT-V

Files: Introduction to files, file operations, reading data from files, writing data to files, error handing during file operations.

Preprocessor Directives: Types of preprocessor directives, examples.

Suggested Reading:

1. A K Sharma "**Computer Fundamentals and Programming**", 2nd Edition, University Press, 2018.
2. Pradeep Dey and Manas Ghosh, "**Programming in C"**, Oxford Press, 2nd Edition, 2017.

References:

1. Byron Gottfried, Schaum's"**Outline of Programming with C**", McGraw-Hill.
2. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India.
3. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill
4. ReemaTharaja "**Introduction to C Programming**", Second Edition, OXFORD Press,2015.
5. https://www.tutorialspoint.com/cprogramming/index.htm
6. https://onlinecourses.nptel.ac.in/noc18-cs10/preview

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18EG C01
ENGLISH

(Common to all Branches)

Instruction	2Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation:	20 Marks
Credits	2

Course Objectives:
1. To enable the students to understand the role and importance of communication and to develop their basic communication skills in English.
2. To equip the students with basics of writing correct sentences to coherent paragraphs.
3. To equip the students with techniques of writing a précis and an essay by using accurate grammar and appropriate vocabulary.
4. To train the students to describe, define and classify processes and to draft formal reports by adhering to the proper structure.
5. To develop the reading skills and reading comprehension techniques of the students.
6. To develop the students reading, writing, grammatical, lexical and communicative competence.

Course Outcomes:
1. The students will understand the nature, process and types of communication and will communicate effectively without barriers.
2. The students will write correct sentences and coherent paragraphs.
3. The students will know how to condense passages by writing précis and write essays by using accurate grammar and appropriate vocabulary.
4. The students will demonstrate advanced writing skills by drafting formal reports.
5. The students will apply their reading techniques and analyze reading comprehension passages.
6. The students will become effective communicators and will display their advanced skills of reading and writing and use correct grammar and appropriate vocabulary in all contexts.

UNIT-I Understanding Communication in English:
Introduction, nature and importance of communication.Process of communication.Basic types of communication - verbal and non-verbal.Barriers to communication.Intrapersonal and interpersonal communication.Johari Window.

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Vocabulary & Grammar: The concept of Word Formation. Importance of proper punctuation.Articles.

UNIT-II Developing Writing Skills I:
Types of sentences. Use of phrases and clauses in sentences.Cohesion and coherence.Paragraph writing. Organizing principles of paragraphs in documents. Vocabulary & Grammar: Cohesive devices. Root words from foreign languages and their use in English. Prepositions.

UNIT-III Developing Writing Skills II:
Techniques for writing precisely. Précis Writing. Essay Writing.
Vocabulary and Grammar: Subject-verb agreement, Noun-pronoun agreement Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives. Redundancies, Clichés.

UNIT-IV Developing Writing Skills III:
Describing, Defining, Classifying, Providing examples or evidence.Writing introduction and conclusion.
Report writing – Importance, structure and elements of style of formal reports.
Vocabulary and Grammar: Misplaced modifiers. Synonyms, antonyms.

UNIT-V Developing Reading Skills:
The reading process, purpose, different kinds of texts. Reading comprehension.Techniques of comprehension – skimming, scanning, drawing inferences and conclusions.
Vocabulary and Grammar : Words often Confused. Standard abbreviations.

Text Books:

1. Language and Life: A Skills Approach, Board of Editors, Orient Black Swan, 2017.
2. Swan Michael,Practical English Usage.OUP. 1995.

Suggested Readings:

1. Wood F.T, Remedial English Grammar, Macmillan,2007.
2. Zinsser William, On Writing Well, Harper Resource Book, 2001.
3. Sanjay Kumar and Pushp Lata,Communication Skills.Oxford University Press, 2011.

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18PY C07

WAVES AND OPTICS LABORATORY
(for EEE only)

Instruction:	3 Hours per Week
Duration of Semester End Examination:	3 Hours
Semester End Examination:	50 Marks
Continuous Internal Evaluation:	25 Marks
Credits:	1.5

Course Objectives:

The objectives of the course is to make the student

1. Apply theoretical physics knowledge in doing experiments.
2. Understand the behavior of the light experimentally.
3. Analyze the behavior of semiconductor materials.

Course Outcomes:

At the end of the course, the student will be able to

1. Understand the concept of errors and find the ways to minimize the errors.
2. Demonstrate interference and diffraction phenomena experimentally.
3. Understand the applications of semiconductor materials.
4. Demonstrate the uses of optical instruments.
5. Use LCR circuits in different applications.

Experiments

1. Error analysis – Estimation of errors in the determination of time period of a torsional pendulum.
2. Melde's experiment.
3. μ of lenses.
4. Newton's rings – Determination of wavelength of given monochromatic source.
5. Single slit diffraction – Determination of wavelength of given monochromatic source.
6. Resolving power of telescope.
7. Cauchy's constants.
8. Laser – Determination of wavelength of given semiconductor red laser.
9. Diffraction Grating – Determination of wavelengths of two yellow lines of mercury light.
10. Viscosity by oscillating disc (Lamp scale method).
11. Hall effect – Determination of Hall coefficient, carrier concentration & mobility of charge carriers of given semiconductor specimen.
12. Energy gap – Determination of energy gap of given semiconductor.
13. Thermistor – Determination of temperature coefficient of resistance of a given thermistor.

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14. LCR circuit (Parallel & Series).
15. Optical fibre – Determination of NA and power losses of given optical fibre.

SUGGESTED READING:

1. *Engineering Physics Manual* by Department of Physics, CBIT, 2016
2. S.K. Gupta*, Engineering Physics Practical*, Krishna's Educational Publishers, 2014.
3. O.P. Singh, V. Kumar and R.P. Singh, *Engineering Physics Practical Manual*, Ram Prasad & Sons Publications, 2009.
4. Indu Prakash, Ram Krishna and A.K. Jha, *A Text Book of Practical Physics*, Kitab Mahal Publications, 2012.

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18CS C02

Programming for Problem Solving
(Programming Lab – I)
(Common to All Programs)

Instruction	4 Periods per week
Duration of Semester-End Examination	3 Hours
Semester-End Examination	50 Marks
Sessional	25 Marks
Credits	2

Course Objectives

1. Setting up programming environment
2. Develop Programming skills to solve problems.
3. Use of appropriate C programming constructs to implement algorithms.
4. Identification and rectification of coding errors in program.
5. Develop applications in a modular fashion.
6. Manage data using files.

Course Outcomes:

At the end of the course students will be able to:

1. Identify and setup program development environment.
2. Implement the algorithms using C programming language constructs.
3. Identify and rectify the syntax errors and debug program for semantic errors.
4. Analyze the results to evaluate the solutionsof the problems.
5. Solve problems in amodular approach using functions.
6. Implement file operations with simple text data.

Lab experiments

1. Familiarization with programming environment.
2. Simple computational problems using arithmetic expressions.
3. Problems involving if-then-else structures.
4. Iterative problems e.g., sum of series.
5. 1D Array manipulation.
6. 2D arrays and strings.
7. Matrix problems, String operations.
8. Simple functions.
9. Recursive functions.
10. Pointers and structures.
11. Dynamic memory allocation and error handling.
12. File handling.

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Design the experiments in such a way that the students will be able to end up the solution for a real world problem that uses most of the concepts of C programming language.
For example: A banking application where it uses the concepts of operators, control structures, switch case for menu, structures, functions, error handling, files etc.

Suggested Reading:

1. Pradeep Dey and Manas Ghosh, "**Programming in C"**, Oxford Press, 2nd Edition, 2017
2. ReemaTharaja "**Introduction to C Programming**", Second Edition, OXFORD Press, 2015

References:

1. https://www.tutorialspoint.com/cprogramming/index.htm
2. https://www.w3resource.com/c-programming/programming-in-c.php
3. https://www.w3schools.in/c-tutorial/

18ME C02

WORKSHOP/ MANUFACTURING PRACTICE

Instruction	1T+4P Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation:	25 Marks
Credits	3

Course Objectives:

1. Give a feel of Engineering Practices & develop holistic understanding of various Engineering materials and Manufacturing processes.
2. Develop skills of manufacturing, safety, precision, quality, intelligent effort, optimization, positive & team work attitude to get things right the first time.
3. To provide basic knowledge of Steel, Plastic, Composite and other materials for suitable applications.
4. Study of Principle and hands on practice on techniques of fabrication, welding, casting, manufacturing, metrology, and allied skills.
5. To advance important hard & pertinent soft skills, productivity, create skilled manpower which is cognizant of industrial workshop components and processes and can communicate their work in a technical, clear and effective way.
6. Engineering Skill development with regard to making components, system integration and assembly to form a useful device.

Course Outcomes – (Laboratory): Student will be able to

1. Fabricate components with their own hands.
2. Get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.
3. Assembling different components, student will be able to produce small mechanisms/devices of their interest.
4. Gain practical skills of carpentry, tinsmithy, fitting, house wiring
5. Gain knowledge of different Engineering Materials and Manufacturing Methods.
6. Understand trades and techniques used in Workshop and chooses the best material/ manufacturing process for the application.

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18EG C02

ENGLISH LAB

(Common to all Branches)

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	35 Marks
Continuous Internal Evaluation:	15 Marks
Credits	1

Course Objectives:

1. To introduce students to phonetics and the different sounds in English.
2. To familiarize the students with the software and give them sufficient practice in correct pronunciation.
3. To enable students to speak English correctly with focus on stress and intonation.
4. The students will enhance their listening skills by practicing IELTS and TOEFL material.
5. To help students overcome their inhibitions while speaking in English and to build their confidence. The focus shall be on fluency rather than accuracy.
6. To help students to understand team work, role behavior and to develop their ability to discuss in groups and make oral presentations.

Course Outcomes:

1. The students will differentiate the speech sounds in English.
2. The students will interact with the software and understand the nuances of pronunciation in English.
3. The students will speak with the proper tone, intonation and rhythm and apply stress correctly.
4. The students will demonstrate their listening skills by analyzing the IELTS and TOEFL listening comprehension texts
5. The students will speak with clarity and confidence.
6. The students will work in teams and discuss various topics and demonstrate their presentation skills through posters.

Exercises

1. **Introduction to English Phonetics**: Introduction to auditory, acoustic and articulatory phonetics, organs of speech: the respiratory, articulatory and phonatory systems.
2. **Sound system of English**: Phonetic sounds and phonemic sounds, introduction to international phonetic alphabet, classification and description of English phonemic sounds, minimal pairs . The syllable: types of syllables, consonant clusters.
3. **Word stress**: Primary stress, secondary stress, functional stress, rules of word stress.

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4. **Rhythm &Intonation** : Introduction to Rhythm and Intonation. Major patterns, intonation of English with the semantic implications.
5. **Listening skills** – practice with IELTS and TOEFL material.
6. **Situational dialogues and role play –** Dialogue writing, **–** Role behavior and role enactment.
7. **Group Discussions -** Dynamics of a group discussion, group discussion techniques, body language.
8. **Public speaking –** Speaking with confidence and clarity in different contexts on various issues.
9. **Poster presentation –** Theme, poster preparation, team work and presentation.

Suggested Reading

1. T Balasubramanian. A Textbook of English Phonetics for Indian Students, Macmillan, 2008.
2. J Sethi et al. A Practical Course in English Pronunciation (with CD), Prentice Hall India, 2005.
3. PriyadarshiPatnaik. Group Discussions and Interviews, Cambridge University Press Pvt Ltd 2011.
4. ArunaKoneru, Professional Speaking Skills, Oxford University Press, 2016.

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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)
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SEMESTER – II

S.No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
	THEORY								
1	18MT C03	Mathematics -II	3	1	-	3	30	70	4
2	18CY C01	Chemistry	3	1	-	3	30	70	4
3	18CE C01	Engineering Mechanics	3	1	-	3	30	70	4
4	18ME C01	Engineering Graphics and Design	1	-	4	3	30	70	3
5	18EE C01	Basic Electrical Engineering	3	1	-	3	30	70	4
	PRACTICALS								
6	18EE C02	Basic Electrical Engineering Lab	-	-	2	2	15	35	1
7	18CY C02	Chemistry Lab	-	-	3	3	25	50	1.5
		Total	**13**	**04**	**09**	**-**	**190**	**435**	**21.5**

L: Lecture T: Tutorial D: Drawing P: Practical
CIE - Continuous Internal Evaluation SEE - Semester End Examination

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18MT CO3

MATHEMATICS– II

(Common to all Branches and except for Bio-Tech)

Instruction	3 L+1T Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation:	30 Marks
Credits	4

Course Objectives

1. To evaluate double and triple integrals of various functions and their significance.
2. To evaluate vector line, surface and volume integrals.
3. To know the relevant method to solve higher order differential equations.
4. To evaluate complex integration.
5. To evaluate real and definite integrals.
6. To know the methods to solve real life problems.

Course Outcomes: On the successful completion of this course student shall be able to

1. Find the areas, volumes and surface of solids revolution.
2. Use Greens, Gauss and Stoke's theorems to find the surface and volume integrals.
3. Able to solve solutions of differential equations with initial and boundary value problems.
4. Solve the problems on analytic functions, Cauchy's theorem and Cauchy's integral formula.
5. Real and complex integrals by using Cauchy's theorems.
6. Solve physical and engineering problems.

UNIT-I: Multivariable Calculus (Integration):

Applications of definite integrals to evaluate surface areas and volumes of revolutions. Double integrals, Change of order of integration, Triple integrals, Change of variables in integrals, Applications: areas and volumes, Centre of mass and Gravity (constant and variable densities).

UNIT-II: Vector Integral Calculus: Line, Surface and Volume integrals, Green's theorem in a plane, Gauss's divergence theorem and Stoke's theorem (without proof).

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First Order Ordinary Differential Equations: Exact first order differential equations , Integrating factors, Linear first order equations , Bernoulli's, Riccati's and Clairaut's differential equations ,Orthogonal trajectories of a given family of curves.

UNIT-III:Ordinarydifferential equations of higher orders:
Solutions of higher order linear equations with constants coefficients, Method of variation of parameters, solution of Euler-Cauchy equation. Ordinary point, singular point and regular singular point, Power Series solution. Legendre Polynomial of first kind (without proof), Rodrigues formula, Generating function, recurrence relations, orthogonality of Legendre polynomials, Bessel's function of first kind (without proof), recurrence relations and problems.

UNIT-IV:Complex Variables –I :
Differentiation, analytic functions, Cauchy-Riemann equations, harmonic functions, finding harmonic conjugate, elementary analytic functions (exponential, trigonometric, logarithm) and their properties; Conformal mappings, Mobius transformations and their properties. Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof).

UNIT-V: Complex Variables – II:
Liouville's theorem and Maximum-Modulus theorem (without proof); Taylor's series, Laurent's series, zeros of analytic functions, singularities, Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine. Improper real integrals with singular points on the upper half plane.

Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

Suggested Reading:

1. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
2. R.K. Jain, S.R.K. Iyengar, Advanced engineering mathematics Narosa Publications, 5th edition,2016.
3. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.

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18CY C01

CHEMISTRY

(Common to all Branches)

Instruction:	3L+1T Hours per Week
Duration of Semester End Examination:	3 Hours
Semester End Examination:	70 Marks
Continuous Internal Evaluation:	30 Marks
Credits:	4

Course Objectives

1. The aim of framing the syllabus is to impart intensive and extensive knowledge of the subject so that students can understand the role of chemistry in the field of engineering.
2. This syllabus helps at providing the necessary introduction of the inorganic chemistry principles and concepts of chemical bonding involved in a comprehensive manner understandable to the students aspiring to become practicing engineers.
3. Thermodynamic and Electrochemistry units give conceptual knowledge about spontaneous processes and how can they be harnessed for producing electrical energy and efficiency of systems.
4. To teach students the value of chemistry and to improve the research opportunities knowledge of stereochemistry and organic reactions is essential.
5. New materials lead to discovering of technologies in strategic areas like defense and space research for which an insight into nano and composite materials of modern chemistry is essential.

Course Outcomes

The concepts developed in this course will aid in quantification of several concepts in chemistry that have been introduced at the 10+2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications. Quantum theory is more than 100 years old and to understand phenomena at nanometer levels; one has to base the description of all chemical processes at molecular levels.

The course will enable the student to:

1. Analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
2. Rationalize bulk properties and processes using thermodynamic considerations & Ionic Equilibria.
3. List major chemical reactions that are used in the synthesis of molecules.

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4. Apply the various methods used in treatment of water for domestic and industrial use.
5. Discuss the various Engineering materials & Drug synthesis & their applications.

UNIT-I Atomic and molecular structure:

Molecular Orbital theory - atomic and molecular orbitals.Linear combination of atomic orbitals (LCAO) method. Molecular orbitals of diatomic molecules. Energy level diagrams of diatomics (H_2, He_2^+, N_2, O_2, O_2^-, CO, NO). Pi- molecular orbitals of butadiene , benzene and their aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties.

UNIT-II Use of free energy in chemical equilibria and Ionic Equilibria:

Use of free energy in chemical equilibria : Thermodynamic functions: Internal energy, entropy and free energy. Significance of entropy and free energy(criteria of spontaneity). Free energy and emf (Gibbs Helmholtz equations and its applications). Cell potentials–electrochemical series. Nernst equation and its applications.Potentiometric Acid base & Redox Titrations.Numericals.

Ionic Equilibria: Solubility product, Determination of solubility product, Applications of solubility product- Determination of solubilities of sparingly soluble salts; Predicting precipitation reactions; Precipitation of an insoluble salt; Precipitation of soluble salts ; Inorganic analysis .Numericals.

UNIT- III Stereochemistry and Organic reactions

Stereochemistry: Representations of 3 dimensional structures , Symmetry and chirality, Stereoisomers - Configurational isomers (Geometrical&Optical isomers), Conformational isomers - Newman and sawhorse representations of n-butane, enantiomers (lactic acid), diastereomers (Tartaric acid) , optical activity, absolute configurations , Sequence rules for R&S notation.

Organic reactions

Types of Organic reactions:

Substitution Reactions-Electrophilic substitution (Nitration of Benzene); Nucleophilic Substitution(S_N1& S_N2); Free Radical Substitution(Halogenation of Alkanes).

Addition Reactions:

Electrophilic Addition – Markonikoff's rule.

Nucleophilic Addition – (Addition of HCN to carbonyl compounds).

Free radical Addition - Anti Markonikoff's rule (Peroxide effect).

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Eliminations-E_1 and E_2 (dehydrohalogenation of alkyl halides).
Oxidation with $KMno_4$, $K_2Cr_2O_7$; **Reduction** with $LiAlH_4$,$NaBH_4$.
Cyclization (Diels - Alder reaction).

UNIT–IV Water Chemistry:
Hardness of water – Types, units of hardness, Disadvantages of hard water , Boiler troubles - scales & sludge formation , causes and effects , Softening of water by ion exchange method and Reverse Osmosis. Specifications of potable water & industrial water. Disinfection of water by Chlorination , Ozonisation & UV radiation.

UNIT-V Engineering Materials and Drugs:
Nano materials-Introduction to nano materials and general applications, basic chemical methods of preparation- Sol gel method. Carbon nanotubes and their applications.
Composite materials- Definition, types of composites, fibre reinforced, glass fibre reinforced and carbon fibre reinforced composites and applications.
Conducting polymers- Definition, classification and applications.
Drugs-Introduction,Synthesis and uses of Aspirin (analgesic), Paracetamol (Antipyretic), Atenolol (antihypertensive).

TEXT BOOKS

1. P.C. Jain and M. Jain, “Engineering Chemistry”, Dhanpat Rai Publishing Company Ltd., New Delhi,16th edition (2015).
2. W.U. Mali, G.D.Tuli and R.D.Madan, “Selected topics in Inorganic Chemistry”, S Chand & Company Ltd, New Delhi, reprint (2009).
3. R.T. Morrison, R.N. Boyd and S.K. Bhattacharjee, “Organic Chemistry”, Pearson, Delhi, 7th edition(2011).
4. G.L. David Krupadanam, D. Vijaya Prasad, K. Varaprasad Rao, K.L.N. Reddy and C. Sudhakar, “Drugs”, Universities Press (India) Limited, Hyderabad (2007).

SUGGESTED READINGS

1. B. H. Mahan, “University Chemistry”, Narosa Publishing house, New Delhi, 3rd edition (2013).
2. B.R. Puri, L.R. Sharma and M.S. Pathania, “Principles of Physical Chemistry”, S. Nagin Chand &Company Ltd.,46th edition (2013).
3. T.W. Graham Solomons, C.B. Fryhle and S.A. Snyder, “Organic Chemistry”, Wiley,12th edition (2017).
4. P.W. Atkins, J.D. Paula, “Physical Chemistry”, Oxford, 8th edition (2006).

18CE C01

ENGINEERING MECHANICS

Instruction:	3L+1T Hours per Week
Duration of Semester End Examination:	3 Hours
Semester End Examination:	70 Marks
Continuous Internal Evaluation:	30 Marks
Credits:	4

Course Objectives:

1. The objective of this course is to understand the resolution of forces and to obtain resultant of all force systems, to understand moment of a force and equilibrium conditions of static loads for smooth and frictional surface.
2. To obtain centroid, centre of gravity and moment of inertia for various regular and composite areas and bodies.
3. To understand the basic structural analysis, principles of virtual work and energy methods.
4. To know the basic concepts of dynamics and analysis as a particle and rigid bodies.
5. To understand the work energy principles, impulse momentum and their applications and to know the concept of simple harmonic motion and free vibration.

Course Outcomes: The students will be able to

1. Solve problems dealing with forces in plane and space force systems, draw free body diagrams to analyze various problems in equilibrium, for smooth and frictional surface.
2. Determine centroid and moment of inertia for elementary, composite areas and bodies.
3. Analyze simple trusses for forces in various members of a truss.
4. Solve problem in kinematics and kinetics of particles and rigid bodies.
5. Analyze body motion using work energy principles, impulse and momentum approach and able to apply the concepts of simple harmonic motion and free vibrations in dynamics.

Unit–I: Resolution, Resultant and Equilibrium of force system and Friction:
Concepts of force, System of forces, components of forces in a plane and in space systems. Resultant of force systems.Moment of forces and its applications.Couples and its applications.Equilibrium of Force systems. Free body diagrams, equation of equilibrium of coplanar and spatial force systems. Static indeterminacy. Types of friction, Laws of friction, application of friction to a single body & connecting systems, wedge friction.

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Unit–II: Centroid, centre of gravity and moment of Inertia:
Centroid of simple figures from first principle, centroid of composite sections. Centre of gravity and its implications, Definition of Area moment of Inertia, Moment of inertia of plane section from first principles, Theorems of moment of inertia, moment of inertia of standard sections and composite sections, Mass moment of inertia of rectangular and circular plates, cylinder, cone & sphere.

Unit–III: Analysis of simple trusses, Virtual work and Energy methods:
Analysis of simple trusses using method of joints, methods of sections. Determine if a member is in tension or compression, zero force members. Virtual displacements, Principle of virtual work for particle and ideal system of rigid bodies, degrees of freedom.Conservative forces and potential energy, energy equation for equilibrium.

Unit–IV: Particle Dynamics:
Rectilinear and curvilinear translation using rectangular, normal and tangential components.Relative and constrained motion. Newton's 2nd Law, rectangular and path coordinates. Basic terms, general principles in dynamics, D' Alembert's principle and its application in plane motion and connected bodies.Instantaneous centre of rotation in plane motion and simple problems.

Unit–V: Work- Energy, Impulse-momentum and Mechanical Vibrations:
Equation of work energy for translation and fixed axis rotation, work energy principles applied to particle motion, connected systems. Introduction to linear impulse momentum, principle of conservation of linear momentum, Impact, direct and oblique. Introduction to vibration, free and forced vibrations, simple harmonic motion, simple pendulum and compound pendulum.

Text Books:

1. Reddy Vijaykumar K. and J. Suresh Kumar," Singer's Engineering Mechanics Statics and Dynamics", B. S. Publications 2011.
2. A. Nelson, "Engineering Mechanics", Tata McGraw Hill, New Delhi, 2010.

Suggested Reading:

1. Irving H. Shames, "Engineering Mechanics", 4th Edition, Prentice Hall, 2006.
2. F. P. Beer and E. R .Johnson, "Vector Mechanics for engineers, Vol. I - Statics, Vol. II - Dynamics",
   9th edition, Tata McGraw Hill, 2011.
3. R. C. Hibbeler, "Engineering Mechanics: Principles of Statics and Dynamics", Pearson Press, 2006.

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18ME C01

ENGINEERING GRAPHICS AND DESIGN

Instruction	1T+4D Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation:	30 Marks
Credits	3

Course Objectives:

1. to prepare to design a system, component, or process to meet desired needs within realistic constraints
2. to prepare the student to communicate effectively.
3. to prepare the student to use the techniques, skills, and modern. engineering tools necessary for engineering practice.
4. to get exposure to a CAD package.

Course Outcomes:

1. Introduction to engineering design and its place in society.
2. Exposure to the visual aspects of engineering design.
3. To become familiar with engineering graphics standards.
4. Exposure to solid modelling.
5. Exposure to computer-aided geometric design.
6. Exposure to creating working drawings.
7. Exposure to engineering communication.

Detailed contents

Traditional Engineering Graphics:

Principles of Engineering Graphics; Orthographic Projection; Descriptive Geometry; Drawing Principles; Isometric Projection; Surface Development; Perspective; Reading a Drawing; Sectional Views; Dimensioning & Tolerances; True Length, Angle; intersection, Shortest Distance.

Computer Graphics:

Engineering Graphics Software; -Spatial Transformations; Orthographic Projections; Model Viewing; Coordinate Systems; Multi-view Projection; Exploded Assembly; Model Viewing; Animation; Spatial Manipulation; Surface Modeling; Solid Modeling; Introduction to Building Information Modeling (BIM).

(Except the basic essential concepts, most of the teaching part can happen concurrently in the laboratory).

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UNIT-1 Introduction to Engineering Drawing:

Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and
Involute;

UNIT-2 Orthographic Projections:

Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes (without traces) ; Projections of planes inclined Planes;

Introduction to CAD package:

Listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids.

UNIT-3 Projections of Regular Solids:

Projection of Prism, Cylinder, Pyramid and Cone : Simple position, axis inclined to one of the reference plane only. Customization & CAD Drawing: consisting of set up of the drawing page and the printer, including scale
settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerancing; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles;

UNIT-4 Sections and Sectional Views of Right Angular Solids:

Sections of solids in simple position Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids.

Annotations, layering & other functions:

applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation, Computer-aided design

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(CAD) software modeling of parts and assemblies. Parametric and non-parametric solid, surface, and wireframe models. Part editing and twodimensional documentation of models. Planar projection theory, including sketching of perspective, isometric, multi view, auxiliary, and section views. Spatial visualization exercises. Dimensioning guidelines, tolerancing techniques; dimensioning and scale multi views of dwelling.

UNIT-5 Isometric Projections:
Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Viceversa, Conventions.

Demonstration of a simple team design project:
Geometry and topology of engineered components: creation of engineering odels and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; geometric dimensioning and tolerancing; Use of solid-modeling software for creating associative models at the component and assembly levels; (Examples of specific components to the branch of study may be included).

Text Books:

1. N.D.Bhatt, Elementary Engineering Drawing, Charotar Publishers,2012
2. K.L.Narayana and P.K.Kannaiah, –Text Book of Engineering. Drawing, Scitech Publications, 2011.
3. Basanth Agrawal and C M Agrawal –Engineering Drawing 2e –, McGraw-Hill Education(India) Pvt.Ltd.

Suggested Reading:

1. Shaw M.B and Rana B.C., –Engineering drawing Pearson, 2ndedition, 2009.
2. K.Veenugopal, –Engineering Drawing and Graphics + Autocad, New Age International Pvt.Ltd,2011.
3. Bhattacharya. B, –Engineering Graphics I. K. International Pvt.Ltd, 2009.

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18EE C01

BASIC ELECTRICAL ENGINEERING

Instruction:	3L+1T Hours per Week
Duration of Semester End Examination:	3 Hours
Semester End Examination:	70 Marks
Continuous Internal Evaluation:	30 Marks
Credits:	4

Course Objectives:

1. To understand the behavior of different circuit elements R,L & C, and the basic concepts of electrical circuit analysis.
2. To know the concepts of AC circuits, RMS value, Average value, Phasor analysis etc.
3. To understand the basic principle of operation of Transformer and DC machines.
4. To understand the basic principle of operation of DC machines and AC machines.
5. To know about different types of electrical wires and cables, domestic and industrial wiring.
6. To understand safety rules and methods of earthing.

Course Outcomes: At the end of the course, the student will be able to

1. Acquire the concepts of Kirchhoff's laws and network theorems and able to get the solution of simple dc circuits.
2. Obtain the steady state response of RLC circuits and also determine the different powers in AC circuits.
3. Acquire the concepts of principle of operation of Transformers and DC machines.
4. Acquire the concepts of principle of operation of DC machines and AC machines.
5. Acquire the knowledge of electrical wiring and cables and electrical safety precautions.
6. Recognize importance of earthing and methods of earthing and electrical installations.

UNIT-I: DC Circuits

Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation, Superposition, Thevenin and Norton Theorems, Time-domain analysis of firstorder RL and RC circuits.

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UNIT-II: AC Circuits

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor, Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel). Three phase balanced circuits, voltage and current relations in star and delta connections.

UNIT-III: Transformers

Construction, Working principle, EMF Equation, Ideal and Practical transformer, Equivalent circuit of Transformer, OC and SC tests on a transformer, Efficiency and Regulation, Auto transformer.

UNIT-IV: DC and AC Machines

DC Generators: Construction, Principle of operation, EMF equation, Classification, Characteristics of shunt, series and compound generators. DC Motors: Classification, Torque equation, Characteristics, Efficiency, Speed Control of Series and Shunt Motors. Three - Phase Induction Motors: Construction, Principle of operation, Torque equation, torque-slip characteristics, Power stages, speed control of induction motors.

UNIT-V: Electrical Installations

Electrical Wiring: Types of wires and cables, Electrical Safety precautions in handling electrical appliances, electric shock, first aid for electric shock, safety rules. Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Earthing, Elementary calculations for energy consumption.

Text books:

1. L. S. Bobrow, Fundamentals of Electrical Engineering, Oxford University Press, 2011.
2. E. Hughes, Electrical and Electronics Technology, Pearson, 2010.

Suggested Reading:

1. D. P. Kothari & I. J. Nagrath, –Basic Electrical Engineering Tata McGraw Hill, 2010.
2. V. D. Toro, –Electrical Engineering Fundamentals Prentice Hall India, 1989.
3. D.C. Kulshreshtha, –Basic Electrical Engineering McGraw Hill,2009
4. P.V.Prasad, S.sivanagaraju, R.Prasad, "Basic Electrical and Electronics Engineering" Cengage Learning, 1st Edition, 2013.

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18EE C02

BASIC ELECTRICAL ENGINEERING LAB

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	35 Marks
Continuous Internal Evaluation:	15 Marks
Credits	1

Course Objectives:

1. To acquire the knowledge of different types of electrical elements.
2. To verify the basic electrical circuit laws and theorems.
3. To determine the parameters and power factor of a coil.
4. To calculate the time and frequency responses of RLC circuits
5. To determine the characteristics of Transformers.
6. To determine the characteristics of dc and ac machines.

Course Outcomes: At the end of the course, the students are expected to

1. Get an exposure to common electrical components and their ratings.
2. Make electrical connections by wires of appropriate ratings.
3. Understand the circuit analysis techniques.
4. Determine the parameters of the given coil.
5. Understand the basic characteristics of transformer.
6. Understand the basic characteristics of dc and ac machines.

List of Laboratory Experiments/Demonstrations:

1. Demonstration of Measuring Instruments and Electrical Lab components
2. Verification of KCL and KVL.
3. Time response of RL and RC circuits.
4. Calculation of permittivity of a choke or coil by Wattmeter Method.
5. Verification of Thevenin's and Norton's theorems.
6. Turns ratio /voltage ratio verification of 1-Ph Transformers.
7. OC and SC tests on a given 1-Ph Transformer.
8. Observation of Excitation Phenomenon in Transformer.
9. Measurement of 3-Ph power in a balanced system (By 2- Wattmeter method).
10. Measurement of 3-Ph Energy by an Energy Meter (Demonstration of Principle).
11. Load test of DC Shunt motor.
12. Speed control of DC Shunt motor.
13. Load test of 3-Ph Induction motor.
14. Demonstration of LT Switchgear Equipment/Components.
15. Demonstration of cut - out section of Machines like DC Machine, Induction Machine etc.

Note: At least **TEN** experiments should be conducted in the semester.

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18CY C02

CHEMISTRY LAB

(Common to all branches)

Instruction:	3 Hours per Week
Duration of Semester End Examination:	3 Hours
Semester End Examination:	50 Marks
Continuous Internal Evaluation:	25 Marks
Credits:	1.5

Course Objectives

1. To impart fundamental knowledge in handling the equipment / glassware and chemicals in chemistry laboratory.
2. The student should be conversant with the principles of volumetric analysis and identification of organic functional groups.
3. To apply various instrumental methods to analyze the chemical compounds and to improve understanding of theoretical concepts.

Course Outcomes

The chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and engineering.

Thestudents will learn to:

1. Estimate rate constants of reactions from concentration of reactants/ products as a function of time.
2. Measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water, etc
3. Synthesize a small drug molecule and Identify the organic compounds.
4. understand importance of analytical instrumentation for different chemical analysis.
5. Perform interdisciplinary research such that the findings benefit the common man.

Chemistry Lab

1. Estimation of temporary and permanent hardness of water using EDTA solution
2. Estimation of amount of chloride in water.
3. Determination of rate constant for the reaction of hydrolysis of methyl acetate.(first order)
4. Estimation of amount of HCl Conductometerically using NaOH solution.
5. Estimation of (a) amount of CH_3 COOH Conductometerically using NaOH solution. (b) amount of HCl and CH_3 COOH present in the given mixture of acids Conductometerically using NaOH solution.

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6. Estimation of amount of HCl Potentiometrically using NaOH solution.
7. Estimation of amount of Fe^{+2} Potentiometrically using $KMnO_4$ solution.
8. Distribution of acetic acid between n-butanol and water.
9. Synthesis of drug - Aspirin.
10. Organic Chemistry- Identification of Functional groups - neutral group (carbonyl groups-acetaldehyde and acetone); acidic group (benzoic acid); basic group (aniline)
11. Determination of surface tension of organic solvents (ethanol, ethyl acetate)
12. Determination of Viscosity.

TEXT BOOKS

1. J. Mendham and Thomas ,"Vogel' s text book of quantitative chemical analysis",Pearson education Pvt.Ltd. New Delhi ,6th ed. 2002.

SUGGESTED READINGS

1. Dr. Subdharani , "Laboratory Manual on Engineering Chemistry", Dhanpat Rai Publishing, 2012.
2. S.S. Dara , "A Text book on experiment and calculation in engineering Chemistry", S.Chand and Company, 9th revised edition, 2015.

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Scheme of Instruction and Syllabi

of

BE / B.TECH B.E. (EEE) III to IV SEMESTERS

of

FOUR YEAR DEGREE COURSE

IN

B.E. (EEE)

under AICTE Model Curriculum

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY
(An Autonomous Institution)
Affiliated to OU; All U.G. and 5 P.G. Programmes (Civil, CSE, ECE, Mech. & EEE)
Accredited by NBA; Accredited by NAAC - 'A' Grade (UGC);
ISO Certified 9001:2015

Chaitanya Bharathi P.O, CBIT, Campus, Gandipet, Kokapet (V),
Gandipet Mandal, Ranga Reddy District, Hyderabad-500075, Telangana
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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)
SCHEME OF INSTRUCTION AND EXAMINATION
B.E/B.Tech under AICTE Model Curriculum
B.E. (EEE)

SEMESTER-III

Sl. No	Course Code	Title of the Course	Scheme of Instruction: Hours per week L	T	P	Scheme of Examination: Duration In Hours	Maximum Marks CIE	SEE	Credits
1.	18MT C07	Applied mathematics	3	1	-	3	30	70	4
2.	18EE C03	Analog Electronic Circuits	3	1	-	3	30	70	4
3.	18EE C04	Electrical Measurements and Instrumentation	3	-	-	3	30	70	3
4.	18EE C05	Electromagnetic Fields	3	1	-	3	30	70	4
5.	18EE C06	Electrical Circuit Analysis	3	1	-	3	30	70	4
6.	18EG M 01	Indian constitution	2	-	-	2	-	50	-
7.	18EE M01	Indian Traditional Knowledge	2	-	-	2	-	50	-
		PRACTICALS							
8.	18EE C07	Analog Electronic Circuits Lab	-	-	2	2	15	35	1
9.	18EE C08	Electrical Measurements and Instrumentation Lab	-	-	2	2	15	35	1
		Total	19	4	4	-	180	520	21

L: Lecture T: Tutorial D: Drawing P: Practical
CIE - Continuous Internal Evaluation SEE - Semester End Examination

Core Courses offered to other Departments:

SEMESTER-III

Sl. No	Course Code	Title of the Course	Scheme of Instruction: Hours per week L	T	P	Scheme of Examination: Duration In Hours	Maximum Marks CIE	SEE	Credits
1	18EE C01	Basic Electrical and Electronics Engineering	3	1	-	3	30	70	4
		PRACTICALS							
2	18EE C02	Basic Electrical and Electronics Engineering Lab	-	-	2	2	15	35	1

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18MT C07

APPLIED MATHEMATICS
(For ECE/EEE)

Instruction	3L+1T Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	4

Course Objectives:
1. To form PDE and solve Linear and Non-Linear equations.
2. To learn the Laplace, Inverse Laplace Transform and Z-Transforms.
3. To find roots of equations, interpolation and Numerical differentiation.
4. To learn Numerical solution of ODE and Engineering problems.
5. To learn fitting of distribution and predicting the future values.

Course outcomes: After completion of this course, students will be able to:
1. Understand the methods to find solution of linear and non-linear PDE and solution of wave equation.
2. Find Laplace, Inverse Laplace and Z-Transforms and solution of engineering problems.
3. Solve Non-Linear algebraic and transcendental equations to find interpolations when tabular values are given.
4. Find solution of initial value problems of ODE.
5. Understand the Methods for analysing the random fluctuations using probability distribution and also identify the importance of principle of Least squares approximations for predictions.

UNIT-I

Partial Differential Equations: Formation of Partial Differential Equations, Solution of Linear (Lagrange's) and Non-linear PDE of First order standard forms and Charpit's Method, Solutions of PDE by method of separation of variables, solution of one dimensional wave equation and its applications.

UNIT-II

Transform Theory: Laplace Transform, Properties of Laplace Transform, Laplace transform of periodic functions. Finding inverse Laplace transform by partial fractions and residue method, solving ODEs by Laplace Transform method. Z-transforms and its basic properties, inverse Z-transform and solutions of difference equation by Z-transform.

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UNIT-III

Numerical Analysis: Solution of Algebraic and transcendental equations by Bisection method, Newton-Raphson method and Regula-Falsi method. Interpolation, Newton's forward and backward difference formulae.Newton's divided difference and Lagrange'sformulae.Numerical Differentiation.

UNIT-IV

Numerical Solutions of ODE: Solutions of First Order Ordinary differential equations, Taylor's series, Euler and modified Euler's methods. Runge-Kutta method of fourth order for solving first and second order equations. Milne's and Adam's predicator corrector methods.

UNIT-V

Basic Statistics: Measures of Central tendency for continuous random variable, Moments, skewness and Kurtosis, Probability distributions: Normal (Gaussian),Rayleigh, Exponential and uniform distributions Correlation and regression. Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas.

Text Books:

1. P. Kandasamy, K. Thilagavathy, K. Gunavathi, "Numerical Methods", S. Chand & Company, 2nd Edition, Reprint 2012.
2. S.S. Sastry, "Introductory methods of numerical analysis", PHI, 4th Edition, 2005.
3. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 35th Edition, 2010.
4. Sheldon Ross, "A First Course in Probability", 9th Edition, Pearson publications, 2014.

Suggested Reading:

1. Erwin Kreyszig, "Advanced Engineering Mathematics", 9th Edition, John Wiley & Sons, 2006.
2. Veerarajan T, "Engineering Mathematics", Tata McGraw-Hill, New Delhi, 2008.
3. S.C.Gupta, V.K.Kappoor, "Fundamentals of Mathematical Statistics", Sultan Chand and Sons, 2014.

> ***Education*** *is the process of imparting knowledge, values, skills and attitudes, which can be beneficial to an individual. On the contrary,* ***Learning*** *is the process of adopting knowledge, values and skills.*
>
> Concept-Based Curriculum and Instruction

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18EE C03

ANALOG ELECTRONIC CIRCUITS

Instruction	3L+1T Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	4

Course Objectives:

1. To understand the characteristics of diodes, BJTs, MOSFETS and the biasing techniques of transistors.
   2. To understand the functioning, DC characteristics of operational amplifiers and also different linear applications of operational amplifiers
3. Study the different non-linear applications of operational amplifiers

Course Outcomes: After completion of this course, students will be able to:

1. Analyze the characteristics of Diodes ,transistors and MOFETS.
2. Understand biasing techniques of transistor and its application as differential and multi stage amplifier
3. Understand the basic characteristics of op-amps and their significance.
4. Analyze different linear application circuits of operational amplifiers
5. Analyze different non-linear application circuits of operational amplifiers

UNIT-I

Diode circuits and BJT Circuits: P-N junction diode, I-V characteristics of a diode; review of half-wave and full-wave rectifiers, Zener diodes.
Structure and I-V characteristics of a BJT; BJT as a switch. BJT as an amplifier: small-signal model, biasing circuits, current mirror; common-emitter, common-base and common collector amplifiers; Small signal equivalent circuits.

UNIT-II

MOSFET Circuits: MOSFET structure and I-V characteristics, MOSFET as a switch, MOSFET as an amplifier: small-signal model and biasing circuits, common-source, common-gate and common-drain amplifiers, small signal equivalent circuits, gain, input and output impedances, trans-conductance.

UNIT-III

Differential, multi-stage and operational amplifiers: Differential amplifier; power amplifier; direct coupled multi-stage amplifier; internal structure of an operational

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amplifier, ideal op-amp, non-idealities in an op-amp (Output offset voltage, input bias current, input offset current, slew rate, gain bandwidth product)

UNIT-IV

Linear applications of op-amp: Idealized analysis of op-amp circuits. Inverting and non-inverting amplifier, differential amplifier, instrumentation amplifier, integrator, active filter, P, PI and PID controllers, Series voltage regulator , oscillators (Wein bridge and phase shift).

UNIT-V

Nonlinear applications of op-amp: Hysteretic Comparator, Zero Crossing Detector, Square-wave and triangular-wave generators. Precision rectifier, peak detector. Monoshot. clamping and clipping circuits

Text Books:

1. A. S. Sedra and K. C. Smith, "Microelectronic Circuits", New York, Oxford University Press, 1998.
2. J. V. Wait, L. P. Huelsman and G. A. Korn, "Introduction to Operational Amplifier theory and applications", McGraw Hill U. S., 1992.
3. J. Millman and A. Grabel, "Microelectronics", McGraw Hill Education, 1988.
4. Analog Electronics, A.K. Maini, Khanna Publishing House

Suggested Readings:

1. Millman and Halkias, " Electronic Devices and Circuits" 2nd Edition, McGraw Hill Publication 2007.
2. Robert L. Boylestad, "Electronic Devices and Circuit Theory", 10th Edition, PHI, 2009
3. D.Roy Choudhury, Linear Integrated Circuits, Shail B.Jain, , New Age Intern.(P) Ltd., 3rd Edition 2007.
4. Gayakwad R.A. Op-Amps and Linear Integrated Circuits, PHI, 4th Edition, 2002.
5. David Bell, "Fundamentals of Electronic Devices and Circuits", 5th Edition, Oxford University Press 2008.

18EE C04

ELECTRICAL MEASUREMENTS AND INSTRUMENTATION

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To understand the principle behind various instruments.
2. To know the various bridges for measurement of R, L and C.
3. To measure various magnetic and electric parameters.

Course Outcomes: After completion this course, students will be able to:

1. Identify a suitable instrument to measure a given parameter.
2. Analyze the need of CT/PT for a given system.
3. Illustrate the concept of the instrument with relevant examples and proper justification.
4. Distinguish between electrical and magnetic measurements and their instruments.
5. Specify the right transducer for a given requirement.

UNIT-I

Introduction to Measurements: Objectives of measurement, static and dynamic characteristics, errors and their classification.

Introduction to Instruments-1: Types of instruments, classification of instruments based on type of measurement and principle of working (PMMC, MI, Dynamometer, Induction and Electrostatic), types of torques (torque equations for MC, MI and dynamometer type instruments).

UNIT-II

Introduction to Instruments-2: Single phase Induction type energy meter, concept of driving torque & braking torque equations, (no derivation) ; Errors and their Compensation, Single phase Dynamometer type Power factor meter, Weston type frequency meter. Construction & theory of Instrument Transformers, Equations for ratio and phase angle error of C.T & P.T (Elementary treatment only).

UNIT-III

Resistance, Inductance and Capacitance parameters: Classification of resistance measuring methods Kelvin's double bridge, Wheatstone bridge and meggar.

Measurement of inductance using Maxwell's inductance bridge, Anderson's bridge. Measurement of capacitance using De-Sauty's bridge and Schering bridge., merits and demerits, applications and related numerical problems.

UNIT-IV

Measurements of Magnetic and Electric Parameters: Ballistic galvanometer-Principle of operation, construction and applications of Ballistic galvanometer, flux meter its construction and principle of operation. Epstein square bridge for measuring Iron losses. Potentiometers,-Principle - Classification – Salient features related to Practical applicability.

UNIT-V

Introduction to Digital Instruments (DVM and Transducers): Introduction to digital Instruments, Digital Voltmeters (DVM), Speed reading, Range selection, Over ranging, Common mode rejection, Digital Multi meters.

Transducers: Introduction, Role of Transducers in measurement system, Strain Gauge, Linear variable Differential transformer (LVDT), Temperature transducers, bimetallic strip, Thermocouples, Resistance Temperature Detectors (RTD), Thermostats, Radiation pyrometers.

Text Books:

1. F.W.Golding and Widdis, Electrical Measurements and measuring Instruments, A.H.Wheeler & Co., 5th Edition, 2007.
2. A.K.Sawhney, A Course in Electrical and Electronics Measurements and Instrumentation, Dhanapat Rai & Sons, NewDelhi, 19th Edition, 2011.
3. CT. Baldwin, Fundamentals of Electrical measurements, Kalyani publications, 2001.

Suggested Readings:

1. Helfrick, Albert D., Cooper, William D., Modern Electronic Instrumentation and Measurement Techniques, PHI Publications, 1990.
2. Stanley Wold, Richard F.M.Smith, Student reference manual for Electronic Instrumentation Laboratories, 2nd Edition, PHI.
3. Alan. S. Morris, Essence of Measurement, PHI, 1996.

Teaching with dialogue education involves listening to learners at every level, respecting them as subjects or decision makers of their own learning and evoking their innate power.

Concept-Based Curriculum and Instruction

18EE C05

ELECTROMAGNETIC FIELDS

Instruction	3L+1T Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	4

Course Objectives:

1. To understand coordinate systems, vector calculus and their applications to electrostatic and magnetic fields.
2. To figure out Maxwell's equations, uniform plane wave and its propagation through different media.
3. To know the sources, effects & control techniques of EMI & EMC.

Course Outcomes: After completion of this course, students will be able to

1. Recognize the importance of different coordinate systems and vector calculus in EM theory.
2. Analyze electric and magnetic field intensity, flux density and potential due to various charge configurations.
3. Differentiate between conduction & convection currents through various materials.
4. Illustrate the Maxwell's equations and EM wave equations in different media.
5. Identify EMI & EMC, the causes and effects, various control methods of EMI.

UNIT-I

Orthogonal Coordinate Systems: Review of Vector Calculus, Rectangular, Cylindrical, Spherical coordinate systems; Line, Surface and Volume integrals; Operator Del, Gradient, Divergence, Curl & Laplacian of a field; Divergence and Stoke theorems.

Electrostatic fields: Various charge configurations, Coulomb's law, Electric field intensity and flux density of different charge distributions, Gauss law, Integral and Point form of Maxwell's Electrostatic Equation.

UNIT-II

Electrostatic Field in Materials: Electrical Potential, Capacitance of Parallel plate capacitor, Equi-potential lines, Properties of materials, convection and conduction currents, conductors, dielectric constant, continuity equation and relaxation

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time, boundary conditions, Poisson's and Laplace's equations, Uniqueness theorem.

UNIT-III

Magneto Static Fields: Biot-Savart's law, Ampere's law, Displacement current, Magnetic scalar and Vector Potentials, boundary conditions, Forces in Magnetic fields, Lorentz force equation, Force between parallel conductors, Inductance Calculations (Solenoid, Toroid), Mutual Inductance.

UNIT-IV

Time Varying Electromagnetic Fields: Faraday's laws of electromagnetic induction, Final forms of Maxwell's Equations, Power and Poynting theorem, Time-Harmonic Electromagnetic fields, Wave equations (One dimension), Plane Wave, Propagation in perfect and lossy-dielectrics.

UNIT-V

Electromagnetic Interference and Compatibility (Theoretical Aspects only): Introduction to Electromagnetic Interference and Electromagnetic Compatibility (EMI & EMC)- Sources and Characteristics of EMI, Control Techniques of EMI, Grounding, Shielding, Filtering. Introduction to numerical electromagnetic.

Text Books:

1. Hayt, W.H and J.A Buck, Engineering Electromagnetics, Tata McGraw Hill, 8th Edition, 2014.
2. Sadiku, M.N.O,S.V. Kulkarni, Principles of Electromagnetics, Oxford University press, 6th Edition, 2015.

Suggested Readings:

1. S. P. Seth, Elements of Electromagnetic Fields, Danpat Rai& Co, 2011.
2. David K. Cheng, Field and Wave Electromagnetics, Pearson Education. 2nd Edition 2014.
3. Ashutosh Pramanik, Electromagnetism Theory and Applications, PHI Pvt. Ltd., 3rd Edition, 2014.

18EE C06

ELECTRICAL CIRCUIT ANALYSIS

Instruction	3L+1T Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	4

Course Objectives:

1. To understand the nature of different circuit elements, laws and network theorems.
2. To study transient response of circuits with initial conditions & forcing functions and also basics of network topology.
3. To understand the Laplace transforms and two-port networks.

Course Outcomes: After completion of this course, students will be able to:

1. Apply network theorems for the analysis of electrical circuits.
2. Understand the circuit analysis using graph theory &Coupled circuits.
3. Obtain the transient and steady-state response of electrical circuits.
4. Analyze circuits using Laplace transformations.
5. Analyze behavior of two port networks.

UNITI

Sinusoidal steady state analysis: Review of AC fundamentals, effective or RMS values, Steady state response of RLC networks with sinusoidal excitations, average power and complex power, series and parallel resonance, Three phase circuits with balanced & unbalanced loads, Displacement neutral, Mutual coupled circuits, Dot Convention in coupled circuits, Ideal Transformer.

UNITII

Network Theorems: Node and Mesh Analysis, Analysis with dependent current and voltage sources, Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Reciprocity theorem, Compensation and Milliman's theorems.

UNITIII

Graph Theory: Formation of Incident, fundamental Tie-set and Cut-set matrices, Concept of duality and dual networks.

Solution of First and Second order networks: Review of solution of first and second order differential equations for Series and parallel RL, RC, RLC circuits,

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initial and final conditions in network elements, forced and force-free responses, time constant, steady state and transient state responses.

UNITIV

Electrical Circuit Analysis Using Laplace Transforms: Review of Laplace Transform, Analysis of electrical circuits using Laplace Transform for standard inputs, convolution integral, inverse Laplace transform, transformed network with initial conditions. Transfer function representation. Poles and Zeros. Frequency response (magnitude and phase plots),

UNITV

Two Port Networks: Two Port Networks, terminal pairs, relationship of two port variables, impedance parameters, admittance parameters, transmission parameters and hybrid parameters, interconnections of two port networks.

Text Books:

1. M. E. Van Valkenburg, "Network Analysis", 3rd Edition, Prentice Hall, 2015.
2. C. K. Alexander and M. N. O. Sadiku, "Electric Circuits",6th Edition, McGraw Hill Education, 2019.
3. W. H. Hayt and J. E. Kemmerly, "Engineering Circuit Analysis", McGraw Hill Education2013.

Suggested Reading:

1. D. Roy Choudhury, "Networks and Systems", 2nd Edition, New Age International, 2010.
2. K. V. V. Murthy and M. S. Kamath, "Basic Circuit Analysis", Jaico Publishers, 2002.

18EG M 01

INDIANCONSTITUTION

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
SEE	50 Marks

Course Objectives:The course will introduce the students to :

1. The history of Indian Constitution and how it reflects the social, political and economic perspectives of the Indian society.
2. Address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. Have knowledge of the various Organs of Governance and Local Administration.

Course Outcomes :After successful completion of the course the students will be able to :

1. Understand the making of the Indian Constitution and its features.
2. Have an insight into various Organs of Governance - composition and functions.
3. Understand powers and functions of Municipalities, Panchayats and Co-operative Societies.
4. Be aware of the Emergency Provisions in India.
5. Understand the Right To equality, the Right To freedom and the Right To Liberty.

Unit-I

Constitution of India - Introduction and salient features . Constitutional history. Directive Principles of State Policy - Its importance and implementation.

UnitII

Union Government and its Administration - Structure of the Indian Union: Federalism, distribution of legislative and financial powers between the Union and the States.

Parliamentary form of government in India. President: role, power and position.

UnitIII

Emergency Provisions in India - National emergency, President rule, Financial emergency

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Unit IV

Local Self Government - District's Administration Head: Role and Importance. Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation.

Panchayati Raj: Introduction, Zilla Panchayat, Elected officials and their roles, CEO Zilla Panchayat: Position and role. Block level: Organizational Hierarchy (Different departments). Village level: Role of Elected and officials.

Unit V

Scheme Of The Fundamental Rights & Duties: Fundamental Duties - the legal status.

Scheme Of The Fundamental Rights - To Equality, to certain Freedom Under Article 19, to Life And Personal Liberty Under Article 21.

Suggested Reading:

1. **The Constitution of India**, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar, **Framing of Indian Constitution**, 1st Edition, 2015.
3. M. P. Jain, **Indian Constitution Law**, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu**, Introduction to the Constitution of India**, Lexis Nexis, 2015

Online Resources:

http://www.nptel.ac.in/courses/103107084/Script.pdf

18EE M01

INDIAN TRADITIONAL KNOWELDGE

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	50 Marks
Credits	0

Course Objectives:

1. To get a knowledge in Indian Culture
2. To Know Indian Languages and Literature and the fine arts in India
3. To explore the Science and Scientists of Medieval and Modern India

Course Outcomes: After completion of this course, students will be able to:

1. Understand philosophy of Indian culture
2. Distinguish the Indian languages and literature
3. Learn the philosophy of ancient, medieval and modern India
4. Acquire the information about the fine arts in India
5. Know the contribution of scientists of different eras.

UNIT-I

Introduction to Culture: Culture, civilization, culture and heritage, general characteristics of culture, importance of culture in human literature, Indian Culture, Ancient India, Medieval India, Modern India

UNIT-II

Indian Languages, Culture and Literature:

Indian Languages and Literature-I: the role of Sanskrit, significance of scriptures to current society, Indian philosophies, other Sanskrit literature, literature of south India.

Indian Languages and Literature-II: Northern Indian languages & literature

UNIT-III

Religion and Philosophy: Religion and Philosophy in ancient India, Religion and Philosophy in Medieval India, Religious Reform Movements in Modern India (selected movements only)

UNIT-IV

Fine arts in India (Art, Technology& Engineering): Indian Painting, Indian handicrafts, Music, divisions of Indian classic music, modern Indian music, Dance and Drama, Indian Architecture (ancient, medieval and modern), Science

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and Technology in India, development of science in ancient, medieval and modern India

UNIT-V

Education system in India: Education in ancient, medieval and modern India, aims of education, subjects, languages, Science and Scientists of Ancient India, Science and Scientists of Medieval India, Scientists of Modern India

Text Books:

1. Kapil Kapoor, Text and Interpretation: The India Tradition,ISBN: 81246033375, 2005
2. Science in Samskrit, Samskrita Bharti Publisher, ISBN-13: 978-8187276333, 2007
3. S. Narain, Examinations in ancient India, Arya Book Depot, 1993
4. Satya Prakash, Founders of Sciences in Ancient India, Vijay Kumar Publisher, 1989
5. M. Hiriyanna, Essentials of Indian Philosophy, Motilal Banarsidass Publishers, ISBN-13: 978-8120810990, 2014

Suggested Reading:

1. Kapil Kapoor, Language, Linguistics and Literature: The Indian Perspective, ISBN-10: 8171880649, 1994.
2. Karan Singh, A Treasury of Indian Wisdom: An Anthology of Spiritual Learn, ISBN: 978-0143426158, 2016.

18EE C07

ANALOG ELECTRONICS CIRCUITS LAB

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	35 Marks
CIE	15 Marks
Credits	1

Course objectives:

1. The V-I Characteristics of diode, Transistor and MOSFET.
2. The frequency response of BJT and FET amplifiers and the performance analysis of multistage amplifiers.
3. To analyze and design various applications of Op-Amp.

Course Outcomes: After completion of this course, students will be able to:

1. Verify the working of PN junction diodes, transistors and their characteristic behavior.
2. Design various rectifiers with different filter combinations.
3. Set up bias point in a transistor.
4. Build a multi stage amplifier and find the frequency response of amplifier.
5. Design and analyze circuits for inverting and non-inverting amplifiers, and linear and non linear applications of Op-Amp

LIST OF EXPERIMENTS

Part A

1. V-I characteristics of (Silicon and Germanium) diodes and measurement of static and dynamic resistance.
2. Zener diode characteristics and its application as an voltage regulator.
3. (a) Design, realization and performance evaluation of rectifier circuits with and without filters (C & ð section) Half wave rectifier.
   (b) Design, realization and performance evaluation of rectifier circuits with and without filters (C & ð section) Full wave rectifier.
4. Plotting the characteristics of BJT and MOSFET.
5. Design of Biasing circuits for BJT
6. Design and Frequency response of Common Emitter BJT amplifier and measurement of Gain, Bandwidth, Input and Output impedances.
7. Design and Frequency response of Single stage and Multi stage RC coupled amplifier using BJT.

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Part B

1. Measurements of Op Amp parameters:
2. Inverting and Non Inverting Amplifiers
3. Design of integrator and differentiator using Op-Amp.
4. Generation of triangular, sine and square wave using IC's.
5. Peak Clamper using Op-Amps.
6. Clippers using Op-Amps..
7. Schmitt Trigger,

Note: At least **FIVE** experiments from **Part-A** and **FIVE** from **Part-B** should be conducted in the semester.

18EE C08

ELECTRICAL MEASUREMENTS AND INSTRUMENTATIONLAB

Instruction	2 Hours per week
Duration of Semester End Exam	2 Hours
Semester End Exam	35 Marks
CIE	15 Marks
Credits	1

Course Objectives:

1. To understand the various Electrical Measuring instruments for measuring various
   electrical quantities.
2. To measure the unknown values of different electrical elements.
3. To become familiar with digital instruments.

Course Outcomes: After completion of this course, students will be able to:

1. Design and validate DC and AC bridges.
2. Learn about various measurements devices, their characteristics and limitations.
3. Understand the operation of DSO and analyse various signals.
4. Demonstrate the principles of magnetic measurements.
5. Select the right instrument for the given circuit.

LISTOF EXPERIMENTS

1. Calibration of single-phase energy meter with Phantom Loading.
2. Measurement of high resistance and insulation resistance using Megger.
3. Measurement of iron losses using Epstein's square bridge.
4. Measurement of unknown frequency using Lissajous Patterns.
5. Study of Digital Instruments
6. Measurement of bandwidth and sampling rate of a signal using DSO.
7. Usage of DSO to capture transients in RLC circuits.
8. Measurement of unknown resistance using Kelvin's double bridge.
9. Measurement of unknown Inductance using Maxwell's bridge and validating with LCR meter.
10. Measurement of unknown inductance using Anderson's bridge and validating with LCR meter.
11. Measurement of unknown capacitance using Schering bridge and validating with LCR meter.

12. Measurement of strain using strain gauge.
13. Measurement of Displacement using LVDT.
14. Measurement of unknown voltage using D.C Crompton's potentiometer.
15. Study of current transformer and potential transformer.

Note: At least **TEN** experiments should be conducted in the semester.

18EE C01

BASICELECTRICALENGINEERING

Instruction	3L+1T Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	4

Course Objectives:

1. To understand the behavior of different circuit elements R,L & C, and the basic concepts of electrical circuit analysis
2. To know the concepts of AC circuits, RMS value, Average value, Phasor analysis etc.,
3. To understand the basic principle of operation of Transformer and DC machines
4. To understand the basic principle of operation of DC machines and AC machines
5. To know about different types of electrical wires and cables, domestic and industrial wiring.
6. To understand safety rules and methods of earthing

Course Outcomes: At the end of the course, the student will be able to

1. Acquire the concepts of Kirchhoff's laws and network theorems and able to get the solution of simple dc circuits
2. Obtain the steady state response of RLC circuits and also determine the different powers in AC circuits
3. Acquire the concepts of principle of operation of Transformers and DC machines
4. Acquire the concepts of principle of operation of DC machines and AC machines
5. Acquire the knowledge of electrical wiring and cables and electrical safety precautions
6. Recognize importance of earthing and methods of earthing and electrical installations

UNIT-I:

Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation,

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Superposition, Thevenin and Norton Theorems, Time-domain analysis of first-order RL and RC circuits.

UNIT-II:

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor, Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel). Three phase balanced circuits, voltage and current relations in star and delta connections.

UNIT-III:

Construction, Working principle, EMF Equation, Ideal and Practical transformer, Equivalent circuit of Transformer, OC and SC tests on a transformer, Efficiency and Regulation, Auto transformer.

UNIT-IV:

DC Generators: Construction, Principle of operation, EMF equation, Classification, Characteristics of shunt, series and compound generators.

DC Motors: Classification, Torque equation, Characteristics, Efficiency, Speed Control of Series and Shunt Motors.

Three - Phase Induction Motors: Construction, Principle of operation, Torque equation, torque-slip characteristics, Power stages, speed control of induction motors.

UNIT-V:

Electrical Wiring: Types of wires and cables, Electrical Safety precautions in handling electrical appliances, electric shock, first aid for electric shock, safety rules.

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Earthing, Elementary calculations for energy consumption.

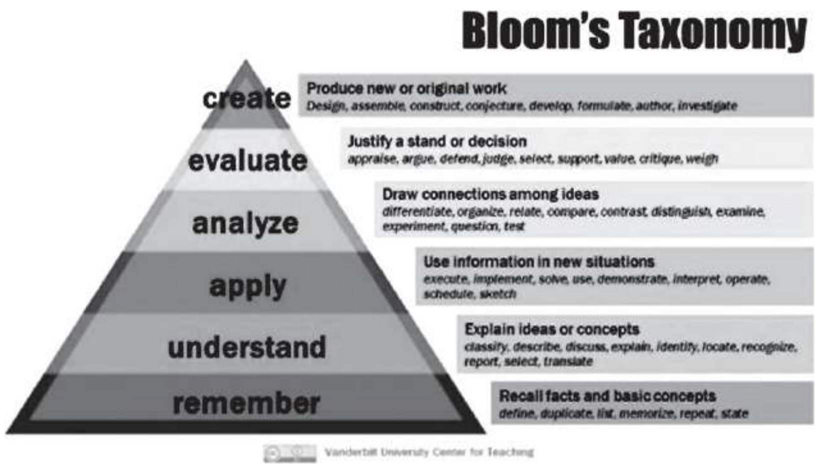
Text books:

1. L. S. Bobrow, Fundamentals of Electrical Engineering, Oxford University Press, 2011.
2. E. Hughes, Electrical and Electronics Technology, Pearson, 2010.

Suggested Reading:

1. D. P. Kothari & I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.

2. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989
3. D.C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill,2009
4. P.V.Prasad, S.sivanagaraju, R.Prasad, "Basic Electrical and Electronics Engineering" Cengage Learning, 1st Edition, 2013.



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18EE C02

BASIC ELECTRICAL ENGINEERING LAB

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	35 Marks
CIE	15 Marks
Credits	1

Course Objectives:

1. To acquire the knowledge of different types of electrical elements.
2. To verify the basic electrical circuit laws and theorems.
3. To determine the parameters and power factor of a coil.
4. To calculate the time and frequency responses of RLC circuits
5. To determine the characteristics of Transformers
6. To determine the characteristics of dc and ac machines

Course Outcomes: At the end of the course, the students are expected to

1. Get an exposure to common electrical components and their ratings
2. Make electrical connections by wires of appropriate ratings
3. Understand the circuit analysis techniques.
4. Determine the parameters of the given coil.
5. Understand the basic characteristics of transformer
6. Understand the basic characteristics of dc and ac machines

List of Laboratory Experiments/Demonstrations:

1. Demonstration of Measuring Instruments and Electrical Lab components
2. Verification of KCL and KVL
3. Time response of RL and RC circuits
4. Calculation of permittivity of a choke or coil by Wattmeter Method
5. Verification of Thevenin's and Norton's theorems
6. Turns ratio /voltage ratio verification of 1-Ph Transformers
7. OC and SC tests on a given 1-Ph Transformer
8. Observation of Excitation Phenomenon in Transformer
9. Measurement of 3-Ph power in a balanced system (By 2- Wattmeter method)
10. Measurement of 3-Ph Energy by an Energy Meter (Demonstration of Principle)
11. Load test of DC Shunt motor
12. Speed control of DC Shunt motor

13. Load test of 3-Ph Induction motor
14. Demonstration of LT Switchgear Equipment/Components
15. Demonstration of cut - out section of Machines like DC Machine, Induction Machine etc.

Note: at least **TEN** experiments should be conducted in the semester

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SCHEME OF INSTRUCTION AND EXAMINATION
B.E/B.Tech under AICTE Model Curriculum
B.E. (EEE)

SEMESTER-IV

Sl. No	Course Code	Title of the Course	Scheme of Instruction Hours per week			Scheme of Examination			
			L	T	P	Duration In Hours	Maximum Marks CIE	Maximum Marks SEE	Credits
1.	18CS C05	Basics of Data Structures	2	-	-	3	30	70	2
2.	18EE C09	Digital Electronics	3	-	-	3	30	70	3
3.	18EE C10	Electrical Machines-1	3	1	-	3	30	70	4
4.	18EE C11	Power Systems-I	3	-	-	3	30	70	3
5.	18ME C09	Principles of Management	3	-	-	3	30	70	3
6.	18CE M01	Environmental Science	2	-	-	2	-	50	-
		PRACTICALS							
7.	18CS C06	Basics of Data Structures lab	-	-	2	2	15	35	1
8.	18EE C12	Digital Electronics Lab	-	-	2	2	15	35	1
9.	18EE C13	Electrical Machines-1 Lab	-	-	2	2	15	35	1
10.	18EG C03	Soft Skills Lab	-	-	2	2	15	35	1
		Total	**16**	**1**	**8**		**210**	**540**	**19**

L: Lecture T: Tutorial D: Drawing P: Practical
CIE - Continuous Internal Evaluation SEE - Semester End Examination

18CS C05

BASICS OF DATA STRUCTURES
(Common for other Programmes)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	2

Pre-requisites: Basic knowledge of programming language such as C or C++ is preferred (but not mandatory) and some mathematical maturity also will be expected.

Course Objectives:
1. To basic linear and non-linear data structures.
2. To analyzing the performance of operations on data structures.
3. To different sorting and searching techniques and their complexities.

Course Outcomes: After completion of this course, students will be able to:
1. Understand the basic concepts of data structures.
2. Understand the notations used to analyze the performance of algorithms.
3. Choose and apply an appropriate data structure for a specified application.
4. Understand the concepts of recursion and its applications in problem solving.
5. Demonstrate a thorough understanding of searching and sorting algorithms.

UNIT - I
Introduction: Data Types, Data structures, Types of Data Structures, Operations, ADTs, Algorithms, Comparison of Algorithms, Complexity, Time- space tradeoff. **Recursion**: Introduction, format of recursive functions, recursion Vs. Iteration, examples.

UNIT - II
Linked Lists: Introduction, Linked lists and types, Representation of linked list, operations on linked list, Comparison of Linked Lists with Arrays and Dynamic Arrays.

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UNIT-III

Stacks and Queues: Introduction to stacks, applications of stacks, implementation and comparison of stack implementations. Introduction to queues, applications of queues and implementations, Priority Queues and applications.

UNIT-IV

Trees: Definitions and Concepts, Operations on Binary Trees, Representation of binary tree, Conversion of General Trees to Binary Trees, Representations of Trees, Tree Traversals, Binary search Tree.

UNIT-V

Graphs: Introduction, Applications of graphs, Graph representations, graph traversals, Minimal Spanning Trees.

Searching and Sorting: Linear searching, binary Searching, sorting algorithms- bubble sort, selection sort, quick sort, heap sort.

Text Books:

1. Narasimhaarumanchi, Data Structures and Algorithms Made Easy, CareerMonk Publications, 2017
2. S. Sahni and Susan Anderson-Freed, Fundamentals of Data structures in C,E.Horowitz, Universities Press, 2nd Edition.
3. ReemaThareja, Data Structures using C, Oxford University Press.

Suggested Reading:

1. D.S.Kushwaha and A.K.Misra, Data structures A Programming Approach with C, PHI.
2. Seymour Lipschutz, Data Structures with C, Schaums Outlines, Kindle Edition

18EE C09

DIGITAL ELECTRONICS

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To understand the working of logic families and logic gates
2. To know the design and implementation of combinational and sequential logic circuits.
3. To Understand the process of A/D and D/A conversions and PLD's in implementing the given logical problems.

Course Outcomes: After completion of this course, students will be able to:

1. Understand working of logic families and logic gates.
2. Design and implement combinational digital circuits.
3. Design and implement Sequential logic circuits
4. Understand the process of Analog to Digital conversion and Digital to Analog conversion.
5. Be able to use PLD's to implement the given logical problems.

UNIT–I

Fundamentals of Digital Systems and Logic families: Digital signals, digital circuits, AND, OR, NOT, NAND, NOR and Exclusive-OR operations, Boolean algebra, examples of IC gates, number systems-binary, signed binary, octal hexadecimal number, binary arithmetic, one's and two's complements arithmetic, codes, error detecting and correcting codes, characteristics of digital ICs, digital logic families, TTL, Schottky TTL and CMOS logic, interfacing CMOS and TTL, Tri – state logic.

UNIT–II

Combinational Digital Circuits: Standard representation for logic functions, K-map representation, simplification of logic functions using K-map, minimization of logical functions. Don't care conditions, Multiplexer, De-Multiplexer/Decoders, Adders, Subtractors, BCD arithmetic, carry look ahead adder, serial adder, digital comparator, parity checker/generator, code converters, priority encoders, decoders/Seven segment display device, Q-M method of function realization.

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UNIT–III

Sequential circuits and systems: A 1-bit memory, the circuit properties of bi-stable latch, the clocked SR flip flop, J- K-T and D-types flip-flops, applications of flip-flops, shift registers, applications of shift registers, serial to parallel converter, parallel to serial converter, ring counter, sequence generator, ripple(Asynchronous) counters, synchronous counters, counters design using flip flops, applications of counters.

UNIT–IV

A/D and D/A Converters: Digital to analog converters: weighted resistor/ converter, R-2R Ladder D/A converter, specifications for D/A converters, examples of D/A converter ICs, sample and hold circuit, analog to digital converters: quantization and encoding, parallel comparator A/D converter, successive approximation A/D converter, counting A/D converter, dual slope A/D converter, A/D converter using voltage of frequency and voltage to time conversion, specifications of A/D converters, example of A/D converter ICs.

UNIT–V

Semiconductor memories and Programmable logic devices: Memory organization and operation, expanding memory size, classification and characteristics of memories, sequential memory, read only memory (ROM), read and write memory (RAM), commonly used memory chips, ROM as a PLD, Programmable logic array, Programmable array logic.

Text Books:

1. R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009.
2. M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016.

Suggested Readings:

1. A. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.
2. S. Salivahanan " Digital circuits and design", 4th edition, Vikas Publishing house, 2010.

18EE C10

ELECTRICAL MACHINES-I

Instruction	3L + 1T Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To Inculcate the principles of Electromechanical Energy Conversions.
2. To analyze the performance aspects of DC Machines.
3. To Impart knowledge of poly phase transformer.

Course Outcomes: After completion of this course, students will able to:-

1. To understand the concepts of electromechanical energy conversion.
2. Acquire the knowledge of Construction, operation characteristics of DC generators.
3. Evaluate performance characteristics, testing and applications of DC Motors.
4. Describe operation, regulation and efficiency of single phase transformer.
5. Analyze the three phase transformer connections and cooling methods.

UNIT-I

Electromechanical energy conversion: Forces and torques in magnetic field system, energy balance, singly excited and multiple excited magnetic systems, co energy. MMF, flux, reluctance, series and parallel magnetic circuits, B-H curve of magnetic materials.

UNIT-II

DC Generators: Constructional features of a DC machine, Principle of operation, armature windings diagram (Lap and Wave winding), EMF equation of a DC generator, Armature reaction and its effects, process of commutation, methods of improving commutation, methods of excitation and classification of DC generators, voltage build-up in a shunt generator, critical field resistance and critical speed, generator characteristics, losses and efficiency, parallel operation and applications of DC generators.

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UNIT-III

DC Motors: Principle of operation, back EMF and significance of back EMF, electromagnetic torque, types of DC motors, characteristics, speed control of DC motors, necessity of starter, three point starter and four point starter, losses and efficiency, applications of DC motors.

Testing of DC machines: Swinburne's test, brake test, Hopkinson's test, fields test, retardation test and separation of losses.

UNIT-IV

Single Phase Transformer : Constructional features, principle of operation, EMF equation, ideal transformer, transformer on NO load and ON load and its phasor diagrams, equivalent circuit, losses in transformer, voltage regulation and efficiency, All day efficiency, parallel operation of transformer.

Testing of transformer: Polarity test, Open circuit and short circuit test, Sumpner's test, separation of losses.

Auto transformer: - Construction, principle, applications and comparison with two winding transformer

UNIT-V

Three Phase Transformers: Construction, types of connection and their comparative features, Scott connection. Tap-changing transformers: No-load and on-load tap-changing of transformers, Three- winding transformers, Cooling of transformers.

Text Books:

1. I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.
2. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.
3. H.Cotton, Advanced Electrical Technology, Wheeler & Co, CBS publishers, 7th Edition, 2005.
4. J.B Gupta, Theory and performance of electrical machines, S.K. Kataria & Sons, 14th Edition, 2014.

Suggested Readings:

1. A. E. Fitzgerald and C. Kingsley, "Electric Machinery", New York, McGraw Hill Education, 2013.
2. A. E. Clayton and N. N. Hancock, "Performance and design of DC machines", CBS Publishers, 2004.
3. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.
4. Ashfaq Hussain "Electrical Machines" Danapatrai and sons, 3rd Edition 2012.

18EE C11

POWER SYSTEMS - I

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To introduce Generation of energy through conventional sources such as: Thermal, Hydro and Nuclear and renewable energy sources
2. To familiarize mechanical design of transmission lines and cables.
3. To familiarize present practices in tariff calculations and understand the classification and connection schemes of distribution systems

Course Outcomes: After completion of this course, students will be able to:

1. Gain knowledge of construction and operation of conventional and non-conventional sources of energy along with financial management
2. Know the effects sag on transmission lines.
3. Acquire the concepts to study the performance of insulators and cables
4. Understand the concept of Overhead Transmission Lines and Cable
5. Understand the concept of Economics of Power Generation and the concept of AC and DC distribution.

UNIT-I

Basic Concepts : Evolution of Power Systems and Present-Day Scenario. Structure of a power system: Bulk Power Grids and Micro-grids.

Generation: Thermal- Hydro -Power Plants: Principles, Choice of site, layout and various parts of generating stations, Brief description of Hydro Power Plant Dam, Spillways, Head works, Surge tank, Penstocks, Line diagram of Thermal Power Station (TPS) showing paths of coal, steam, water, air, ash and flue gasses, Brief description of TPS components: Economizers, Boilers, Super heaters, Turbines, Condensers, Chimney and Cooling towers.

Nuclear Station: Schematic Arrangement of Nuclear Power Station, Advantages and disadvantages, Types of Nuclear reactors

UNIT-II

Solar and Wind Sources: Solar cell fundamentals, Solar Cell characteristics, solar cell classification, solar cell, Module, Panel and Array Construction,

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Maximizing the solar PV output and load matching, Solar PV Systems
Basic Principles of Wind Energy Conversion, The Nature of the Wind, The Power in the Wind, Forces on the Blades, Wind Energy Conversion, Wind Data and Energy Estimation, Site Selection Considerations.

UNIT-III

Line Parameter Calculations: Inductance & Capacitance calculations of Transmission Line, single-phase and three-phase symmetrical composite conductors, GMD, GMR, Transposition of conductors, Bundled conductors, effect of earth capacitance.

UNIT-IV

Overhead Transmission Lines and Cables: Overhead line materials, supports, types, Ground wires, Sag /Tension calculations, Equal / Unequal supports, Effects of wind, ice / Erection Conditions Stringing charts. Insulators, Types, Material for construction, potential distribution over string of insulators, equalizing of potential, Methods.
Underground Cables: Construction of Cables, Insulating Materials for Cables, Classification of Cables, Insulation Resistance of a Single-Core Cable, Capacitance of a Single-Core Cable, Dielectric Stress in a Single-Core Cable, Most Economical Conductor Size in a Cable, Grading of Cables,Capacitance Grading, Inters heath Grading, Capacitance of 3-Core Cables, Measurements of Ce and Cc.

UNIT-V

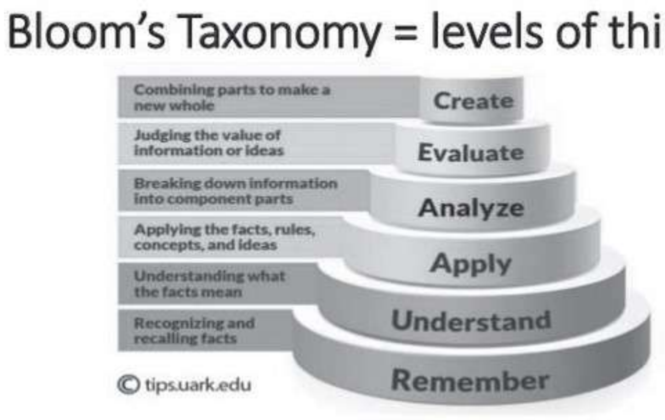
Economics of Power Generation: Load curve, Load demand and diversified factors, Base load operation, Types of costs and depreciation calculations; Tariffs, different types of tariffs; Methods of power factor improvement.
General Aspects of AC and DC Distribution Systems-Types of D.C. & A.C Distributors, Calculations for Distributor fed at one end, distributor fed at both ends.

Text Books:

1. J. Grainger and W. D. Stevenson, "Power System Analysis", McGraw Hill Education, 1994.
2. C.L.Wadhwa, "Electric Power Systems Theory", New Academic science Limited, 2012.
3. B.H. Khan, "Non Conventional Energy Resources" Mc Graw Hill Education, 2015.

Suggested Reading:

1. A. R. Bergen and V. Vittal, "Power System Analysis", Pearson Education Inc., 1999.
2. D. P. Kothari and I. J. Nagrath, "Modern Power System Analysis", McGraw Hill, 2003.
3. B. M. Weedy, B. J. Cory, N. Jenkins, J. Ekanayake and G. Strbac, "Electric Power Systems", Wiley, 2012.



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18ME C09

PRINCIPLES OF MANAGEMENT

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: To make the students to

1. To Understand basic fundamentals and insights of management
2. To Understand the nature and purpose of planning
3. To Gain the knowledge about the frame work of organizing
4. To Understand the essence and significance of directing
5. To Recognize the importance of controlling and its outcomes

Course Outcomes: At the end of this course, student will be able to:

1. Identify and evaluate the principles of management
2. Demonstrate the ability to have an effective and realistic planning
3. Identify the nature and the type of organization
4. Apply the tools and techniques of directing
5. Explain and evaluate the necessity for controlling and further refinement of an organization.

UNIT-I

Management: Definition of management, science or art, manager vs entrepreneur; managerial roles and skills;. Evolution of management, Basic management theories by FW Taylor, Henry Fayol, Types of Business Organizations, sole proprietorship, partnership, company, public and private enterprises; Organization culture and environment; Current trends and issues in management

UNIT-II

Planning: Nature and purpose of Planning, types of Planning, objectives, setting objectives, policies, Strategic Management, Planning Tools and Techniques, Planning plant location and layout, Decision making steps & processes.

UNIT-III

Organizing: Nature and purpose of Organizing, formal and informal organization, organization structure, types, line and staff authority, departmentalization, delegation of authority, centralization and decentralization, job design, human

resource management, HR planning, Recruitment selection, Training & Development, Performance Management, Career planning and Management

UNIT-IV

Directing: Individual and group behavior, motivation, motivation theories, motivational techniques, job satisfaction, job enrichment, leadership, types & theories of leadership, effective communication.

UNIT-V

Controlling: system and process of controlling, budgetary and non-budgetary control techniques, use of computers and IT in management control, productivity problems and management, control and performance, direct and preventive control, reporting.

Text Books:

1. S.P. Robins and M. Couiter, "Management", 10/e., Prentice Hall India, 2009.
2. JAF Stoner, RE Freeman and DR Gilbert, "Management", 6/e., Pearson Education, 2004.

Suggested Reading:

1. P.C. Tripathy & P.N. Reddy, "Principles of Management", Tata McGraw Hill, 1999
2. Harold Koontz and Cyril O'Donnell "Principles of Management'', Tata McGraw Hill, 2017

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18CE M01

ENVIRONMENTAL SCIENCE

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	50 Marks
CIE	0 Marks
Credits	0

Course Objectives:

1. To Identify environmental problems arising due to engineering and technological activities and the science behind those problems.
2. To Become aware about the importance of eco system and biodiversity for maintaining ecological balance
3. To identify the importance of interlinking of food chain
4. To Learn about various attributes of pollution management and waste management practices.
5. To make the students contribute for capacity building of nation for arresting and/or managing environmental disasters.

Course Outcomes: At the end of the course, the student should have learnt

1. To define environment, identify the natural resources and ecosystems and contribute for the conservation of bio-diversity.
2. To suggest suitable remedial measure for the problems of environmental pollution and contribute for the framing of legislation for protection of environment.
3. To relate the social issues and the environment and contribute for the sustainable development.
4. To follow the environmental ethics.
5. To contribute for the mitigation and management of environmental disasters.

UNIT–I:

Environmental Studies: Definition, Scope and importance, need for public awareness.

Natural resources: Use and over utilization of Natural Resources - Water resources, Food resources, Forest resources, Mineral resources, Energy resources, Land resources.

UNIT–II:

Ecosystems: Concept of an ecosystem, structure and function of an ecosystem, role of producers, consumers and decomposers, energy flow in an ecosystem,

food chains, food webs, ecological pyramids, Nutrient cycling, Bio-geo chemical cycles, Terrestrial and Aquatic ecosystems.

UNIT–III:

Biodiversity: Genetic, species and ecosystem biodiversity, Bio-geographical classification of India, India as a Mega diversity nation. Values of biodiversity, hot-spots of biodiversity, threats to biodiversity, endangered and endemic species of India, methods of conservation of biodiversity.

UNIT–IV:

Environmental Pollution: Cause, effects and control measures of air pollution, water pollution, marine pollution, soil pollution, noise pollution and Solid waste management, nuclear hazards

Environmental Legislations: Environment protection Act, Air, Water, Forest & Wild life Acts, issues involved in enforcement of environmental legislation, responsibilities of state and central pollution control boards

UNIT–V:

Social issues and the environment: Water conservation methods: Rain water harvesting and watershed management, Environmental ethics, Sustainable development and Climate change: Global warming, Ozone layer depletion, forest fires, and Contemporary issues.

Text Books:

1. Y. Anjaneyulu, "*Introduction to Environmental Science*", B S Publications, **2004**.
2. Suresh K. Dhameja, "*Environmental Studies*", S. K. Kataria& Sons, **2009**.

Suggested Reading:

1. C. S. Rao," *Environmental Pollution Control Engineering*", Wiley, **1991**.
2. S. S. Dara, "*A Text Book of Environmental Chemistry &Pollution Control*", S. Chand Limited, 2006

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18CS C06

BASICS OF DATA STRUCTURES LAB

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
SEE	35 Marks
CIEv	15 Marks
Credits	1

Pre-requisites: Any Programming Language(C)

Course Objectives:

1. Design and construct simple programs by using the concepts of Data structures as abstract data type.
2. To have a broad idea about how efficiently pointers can be used in the implement of data structures.
3. To enhance programming skills while improving their practical knowledge in data structures.
4. To strengthen the practical ability to apply suitable data structure for real time applications.

Course Outcomes: The Student will be able to

1. Implement the abstract data type.
2. Implement linear data structures such as stacks, queues using array and linked list.
3. Understand and implement non-linear data structures such as trees, graphs and its traversal techniques.
4. Implement various kinds of searching, sorting techniques.
5. Develop the suitable data structure for real world problem.

List of Experiments

1. Implementation of operations on arrays.
2. Implementation of Stack.
3. Implementation of Queue.
4. Implementation of basic operations on Single Linked List.
5. Implementation of Searching techniques.
6. Implementation of Sorting techniques.
7. Case study like Banking System, Students Marks Management, Canteen Management etc.

Text Books:

1. Brian W Kernighan, Dennis Ritchie, C Programming Language, PH PTR, 2nd Edition.
2. Richard M Reese, Understanding and Using C Pointers,O'Reily , 2013.

Web Links:

https://nptel.ac.in/courses/106102064/

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18EE C12

DIGITAL ELECTRONICS LAB

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	35 Marks
CIE	15 Marks
Credits	1

Course Objectives:

1. To verify Demorgan's Theorem, SOP, POS forms
2. To design and implement Full/Parallel Adders, Subtractors and Magnitude Comparators, multiplexers, de-multiplexers and decoders using logic gates
3. To construct various flip-flops, shift registers and design different counters.

Course outcomes: After completion of this course, the students will be able to:

1. Demonstrate the truth table of various expressions and combinational circuits using logic gates.
2. Design, test and evaluate various combinational circuits such as adders, subtractors, comparators, multiplexers and demultiplexers.
3. Construct flips-flops,
4. Design synchronous and asynchronous counters
5. Apply shift registers in various circuits.

LIST OF EXPERIMENTS

1. Verify
   (a) Demorgan's Theorem for 2 variables.
   (b) The sum-of product and product-of-sum expressions using gates.
2. Design and implement
   (a) Full Adder using basic logic gates.
   (b) Full subtractor using basic logic gates
3. Design and implement 4-bit Parallel Adder/ subtractor using IC 7483.
4. Design and Implementation of 4-bit Magnitude Comparator using IC 7485.
5. Realize
   (a) 4:1 Multiplexer using gates.
   (b) 3-variable function using IC 74151(8:1MUX).
6. Realize 1:8 Demux and 3:8 Decoder using IC74138.

7. Realize the following flip-flops using NAND Gates.
   (a) Clocked SR Flip-Flop
   (b) JK Flip-Flop
8. Realize the following shift registers using IC7474
   (a) SISO (b) SIPO (c) PISO (d) PIPO.
9. Realize the Ring Counter and Johnson Counter using IC7476.
10. Realize the Mod-N Counter using IC7490.
11. Synchronous counters.
12. Asynchronous counters.

Note: At least **TEN** experiments should be conducted in the Semester

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18EE C13

ELECTRICAL MACHINES-I LAB

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	35 Marks
CIE	15 Marks
Credits	1

Course objectives:

1. To understand the practical connections of the machines.
2. To draw the characteristics of different types of generators.
3 To test the DC machines and single phase transformer under different loading conditions for their performance.

Course Outcomes: After completion of this course, students will be able to:

1. Make the connections for DC machines and single phase transformer for their applications.
2. Design the meter ratings for various applications of DC machines and single phase transformer.
3. Control the speed of the DC motor by different methods.
4. Determine the efficiency of the given DC machine and single phase transformer.
5. Test the DC machine and single phase transformer for their performance.

LIST OF EXPERIMENTS

1. OCC and Load characteristics of separately excited DC generator.
2. OCC and load characteristics of DC shunt generator.
3. Load characteristics of DC compound generator.
4. Speed control of DC shunt motor by field control and armature control
5. Swinburne's test on DC shunt machine to predetermine the efficiency of DC shunt machine at any given load
6. Load test on DC shunt motor.
7. Load test on DC series motor.
8. Hopkinson's test on DC shunt machines.
9. Separation of stray losses of DC shunt machine.
10. OC and SC test on single phase transformer.
11. Load test on single phase transformers.
12. Sumpners test on two identical transformers.

Note: At least **TEN** experiments should be conducted in the semester.

18 EG C03

SOFT SKILLS LAB

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	35 Marks
CIE	15 Marks
Credits	1

Course Objectives: The course will introduce the students to:

1. Imbibe an impressive personality, etiquette, professional ethics & values, effective time management & goal setting.
2. Understand the elements of professional update & upgrade through industry exposure in a mini-live project. Understand confidence building strategies and thereby to make effective presentations through PPTs.
3. Learn what constitutes proper grooming and etiquette in a professional environment. Acquire the necessary skills to make a smooth transition from campus to corporate.

Course Outcomes: After successful completion of the course the students will be able to :

1. Be assertive and set short term and long term goals. Also learn to manage time effectively and deal with stress.
2. Win in professional communication situations and participate in group discussions with confidence. Write abstracts.
3. Write effective resumes. Plan, prepare and face interviews confidently.
4. Adapt to corporate culture by being sensitive - personally and sensible - professionally. Draft an SOP.
5. Apply the soft skills learnt in the mini-live project, by collecting and analyzing data and making oral and written presentations on the same.

Exercise 1

Main Topics: Thinking Skills, Personality Development – Effective Time Management, setting realistic goals, self-confidence and assertiveness, stress management, moral values.

Flipped Sessions: Personal Sensitivity & Professional Sensibility (Reading & Discussion)

Writing Input: Writing to Express - Drafting & Delivering a Speech (Free Writing Exercise)

Exercise 2

Main Topics: Advanced Group Discussion with Case studies : Dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and coherence.

Flipped Sessions: Importance of Professional Updating & Upgrading (Reading & Discussions)
Writing Input: Writing with Precision - Writing Abstracts.

Exercise 3
Main Topics: Interview Skills – concept and process, pre-interview planning, opening strategies, answering strategies, mock interviews. Resume' writing – structure and presentation, planning, defining the career objective, projecting ones strengths and skills.
Flipped Sessions: Mock Interviews (Video Sessions & Practice)
Writing Input: Writing to Reflect - Resume Writing.

Exercise 4
Main Topic: Corporate Culture – Grooming and etiquette, communication media, academic ethics and integrity
Flipped Sessions: Corporate Culture, Etiquette & Grooming (Video Sessions & Practice through Role-play)
Writing Input: Writing to Define - Writing an effective SOP.

Exercise 5
Main Topic: Mini Project – General/Technical. Research, developing a questionnaire, data collection, analysis, written report and project seminar. Elements & Structure of effective presentation. Presentation tools – Body language, Eye-contact, Props & PPT.
Flipped Sessions: Effective Presentations (Video & Writing Sessions, Practice through Emulation)
Writing Input: Writing to Record - Writing minutes of meeting.

Suggested Reading:

1. Madhavi Apte , "**A Course in English communication**", Prentice-Hall of India, 2007
2. Dr. Shalini Verma, **"Body Language- Your Success Mantra**", S Chand, 2006
3. Ramesh, Gopalswamy, and Mahadevan Ramesh, "**The ACE of Soft Skills",** New Delhi: Pearson, 2010
4. Van Emden, Joan, and Lucinda Becker, "**Presentation Skills for Students**", New York: Palgrave Macmillan, 2004

* Flipped Class-room: Students explore the concept first and then trainer explains it, students work on their own.

Web Resources:
1. https://www.goskills.com/Soft-Skills
2. https://www.trainerbubble.com
3. https://www.skillsconverged.com

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Scheme of Instruction and Syllabi
of
Choice Based Credit System (CBCS) of

BE / B.TECH V AND VI SEMESTERS
OF
FOUR YEAR DEGREE COURSE
IN

ELECTRICAL & ELECTRONICS ENGINEERING

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY(TM)

(An Autonomous Institution)

Affiliated to OU; All U.G. and 5 P.G. Programmes (Civil, CSE, ECE, Mech. & EEE)

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Chaitanya Bharathi P.O, CBIT Campus, Gandipet, Kokapet (V),

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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

Choice Based Credit System (with effect from 2018-19)

B.E (Electrical and Electronics Engineering)

SEMESTER-V

S.No	Course Code	Title of the Course	Scheme of Instruction		Scheme of Examination			
			Hours per week		Duration in Hours	Maximum Marks		Credits
			L/T	P/D		CIE	SEE	
THEORY								
1.	**16EEC15**	Power Systems – II	3/1	-	3	30	70	4
2.	**16EEC16**	Electrical Machinery – II	3/1	-	3	30	70	4
3.	**16EEC17**	Power Electronics	4	-	3	30	70	4
4.	**16EEC18**	Linear Control Systems	3/1	-	3	30	70	4
5.	**16EEEXX**	Program Specific Elective-1	3	-	3	30	70	3
PRACTICALS								
6.	**16EEC19**	Electrical Machinery – II Lab	0/1	2	3	25	50	2
7.	**16EEC20**	Power Electronics Lab	0/1	2	3	25	50	2
8.	**16EEC21**	Linear Control Systems Lab	0/1	2	3	25	50	2
			22	**06**	**-**	**225**	**500**	**25**

L: Lecture T: Tutorial D: Drawing P: Practical
CIE - Continuous Internal Evaluation SEES - Semester End Examination

Course Code	Program Specific Elective-1
16EE E01	Non-Conventional Energy Sources (NCES)
16EE E02	Electrical Engineering Materials (EEM)
16EE E03	Electronic Instrumentation (EI)
16MT E01	Statistical and Numerical Methods (SNM)
	Courses offered to other Departments
16EE E04 **16EEC22**	Electrical Technology (for BE3/4, ECE, V-SEM) (Elective) Electrical Machines and Microcontroller Applications Lab (Core) (for BE3/4, Mech & Prod, V-SEM)

16EEEC15

POWER SYSTEMS – II

Instruction	3L+1T Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	4

Course Objectives: The objective of the course is to

1. Comprehend inductance and capacitance calculations for different line configurations.
2. Understand per unit system representation in power systems.
3. Know the importance of transmission line representation in terms of short, medium and long lines in finding performance of lines.
4. Study the importance of sequence components in power systems.
5. Understand the importance of symmetrical and un-symmetrical faults in power systems.
6. Study the causes of over voltages and Bewley lattice diagram.

Course Outcomes: After completion of the course, the student will be able to

1. Compute the inductance and capacitance of Transmission lines.
2. Solve the problems on transmission line performance and power circle diagrams.
3. Analyze the causes of corona and factors affecting corona.
4. Describe different types of faults and its relevance in relay settings.
5. Develop the transmission line wave equation and find various coefficients of lines which will be useful to draw Bewley Lattice diagram.
6. Calculate the per unit values of the given power systems.

UNIT-I

Line Parameter Calculations: Review of 3 phase circuit analysis, Symmetrical components importance**,** Inductance & Capacitance calculations of Transmission Line, single-phase and three-phase symmetrical composite conductors, GMD, GMR, Transposition of conductors, Bundled conductors, effect of earth capacitance.

UNIT-II

Modeling of Transmission Lines: Short, medium, long lines, Line calculations, Tuned Lines, Surge impedance loading.

Corona: Causes, Disruptive and Visual Critical Voltages, Power loss, minimization of Corona effects.

UNIT-III

Per Unit System of Representation: Use of per unit quantities in power systems, Advantages of per unit system.

Symmetrical Faults: Short Circuit Currents, Reactance of Synchronous Machines, fault calculations, Short circuit capacity of a bus.

UNIT-IV

Unsymmetrical Faults: Symmetrical components of unsymmetrical Phasors, Power in terms of symmetrical components, sequence impedance and sequence networks. Sequence networks of unloaded generators, Sequence impedances of circuit elements, Single line to ground, line-to-line and double line to ground faults on unloaded generator, Unsymmetrical faults of power systems.

UNIT-V

Transients in Power Systems: Causes of Overvoltage, Travelling Wave Theory, Wave equation, Reflection and refraction coefficients, Junction of cable and overhead lines, Junction of three lines of different natural impedances, Bewley Lattice diagram, Introduction to EMTP.

Text Books:

1. C.L. Wadhwa, "Electrical Power Systems", Wiley Eastern Ltd., 4th Edition, 2006.
2. I.J. Nagrath, D.P.Kothari, "Modern Power Systems Analysis", TMH Edition, 2003.

Suggested Reading:

1. John J. Grainger, William D. Stevenson Jr. "Power System Analysis", Tata McGraw Hill, 2003.
2. A.Chakrabarti, M.L.Soni, P.V.Gupta, U.S.Bhatnagar, "A Text Book on Power System", Dhanpat Rai & Co, 1999.
3. Eiichi Haginomori, Tadashi Koshiduka, Junichi Arai, Hisatochi Ikeda, "Power System Transient Analysis: Theory and Practice Using Simulation Programs" (ATP-EMTP),Wiley Publications, First edition,2016.

16EEC16

ELECTRICAL MACHINERY-II

Instruction	3L+1T Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	4

Course Objectives: The objective of the course is to

1. Understand the cooling arrangement methods in power transformers, testing methods of transformers.
2. Study the principles of tap changing, effects of third harmonic voltages and auto-transformer.
3. Understand constructional features of different types of three phase induction motors.
4. Discuss about speed control and starting methods of three phase induction motors.
5. Analyze unbalanced operation of three phase induction motors and three phase transformers.
6. Familiarize the construction details, principle of operation, prediction of performance of single phase induction motors.

Course Outcomes: After completion of the course, the student will be able to

1. Describe different methods of cooling arrangements of transformers.
2. Apply basic principles of tap changing and auto-transformer.
3. Explain the operation and performance analysis of three phase induction motors.
4. Apply the concepts of speed control and starting methods of three phase induction motors.
5. Analyze unbalanced operation of three phase induction motors and three phase transformers.
6. Discuss the concept of single phase induction motors and operate different types of single phase induction motors.

UNIT-I

Transformers: Cooling arrangement in Transformers, Testing of Transformers, Routine Tests and Special tests, Measurement of Voltage ratio and check for voltage vector relationship, Measurement of Insulation resistance, Maintenance of Transformers, Tap changer on transformers, No-load tap changer, On-load tap changer, Third harmonic voltages and tertiary winding in three phase transformers, Auto Transformer, Comparison with two winding transformers, Conversion of two winding transformer to auto transformer.

UNIT-II

Three-phase Induction Motor: Constructional features, Rotating Magnetic field theory, Principle of operation of squirrel cage and slip ring motors, Vector Diagram, Equivalent circuit, Expression for torque, Starting torque, Maximum torque, Slip/ Torque characteristics, Performance characteristics, Equivalent circuits from test, Current loci circle diagram, Predetermination of characteristics of Induction Motors.

UNIT-III

Starting methods of Induction Motors: Modes of operation, torque and power limits of Induction motors, Speed control methods, Resistance Control, Voltage control, pole changing, Cascading, variable frequency control, Cogging, Crawling, Double cage Induction motors, Induction generator, Doubly fed Induction Generator.

UNIT-IV

Unbalanced Operation: Voltage Unbalance, Unbalanced Operation of 3-phase Induction Motor, Per Phase Equivalent Circuits, Single Phasing, Unbalanced Operation of 3-Phase Transformers, Single-phase load on Three-phase transformers Single Phasing in 3-phase transformers- Delta /Star and Star/Delta transformers.

UNIT-V

Single Phase Motors: Single phase motors, Theory and operation of single phase motors, Shaded pole, Split phase and capacitor motors, Compensated and uncompensated series and repulsion motors. Linear Induction motors.

Text Books:

1. P.S. Bhimbra, "Electrical Machinery", Khanna Publications, 7th Edition, 2003.
2. Nagrath I.J & Kothari D.P, "Electrical Machines", Tata McGraw Hill Publications, Sigma Series, 2006.
3. J.B Gupta , "Theory and Performance of Electrical Machines", S.K. Kataria & Sons,14th Edition, 2014.

Suggested Reading:

1. Juha pyrhone, Tapani Jokinen, "Design of Rotating Electrical Machines", John Wiley & Sons, Ltd. 2008.
2. Fitzgerald, Kingsley, Umans, "Electric Machinery", Tata Mc-Graw Hill Publications, 6th Edition, 2002.
3. Ashfaq Hussain , "Electrical Machines", Danpatrai and sons, 3rd Edition, 2012.

16EEEC17

POWER ELECTRONICS

Instruction	4 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	4

Course Objective: The objective of the course is to

1. Identify the characteristics of different static switches.
2. Understand the necessity of protection, turn-ON & turn-OFF methods of SCR.
3. Know the principles of AC-DC, DC-DC, AC-AC and DC-AC energy conversions.
4. Study various methods of voltage control in power converters.
5. Become familiar with quadrant operation of different power converters.
6. Recognize applications of various static switches and power converters.

Course Outcomes: After completion of the course, the student will be able to

1. Gain knowledge of basic operation of various power semiconductor devices and to compare their characteristics.
2. Analyze protection circuit, turn-ON & turn-OFF methods for SCR.
3. Acquaint with the principles of phase controlled converters.
4. Analyze the operation principles of different DC-DC, AC-AC converters.
5. Identify different topologies of DC-AC converters.
6. Know the practical application of static switches and power electronic converters.

UNIT-I

Power Diodes and Transistors: Power diode, characteristics, Recovery characteristics, Types of power diodes, General purpose diodes, Fast recovery diodes, their applications. Bipolar Junction Transistors(BJT), Power MOSFETs, IGBTs-Basic structure and working, Steady state and switching characteristics, Comparison of BJT, MOSFET and IGBT, Their applications.

UNIT-II

Silicon Controlled Rectifier (SCR): SCR-Static characteristics, Two transistor analogy, Protection of SCRs, Dynamic characteristics, Series and parallel operation of SCRs, SCR trigger circuits-R, RC and UJT triggering circuits, Commutation methods of SCR.

UNIT-III

Principles of Phase Controlled Converters: Study of Single-phase and three-phase half wave and full wave controlled rectifiers with R, RL, RLE loads, significance of freewheeling diode, Effect of source inductance, Dual converters - circulating and non circulating current modes.

UNIT-IV

DC-DC Converters: Principles of Step-down, Step-up, Step UP/Down choppers, Time ratio control and current limit control, Types of choppers Type- A, B, C, D and E, Introduction to Buck, Boost and Buck-Boost regulators.

AC-AC Converters:

Principle of operation of Single phase Cyclo-converters and their applications. Single-phase AC Voltage Controllers with R and RL loads.

UNIT-V

Inverters: Principle of operation of Single-phase Inverters, Voltage control methods, Single pulse width modulation, Multiple pulse width modulation, Sinusoidal pulse width modulation, Comparison of Voltage Source Inverters and Current Source Inverters, Three-phase bridge Inverters, 180^0 & 120^0 modes of operation.

Text Books:

1. Singh.M.D, Khanchandani.K.B, "Power Electronics", Tata McGraw Hill, 2nd Edition, 2006.
2. Rashid.M.H., "Power Electronics Circuits Devices and Applications", Prentice Hall of India, 2003.
3. Bimbra.P.S, "Power Electronics", Khanna Publishers, 3rd Edition, 2013.

Suggested Reading:

1. Mohan, Undeland , Robbins, "Power Electronics", John Wiley, 1996.
2. P.C.Sen, "Power Electronics", Tata Mc-Graw Hill, 1st Edition, 2001.

16EEC18

LINEAR CONTROL SYSTEMS

Instruction	3L + 1T Hour per week
Duration of Semester Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	4

Course Objectives: The objective of the course is to

1. Understand different types of linear control systems and their mathematical modeling.
2. Gain knowledge of real time applications of closed loop control systems.
3. Study the transfer function of control system components.
4. Study the stability analysis in time domain.
5. Study the stability analysis in frequency domain.
6. Study the concepts of State space representation of Linear Time invariant systems (LTI).

Course Outcomes: After completion of the course, the student will be able to

1. Define different mathematical models for any LTI systems.
2. Outline the transfer function of components used in feedback control systems.
3. Specify design region in the s-plane in terms of settling-time, rise-time and overshoot to step-response.
4. Illustrate the concepts of stability analysis in time domains, which is essential to analyze any system performance.
5. Illustrate the concepts of stability analysis in frequency domains, which is essential to analyze any system performance.
6. Employ the concepts of state space controls.

UNIT-I

Introduction: Open loop, Closed loop System with illustrations and other classification of control systems, Impulse response and Transfer Function, Mathematical modelling of Mechanical and Electrical Systems, Analogous systems, Feedback control characteristics - effects of feedback.

UNIT-II

Transfer Function Representation: Components of control system- Potentiometers, Synchros, DC and AC servo motors, Block diagram representation and its reduction techniques, Signal flow graphs, problems on conversion from block diagram to signal flow graph.

UNIT-III

Time Response Analysis: Standard test signals, Time response of first and second order systems for unit step input, Time domain specifications , Type of system - Steady state error, static error coefficients,

Stability Analysis-Concept of stability, Routh-Hurwitz criterion, Root locus technique, effect of addition of poles and zeros to open loop transfer function on Root locus, Introduction to PID Controller.

UNIT-IV

Stability Analysis-Frequency Domain: Frequency Domain specifications for a standard second order system, Correlation between time and frequency domain specifications, Stability analysis from Bode plots, Polar plots and Nyquist plots, Introduction to compensators.

UNIT-V

State Space Representation: Concept of State, State Variable, State Models of linear time invariant systems, Derivation for state models from transfer functions and differential equations, Solution of State equation by Laplace method, State Transition matrix and properties, Concept of Observability and Controllability.

Text Books:

1. I.J.Nagrath, M.Gopal, "Control System Engineering", New Age International (P) Limited Publishers, 5th Edition, 2008.
2. B.C. Kuo, "Automatic Control Systems", John wiley and son's Publishers, 9th Edition, 2009
3. K.Ogata, "Modern Control Systems", 5th Edition.PHI publication, 2010.

Suggested Reading:

1. M.Gopal, "Control Systems Principles and Design",- Tata McGraw Hill, 2nd Edition, 2003.
2. N.C Jagan, "Control Systems", BS Publications, 2nd Edition, 2008
3. N. Nise, "Control Systems Engineering",6th Edition, Willey Publications, 2011.

16EEC19

ELECTRICAL MACHINES - II LAB

Instruction	1T+2Periods per week
Duration of Semester End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	2

Course Objectives: The objective of the course is to

1. Understand and apply Scott connection for three phase to two phase conversion.
2. Comprehend the principles of voltage regulation of Alternators and compute the values by different methods .
3. Predict the performance of Three Phase Induction Motor by conducting No-load test and Blocked rotor test
4. Operate the induction motor with various speed control methods and compare the different methods.
5. Analyze the performance of three phase induction motor under different loading conditions and assess the performance.
6. Estimate the improvement in power factor of Induction Motor using capacitors.

Course Outcomes: After completion of the course, the student will be able to

1. Apply phase conversion method to obtain balanced two phase supply from three phase supply.
2. Appraise the voltage regulation of Synchronous generator using various methods.
3. Assess the performance of three phase induction motor by conducting no-load test and blocked rotor tests.
4. Discuss practical aspects of AC machine analysis.
5. Assess the proper AC machine and its usage for a given load application
6. Use capacitors for power factor improvement.

List of Experiments:

1. Three phase to Two-phase conversion (Scott connection).
2. Heat run test on Three-phase transformer.
3. No-load test, blocked rotor test and load test on 3-phase Induction motor.
4. Speed control of Three-phase Induction motor by
   a). Rotor impedance control
   b). V/f control.
5. Synchronization of an alternator with infinite bus-bars by dark lamp method.
6. Performance characteristics of Single-phase Induction motor.

7. No- load test of slip ring induction motor to determine the relationship between
   i) Applied voltage and speed,
   ii) Applied voltage and rotor current,
   iii) Applied voltage and stator current,
   iv) Applied voltage and power factor,
   v) Applied voltage and power input.
8. Voltage regulation of Alternator by
   a). Synchronous Impedance method
   b). Ampere-Turn method.
   c). Zero Power factor method.
9. Voltage Regulation of Alternator by slip test.
10. Determination of V curves and inverted V curves of synchronous motor.
11. Power angle characteristics of a synchronous motor.
12. To determine the transient and sub-transient reactance's and time constants of synchronous machine.
13. Power Factor Improvement of Induction motor using capacitors.

Note: At least TEN experiments should be conducted in the semester.

16EEC12

POWER ELECTRONICS LAB

Instruction	1T + 2P Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	2

Course Objectives:

1. To obtain and plot the characteristics of different static switches.
2. To analyze the triggering and commutation circuits for SCR.
3. To familiarize the conversion principle of single & three phase controlled rectifiers.
4. To understand the operation of various DC-DC conversion circuits and their applications.
5. To know the operation of various AC-AC conversion circuits and their applications.
6. To identify about DC-AC conversion in single phase circuits.

Course Outcomes: After completion of the course, the student will be able to

1. Analyze the effects of control signals on static switches.
2. Distinguish the characteristics of different controlled switches and their applications.
3. Acquainted with the conversion principles of AC-DC converters.
4. Observe the operation of different DC-DC choppers.
5. Familiar with AC-AC converters
6. Understand the principle of DC-AC conversion.

List of Experiments

1. S.C.R. Characteristics
2. BJT, MOSFET and IGBT Characteristics
3. Gate triggering circuits for SCR using R, RC and UJT.
4. Single phase step down Cyclo converter with Rand RL loads.
5. A.C voltage controllers with R and RL loads.
6. Study of forced commutation techniques.
7. Single phase full converter as a rectifier and inverter.
8. Single phase fully controlled bridge rectifier with Rand RL loads.
9. Single phase half controlled bridge rectifier with Rand RL loads.
10. Three phase half controlled bridge rectifier with Rand RL loads.
11. Three phase fully controlled bridge rectifier with Rand RL loads.
12. Buck and Boost choppers.
13. Voltage commutated chopper with R&RL loads
14. Current commutated chopper with R&RL loads.
15. Half and Full bridge inverter with R&RL loads.

Note: At least **TEN experiments** should be conducted in the semester.

16EEC21

LINEAR CONTROL SYSTEMS LAB

Instruction	1T + 2 Periods per week
Duration of Semester End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	2

Course Objectives: The objective of the course is to

1. Understand the characteristics of DC Servo Motor.
2. Understand the characteristics of AC Servo Motor.
3. Understand Synchro pair operation.
4. Understand the time domain specifications in time domain.
5. Understand the frequency response of compensating networks.
6. Study the closed loop performance for given plant using
   i) P, PI and PID controllers ii) ON/OFF controller.

Course Outcomes: After completion of the course, the student will be able to

1. Define DC, AC Servo Motors Characteristics.
2. Describe and analyze Synchro pair Characteristics.
3. Design and Analyze the performance of a given second order plant in time domain.
4. Design and Analyze the performance of a given second order plant in frequency domain.
5. Select and state the design function of position and level control systems.
6. Acquire knowledge in analyzing the performance of P, PI, PID and ON/OFF controller.

List of Experiments

1. Characteristics of D.C. Servo motor.
2. Characteristics of A.C. Servo motor.
3. Characteristics of Synchro Pair.
4. Step response of second order system.
5. Frequency response of compensating networks.
6. Closed loop P, PI and PID Controller for temperature of a given plant.
7. Step response and Frequency response of a given plant.
8. Level Control System.
9. Temperature control system-ON/OFF Control.
10. Characteristics of magnetic amplifier.
11. Linear System simulator.
12. DC Position Control System.
13. AC Position Control System.

Note: **At least TEN experiments should be conducted in the Semester.**

16EEE01

NON-CONVENTIONAL ENERGY SOURCES

Instruction	3Hours per week
Duration of Semester Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To understand the fundaments of energy and significance of conventional and non conventional energy sources.
2. To comprehend the list of various Energy Sources
3. To know the design of solar PV system
4. To become familiar in implementing solar thermal systems.
5. To become aware about wind energy conversion systems.
6. To understand the need of Energy Conservation and its related features.

Course Outcomes: The student will be able to

1. Acquire the knowledge of various Non conventional energy sources and its relative merits and demerits.
2. Identify the need of energy conservation and storage methods.
3. Experiment with solar photo voltaic systems to validate theoretical analysis.
4. Compare the various MPPT techniques.
5. Assess the solar thermal application for a given requirement
6. Justify the suitability of wind Energy Conversion Systems for a given site conditions.

UNIT-I

Fundamentals of Energy: Introduction, Classification of energy resources, importance of Non Conventional Energy Sources, Common forms of energy, Advantages and Disadvantages of conventional energy sources, Merits and Demerits of non conventional energy sources, various aspects of energy conservation, co- generation, Energy storage methods (Elementary treatment only)

UNIT-II

Introduction to Energy Sources: Solar Energy, Wind energy, Biomass energy, Geothermal energy, Ocean energy, Fuel Cell, MHD, Small Hydro resources.

UNIT-III

Solar Photo Voltaic Systems: Solar cell fundamentals, Solar Cell characteristics, solar cell classification, solar cell, Module, Panel and Array Construction, Maximizing the solar PV output and load matching, MPPT, Solar PV Systems, solar PV applications.

UNIT-IV

Solar Thermal Systems: Solar collectors, Solar water heater, solar cooker, Solar furnace, Solar dryer, Solar distillation.

UNIT-V

Wind Energy Systems: Origin of winds, wind turbine sitting, major applications of wind power, wind turbine aerodynamics, Wind energy conversion systems (WECS), Wind Energy Storage.

Text Books:

1. B.H. Khan, "Non Conventional Energy Resources" McGraw-Hill Education, 2015.
2. Chetan Singh Solanki, "Renewable Energy Technology - A practical guide for beginners", PHI, 2009.

Suggested Reading:

1. D.P.Kothari, KC Singal, Rakesh Ranjan, "Renewable Energy Sources and Emerging Technologies", PHI, 2014.
2. Mukharjee D., "Renewable Energy Systems", New Age International 2004.

16EE E02

ELECTRICAL ENGINEERING MATERIALS

Instruction	3Hours per week
Duration of Semester Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The objective of the course is to

1. Analyze the mechanical, magnetic and the electrical properties of materials.
2. Select materials for various engineering application.
3. Establish how failures occur in materials and how to prevent them.
4. Observe the changes in behavior of the material while subjected to stress.
5. Know the economical aspects of a design.
6. Update the technical advancements in materials technology.

Course Outcomes: After completion of the course, the student will be able to

1. Classify the given material based on its properties.
2. Select a proper material for a given application.
3. Experiment on materials in order to test its adaptability.
4. Investigate the suitability of material for the latest technological requirement.
5. Compare and contrast the characteristics of the materials.
6. Assess the changes in properties while alloying

UNIT- I

Conducting Materials: Electrical conducting Materials, High conductivity materials, Materials of High Resistivity, Materials used for precision work, rheostats; heating devices, Super conductivity, Special types of alloys, Applications & Properties of semiconductors, Silicon wafers, integration techniques, Large and very large scale integration techniques (VLSI).

UNIT -II

Insulating Materials: Classification of Insulting materials, temperature rise, electrical properties of insulating materials used for wires-laminations- machines and their applications, Ceramics, Plastics, DC electrical properties, AC electrical properties, Dielectric properties of insulators, Dielectric materials used for various electrical applications, suitability.

UNIT- III

Magnetic Materials: Magnetic parameters, the three types of magnetic material, measuring magnetic materials, Application of soft magnetic materials, Magnetic recording media, Hard (permanent) magnets, Ferrites, Samarium, Cobalt alloys, Neodymium Iron Boron (Nd Fe B).

UNIT- IV

Optical Properties of Materials: EM Radiation Spectrum, Optical properties in materials, Photo electric emission, Photo conductivity, Lasers, Optical fibres, Fibre cables.

UNIT -V

Materials for Direct Energy Conversion Devices: Solar cells, equivalent circuit of a solar cell, fuel cell, MHD generators, storage of hydrogen, thermoelectric generators, Nano applications in Electrical Engineering.

Text Books:

1. G.K Benergy, "Electrical and Electronic Engineering Materials", PHI, 2014
2. Ian P. Jones, "Materials Science for Electrical and Electronic Engineers", Oxford University Press, 2008.
3. R. K Sukhla, "Electrical Engineering Materials", McGraw Hill Education, 2013.

Suggested Reading:

1. Dhir, "Electronic Components & Materials", McGraw Hill Education, 2012.
2. TTTI Madras, "Electrical Engineering Materials", McGraw Hill Education, 2014.

16EE E03

ELECTRONIC INSTRUMENTATION SYSTEMS

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course objectives: The objective of the course is
1. Understand the concept of transducers.
2. Know the principles of data converters.
3. Understand construction and working details of different signal generators & signal analyzers.
4. Describe various digital frequency and time related measurements.
5. Illustrate automatic instrumentation systems.
6. Know the fundamentals of different CRO's.

Course Outcomes: After completion of this course, the student will be able to
1. Choose appropriate transducer for a given application
2. Design data converters to the required specifications.
3. Estimate the distortion of a signal.
4. Construct different signal generators.
5. Explain the working of different subsystems of different CRO's
6. Develop/design the automatic instrumentation systems.

UNIT-I

Analog and Digital Measuring Systems: Interfacing Active and Passive Transducers, Amplifiers: Instrumentation amplifiers (Fixed and Programmable gain types and its specifications), Isolation amplifiers (Types and its specifications).
Digital to Analog Converters: R-2R ladder and Inverted ladder DACs. Main DAC specifications. Analog to Digital Converter: R-2R Ladder and Inverted Ladder DACs, Main DAC specifications, Analog to Digital Converters: Parallel (or Flash) ADC successive approximation, ADC Microprocessor compatibility, Dual slope ADC, Principal specifications of an ADC.

UNIT-II

Digital Voltmeters and Multimeters: Simple D.C Voltage attenuator, Current to Voltage converter, Resistance to Voltage Converter, Automatic ranging and Automatic zeroing, RMS detector in DMM and RMS and True RMS, Digital Frequency and Time measurements, Frequency Measurements, Frequency ratio time interval and Pulse width measurements, Scaling and Checking modes. Counting errors, Input signal conditioning, Trigger level, Hysteresis.

UNIT-III

Signal Analysis: Wave Analyzers: Signal analysis and wave Analyzer, Type and Applications. Harmonic Distortion Analyzers: harmonic Distortion, heterodyne harmonic Analyzer or Wave meter, Tuned circuit, Fundamental Suppression. Spectrum Analysis: Block Diagram, Phase locked circuit for the local oscillator, Successive limiting type of Log IF amplifier.

UNIT-IV

Signal Generators: Fixed and variable Audio frequency oscillator, Audio frequency sine and square wave generator, function generator, square wave pulse generator, random noise generator, TV sweep generator, marker generator and beat frequency oscillator(BFO). synchronized signal generator interfaced with 488 Bus, relay switched attenuator, IEE 488 Electrical interface.

UNIT-V

Cathode Ray Oscilloscope: Block Diagram, Basic Concepts, Vertical amplifier, Time Base, Trigger Delay line and their role in a CRO, Digital storage Oscilloscope, Magnetic Re orders, Digital Interface for Programmable Instrumentation, Description and Sample examples of Automatic Instrumentation.

Text Books:

1. H .S. Kalsi, “Electronic Instrumentation”, TMH publications, 2nd Edition, 2007.
2. A.K.Sawhney, “A Course in Electrical and Electronics Measurements and Instrumentation”, Dhanpat Rai & Sons, 4th Edition, 2012.

Suggested Reading:

1. E.W Golding “Electrical Measurements and Measuring Instruments”, TMH publications, 2011.
2. Helfrick, Albert D. Cooper, William D, “Modern Electronic Instruments & Measuring Instruments”, PHI, 1992.

16MT E01

STATISTICAL AND NUMERICAL METHODS

Instruction	3L Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits:	3

Course Objectives:

1. To compute the statistical averages& different properties.
2. To study the probability distributions for stochastic data.
3. To understand for finding solution of non-linear equations.
4. To study the process of calculating the value of the numerical derivative of a functions & numerical integration of a given data.
5. To identify the solution for initial value problem numerical differential equations.
6. To compute and analyse the physical data.

Course Outcomes: On the successful completion of this course, the student shall be able to

1. Analyse the statistical averages and different properties for probability function.
2. Fit the probability distribution for the random data.
3. Solve the non-linear equations for finding the roots.
4. Solving the Differentiation & Integration for numerical data.
5. Solving the ordinary differential equations using single & multi-step methods.
6. Solving the multivariable problems.

UNIT-I

Random Variables: Mathematical Expectation, Variance, Co-Variance and its properties, Probability function, Moments, mgf, cgf and its properties**.**

UNIT-II

Probability Distributions: Discrete distribution: Binomial, Poison distributions, finding Mean and Variance through mgf. Continuous distribution: Normal distribution, Exponential & Uniform distributions**.**

UNIT-III

Solution for Non-linear Equations: Algebraic & transcendental equations**,** Bisection method, Regular False Method and Newton Raphson method, interpolation, Newton’s forward and backward formulas.

UNIT-IV

Numerical Differentiation & Integration: Numerical differentiation using numerical forward & backward interpolation formula, Numerical integration: Simpson's 3/8th rule, Weddle's rule.

UNIT-V

Numerical Solution of Ordinary Differential Equations: Picard's method, Euler's method, R.K method (fourth order) and Milne Thompson's method (predictor & corrector).

Text Books:

1. S.C Gupta and V.K.Kapoor, "Fundamentals of Mathematical statistics", S.Chand &Co.2006 Publishers.
2. M.K.Jain, S.R.K Iyengar and R.K.Jain, "Numerical methods for Scientific & Engineering Computation", New Age International publications, 2008.

Suggested Reading:

1. Miller and Freund, "Probability and Statistics for Engineers", Pearson, 2005.

2. S.S.Shastry, "Introductory methods of Numerical Analysis", PHI publication, 5th Edition.

Core Courses offered to other Departments

SEMESTER – V

S.No	Course Code	Title of the Course	Scheme of Instruction		Scheme of Examination			Credits
			Hours per week		Duration of SEE in Hours	Maximum Marks		
			L/T	P/D		CIE	SEE	
PRACTICALS								
1	**16EE C22**	Electrical Machines and Microcontroller Applications Lab (Core) (for BE3/4, Mech & Prod, V-SEM)	0/1	2	3	25	50	2
TOTAL			**1**	**2**	**-**	**25**	**50**	**2**

Elective Courses offered to other Departments

SEMESTER – V

S.No	Course Code	Title of the Course	Scheme of Instruction		Scheme of Examination			Credits
			Hours per week		Duration of SEE in Hours	Maximum Marks		
			L/T	P/D		CIE	SEE	
PRACTICALS								
1	**16EE E04**	Electrical Technology (for BE3/4, ECE, V-SEM)	3/0	0	3	30	70	3
TOTAL			**3**	**0**	**-**	**30**	**70**	**3**

L: Lecture T: Tutorial P: Practical D: Drawing
CIE - Continuous Internal Evaluation SEE - Semester End Examination

16EE C22

ELECTRICAL MACHINES AND MICRO CONTROLLER APPLICATIONS LAB

(Common to BE3/4, Mech. & Prod, V- SEM)

Instruction	1T + 2 Periods per week
Duration of Semester End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	2

Course Objectives:

1. To understand the testing of 1-phase transformers.
2. To comprehend various characteristics of DC machines.
3. To understand the characteristics of different AC machines.
4. To learn operations on 8051 microcontroller.
5. To understand basics of interfacing devices with 8051 microcontroller.

Course Outcomes: The student will be able to

1. Test the 1-phase transformer.
2. Know the right instrument and its usage for the given circuit.
3. Identify the suitable machine for required application.
4. Process the data using 8051 microcontroller
5. Interface the given device with 8051 microcontroller.

List of Experiments:

Cycle -I

1. Magnetization characteristics of a separately excited DC generator.
2. Load characteristics of a shunt generator.
3. Performance characteristics of a shunt motor.
4. Performance characteristics of a compound motor.
5. Speed control of DC shunt motor.
6. O.C. and S.C. tests on single phase transformer.
7. Load test on a three phase induction motor. .
8. Speed control methods of induction motor.
9. To determine the load characteristics of a DC series motor.

Note: At least **SIX** experiments should be conducted in the semester from cycle - I.

Cycle -II

1. 8051 Microcontroller Experiments.
2. Data Transfer - Block move, Exchange, sorting, Finding largest element in an array.
3. Arithmetic Instructions : Multi byte operations.
4. Boolean & Logical Instructions (Bit manipulations).
5. Use of JUMP and CALL instructions.
6. Control of stepper Motor using 8051.
7. A/D converter interface with 8051 Microcontroller.
8. D/A converter Interface with 8051 Microcontroller.

Note: At least **FOUR** experiments should be conducted in the semester from cycle - II.

16EEE04

ELECTRICAL TECHNOLOGY
(BE 3/4 ECE, V Sem.)

Instruction	3Hours per week
Duration of Semester Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The objective of the course is to

1. Know the fundamentals of DC Generators and DC motors.
2. Study AC generators & Transformers.
3. Understand the concepts of poly phase systems.
4. Know the concepts of Single - Phase and Three - Phase Induction motors.
5. Understand fundamentals of Power system.
6. Understand basics of Non - Conventional Energy Sources.

Course Outcomes: After completion of the course, the students will be able to

1. Know the fundamentals of DC Generators and DC motors.
2. Study AC generators & Transformers.
3. Understand the concepts of poly phase systems.
4. Know the concepts of Single - Phase and Three - Phase Induction motors.
5. Understand fundamentals of Power system.
6. Know the difference between Conventional and Non - Conventional Energy Sources.

UNIT-I

D.C. Generators: Constructional details, Simple lap & wave windings, Methods of excitation, Induced EMF, Basic ideas of armature reaction and commutation, Characteristics of shunt, series and compound generators and their applications.

DC Motors: Significance of back EMF, Torque developed in motors, three point starter, Characteristics of shunt, series and compound motors, Speed control of DC motors.

UNIT-II

Poly Phase System: Advantages of three phase system, Star and delta connections, Relationship between line and phase quantities, Measurement of power by Two Wattmeter method.

A.C. Generators: Construction, EMF equation, Armature reaction, -Synchronous impedance, Regulation.

UNIT-III

Transformers: Single Phase transformer, Construction, Working principle, EMF equation, Ideal transformer, Phasor diagram under no load and loaded conditions, OC and SC tests on transformer, Efficiency and regulation.

UNIT-IV

Induction Motors: Construction, Production of rotating magnetic field, Slip, Slip-torque characteristics, Starting methods of Induction motors.
Single-Phase Induction Motors: Construction, Theory of operation, Characteristics of shaded pole, Split phase and capacitor motors, Applications.

UNIT-V

Power Systems: Basic ideas of thermal, hydro, nuclear and non-conventional generating systems and layout, Block diagram of power systems, advantages of non-conventional generation systems.

Text Books:

1. H. Cotton, "Electrical Technology", CBS Publishers and distributors, 7th Edition, 2005.
2. V.K.Mehta, "Principles of Electrical Engineering", S. Chand and Co, 2nd Edition, 2004.
3. M.L.Soni, PV Gupta, VS Bhatnagar, "A course in Electrical Power", Dhanpat Rai and Sons, 4th Edition,2008.

Suggested Reading:

1. P.V. Prasad, S. Siva Nagaraju, "Electrical Engineering, Concepts & Applications", Cengage Learning, 1st Edition, 2012.
2. B.L.Theraja, "Electrical Technology", Vol.I and Vol.II, S.Chand and Co, 23rd Edition.
3. M.S.Naidu, Kamakshaiah, "Electrical Technology", TMH Publications,1st Edition,2007.

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

Choice Based Credit System (with effect from 2018-19)

B.E (Electrical and Electronics Engineering)

SEMESTER-VI

S. No	Course Code	Title of the Course	Scheme of Instruction		Scheme of Examination			
			Hours per week		Duration in Hours	Maximum Marks		Credits
			L/T	P/D		CIE	SEE	
THEORY								
1.	**16EEC23**	Electrical Machinery – III	3/1	-	3	30	70	4
2.	**16EEC24**	Switchgear and Protection	3	-	3	30	70	3
3.	**16EEC25**	Power Semiconductor Drives	3	-	3	30	70	3
4.	**16EEC26**	Microprocessor and Microcontrollers	4	-	3	30	70	4
5.	**16EEEXX**	Program Specific Elective- 2	3	-	3	30	70	3
6.	**16EEEXX**	Program Specific Elective - 3	3	-	3	30	70	3
PRACTICALS								
7.	**16EEC27**	Microprocessor and Microcontrollers Lab	0/1	2	3	25	50	2
8.	**16EEC28**	Power Systems Lab	0/1	2	3	25	50	2
9.	**16EEC29**	Mini Project	-	2	-	50	-	1
10.	**16EEC30**	Industrial Visit	Satisfactory / Unsatisfactory					
			22	**06**	-	**280**	**520**	**25**

L: Lecture T: Tutorial D: Drawing P: Practical

CIE - Continuous Internal Evaluation SEE - Semester End Examination

Course Code	Program Specific Elective-2
16EEE05	High Voltage Engineering (HVE)
16EEE06	Artificial Intelligence Techniques in Electrical Engineering (AITEE)
16EEE07	Switch Mode Power Converters (SMPC)
16EEE08	Optimization Techniques (OT)

Course Code	Program Specific Elective-3
16EEE09	Advanced Control System (ACS)
16EEE10	Electrical Distribution Systems & Automation (EDSA)
16EEE11	High Voltage DC Transmission (HVDC)
16EEE12	Simulation Techniques for Electrical Engineering(STEE)
Elective Courses offered to other Departments	
16EE E13	Industrial Electronics (BE ¾ ECE, VIth Sem)

16EEC23

ELECTRICAL MACHINERY-III

Instruction	3L+1T Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	4

Course Objectives:

1. To study the construction and operating principles of synchronous machines
2. To understand different types of alternator voltage regulation methods for cylindrical rotor, salient pole types.
3. To describe the synchronizing procedure with the grid and study the parallel operation of alternators.
4. To discuss about synchronous motor performance and its starting methods.
5. Impart knowledge about transient behavior of synchronous machines and their stability.-
6. To understand the construction details, principle of operation, prediction of performance of Electrical special machines.

Course Outcomes: After completion of the course, the student will be able to

1. Explain basic principles of synchronous machines
2. Estimate the voltage regulation of alternators by different methods.
3. Describe the various starting methods of synchronous motors.
4. Analyze the concepts of synchronous motor.
5. Examine the stability of synchronous machines under different operating conditions.
6. Explain and apply the concept of permanent magnet motor and special machines for a given load application.

UNIT-I

Synchronous Machines: Constructional Details, Types of windings, Winding factors, e.m.f. equation, Fractional pitch and fractional slot windings, Suppression of harmonics and tooth ripple, Armature reaction and reactance, Synchronous impedance.

UNIT-II

Synchronous Generator: Voltage Regulation, Phasor diagram of alternator with non-salient poles, O.C. and S.C characteristics, Synchronous impedance, Ampere-turn, ZPF methods for finding regulation, Principle of two reaction theory and its application for the salient pole synchronous machine analysis, Synchronism and parallel operation.

UNIT-III

Synchronous Motor: Theory of operation, Vector diagram, Variation of current and power factor with excitation, Hunting and its prevention, Current and power diagram Predetermination of performance, Methods of Starting and Synchronizing. Synchronizing Power, Synchronous Condenser.

UNIT- IV

Transient Stability Studies: Elementary ideas of transient behavior of an Alternator-Three phase short circuit of an Alternator, Analysis of symmetrical and asymmetrical short circuit current.

UNIT-V

Special Machines: Permanent Magnet Motors, Switched Reluctance Motors, Hysteresis Motors, Stepper motor and BLDC motor.

Text Books:

1. P.S. Bhimbra, "Electrical Machinery", Khanna Publications, 7th Edition, 2003.
2. Nagrath I.J and Kothari D.P, "Electrical Machines", Tata McGraw Hill Publications, Sigma series, 2006
3. J.B Gupta ,S.K. Kataria & Sons, "Theory and performance of electrical machines", 14th Edition, 2014.

Suggested Reading:

1. Juha Pyrhonen, Tapani Jokinen, Valeria Hrabovcova, "Design of Rotating Electrical Machines", John Wiley & Sons, Ltd. 2008
2. Fitzgerald, Kingsley, Umans, "Electric Machinery", Tata Mc-Graw Hill Publications, 6th edition, 2002
3. Ashfaq husain, "Electrical machines", Danpatrai and sons, 3rd Edition, 2012.

16EEC24

SWITCHGEAR AND PROTECTION

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The objective of the course is

1. To know the operation and types of fuses used in power system.
2. To analyze principles of operation of the different types of relays.
3. To comprehend the different principles of protective schemes in power system.
4. To understand the principles of operation of the different types of circuit breakers.
5. To be acquainted with different lightning arrestors and the appropriate circuit for the protection of the various components of power system.
6. To identify the importance of various grounding methods.

Course Outcomes: After completion of the course, the student will be able to

1. Classify various components used in power system protection.
2. Indicate the relay settings of over current and distance relays.
3. Recognize arc quenching mechanisms used in different circuit breakers.
4. Explain the concept of unit and non-unit protection, and how the various associated parameters affect it.
5. Distinguish types and testing of CBs and their applications
6. Review protection of transmission lines, equipment protection and types of lightening arrestors against over voltages.

Unit-I

Protective Relays: Need for protection, Backup protection, Zones of protection, Definitions of relay pickup, dropout and reset values, Classification of relays, Operating principles and construction of electromagnetic and induction relays, Over current, Over voltage and Power relays, Directional features, Universal relay torque equation. Over current protection for radial feeders and ring mains, Protection of parallel lines, Relay settings for over Current relays, Earth fault and phase fault protection.

Unit-II

Static phase and Amplitude Comparators: Characteristics of Dual input comparators, Distance protection, 3-step Distance relays, Characteristics of distance relays on the RX diagram, static over current relay (Block diagram approach). Basics of digital relays. Need of numerical relays, Advantages of numerical relays over solid state relays.

Unit-III

Transformer and Generator Protection: Differential relays, Percentage differential relays, Protection of generator and transformer using percentage differential relays, Split phase, Inter turn protection, Overheating, Loss of excitation, Protection of generators, Buchholz relay, Protection of earthing transformers, Generator transformer unit protection.

Unit-IV

Circuit Breakers: Need for circuit breakers, Arc Properties, Principles of arc quenching theories, Recovery and Restriking voltages, Rated symmetrical, asymmetrical breaking current, Rated making current, Rated capacity, Voltage and Frequency of circuit breakers, Current chopping, Resistance switching, Derivations of RRRV, Types of circuit breakers, Oil, Air, SF6 and Vacuum circuit breakers, Testing of circuit breakers.

Unit-V

Over Voltage Protection: Protection of transmission lines against direct lightening strokes, Ground wires, Protection angle, Protection zones, Height of ground wire, Conductor clearances. Conductor heights, Tower footing resistance and its effects, Equipment protection assuming rod gaps, Arcing horns, Different types of lightening arrestors, construction, Surge absorbers, Peterson coil, Insulation coordination.

Text Books:

1. C.L. Wadhwa, "Electrical Power System", Wiley Eastern Ltd., 2nd Edition, 2013
2. Badriram & Viswakarma, "Power System Protection and Switchgear", Tata McGraw Hill, 2011
3. Sunil S. Rao, " Switchgear and Protection", Khanna Publications, 2008
4. J.B. Gupta, "Switchgear and Protection", S.K. Kataria& Sons, 3rd Edition, 2014.

Suggested Reading:

1. B. Ravindranath, M. Chander , "Power System Protection &Switchgear", New Age International, 2011
2. OZA, "Power System Protection and Switchgear", Tata McGraw Hill, 2010.
3. Y.G. Paithankar, "Power System Protection", PHI, 2nd Edition, 2010.

16EEC25

POWER SEMICONDUCTOR DRIVES

Instruction	3Hours per week
Duration of Semester End Examination	3 Hours
University Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The objective of the course is to

1. Deal with selection of a particular drive for a given application.
2. Comprehend D.C drive concepts and applications.
3. Assimilate the concepts and applications of Induction motor drives.
4. Assimilate the concepts and applications of synchronous motor drives.
5. Deal with adaptability of a particular drive (synchronous motor, BLDC, stepper motors and SRM) for given load requirements.
6. Deal with heating- cooling conditions, classes of duty and determine the motor rating.

Course Outcomes: After completion of the course: the student will be able to

1. Select a particular drive for a given application.
2. Design a proper controller for a D.C motor drive with the given detailed specifications.
3. Acquire knowledge in various speed control techniques of induction motor drives.
4. Acquire knowledge in various speed control techniques of synchronous motor drives.
5. Identify the adaptability of a particular drive (synchronous motor, BLDC, stepper motors and SRM) for given load requirements.
6. Discuss about heating- cooling conditions, classes of duty and determine the motor rating.

UNIT-I

Electrical Drives - Introduction: Advantages of Electrical Drives, Parts of Electrical Drives, Choice of Electrical Drives. Dynamics of Electrical Drives: Fundamental Torque Equations, Speed Torque Conventions and Multiquadrant Operation, Equivalent Values of Drives Parameters, Components of Load Torques, Nature and Classification of Load Torques, Calculation of Time and Energy, Loss in Transient Operations, Steady State Stability, Load Equalization. Selection of Motor Power Rating : Thermal Model of Motor for Heating and Cooling, Classes of Motor Duty, Determination of Motor Rating.

UNIT-II

DC Motor Drives: DC Motors and Their Performance, Starting, Braking, Controlled Rectifier Fed dc Drives, Single- Phase Fully-Controlled Rectifier Control of DC

Separately Excited Motor, Single- Phase Half-Controlled Rectifier Control of dc Separately Excited Motor, Three- Phase Fully-Controlled Rectifier Control of dc Separately Excited Motor, Three-Phase Half-Controlled Rectifier Control of dc Separately Excited Motor, Multi-quadrant Operation of dc separately Excited Motor Fed from Fully-controlled Rectifier, Supply Harmonics, Power Factor and Ripple in Motor Current, Chopper Controlled dc Drivers, Chopper control of separately Excited dc motors, Chopper control of series motor, Source current harmonics in Choppers, Converter ratings and closed-loop control.

UNIT- III

Induction Motor Drives*:* Braking, Regenerative braking, Plugging or reverse voltage braking, Dynamic (or rheostatic) braking, Transient Analysis, Stator Voltage Control, variable Frequency control from Voltage sources, Voltage Source Inverter (VSI) Control, Cycloconverter control, Closed loop speed control and converter Rating for VSI and Cyclo-converter, Induction Motor Drives, Variable Frequency Control from a Current Source, Rotor Resistance control, Slip Power Recovery, Static Kramer drive , Static Scherbius drive.

UNIT-IV

Synchronous Motor Drives : Operations from Fixed Frequency Supply, Synchronous Motor variable speed drives, Variable frequency control of Multiple Synchronous Motors, Self–controlled Synchronous Motor Drive Employing Load Commutated Thyristor Inverter, Starting Large Synchronous Machines, Self-controlled Synchronous Motor Drive Employing a Cyclo-converter, Permanent Magnet ac Motor Drives, Brushless dc Drives.

UNIT-V

Special Machines & Drives: Linear Induction Motor and its control, Stepper(or Stepping) Motors, Variable reluctance, permanent magnet, Important features of stepper motors, Torque versus stepping(or pulsing) rate characteristics, Drive circuits for stepper motors, Switched (or variable) Reluctance Motor, Operation and control requirements, Converter circuits, Modes of operation.

Text Books:

1. G.K.Dubey, “Fundamentals of Electric Drives”, Narosa Publishing House, 2nd Edition, 2016.
2. S.K.Pillai, “A Course in Electric Drives”, New Age International, 3rd Edition, 2015.

Suggested Reading:

1. VedamSubrahmanyam, “Electric Drives-Concepts and Applications”, TMH, 2nd Edition, 2010.
2. N.K.De & P.K.Sen, “Electrical Drives”, PHI, 1st Edition, 2006.

16EEC26

MICROPROCESSORS AND MICROCONTROLLERS

Instruction	4 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	4

Course Objectives: The objective of the course is to

1. Understand the Fundamentals of 8086 Microprocessors and its Programming.
2. Study the Interfacing of 8086 microprocessors using its various ports.
3. Understand the fundamentals of 8051 Microcontroller, programming and its interfacing.
4. Know about the data converters and their interfacing with 8086 Microprocessor.
5. Choose a suitable interrupt for a specific task while programming.
6. Make students know about the various day-to-day applications of Microcontroller.

Course Outcomes: After completion of the course, the student will be able to

1. Outline the Internal architecture of 8086 processor.
2. Summarize the instruction in set of 8086 processor.
3. Apply the knowledge of instruction set to write .
4. Review of different interfacing devices that are compatible with 8086 Microprocessor.
5. Outline the internal architecture of 8051 microcontroller.
6. Indentify different communicating devices that are compatible with 8051 Microcontroller.

UNIT- I

Introduction to Microprocessor and 8086 Microprocessor: Fundamentals of a microprocessor and its evolution, Architecture of 8086 Microprocessor- Segmented memory, Addressing modes, Instruction set, Pin diagram, Minimum and Maximum mode operations.

UNIT-II

Programming using 8086 Microprocessor: Assembly language programming, Assembler directives, simple programs using Assembler directives, strings, procedures, and Macros, Timings and delays.

UNIT-III

Interfacing with 8086 Microprocessor: Memory and I/O interfacing, 8255 (PPI) A/D and D/A interfacing, Programmable Interval Timer (8253), Keyboard / display controller 8279, interrupts of 8086.

UNIT-IV

Introduction to 8051 Microcontroller and its Programming: 8051 Microcontroller and its Architecture, I/O ports, Instruction set, Assembly language programming, connecting External memory.

UNIT-V

Interrupts, serial I/O, Timers, Counters, Applications of microcontrollers-Interfacing LEDs, Seven Segment display, Keyboard Interfacing,

Text Books:

1. A.K.Ray, K.M.Burchandi**,** "Advanced Microprocessors and peripherals", Tata McGraw Hill Co., 2006.
2. Mohammad Ali Mazidi, Janice Gillespie Mazidi, "The 8051 Microcontroller and Embedded Systems using assembly and 'C'", Prentice Hall of India, 2008.

Suggested Reading:

1. Douglas. V.Hall, "Microprocessors and Interfacing", Tata McGraw Hill, 2006.
2. Krishna Kant, "Microprocessors and Microcontrollers-Architecture, Programming and System Design 8085, 8086, 8051, 8096", Prentice Hall India, 2007.
3. K.J. Ayala, "The 8051 Microcontroller Architecture, Programming and Applications", Thomson publishers, 2nd Edition.

16EEC27

MICROPROCESSORS & MICROCONTROLLERS LAB

Instruction	1T + 2P Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	2

Course Objectives: The objective of the course is to

1. Write and execute simple programs using MASM software tool.
2. Get the students acquainted with the processor kit and improve their Programming skills.
3. Make the students work with controller and understand how to program and get the desired output in different platforms.
4. Describe various instruction set of 8086 microprocessor used in programming.
5. Illustrate the need of interfacing experiments.
6. Aanalyze the processer and controller kits.

Course Outcomes: After completion of the course, the student will be able to

1. Use instruction set of 8086 Microprocessor to develop ALP's.
2. Write ALP programs of 8086 microprocessor that suits for MASM software.
3. Demonstrate the functioning of interfacing devices using 8086 programming.
4. Use instruction set of 8051 microcontroller to develop ALP's
5. Demonstrate the functioning of interfacing devices using 8051 programming through Keil software.
6. Relate the experiments done in laboratory for doing mini projects and academic project.

List of Experiments

For 8086Microprocessor:

Section 1: Using MASM/TASM (**Any 3** **of** the below mentioned Expts. are to be conducted in this Section).

1. Programs for signed/unsigned multiplication and division.
2. Programs for finding average of N 16-bit numbers.
3. Programs for finding the largest number in an array.
4. Programs for code conversion like BCD numbers to 7-Segment.
5. Programs for computing factorial of a positive integer number.

Section 2: Using 8086 Kit(Interfacing) (**Any 2 of** the below mentioned Expts. are to be conducted in this Section).

1. 8255-PPI: Write ALP's to generate triangular, saw-tooth and square waveforms using DAC.
2. 8279-Keyboard Display: Write a small program to display a string of characters.
3. Write an ALP to display some alpha-numeric characters on a seven-segment display module.
4. Traffic Signal Controller.

For 8051 Microcontroller:

Section 3: Using 8051 Kit (**Any 3 of** the below mentioned Expts. are to be conducted in this section).

1. Data Transfer - Block move, Exchange, sorting, Finding largest element in an array.
2. Arithmetic Instructions :Multi byte operations
3. Boolean & Logical Instructions (Bit manipulations).
4. Use of JUMP and CALL instructions.
5. Programs to generate delay and programs using serial port and on chip timer/counter.

Section 4: Program Development using 'c' cross compiler for 8051 (**Any 2 of** the below mentioned Expts. are to be conducted in this section).

1. DAC interfacing for Generation of Sinusoidal Waveform.
2. Stepper motor control(clockwise and anticlockwise directions).
3. Interfacing of Keyboard and 7-segment Display Module.
4. ADC interfacing for temperature monitoring.

Major Equipment required for the LAB:

1. 8086 Microprocessor trainer kit(s) with in-built assembler/disassembler.
2. 8051 Microcontroller trainer kit(s).
3. Interfacing Modules for both 8086 and 8051.
4. MASM Software and Kiel/Ride Cross-'c' compiler Software.

16EEC28

POWER SYSTEMS LAB

Instruction	1T + 2P Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	2

Course Objectives: The objective of the course is to

1. Understand the power transfer to capability in terms of stability in transmission system.
2. Determine regulation & efficiency of short, medium and long transmission lines and to calculate A, B, C, D constants and study Ferranti effect in long lines.
3. Understand the importance of protective relays in power system such as different protection of transformer IDMT Characteristics of over current relay, Buchholz relay and static relays.
4. Understand steps involved in finding sequence parameter of Transformers and alternators.
5. Understand importance of di-electric strength of oil and efficiency of string of insulators.
6. View the significance of parallel operation of alternators and its practical importance.

Course Outcomes: After completion of the course: the student will be able to

1. Calculate ABCD constants of transmission lines and evaluate regulation, efficiency.
2. Examine relay setting for safe operating of power system.
3. Identity sequence parameters of transformer and alternator and draw its importance.
4. Calculate the time constant of an alternator.
5. Devise the dielectric strength of oil and calculate the efficiency of string insulators.
6. Appraise regulation and efficiency of transmission lines, calculate ABCD constants, importance of protective relays and calculation of parameters of transformers, alternators by conducing suitable tests.

List of Experiments

1. Determination of regulation & efficiency of 3-Phase transmission lines.
2. IDMT characteristics of Over-current relay.
3. Determination of A, B, C, D constants of 1-Phase transmission line.
4. Differential protection of 1-phase transformer.

5. Sequence impedance of 3-Phase Alternators by fault Analysis.
6. Determination of positive, negative and zero-sequence impedance of 3 -Phase transformers.
7. Synchronous machine reactance and time constant from 3-Phase S.C test.
8. Characteristics of Static relays.
9. Static excitation of Synchronous Generator.
10. Determination of dielectric strength of oil & Study of Buchholz relay.
11. Parallel operation of Alternators.
12. Measurement of capacitance of 3-core cables.
13. Fault location of Underground cables.
14. Determination of Voltage distribution and String efficiency of string of Insulators.
15. Study of Series- shunt compensation of a long transmission line.
16. Operation of relays in long transmission lines.
17. Ferranti effect in long lines.

Note: At least **TEN** experiments should be completed in the semester.

16EE C29

MINI PROJECT

Instruction	2 Hours per week
CIE	50 Marks
Credits	1

Course Objectives: The objective of the course is to

1. Understand the methods to carryout mini project in the area pertaining to Electrical and Electronics Engineering.
2. Understand the procedures/ methods to formulate the project scope of work and collect required literature.
3. Familiarizing the way to problem formulation and identify suitable techniques to solve.
4. Summarize the results and draw the conclusions.
5. Get exposure in report writing.
6. Discuss the practical application aspect of the project.

Course Outcomes: After completion of the course the student will be able to

1. Identify scope to carryout mini project in the area pertaining to Electrical and Electronics Engineering.
2. Formulate project scope and collect required information as literature survey.
3. Formulate problem to apply suitable techniques to solve.
4. Discuss the results and draw the conclusions
5. Discuss the practical aspects for suitable implementation.
6. Get exposure in report writing.

Mini Project is a course that a student has to undergo during his/her academic term, which involves the student to explore in a discipline that belongs to their research interest within their program area. It is a credit based course. The Mini Project shall be carried out during 6th semester along with other lab courses by having regular weekly slots. Students will take mini project batch wise and the batches will be divided as per the guidelines. The topic of mini project should be so selected enabling the students to complete the work in the stipulated time with the available resources in the respective laboratories. The scope of the mini project could be handling part of the consultancy work, maintenance of the existing equipment, development of new experiment setup or can be a prelude to the main project with a specific outcome.

16EEC30

INDUSTRIAL VISIT

Instruction	Any one Industry Visit
Sessional /Examination	*Grade

Course Objectives: The objective of the course is to

1. Physically see the process of manufacturing procedure and steps involved.
2. Collect the information in respect of materials, sources of supply.
3. Understand the sequential stages involved in manufacturing process.
4. Understand the procedure to write the 'industry visit' technical report by compiling all the information collected during the visit.
5. Understand the safety procedures and pre-cautions followed in Industry, confidentiality of the process and the man power required.

Course Outcomes: After completion of the course the student will be able to

1. Know the importance of visiting an engineering industry from the point of view of process of manufactory procedures and set-up.
2. Summarize the required information with regard to materials, source of supply in respect of a product.
3. Know the stages in manufactory of a product.
4. Prepare the 'industry visit' technical report covering the details of visit and it importance.
5. Visualize the safety precautions to be follow in industry, confidentiality of the product processing as the man power required.

Students are expected to visit at least one industry during the semesters from 4^{th} to 7^{th} and submit a detailed technical report on the study -visit to the Department. The Department should evaluate the report through a Committee consisting of Head of the Department and two more faculty members to award the Grades *.

* Satisfactory /Unsatisfactory.

16EEE 05

HIGH VOLTAGE ENGINEERING

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The objective of the course is to

1. Determine the breakdown mechanism in gases, liquids and solid dielectrics.
2. Understand the methods of generation and measurement of high voltages and currents.
3. Know the steps involved procedure for testing of high voltage equipment.
4. Understand the procedure for generation of impulse voltages and current
5. Know the importance of testing of HV electrical equipment.
6. Know the procedure and methodology of
   (i) Breakdown mechanism in Gases, Liquids and solid dielectrics
   (ii) Methods of generation and measurement of High voltages and currents and
   (iii) Classify the procedure for testing of High voltage equipment.

Course Outcomes After completion of the course the student will be able to

1. Describe breakdown mechanism in Gases and specially pertaining to high voltage engineering and its importance.
2. Discuss different aspects of breakdown mechanism in liquids and solids specifically pertaining to high voltage aspect.
3. Distinguish in respect of generation of High Voltages and currents, generation of impulse voltage and currents. To Analyze multistage impulse generation of impulses voltages and current generation.
4. Explain relating to measurement of high AC currents, High DC currents measurement of impulse currents and associated measuring equipment.
5. Classify in testing of high voltage electrical equipment such as power capacitor, power transformers, circuit breakers, insulators, bushings, cables, surge arresters etc.
6. Summarize (i) Breakdown mechanism in Gases, Liquids and solid dielectrics.
   (ii) Methods of generation and measurement of High voltages and currents and
   (iii) Classify the procedure for testing of High voltage equipment.

UNIT-I

Breakdown Mechanism in Gases: Mechanism of breakdown, Types of collisions, Ionization processes, Townsend's First and second Ionization coefficients, Townsend's breakdown mechanism, Time lags for breakdown, Streamer theory of breakdown, Paschen's Law, Penning effect, Corona discharges.

UNIT II

Breakdown Mechanism in Liquids and Solids: Breakdown in liquid dielectrics: Classification of liquid dielectrics, Pure liquids and commercial liquids, conduction and breakdown in pure liquids and commercial liquids. Testing of transformer oil. Breakdown in solid dielectrics: Intrinsic breakdown, Electro-mechanical breakdown, Thermal breakdown, Breakdown due to treeing and tracking, Breakdown due to internal discharges.

UNIT-III

Generation of High Voltages and Currents: Generation of Hugh DC voltages: Half and full wave rectifier circuits, Voltage doubler circuits, Cockroft Walton voltage multiplier circuit. Generation of Hugh AC voltages: Electrostatic generator, Van de Graf generator, Cascaded transformers, Series resonant circuit. Generation of Impulse Voltages and Currents: Analysis of impulse generator circuit, Multistage Impulse generator circuit, Impulse current generation.

UNIT-IV

Measurement of High Voltage and Currents: Sphere gap, Uniform field spark gap, Rod gap, electrostatic voltmeter, Generating voltmeter, Chubb Fortescue method, Impulse voltage measurement using voltage dividers. Measurement of high D.C currents using Hall generators, Measurement of high A.C currents using current transformer and electro-optical system. Measurement of Impulse currents: Resistive shunts, Rogouuski coils, Faraday generator.

UNIT-V

Testing of High Voltage Equipment: Testing of Power capacitors. Testing of power transformers. Testing of circuit breaker. Testing of Insulators and bushings. Testing of Cables. Testing of Surge Arresters.

Text Books

1. M.S.Naidu and V.Kamaraju, "High Voltage Engineering", Tata McGraw Hill 4th Edition, 2009.
2. C.L. Wadhwa, "High Voltage Engineering", Wiley Eastern Ltd.., 2007.

Suggested Reading:

1. E.Kuffel and W.S. Zaengl, "High Voltage Engineering", Pergamon Press, 3rd Edition, 2016.

16EE E06

AI TECHNIQUES IN ELECTRICAL ENGINEERING

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
University Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The objective of the course is to

1. Practice the concepts soft computing techniques and comprehensive knowledge of fuzzy logic control and to design the fuzzy control.
2. Expose students to the basic ideas, challenges, techniques and problems in artificial intelligence.
3. Know different types of neural networks and training algorithms
4. Know the applications of AI Techniques in electrical engineering applications
5. Analyse the metaheuristic techniques in real-world problems.
6. Introduce to the basic concepts of Artificial Intelligence with illustrations of current state of the art research and applications.

Course Outcomes: After the completion of the course the student will be able to

1. Understand concepts of ANNs, Fuzzy logic and metaheuristic Techniques.
2. Remember difference between knowledge based systems and algorithmic based systems.
3. Understand operation of Fuzzy controller and metaheuristic algorithms
4. Apply soft computing techniques for real-world problems
5. Analyse critically the techniques presented and apply them to electrical Engineering problems.
6. Apply metaheuristic techniques to Electrical problems.

UNIT-I

Artificial Neural Networks: Introduction, Models of Neural Network, Architectures, Knowledge representation, Artificial Intelligence and Neural networks, Learning process, Error correction learning, Hebbian learning, Competitive learning, Boltzman learning, Supervised learning, Unsupervised learning, Reinforcement learning, learning tasks.

UNIT- II

Fuzzy Logic: Introduction, Fuzzy versus crisp, Fuzzy sets, Membership function, Basic Fuzzy set operations, Properties of Fuzzy sets, Fuzzy cartesion Product, Operations on Fuzzy relations, Fuzzy logic, Fuzzy Quantifiers, Fuzzy Inference, Fuzzy Rule based system, Defuzzification methods.

UNIT- III

Metaheuristic Techniques-1: Introduction, Particle Swarm Optimization- swarm intelligence, PSO algorithms,Accelerated PSO, Implementation- Multimodal Functions, Validation, Simulated Annealing-Annealing and Probability, Choice of Parameters, SA Algorithm, Implementation, Ant Algorithms- Behaviour of Ants, Ant Colony Optimization, Double Bridge Problem, Virtual Ant Algorithm.

UNIT-IV

Metaheuristic Techniques-2: Bee Algorithms- Behavior of Honey Bees, Bee Algorithms- Honey Bee Algorithm, Virtual Bee Algorithm, Artificial Bee Colony Optimization, Applications, Harmony Search algorithm, Music-Based Algorithms, Harmony Search, Implementation.

UNIT-V

Applications of AI Techniques: Economic load dispatch, Load frequency control, Single area system and two area system, Reactive power control, speed control of DC and AC Motors.

Text Books:

1. S.Rajasekaran and G.A.V.Pai, "Neural Networks, Fuzzy Logic & Genetic Algorithms",PHI, New Delhi, 2010.
2. Xin-SheYang, "Engineering Optimization: An Introduction with Metaheuristic Applications",Wiley publication, 2010.

Suggested Reading:

1. P.D.Wasserman,VanNostrandReinhold, "Neural Computing Theory & Practice", New York,1989.
2. Bart Kosko, "Neural Network & Fuzzy System" Prentice Hall, 1992.

16EEE07

SWITCH MODE POWER CONVERTERS

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
University Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The objective of the course is to

1. Understand various advanced power electronics devices.
2. Study basic converter topologies.
3. Comprehend the design of resonant converters.
4. Describe the operation of multilevel inverters with switching strategies. for high power applications.
5. Understand different kinds of DC/AC power supplies.
6. Make the students know about design of SMPS.

Course Outcomes: After completion of the course, the student will be able to

1. Outline various features of advanced power electronics devices.
2. Develop and analyze various converter topologies.
3. Analyze different resonant converter topologies.
4. Apply the knowledge of different Multilevel Inverters that suits for industrial applications.
5. Compare the AC and DC power supplies.
6. Design AC and DC switched mode power supplies.

UNIT-I

Modern Power Semiconductor Devices: Gate Turn Off- SCR(GTO-SCR), MOS Turn off Thyristor(MTO), Emitter Turn Off Thyristor (ETO), Integrated Gate-Commutated Thyristor(IGCTs), MOS-controlled thyristors(MCTs), symbol, structure and equivalent circuit, comparison of their features.

UNIT-II

Converter Circuits: DC/DC converters - buck, boost, buck-boost & Cuk converters and their principles of operation; continuous and discontinuous modes of operation, Design aspects of DC-DC converters.

UNIT-III

Resonant Converters: Introduction, Classification of Resonant Converters, Basic Resonant circuit concepts, Load Resonant Converters, Resonant switch converters, zero current and zero voltage resonant converters, comparison between ZCS and ZVS resonant converters.

UNIT-IV

Multilevel Inverters: Multilevel concept , Classification of multilevel inverters, Diode clamped Multilevel inverter, principle of operation , main features , improved diode Clamped inverter, principle of operation, Flying capacitors multilevel inverter, principle of operation, main features, cascaded multilevel inverter, principle of operation, main features, Multilevel inverter applications.

UNIT-V

DC & AC Power Supplies: DC power supplies, classification, switched mode DC power supplies, fly back Converter, forward converter, push-pull converter, half bridge converter, Full bridge converter, Resonant DC power supplies, bidirectional power supplies, Applications, AC power supplies, classification, switched mode AC power supplies, Uninterruptible Power supplies applications.

Text Books:

1. Mohammed H. Rashid, "Power Electronics", Pearson Education, Third Edition – first Indian reprint -2004.
2. Ned Mohan Tore M. Undeland, "Power Electronics: Converters, Applications and Design", John Wiley & Sons, 3rd Edition, 2007.

Suggested Reading:

1. H. W. Whittington, B. W. Flynn and D. E. MacPherson, "Switched Mode Power Supplies, Design and Construction", Universities Press, 2009 Edition.
2. Umanand L., Bhat S.R., "Design of Magnetic Components for Switched Mode Power Converters", Wiley Eastern Ltd., 1992
3. Robert. W. Erickson, D. Maksimovic, "Fundamentals of Power Electronics", Springer International Edition, 2005.

16EEE08

OPTIMIZATION TECHNIQUES

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The objective of the course is

1. To study about classical optimization techniques which include single variable and multi variable optimization with equality constraints.
2. To study about linear programming.
3. To study non linear programming with direct search methods.
4. To study different gradient methods.
5. To study about Genetic algorithms.
6. To Analyze Economic load dispatch with the application of Genetic algorithm.

Course Outcomes: After completion of the course, the student will be able to

1. Solve the classical optimization problems.
2. Formulate linear programming problem and get the solution with simplex method, Graphical method.
3. Solve the nonlinear programming problems with various search methods such as Fibonacci method, golden section method etc.
4. Solve the non-linear programming problem with gradient methods.
5. Explain different mechanisms in Genetic algorithms.
6. Estimate the Economic load dispatch using genetic algorithms.

UNIT- I

Introduction: Classical optimization techniques: Statement of optimization problem, Objective function, Classification of optimization problems, Single-variable & Multi-variable Optimization without constraints. Multi-variable optimization with equality Constraints. Lagrange multiplier method, Multi-variable optimization with inequality constraints, Kuhn- Tucker conditions.

UNIT-II

Linear Programming: Standard form, Formulation of the LPP, Solution of simultaneous equations by Pivotal condensation, Graphical method, Simplex algorithm.

UNIT-III

Non-Linear Programming-I: One dimensional Search method: Fibonacci method, Golden Section method.

Direct Search method: Univariate Search method, Hook and Jeeve's method, Powell's method.

UNIT-IV

Non Linear Programming-II:

Gradient methods: Steepest Descent, Conjugate Gradient, Newton method and Quasi Newton method.

UNIT-V

Genetic Algorithms: Introduction, Encoding, Fitness Function, Basic Operators, Single Point cross over, two point cross over, uniforms cross over, mutation operator, Selection Techniques, Tournament Selection, Roulette wheel selection, Application to Economic load dispatch.

Text Books:

1. S.S.Rao, "Engineering Optimization Theory and Applications", New Age International, 3rd Edition, 1998.
2. Jasbir S.Arora, "Introduction to Optimum Design", McGraw Hill International Edition,1989.

Suggested Reading:

1. Kalyanmoy Deb, "Multi Objective Optimization using Evolutionary Algorithms", Wiley publications, 2013.
2. S. Rajasekharam, G.A. Vijaya Lakshmi, "Neural networks, Fuzzy logic and Genetic Algorithms Synthesis and Applications", PHI publications, 2010.

16EE E09

ADVANCED CONTROL SYSTEMS

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The objective of the course is to

1. Understand the classical approach in designing compensators.
2. Gain the mathematical knowledge of z-transforms in representing sampled data control systems.
3. Understand the concepts of stability analysis in sampled data control system.
4. Uunderstand the concepts of controllability and observability tests for Discrete - time and time invariant systems.
5. Understand the importance of response of non-linear systems and construction of phase plane trajectories.
6. Understand the procedures to perform stability study using Liapunov's criteria and construction of Liapunov function.

Course Outcomes: After the completion of the course the students will be able to

1. Design different types of compensators.
2. Represent discrete time systems and obtain solution.
3. Calculate and analyze sample data control system stability.
4. Apply the concepts of controllability and observability - tests for discrete-time systems.
5. Analyze the response of non-linear systems and construction of phase plane trajectories.
6. Justify the stability study through Liapunov's criteria and construction of Lyapunov function.

UNIT-I

Introduction to Compensator Designs: Preliminary considerations of classical design, Realization of basic compensators, cascade compensation in time domain, cascade compensation in frequency domain using bode plots.

UNIT-II

Sampled Data Control Systems: Introduction, Spectrum analysis of sampling process, signal reconstruction, difference equations, Z-transform, Pulse transfer function, Inverse Z transform, Analysis of sampled data control systems, Z and S domain relationships, Stability analysis-Jury's stability test, bilinear transformation.

UNIT-III

State-space Analysis and Design: State space representation of discrete time systems, phase variable and canonical form of state model, solution of discrete time state equation using z-transform, concept of Controllability and Observability, Controllable and Observable phase variable form of state model, control system design through pole placement by state feedback.

UNIT-IV

Nonlinear Systems: Introduction, common physical nonlinearities, phase plane-method, Singular points, stability of non linear system, Construction of phase trajectories- Isoclines method, ä-method, The Describing Function-basic concepts, Derivation of describing functions- dead zone and saturation, relay with dead zone and hysteresis.

UNIT-V

Liapunov's Stability Analysis: Introduction, Liapunov's stability criterion, direct method of Liapunov and the linear system, Methods of constructing Liapunov function for non linear systems- Krasovskii's method, Variable gradient method.

Text Books:

1. I. J Nagrath, M. Gopal, "Control Systems Engineering", New Age International (P) Limited, 2017.
2. Ogata .K, "Discrete Time control Systems", PHI Publications, 2nd Edition 1995.

Suggested Reading:

1. M. Gopal, "Digital Control and State Variable Methods", Tata McGraw Hill, 2/e, 2003.
2. K. Ogata, "Modern Control Engineering", Pearson Publications, 5th Edition, 2015.

16EEE10

ELECTRICAL DISTRIBUTION SYSTEMS AND AUTOMATION

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The objective of the course is to

1. Study the load characteristics of distribution systems.
2. Understand the substation schemes, voltage drop calculation of different service areas.
3. Know about primary and secondary distribution systems and their characteristics.
4. Study different voltage control methods.
5. Study the application of capacitors in distribution systems.
6. Study the distribution automation control functions.

Course Outcomes: After completion of the course, the student will be able to

1. Estimate the load factors, diversity factor etc. for different systems.
2. Describe the substation bus schemes and calculate the rating of substations.
3. Compute voltage drop and power losses of primary and secondary distribution systems.
4. Estimate the reactive power requirements of distribution systems.
5. Describe the voltage control methods used in Distribution Systems.
6. Explain the Distribution automation control functions and communication used in Distribution automation.

UNIT-I

Load Characteristics: Demand, demand curve, load duration curve, Diversified demand, Non-coincident Demand, Coincidence factor, Contribution factor problems, Relationship between load and loss factors load growth, Rate structure, Customer billing, Classification of loads (residential, commercial, agricultural, and industrial) and their characteristics.

UNIT-II

Sub-Transmission Lines and Substations: Types of sub-transmission lines, Distribution substations, Substation bus schemes, Rating of distribution substation, Service area with multiple feeders, Percent voltage drop calculations.

UNIT-III

Primary and Secondary Feeders: Types of primary systems, Radial type, Loop type and Primary network, Primary feeder loading, Radial feeder with uniformly distributed load, Secondary voltage levels, Secondary banking, Secondary networks.

UNIT-IV

Voltage Drop and Power Loss Calculations: Voltage drop and power loss calculations, 3-phase, Non 3-phase primary lines, Single phase two-wire laterals with ungrounded neutral, Single phase two wire unigrounded laterals, Two phase plus neutral lateral, Method to analyze distribution costs, Voltage control methods, Feeder voltage regulators.

UNIT-V

Application of Capacitors to Distribution Systems: Effects of series and shunt capacitors, Power factor correction, Economic justification for capacitors, Location and sizing of capacitors in distribution system. **Distribution System Automation**: Definitions, control functions, Level of penetration of DA, Types of communication systems, Supervisory control and data acquisition.

Text Books:

1. Turan Gonen, "Electric Power Distribution Engineering", TMH, 3rd Edition, 2016.
2. A.S.Pabla, "Electric Power Distribution", TMH, 6th Edition, 2012.

Suggested Reading:

1. M. K. Khed Kar, G.M. Dhole, "Electric Power Distribution Automation", University Science Press, 2010
2. William Kersting, "Distribution System Modeling and Analysis", 3rd Edition CRC Press, 2015.
3. S.Sivanagaraju, and V.Sankar, "Electric Power Distribution and Automation", Dhanpat Rai & Co, 2012.

16EEE11

HIGH VOLTAGE DC TRANSMISSION

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
University Examination	70 Marks
CIE	30 Marks
Credits	3

Course objectives: The objective of the course is to

1. Deal with the basics of HVDC Transmission and comparison between HVAC and HVDC.
2. Deal with power conversion between Ac to DC and DC to AC.
3. Deal with control of HVDC converters.
4. Deal with HVDC filters.
5. Deal with the protection of HVDC systems.
6. Deal with MTDC transmission systems.

Course outcomes: After completion of the course students will be able to

1. Compare between HVDC and HVAC Transmission systemsand discuss about basics of HVDC.
2. Analyze 6 pulse,12 pulse circuits and to calculate power conversion between Ac to DC and DC to AC.
3. Discuss about various control methods and also able to draw the control characteristics.
4. Discuss about the various filters used in HVDC/HVAC transmission systems.
5. Discuss about the protection of HVDC transmission systems.
6. Discuss about MTDC transmission systems and their control aspects.

UNIT-I

General consideration of DC and AC transmission systems: Comparison of AC and DC transmission systems, Application of DC transmission, Economic Consideration, Kinds of DC links, planning for HVDC transmission, Modem trends in DC transmission, Corona loss in AC & DC systems.

UNIT-II

Converter Circuits: Properties of Converter circuits, Different kinds of arrangements, Analysis of Bridge converters with grid control, with and without overlap angle, Equivalent circuit of rectifier. Inversion: Operation as Inverter, Equivalent circuit of Inverter.

UNIT-III

Control: Basic means of control, Limitations of manual control, Desired features of control, Combined characteristics of rectifier and inverter, Power reversal, constant minimum angle, Ignition angle control, Constant current control, Constant Extinction angle control.

UNIT-IV

Protection: Short circuit current, Arc-back, Commutation failure, Bypass valves, DC reactors, DC circuit breakers, Protection against over voltages, Harmonic filters.

UNIT-V

Multi-terminal DC Systems: Application of MTDC systems, Types of MTDC systems, Comparison of series and parallel MTDC systems, Control of MTDC system.

Text Books:

1. Padiyar KR., “HVDC Power Transmission Systems”, New age, 2017
2. S.Kamakshaiah and V.Kamaraju., “HVDC transmission” , McGraw Hill 2017.

Suggested Reading:

1. Kimbark E.W., “Direct Current Transmission” Vol-I, JohnWtley, 1971. 1990.
2. Arrillaga J., “High Voltage Direct Current Transmission”, Peter Peregrinus Ltd., London, Pergamon Press, 1983.

16EEE12

SIMULATION TECHIQUES FOR ELECTRICAL ENGINEERING

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The objective of the course is to

1. Introduce various simulation techniques for electrical engineering graduates.
2. Provide a platform to know about modeling of components.
3. Create an environment to work with different software technologies.
4. Build confidence in writing programmes.
5. Make familiar about logical operations.
6. Become aware about the analysis of DC & AC circuits.

Course Outcomes: After completion of the course, the student will be able to

1. Classify software techniques based on application and system requirement.
2. Infer various logical operations.
3. Draw the graphs for analysis of data.
4. Identify the bug in the program and also procedure to debug the same.
5. Model circuit elements by distinguishing them AC and DC.
6. Simulate the given circuit and validate by conventional means.

UNIT-I

Basics: MATLAB environment, variables, Basic data types, Relational and Logic operators, Conditional statements, Input and Output, Loops and bracing.

UNIT-II

Matrices: Creating and Manipulating matrices, Matrix mathematics and Matrix functions, Colon operator, Line space, Cross product, Dot product, Logical functions, Logical indexing, 3 – dimensional arrays, Cell arrays, Structures, Plotting: 2-D and 3-D plots: Basic plots, subplots, Histograms, Bar graphs, Pie charts.

UNIT-III

M –file Scripts: Creating saving and running an M – file, creating and running of a function, function definition line, H1 and help text lines, Function body, Sub – functions, File I/O handling,

UNIT-IV

PSpice for Circuit Analysis: Introduction to PSpice, Description of circuit elements, nodes and sources, input and output variables, modeling of the above elements, types of DC analysis, types of AC analysis and Transient Analysis.

UNIT-V

PSpice for Electronic Devices and Circuits: Diode model, BJT model, MOSFET model, IGBT model, SCR model, Sub routines, diode rectifiers, controlled rectifiers.

Text Books:

1. Muhammad H. Rashid, "Power Electronics: Circuits, Devices, and Applications", Pearson Education India. 3rd Edition, 2009.
2. D Hanselman and B little field, "Mastering MATLAB 7", Pearson Education, 2005.
3. Y Kirani Singh and B BChaudhari, " MATLAB Programming", Prentice Hall of India, 2007.

Suggested Reading:

1. Muhammad H. Rashid, "Spice for Power Electronics and Electric Power", CRC Press 3rd Edition, 2012.
2. A Gilat, "MATLAB: An Introduction with Applications", John Wiley and Sons, 2004.
3. Steven T Karris, "Introduction to Simulink with Engineering Applications", Orchard Publication, 2nd Edition, 2008.

Elective Courses offered to other Departments

SEMESTER – VI

S.No	Course Code	Title of the Course	Scheme of Instruction		Scheme of Examination			Credits
			Hours per week		Duration of SEE in Hours	Maximum Marks		
			L/T	P/D		CIE	SEE	
PRACTICALS								
1	**16EE E13**	**INDUSTRIAL ELECTRONICS (BE 3/4 ECE, VI Sem)**	3/0	0	3	30	70	3
TOTAL			**3**	**0**	**-**	**30**	**70**	**3**

L: Lecture T: Tutorial P: Practical D: Drawing
CIE - Continuous Internal Evaluation SEE - Semester End Examination

16EE E13

INDUSTRIAL ELECTRONICS

(BE 3/4 ECE, VI Sem.)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
University Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objective: The objective of the course is to

1. Introduce the characteristics of various power semiconductor switches and their applications.
2. Know the importance of protection, triggering and commutation technique s of SCR.
3. Make acquainted with the operating principles of AC-DC, DC-DC, AC-AC and DC-AC converters.
4. Understand various voltage control techniques in power converters.
5. Comprehend quadrant operation of various power converters.
6. Recognize various application of power converters.

Course Outcomes: After completion of the course, the student will be able to

1. Analyze basic operation of various power semiconductor devices and to compare their characteristics.
2. Design protection circuit and control circuits for SCR.
3. Analyze the operation principles of different AC-DC, DC-DC, AC-AC, and DC-AC converters.
4. Identify different voltage control strategies in different converters.
5. Be acquainted with different quadrant operation of power converters.
6. Know the practical application of power electronic converters

UNIT-I

Power Diodes and Transistors: Power diode, characteristics, Recovery characteristics, Types of power diodes, General purpose diodes, Fast recovery diodes, their applications, Power MOSFET and IGBT.

UNIT-II

Silicon Controlled Rectifier (SCR): SCR-Static characteristics, Two transistor analogy, Protection of SCRs, Dynamic characteristics, ,SCR trigger circuits-R, RC and UJT triggering circuits, turn-off methods of SCR, GTO- SCR, Comparison between SCR and GTO-SCR.

UNIT-III

Phase controlled converters: Study of Single-phase half wave and full wave controlled rectifiers with R, RL, RLE loads, significance of freewheeling diode, Dual converters - circulating and non circulating current modes.

DC-DC Converters: Principles of Step-down, Step-up, Step UP/Down choppers, Time ratio control and current limit control, Types of choppers Type- A, B, C, D and E.

UNIT-IV

AC-AC Converters: Principle of operation of Single phase Cyclo-converters and their applications. Single-phase AC Voltage Controllers with R and RL loads.

Inverters: Principle of operation of Single-phase Inverters, Voltage control methods, Single pulse width modulation, multiple pulse width modulation, Sinusoidal pulse width modulation.

UNIT-V

Industrial Applications: Overview of Switched mode power supplies, Online and offline UPS (block diagrams), Thyristor controlled reactors, switched capacitor networks, Emergency light control, automatic water level control, resistance heating, induction and dielectric heating.

Text Books:

1. Singh.M.D and Khanchandani.K.B, “Power Electronics”, Tata McGraw Hill, 2nd Edition, 2006.
2. Rashid.M.H. “Power Electronics Circuits Devices and Applications”. Prentice Hall of India, 2003.
3. Bimbra.P.S, “Power Electronics”, Khanna Publishers, 3rd Edition, 2013.

Suggested Reading:

1. Mohan, Undeland, Robbins, “Power Electronics”, John Wiley, 1996.
2. P.C.Sen, “Power Electronics”, Tata Mc-Graw Hill, 1st Edition, 2001.
3. G. K. Mithal, “Industrial Electronics”, Khanna Publishers, Delhi, 2000.

Department of Electrical and Electronics Engineering

Chaitanya Bharathi Institute of Technology (A)

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VISION and MISSION of the Institute

Vision

To be a centre of excellence in technical education and research

Mission

To address the emerging needs through quality technical education and advanced research

Quality Policy

Chaitanya Bharathi Institute of Technology imparts value based technical education and training to meet the requirements of student, industry, trade/profession, research and development organisations for self-sustained growth of society.

VISION and MISSION of the Department

Vision

To be in forefront in assimilating cutting edge technologies in the field of Power & Electronics arena

Mission

To solve practical problems through industry institute interaction for implementation and to encourage taking up multidisciplinary research while maintaining ethics and morals for the sustainable development of the society.

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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY(A)
SCHEME OF INSTRUCTION AND EXAMINATION
VII-Semester of B.E/B.Tech under CBCS
B.E.(EEE)

SEMESTER-VII

S. No	Course Code	Title of the Course	Scheme of Instruction: Hours per week L/T	P/D	Scheme of Examination: Duration in Hours	Maximum Marks CIE	SEE	Credits
THEORY								
1.	16EE C31	Power System Operation and Control	4	-	3	30	70	4
2.	16EE C32	Utilization of Electrical Energy	3	-	3	30	70	3
3.	16EE C33	DSP and Embedded Systems	4	-	3	30	70	4
4.	16EE EXX	Program Specific Elective- 4	3	-	3	30	70	3
5.	16XX OYY	Open Elective-I	3	-	3	30	70	3
PRACTICALS								
6.	16EE C34	Power Systems Simulation Lab	0/1	2	3	25	50	2
7.	16EE C35	Digital Signal Processor and Embedded Systems Lab`	0/1	2	3	25	50	2
8.	16EE C36	Project Seminar	0	3	-	50	-	2
			19	07	-	250	450	23

L: Lecture T: Tutorial D: Drawing P: Practical
CIE - Continuous Internal Evaluation SEE - Semester End Examination

Course Code	Program Specific Elective-4
16EEE14	Basic VLSI Design
16EEE15	Computer Methods in Power Systems(CMPS)
16EEE16	Power Quality Engineering(PQE)
16EEE17	Special Electrical Machines(SEM)

Course Code	Open Elective-I
16PY O01	History of Science and Technology
16EG O02	Gender Sensitization
16CE O02	Disaster Mitigation and Management (DMM)
16CS O10	Machine Learning Using Phyton
16ME O01	Entrepreneurship

16EE C31

POWER SYSTEM OPERATION AND CONTROL

Instruction	4 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70Marks
CIE	30 Marks
Credits	4

Course Objectives:
1. To understand the formulation of Load-Flow problems applying different methods and economic operation of power systems
2. To understand the importance of Load Frequency Control and stability of power systems.
3. To study the reactive power control and basic FACTS controllers

Course Outcomes: After completion of this course, students will be able to:
1. Acquire knowledge in assessing the importance of load flow studies in power system operation. Carryout Load-Flow studies with different methods compare and interpret the results.
2. Acquire knowledge in conducting Economic operation of power system without and with losses
3. Acquire knowledge in conducting Load Frequency Control for single and two area systems and also distinguish between different control methods.
4. Acquire knowledge in analyzing the Stability aspects of power system.
5. Acquire knowledge in assessing the system improvement through reactive power control and FACTS controllers.

UNIT-I

Load Flow Studies: Formulation of Y bus for a system, modeling of tap changing and phase shifting transformer, Formulation of load flow problem, Solution of load flow by Gauss Seidel, Newton- Raphson, Decoupled and Fast Decoupled methods, comparison of different load flow methods.

UNIT-II

Economic Operation of Power System: Input-Output curves, Heat rates and incremental cost curves, Equal Incremental cost criterion Neglecting transmission losses with and without generator limits, B_{mn} Coefficients, Economic operation including transmission losses.

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UNIT-III

Load Frequency Control: Governor Characteristics, Regulation of two generators, coherency, concept of control area, Incremental power balance of a control area, Single area control, Flat frequency control, Flat tie-line frequency control, Tie-line bias control, Advantages of pool operation, Development of model for two- area control.

UNIT-IV

Power System Stability: Definitions Steady state stability and Transient stability, Steady state stability of a synchronous machine connected to infinite bus, calculation of steady state stability limit, synchronous machine models with and without saliency, Equal area criterion, Application of equal area criterion, Swing equation, Step by step solution of Swing equation, factors effecting transient stability, Auto Reclosures, mathematical formulation of voltage stability problem.

UNIT-V

Reactive Power Control: Reactive power generation by synchronous generators, Automatic voltage regulators, FACTS Controllers, SVC, TCSC, STATCOM, UPFC.

Text Books:

1. I. J. Nagrath and D.P. Kothari, Modern Power System Analysis, TMH Publication, 4th Edition 2011
2. C.L.Wadhwa, Electrical Power System, New Age International Publications, 3rd Edition, 2014
3. O. Elgard, Electric Energy Systems Theory, TMH Publication, 2nd Edition, 2001.

Suggested Reading:

1. A. Chakrabarthy and S. Halder, Power System Analysis Operation & control, PHI Publications, 3rd Edition, 2010
2. J.J.Grainger and William D Stevenson, Power System Analysis, Mc Graw Hill Publishers, 2016
3. S. Sivanagaraju, and G. Srinivas, 'Power system, Operation and Control', Pearson publications, 2010.

16EE C32

UTILIZATION OF ELECTRICAL ENERGY

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. Understand the adaptability of heating and welding concepts for a given application
2. Know the necessity of illumination and batteries for specified requirement
3. Know selection of proper traction system and its corresponding drive for industrial applications

Course outcomes: After completion of this course, Students will able to:

1. Select the proper furnace system for a given requirement
2. Distinguish the adaptability of heating and welding concepts for a given application
3. Identify the necessity of illumination for specified requirement
4. Select proper traction system and its corresponding drive for industrial applications
5. Able to estimate energy consumption levels at various modes of operation.

UNIT-I

Electric Heating: Introduction, Classification of electric heating, Electric Resistance Heating, Resistance Ovens, Properties of good heating material, Different types of heating material, Causes of failure of heating element, Design of heating element- Numerical Problems.

Arc Furnaces: Direct Arc Furnace, Indirect Arc Furnace, Induction Heating, Direct Core-type Induction Furnace, Vertical Core-Type Induction Furnace, Indirect Core-Type Induction Furnace, Coreless Induction Furnace, High Frequency Eddy-current Heating, Dielectric Heating- Numerical Problems.

UNIT-II

Electric Welding: Introduction, Classification of Welding Processes, Formation and Characteristics of Electric Arc, Effect of Arc Length, Electrodes for Metal Arc Welding, Advantages of Coated Electrodes, Types of Joints - Welding Transformer.

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Electric Arc welding: Carbon Arc Welding, Submerged Arc Welding, Atomic Hydrogen Welding.

Resistance Welding: Spot Welding, Seam Welding, Projection Welding, Butt Welding, Flash Butt Welding, Upset Welding, Electron Beam Welding, Laser Welding - Numerical Problems

UNIT-III

Illumination: Introduction, Terms used in illumination, laws of illumination, Polar Curves of C.P. Distribution – Determination of M.S.C.P. and M.H.C.P. from Polar Diagrams- Rousseau's construction, Lighting Schemes- Design of Lighting Schemes- Application to factory lighting, Street lighting and Flood lighting - Numerical Problems

Electric Lamps: Incandescent lamps and modern luminaries like CFL, LED and their operation, energy saving in illumination systems - Numerical Problems

UNIT-IV

Electric Traction-I: Introduction, Systems of electric traction and track electrification- DC system, single phase and 3-phase low frequency and high frequency system, composite system, kando system, comparison between AC and DC systems- Train Movement-Typical Speed/Time Curve - Factors affecting scheduled speed - Simplified Speed/Time Curve - Average and Schedule Speed - Tractive Effort for Propulsion of a Train - Power Output from Driving Axles - Energy Output from Driving Axles - Numerical Problems.

UNIT-V

Electric Traction-II: Specific Energy Output - Evaluation of Specific Energy Output - Energy Consumption - Specific Energy Consumption - Adhesive Weight - Coefficient of Adhesion - Mechanism of Train Movement - Numerical Problems

Text Books:

1. C L Wadhwa, Generation, Distribution and Utilization of Electrical Energy- 3 rd Edition New age international publishers, 2015.
2. B.L. Theraja, A Textbook of Electrical Technology Volume-III Transmission and Distribution S. Chand Limited, 23rd Edition, 2013.
3. Partab H, Art and Science of Utilization of Electric power, Dhanpatrai & Sons, 2014

Suggested Reading:

1. J.B.GUPTA, Utilization of Electric Power and Electric Traction- S.K.Kataria & Sons, 2013.
2. R K. Rajput, Utilization of Electrical Power-, 2 nd Edition, Laxmi Publications (p) Ltd, 2016.

16EE C33

DSP & EMBEDDED SYSTEMS

Instruction	4 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	4

Course Objectives:

1. To introduce basic concepts of signals and systems and representation of digital system.
2. To introduce digital signal processor
3. To introduce fundamentals of Real time operation and ARM processor

Course Outcomes: After completion of this course, students will be able to:

1. Identify the digital system and find its response.
2. Design FIR and IIR filter.
3. Be familiar with architecture and features of TMS 320F/2047 DSP.
4. Understand the basic concepts of real time operating systems
5. Be familiar with architecture and features of ARM processor.

UNIT-I

Introduction to signals and systems: Classification of Signals & Systems, Linear shift invariant systems, stability and causality, Sampling of Continuous signals, Signal Reconstruction, quantizing & encoding, linear constant co-efficient difference equations, properties of discrete system- linearity. Analog to digital conversion - Nyquist criteria

UNIT-II

Fourier transforms and filters: Magnitude and phase response discrete time systems - Computation of DFT and IDFT -Properties of Discrete Fourier Transform, - Linear and circular Convolution of sequence using DFT. Fast Fourier transform: Radix-2 decimation in time and decimation in frequency FFT algorithms, Inverse FFT. Introduction to IIR Low pass butter worth & Chebyshev digital filters using impulse invariant and bilinear transformation techniques, FIR Rectangular and Kaiserwindows

UNIT-III

DSP Processors: Differences between DSP and other mp architectures,. Basic architectural features, DSP computational building blocks, Bus and Memory architecture, Address generation unit, speed issues, fixed point DSPs - Architecture of TMS 320C 54X Processor , addressing modes, on-chip peripherals, Real Time operating constraints

UNIT-IV

Real-Time Operating Systems: Tasks and Task States, Tasks and Data, Semaphores, Shared Data, Message Queues, Mailboxes and Pipes, Timer Functions, Events, Memory Management, Interrupt Routines in an RTOS Environment. Semaphores and Queues, Hard Real-TimeScheduling Considerations, Host and Target machines, Linker/Locators for Embedded Software.

UNIT-V

Advanced architectures: ARM Processor, memory organization and Instruction level parallelism, Net advanced embedded systems: Bus protocols, 12C bus and CAN bus, Internet- Enabled Systems

Text Books:

1. Avatar Singh and S. Srinivasan, " Digital Signal Processing Implementations Using DSP Microprocessors", Thomson Brooks, 2004.
2. Wayne Wolf, "Computers as Components - Principles of Embedded Computer System Design", Morgan Kaufmann Publisher, 2006.

Suggested Reading:

1. B. Ventakaramani, M. Bhaskar, "Digital Signal Processes, Architecture Processing and Applications", Tata McGraw Hill, 2002.
2. David E-Simon, "An Embedded Software Primer", Pearson Education, 2007.
3. K.V.K.K.Prasad, "Embedded Real-Time Systems: Concepts, Design & Programming", Dreamtech press, 2005.

16EE C34

POWER SYSTMES SIMULATION LAB

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	2

Course Objectives:

1. To understand the load flows, transient stability studies, economic load dispatch and load frequency control in power system
2. To understand the time and frequency response of the system
3. To Simulate and compare the output of converters with different loads

Course Outcomes: After completion of this course, students will be able to:

1. Acquire knowledge about Load frequency control
2. Analyse Load flow studies and economic load dispatch
3. Acquire knowledge about transient stability studies
4. Analyse semi, full and buck & boost converters
5. Acquire knowledge about time and frequency response of the system

List of Experiments:

1. Determination of power angle diagram for Salient and Non-salient pole synchronous machine.
2. Frequency response characteristics using Bode plot
3. Root Locus & Nyquist method
4. Design of lag, lead and lag-lead compensator
5. Computation of line parameters
6. Modeling of Transmission Lines
7. Load Flow Studies.
8. Fault Analysis.
9. Transient stability studies.
10. Economic load dispatch.
11. Load Frequency control of single-area and two-area systems
12. Single-phase semi-converter with R and RL loads
13. Single-phase full-converter with R and RL loads
14. Analysis of Buck and Buck-Boost converter

Note: At least **TEN** experiments should be conducted in the Semester

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16EE C35

DIGITALSIGNALPROCESSING & EMBEDDED SYSTEMS LAB

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	2

Course Objectives:

1. To learn to analyze and synthesize signal using DSP
2. To acquire knowledge on digital control of electrical appliances
3. To practice programming using embedded processor and to learn to interface various electrical equipments to embedded controller

Course Outcomes: After completion of this course, students will be able to:

1. Control AC machines using DSP
2. Control DC machines using DSP
3. To simulate control signals using MATLAB
4. To generate the output sequence using micro controller.
5. Control the operation of different equipments to embedded controller

List of Experiments:

1. Verification of Convolution Theorem Using MATLAB.
2. Computation of DFT, IDFT using Direct and FFT methods.
3. Verification of Sampling Theorem
4. Design of Butterworth and Chebyshev LP & HP filters.
5. DC Motor speed control using DSP.
6. Three phase IM speed control using DSP
7. Simulation of switching sequence for relay operations.
8. Simulation of switching sequence with time delay.
9. Simulation of relay operations using different ports.
10. Interfacing 7 segment display using SPI through microcontroller.
11. Interfacing ADC through microcontroller.
12. Interfacing DAC through microcontroller.
13. Interfacing stepper Motors through microcontroller.

Note: Any **Ten** experiments from should be conducted from the above list in the semester.

16EE C36

PROJECT SEMINAR

Instruction	3 Hours per week
CIE	50 Marks
Credits	2

The objective of 'Project Seminar' is to enable the student take up investigative study in the broad field of Engineering / Technology, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on an individual basis or two/three students in a group, under the guidance of a supervisor. This is expected to provide a good initiation for the student(s) towards R&D. The work shall include:

1. Survey and study of published literature on the assigned topic;
2. Working out a preliminary Approach to the Problem relating to the assigned topic;
3. Conducting preliminary Analysis/Modelling/Simulation/Experiment/ Design/Feasibility;
4. Preparing a Written Report on the Study conducted for Presentation to the Department;
5. Final Seminar, as oral Presentation before a departmental Committee.

Guidelines for the award of Marks:

Max. Marks: 50

Evaluation by	**Max. Marks**	**Evaluation Criteria / Parameter**
Supervisor	20	Project Status / Review
	5	Report
Department Committee	5	Relevance of the Topic
	5	PPT Preparation
	5	Presentation
	5	Question and Answers
	5	Report Preparation

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16EE E14

Program Specific Elective-4
BASIC VLSI DESIGN

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To understand the MOSFET structures and operations
2. To learn to design logic circuits using pMOS and nMOS
3. To learn to design concepts of CMOs and HDL Programing.

Course Outcomes: After completion of this course, students will be able to:

1. To design logic circuits using pMOS and nMOS technologies
2. To design cMOS logic circuits.
3. To simulate logical circuits using HDL programming
4. To understand different modeling strategies
5. To understand FPGA design strategies.

UNIT-I

MOS CIRCUIT DESIGN PROCESS: Introduction of MOSFET: Symbols, Enhancement mode-Depletion mode transistor operation – Threshold voltage derivation – body effect – Drain current Vs voltage derivation – channel length modulation. nMOS and pMOS inverter – Determination of pull up to pull down ratio –Stick diagrams – VLSI Circuit Design Flow.

UNIT-II

MOS TECHNOLOGY: Chip Design Hierarchy – IC Layers – Photolithography and Pattern Transfers – Basic MOS Transistors – CMOS Fabrication: n-well – p-well – twin tub – Latch up and prevention (SOI) – Submicron CMOS Process- Masks and Layout - CMOS Design Rules: Lambda based layout.

UNIT-III

LOGIC DESIGN USING nMOS and cMOS: Gate delays – Logical Effort - CMOS Static Logic – Transmission Gate Logic – Tri-State Logic – Pass Transistor Logic – Dynamic CMOS Logic –Realization of logic gates – using nMOS and CMOS technologies– Stick diagrams of logic gates-Simple full adder – four input Encoder- Decoder.

UNIT-IV

VERILOG HDL: Hierarchical modeling concepts – Basic concepts: Lexical conventions – Data types – Modules and ports. Gate level modeling – Dataflow modeling – Behavioral modeling – Design examples of Combinational and Sequential circuits – Switch level modeling.

UNIT-V

VLSI IMPLEMENTATION STRATEGIES: Introduction – Design of Adders: carry look ahead-carry select-carry save. Design of multipliers Introduction to FPGA – Full custom and Semi custom design, Standard cell design and cell libraries, FPGA building block architectures.

Text Books:

1. Douglas A.Pucknell & Kamran Eshraghian," Basic VLSI Design", 3rd edition, Prentice Hall India, 2001.
2. Wayne Wolf, "Modern VLSI Design: System -on-chip design", Pearson Education, 3rd edition, 2002.

Suggested Reading:

1. David A. Johns & Ken Martin, "Analog Integrated Circuit Design", John Wiley & Sons, 2004.
2. Neil. H.E. Weste & Kamran Eshraghian," principles of CMOS VLSI Design: A systems perspective", 2nd edition, Pearson Education, 2004.

16EE E15

COMPUTER METHODS IN POWER SYSTEMS

Instruction	3Hours per week
Duration of Semester End Examination	3Hours
Semester End Examination	70Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To study the formulation of various incidence matrices and network matrices such as YBUS, YBR and Zloop
2. To know about the formation of ZBUS for given power system network.
3. To understand the calculation of fault currents using ZBUS in three phase power system network.

Course Outcomes: After completion of this course, students will be able to:

1. Draw the graph and find the network metrics for the given power system network.
2. Modify the Zbus for changes in the network structure.
3. Determine the fault currents in three-phase power system for different faults
4. Acquire the knowledge of different transformation techniques
5. Find the ZBUS for given three-phase network.

UNIT-I

Graph Theory: Definitions, Incidence Matrices, Element node incidence matrix, Bus incidence matrix, Branch path incidence matrix, Basic and Augmented cut set incidence matrices, Basic and Augmented branch incidence matrices, Basic and Augmented loop incidence matrices, Construction of Primitive network element.

UNIT-II

Formulation of Network Matrices: Formation of Ybus, YBR and Zloop by Singular Transformation Method, Derivation of YBR, Yloop, Zbus and Ybus from non-singular transformation method.

UNIT-III

Formation of ZBus: Partial network, Algorithm for the Modification of ZBus Matrix for addition element for the following cases: Addition of element from a new bus to reference, Addition of element from a new bus to an old bus, Addition

of element between an old bus to reference and Addition of element between two old busses, Modification of ZBus for the changes in network.

UNIT-IV

Three-phase Networks: Representation and performance equation of 3-phase network elements ,Three phase network elements with balanced and unbalanced excitation, Transformation matrices, Symmetrical and Clarke's components, Algorithm for formation of 3-phase bus impedance matrix, Modification of three phase ZBUS for changes in network

UNIT-V

Short Circuit Studies: Basic assumption in short circuit studies, System representation, General equations for short circuit study in phase variables and Symmetrical components for fault current and node voltage, Short circuit calculations for balanced three phase network using ZBUS, Fault impedance and admittance matrices, Analysis of 3-phase line to ground and double line to ground faults, Flow chart for short circuit study.

Text Books:

1. Stagg & El-Abiad, Computer methods in Power System Analysis, 9th Edition, Tata McGraw Hill, 1983.
2. M.A.Pai, Computer techniques in Power System Analysis, 3rd Edition, Tata McGraw Hill, 2014.

Suggested Reading:

1. L.P.Singh, Advanced Power System Analysis & Dynamics, 6th Edition, New Age International Publishers, 2014.
2. Kusic Gearge L, Computer Aided Power System Analysis, 2nd Edition, CRC Press, 2008.

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16EE E16

POWER QUALITY ENGINEERING

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. Understand the theoretical concepts and standards of Power Quality (PQ), and methods to calculate and analyze voltage sag in distribution systems.
2. Understand PQ issues and sources of harmonics in Industrial systems and its mitigation
3. Understand the problems and solutions to wiring and Grounding

Course Outcomes: After completion of this course, students will be able to:

1. Understand the basic concepts of power quality and acquire the knowledge in measurement and standards of PQ problems
2. Acquire the knowledge to analyze voltage sag in distribution systems
3. Acquire the knowledge of theoretical concepts and standards of Power Quality issues in industrial systems.
4. Acquire the knowledge in identifying sources of harmonic & mitigation of harmonics in industrial systems.
5. Acquire the knowledge in Solutions to Wiring and Grounding Problems.

UNIT-I

Power Quality problems in distribution systems: Sag, Swells, Interruptions, Wave-form Distortions: harmonics, noise, notching, dc-offsets, fluctuations. Flicker and its measurement. Tolerance of Equipment: CBEMA curve. Power quality monitoring, PQ measurement equipment.

UNIT-II

Voltage Sags-Characterization: Voltage Sag Magnitude, Sag Magnitude in Radial and Non-Radial Systems, Voltage sag Calculations in Meshed Systems, Magnitude-Duration Plots.

UNIT-III

PQ Consideration in Industrial Power Systems: Adjustable speed drive (ASD) systems and applications, Characterization of voltage sags experienced by three-phase AC-ASD,DC-ASD systems, Effects of momentary voltage dips on the operation of induction and synchronous motors. PQ monitoring standards.

UNIT-IV

Harmonics: Sources of power system harmonics, Harmonic distortion, Harmonic Indices, Odd and Even Order Harmonics, Causes of Voltage and Current Harmonics, Locating Harmonic sources, Effect of Harmonics on Power System Devices, Mitigation of harmonics.

UNIT-V

Transient Over-voltages & Wiring and Grounding: Sources of Transient Overvoltage's, Principles of Overvoltage Protection Devices for Overvoltage Protection, Definitions, Reasons for Grounding, Typical Wiring and Grounding Problems, Solutions to Wiring and Grounding Problems.

Text Books:

1. C.Sankaran, 'Power Quality', CRC Press, 2001.
2. R.Sastry Vedam, M.Sarma, "Power Quality- Var Compensation in Power Systems ", CRC Press, 2009.

Suggested Reading:

1. Math H.J. Bollen, 'Understanding Power Quality Problems', IEEE Press, 2000.
2. Roger C.Dugan, Mark F.McGranaghan, Surya Santoso, H.Wayne Beaty, 'Electrical Power Systems Quality', 3rd Edition,Tata McGraw-Hill, 2012.

16EE E17

SPECIAL ELECTRICAL MACHINES

Instruction	3 Hours per week
Duration of Semester Examination	3 Hours
Semester End Examination	70 Marks
Sessional	30 Marks
Credits	3

Course Objectives:

1. To study the operating principles different special machines
2. To make the learner to be aware of latest special machines which are in vogue.
3. To be familiar with design features of special electrical machines

Course Outcomes: After completion of this course, students will be able to:

1. Identify appropriate machine for a specific application.
2. Recognize the principle of operation and characteristics of the given special machine.
3. Familiar with driver circuit used for special machines
4. Develop equivalent circuit of a given special electrical machine
5. Distinguish the special machine with the obtained characteristics

UNIT-I

Stepper Motors and its Mathematical Analysis: Introduction, Synchronous Induction (or Hybrid) Stepper Motor, Hybrid stepping motor: Construction, Principle of operation, energisation with two phase at a time, An Open -Loop Controller for a 2-Phase Stepper Motor, Variable Reluctance (VR) Stepping Motor, Open -Loop Control of 3-Phase VR Step Motor, Voltage current relation and torque expression, Transformation of equation into d-q reference frame, Normalization of d-q axis.

UNIT-II

Switched reluctance motor : Introduction , Improvements in the design of conventional reluctance motors, Some distinctive difference between SR and conventional reluctance motor, Principle of operation of SRM, Some design aspects of stator and rotor pole arcs, Power converter for SR motor, A numerical example, Derivation of torque expression, General -Linear case.

UNIT-III

Permanent magnet materials and motors: Introduction, Minor hysteresis loops and recoil line, Stator frame (pole and yoke part) of conventional PMDC motors,

Equivalent circuit of PM, Development of electronically commutated DC motor from conventional DC motor.

UNIT-IV

BLDC motors: Types of construction, Principle of operation, Sensing and switching logic scheme, Drive and power circuits, Theoretical Analysis and Performance prediction.

UNIT-V

Linear induction motor: Development of double sided LIM from rotary type IM, A schematic of LIM drive from electric traction, Field analysis of a DSLIM, Fundamental assumption, Transverse edge (or finite width) effects in LIM, Solution for current distribution in rotor, Force calculation on rotor of finite width : estimation of resistivity factor.

Text Books:

1. K. Venkatarathnam, “Special Electrical Machines”, Universities Press(India) Pvt. Ltd., 2013
2. E.G. Janardhan, “Special Electrical Machines”, Prentice Hall India, 2014

Suggested Reading:

1 . H. Bülent Ertan, M. Yildirim Üçtug, Ron Colyer, Alfio Consoli, “Modern Electrical Dives” Springer Science+Bussiness Media, 2000

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16PY O01

Open Elective-I

History of Science and Technology

Instruction	3 Hours per week
Duration of Semester Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To enablestudents to understand science as a socio-cultural product in specific socio-historical contexts.
2. To expose students to philosophical, historical and sociological perspectives to look atscience as a practice deeply embedded in culture and society.
3. To inculcate the scientific culture and ethics in the development of technologies.

Course Outcomes:

1. Demonstrate knowledge of broad concepts in the history of science, technology ranging over time, space and cultures.
2. Recognize the values of a wide range of methodologies, conceptual approaches and the impact of competing narratives within the history of science, technology.
3. Identify, locate and analyze relevant primary and secondary sources in order to construct evidence-based arguments.
4. Think independently and critically, using appropriate methodologies and technologies to engage with problems in the history of science, technology.
5. Demonstrate academic rigor and sensitivity to cultural and other diversity, and understanding of the ethical implications of historical and scientific enquiry within a global context.

UNIT-I

Science - The Beginning (through 599 BC): The Stone Ages, Knowledge among hunter gatherers,Agricultural Revolution and other revolutions,Civilization,Major advances.

Science in Antiquity (600 BC - 529 AD): Philosophy, a precursor to science, Hellenistic world and the Roman Empire, Other cultures of the period, major advances.

UNIT-II

Medieval Science (530 AD - 1452 AD): The decline of science in Europe , Science in China, Science and mathematics in India, Arab science, revival of science in Europe, technology revolution of the Middle ages, Major advances.

The Renaissance and the Scientific Revolution (1453 AD – 1659 AD): Renaissance, Scientific Revolution, Technology, Major advances.

UNIT-III

Scientific Method: Measurement and Communication (1660 AD – 1734): European domination, The scientific method, Major advances.

The Industrial Revolution (1735 AD – 1819 AD): Industrial Revolution, Rise of the engineer, Major Advances.

UNIT-IV

Science and Technology in the 19th Century (1820 AD – 1894 AD): philosophical basis of 19th-century science,Science and the public, Science and technology, Major advances.

Rise of Modern Science and Technology (1895 AD – 1945 AD): The growth of 20thcentury science, Newphilosophies, Quantum reality, Energy sources, Electricity: a revolution intechnology, Majoradvances.

UNIT-V

Big Science and the Post-Industrial Society (1946 AD – 1972 AD): Big science, Specialization and changing categories, Technology changes society, Major advances.

The Information Age (1973 AD – 2015 AD): Information and society, Globalization, The post-industrial society,Problems of the Information age, Major Advances

Text Books:

1. Bryan Bunch and Alexander Hellemans, "The History of Science and Technology", Houghton Mifflin Company (New York), 2004
2. JD Bernal, "Science in History", 4 Volumes, Eklavya Publishers, 2012

Suggested Readings:

1. "The 100 Most Influential Scientists of All Time", Edited by Kara Rogers, Britannica Educational Publishing, 2010
2. Alberto Hernandez, "A Visual History of Science and Technology", The Rosen Publishing Group, 2016

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16EG O02

GENDER SENSITIZATION

Instruction	3 Hourss per week
Duration of SEE Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course will introduce the students to

1. To develop students' sensibility with regard to issues of gender in contemporary India.
2. To provide a critical perspective on the socialization of men and women.
3. To expose the students to debates on the politics and economics of work. To help students reflect critically on gender violence.

Course Outcomes: After successful completion of the course the students will be able to

1. Develop a better understanding of important issues related to what gender is in contemporary India.
2. Be sensitized to basic dimensions of the biological, sociological, psychological and legal aspects of gender. This will be achieved through discussion of materials derived from research, facts, everyday life, literature, and film.
3. Attain a finer grasp of how gender discrimination works in our society and how to counter it. Students will acquire insight into the gendered division of labour and its relation to politics and economics.
4. Understand what constitutes sexual harassment and domestic violence and be made aware of New forums of Justice.
5. Draw solutions as to how men and women, students and professionals can be better equipped to work and live together as equals.

UNIT – I
Understanding Gender:
Gender: Why Should We Study It? (*Towards a World of Equals*: Unit -1)
Socialization: Making Women, Making Men (*Towards a World of Equals*: Unit -2)
Introduction. Preparing for Womanhood. Growing up Male. First lessons in Caste. Different Masculinities.

UNIT – II
Gender And Biology:
Missing Women: Sex Selection and Its Consequences (*Towards a World of Equals*: Unit -4)

Declining Sex Ratio. Demographic Consequences.
Gender Spectrum: Beyond the Binary (*Towards a World of Equals*: Unit -10)
Two or Many? Struggles with Discrimination.

UNIT – III
Gender and Labour:
Housework: the Invisible Labour (*Towards a World of Equals*: Unit -3)
"My Mother doesn't Work." "Share the Load."
Women's Work: Its Politics and Economics (*Towards a World of Equals*: Unit -7)
Fact and Fiction. Unrecognized and Unaccounted work. Additional Reading: Wages and
Conditions of Work.

UNIT - IV
Issues Of Violence
Sexual Harassment: Say No! (*Towards a World of Equals*: Unit -6)
Sexual Harassment, not Eve-teasing- Coping with Everyday Harassment- Further Reading:
"Chupulu".
Domestic Violence: Speaking Out (*Towards a World of Equals*: Unit -8)
Is Home a Safe Place? -When Women Unite [Film]. Rebuilding Lives. Additional Reading:
New Forums for Justice.
Thinking about Sexual Violence (*Towards a World of Equals*: Unit -11)
Blaming the Victim-"I Fought for my Life…." - Additional Reading: The Caste Face of Violence.

UNIT – V
Gender: Co - Existence
Just Relationships: Being Together as Equals (*Towards a World of Equals*: Unit -12)
Mary Kom and Onler. Love and Acid just do not Mix. Love Letters. Mothers and Fathers.
Additional Reading: Rosa Parks-The Brave Heart.

Textbook:

1. A. Suneetha, Uma Bhrugubanda, DuggiralaVasanta, Rama Melkote,VasudhaNagaraj, AsmaRasheed, GoguShyamala, DeepaSreenivas and Susie Tharu **"Towards a World of Equals: A**

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Bilingual Textbook on Gender" published by Telugu Akademi, Hyderabad, Telangana State, **2015**.

Suggested Reading:

1. Menon, Nivedita. Seeing like a Feminist. New Delhi: Zubaan-Penguin Books, 2012
2. Abdulali Sohaila. **"I Fought For My Life…and Won."**Available online at: http://www.thealternative.in/lifestyle/i-fought-for-my-lifeand-won-sohaila-abdulal/

Web Resources:

1. https://aifs.gov.au/publications/gender-equality-and-violence-against-women/introduction
2. https://theconversation.com/achieving-gender-equality-in-india.

Note: Since it is an Interdisciplinary Course, Resource Persons can be drawn from the fields of English Literature or Sociology or Political Science or any other qualified faculty who has expertise in this field from engineering departments.

16CE O02

DISASTER MITIGATION AND MANAGEMENT

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: To enable the student

1. To equip the students with the basic knowledge of hazards, disasters, risks and vulnerabilities including natural, climatic and human induced factors and associated impacts
2. To impart knowledge in students about the nature, causes, consequences and mitigation measures of the various natural disasters
3. To enable the students to understand risks, vulnerabilities and human errors associated with human induced disasters
4. To enable the students to understand and assimilate the impacts of any disaster on the affected area depending on its position/ location, environmental conditions, demographic, etc.
5. To equip the students with the knowledge of the chronological phases ina disaster management cycle and to create awareness about the disaster management framework and legislations in the context of national and global conventions

Course Outcomes: At the end of the course the student

1. Ability to analyse and critically examine existing programs in disaster management regarding vulnerability, risk and capacity at different levels
2. Ability to understand and choose the appropriate activities and tools and set up priorities to build a coherent and adapted disaster management plan
3. Ability to understand various mechanisms and consequences of human induced disasters for the participatory role of engineers in disaster management
4. To understand the impact on various elements affected by the disaster and to suggest and apply appropriate measures for the same
5. Develop an awareness of the chronological phases of disaster preparedness, response and relief operations for formulating effective disaster management plans and ability to understand various

participatory approaches/strategies and their application in disaster management

UNIT-I:

Introduction: Basic definitions- Hazard, Disaster, Vulnerability, Risk, Resilience, Mitigation, Management; classification of types of disaster- Natural and man-made; International Decade for natural disaster reduction (IDNDR); International strategy for disaster reduction (ISDR), National disaster management authority (NDMA).

UNIT-II:

Natural Disasters: Hydro meteorological disasters: Causes, Early warning systems- monitoring and management, structural and non-structural measures for floods, drought and Tropical cyclones; Geographical based disasters: Tsunami generation, causes, zoning, Early warning systems- monitoring and management, structural and non-structural mitigation measures for earthquakes, tsunami, landslides, avalanches and forest fires. Case studies related to various hydro meteorological and geographical based disasters.

UNIT-III:

Human induced hazards: Chemical disaster- Causes, impacts and mitigation measures for chemical accidents, Risks and control measures in a chemical industry, chemical disaster management; Case studies related to various chemical industrial hazards eg: Bhopal gas tragedy; Management of chemical terrorism disasters and biological disasters; Radiological Emergencies and case studies; Case studies related to major power break downs, fire accidents, traffic accidents, oil spills and stampedes, disasters due to double cellar construction in multi-storeyed buildings.

UNIT-IV:

Disaster Impacts: Disaster impacts- environmental, physical, social, ecological, economical, political, etc.; health, psycho-social issues; demographic aspects-gender, age, special needs; hazard locations; global and national disaster trends; climate change and urban disasters.

UNIT-V:

Concept of Disaster Management: Disaster management cycle – its phases; prevention, mitigation, preparedness, relief and recovery; risk analysis, vulnerability and capacity assessment; Post-disaster environmental response-water, sanitation, food safety, waste management, disease control; Roles and responsibilities of government, community, local institutions, NGOs and other

stakeholders; Policies and legislation for disaster risk reduction, DRR programmes in India and the activities of National Disaster Management Authority.

Text Books:

1. Pradeep Sahni, *" Disaster Risk Reduction in South Asia*", Prentice Hall, 2003.
2. B. K. Singh,*" Handbook of Disaster Management*: *techniques & Guidelines*", Rajat Publication, 2008.

Suggested Reading:

1. Ministry of Home Affairs". *Government of India, "National disaster management plan, Part I and II",*
2. K. K. Ghosh," *Disaster Management",* APH Publishing Corporation, 2006.
3. http://www.indiaenvironmentportal.org.in/files/file/disaster_management_india1.pdf
4. http://www.ndmindia.nic.in/ (National Disaster management in India, Ministry of Home Affairs)
5. Hazards, Disasters and your community: A booklet for students and the community, Ministry of home affairs.

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16CS O10

MACHINE LEARNING USING PYTHON

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The main objectives of this course are:

1. Get an idea of Machine Learning algorithms to solve real world problems.
2. Study various machine learning algorithms.
3. Analyze data using machine learning techniques.

Course Outcomes: On Successful completion of this course, student will be able to

1. Understand the basics concepts of Machine Learning and Python.
2. Apply feature engineering techniques and visualization tools to the data.
3. Analyze the various types of data by using python based machine learning techniques.
4. Identify and evaluate various recommender systems.
5. Design solutions to real world problems using deep learning algorithms.

UNIT-I

Introduction to Machine Learning: Introduction, Machine Learning process. **Introduction to Python**: Features, sources and installation of Python, IDEs, Basics of Python, Data Structures and loops.

UNIT-II

Feature Engineering: Introduction to Features and need of feature Engineering, Feature extraction and selection, Feature Engineering Methods, Feature Engineering with Python. **Data Visualization:** Various charts, histograms, plots.

UNIT-III

Regression: Simple and multiple regressions, Model assessment, various types of errors, errors, ridge regression, Lasso regression, non-parameter regression. **Classification:** Linear classification, logistic regression, Decision Trees, Random Forest, Naïve Bayes.

UNIT-IV

Unsupervised Learning: Clustering, K-Means clustering, Hierarchical clustering. **Text Analysis:** Basic text analysis with Python, regular expressions, NLP, text classification. **Time Series Analysis**: Date and time handling, window functions, correlation, time series forecasting.

UNIT-V

Neural Network and Deep Learning: Neural network- gradient descent, activation functions, parameter initialization, optimizer, loss function, deep learning, deep learning architecture, memory, deep learning framework. **Recommender System:** Recommendation engines, collaborative filtering.

Text Books:

1. Abhishek Vijavargia "Machine Learning using Python", BPB Publications, 1st Edition, 2018
2. Tom Mitchel "Machine Learning", Tata McGraWHill, 2017
3. Reema Thareja "Python Programming", Oxford Press, 2017.

Suggested Reading:

1. Yuxi Liu, Python Machine Learning by Example, 2nd Edition, PACT, 2017

Online Resources:

1. https://www.guru99.com/machine-learning-tutorial.html
2. https://www.tutorialspoint.com/machine_learning_with_python/index.htm
3. https://www.tutorialspoint.com/python/
4. https://docs.python.org/3/tutorial/
5. https://www.geeksforgeeks.org/machine-learning/

16ME O01

ENTREPRENEURSHIP

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Objectives: Student will understand
1. The environment of industry and related opportunities and challenges
2. Concept and procedure of idea generation
3. Elements of business plan and its procedure
4. Project management and its techniques
5. Behavioral issues and Time management

Outcomes: After completing this course, students will be able to:
1. Identify opportunities and deciding nature of industry
2. Brainstorm ideas for new and innovative products or services
3. Analyze the feasibility of a new business plan and preparation of Business plan
4. Use project management techniques like PERT and CPM
5. Analyze behavioural aspects and use time management matrix

UNIT-I
Indian Industrial Environment: Competence, Opportunities and Challenges, Entrepreneurship and Economic growth, Small Scale Industry in India, Objectives, Linkage among small, medium and heavy industries, Types of enterprises, Corporate Social Responsibility.

UNIT-II
Identification and Characteristics of Entrepreneurs: First generation entrepreneurs, environmental influence and women entrepreneurs, Conception and evaluation of ideas and their sources, Selection of Technology, Collaborative interaction for Technology development.

UNIT-III
Business Plan: Introduction, Elements of Business Plan and its salient features, Technical Analysis, Profitability and Financial Analysis, Marketing Analysis, Feasibility studies, Executive Summary.

UNIT-IV
Project Management: During construction phase, project organization, project planning and control using CPM, PERT techniques, Human aspects of project management, Assessment of tax burden

UNIT-V
Behavioral Aspects of Entrepreneurs: Personality, determinants, attributes and models, Leadership concepts and models, Values and attitudes, Motivation aspects, Change behavior
Time Management: Approaches of time management, their strengths and weaknesses. Time management matrix and the urgency addiction

Text Books:
1. Vasant Desai, “Dynamics of Entrepreneurial Development and Management”, Himalaya Publishing House, 1997.
2. Prasanna Chandra, “Project-Planning, Analysis, Selection, Implementation and Review”, Tata Mcgraw-Hill Publishing Company Ltd. 1995.
3. S.S. Khanka, “Entrepreneurial Development”, S. Chand & Co. Pvt. Ltd., New Delhi

Suggested Reading:
1. Robert D. Hisrich, Michael P. Peters, “Entrepreneurship”, 5/e, Tata Me Graw Hill Publishing Company Ltd., 2005.
2. Stephen R. Covey and A. Roger Merrill, “First Things First”, Simon and Schuster Publication, 1994.
3. Sudha G.S., “Organizational Behavior”, National Publishing House, 1996.

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VIII-Semester of B.E/B.Tech under CBCS
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SEMESTER-VIII

S. No	Course Code	Title of the Course	Scheme of Instruction		Scheme of Examination			
			Hours per week		Duration in Hours	Maximum Marks		Credits
			L/T	P/D		CIE	SEE	
THEORY								
1.	16EEEXX	Program Specific Elective - 5	3	-	3	30	70	3
2.	16EEEXX	Program Specific Elective -6	3	-	3	30	70	3
3.	16XXXXX	Open Elective -II	3	-	3	30	70	3
PRACTICALS								
4.	16EE C37	Seminar	-	3	-	50	-	2
5.	16EE C38	Project	-	6	Viva voce	50	100	6
			09	09	-	190	310	17

L: Lecture T: Tutorial D: Drawing P: Practical
CIE - Continuous Internal Evaluation SEE - Semester End Examination

Course Code	Program Specific Elective-5	Equivalent NPTEL Courses
16EE E18	Electrical Machine Design(EMD)	
16EE E19	Flexible AC Transmission Systems(FACTS)	FACTS Devices
16EE E20	Power System Reliability (PSR)	
16EE E21	Smart Grid(SG)	Introduction to Smart Grids

Course Code	Program Specific Elective-6	Equivalent NPTEL Courses
16EE E22	Embedded System Design (ESD)	Embedded System Design with ARM
16EE E23	Advanced Power System Protection (APSP)	
16EE E24	Power System Operation and Deregulation(PSOD)	
16EE E25	Electrical Estimation and Costing(EEC)	

Course Code	Open Elective-II	Equivalent NPTEL Courses
16EG O01	Technical Writing Skills	
16ME O04	Intellectual Property Rights (IPR)	Intellectual Property Rights
16 ME O08	Industrial Administration and Financial Management (IAFM)	
16CS O03	IOT and Applications	Introduction to IoT
16CS O04	Basics of Data Science Using R	Machine Learning

Note: Student undergoing internship is permitted to take-up Equivalent NPTEL courses with the prior permission from BoS.

16EE C37

SEMINAR

Instruction	3Hours per week
CIE	50 Marks
Credits	2

The goal of a seminar is to introduce students to critical reading, understanding, summarizing, explaining and preparing report on state of the art topics in a broad area of his/her specialization. Seminar topics may be chosen by the students with advice from the faculty members and the student shall read further relevant articles in the domain.

The seminar must be clearly structured and the power point presentation shall include following aspects:

1. Introduction to the field
2. Literature survey
3. Consolidation of available information
4. Summaryand Conclusions
5. References

Each student is required to:

1. Submit a one page synopsis of the seminar talk for display on the notice board.
2. Deliver the seminar for a maximum duration of 30 minutes, where the presentation should be for 20 minutes in PowerPoint, followed by Question and Answers session for 10 minutes.
3. Submit the detailed report of the seminar in spiral bound in a précised format as suggested by the department.

Seminars are to be scheduled from 3rd week to the last week of the semester and any change in schedule shall be discouraged.

For the award of sessional marks students are judged by three (3) faculty members and are based on oral and written presentations as well as their involvement in the discussions during the oral presentation.

Note: Topic of the seminar shall preferably be from any peer reviewed recent journal publications.

Guidelines for awarding marks		
Sl No.	**Description**	**Max Marks**
1.	Contents and relevance	10
2.	Presentation skills	10
3.	Preparation of PPT slides	05
4.	Questions and answers	05
5.	Report in a prescribed format	20

16EE C38

PROJECT

Instruction	6 Hours per week
CIE	50 Marks
SEE	100 Marks
Credits	6

The object of Project is to enable the student extend further the investigative study, either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry. This is expected to provide a good training for the student(s) in R&D work and technical leadership. The assignment to normally include:

1. In depth study of the topic assigned;
2. Review and finalization of the Approach to the Problem relating to the assigned topic;
3. Preparing an Action Plan for conducting the investigation, including team work;
4. Detailed Analysis/Modelling/Simulation/Design/Problem Solving/ Experiment as needed;
5. Final development of product/process, testing, results, conclusions and future directions;
6. Preparing a paper for Conference presentation/ Publication in Journals, if possible;
7. Preparing a Dissertation in the standard format for being evaluated by the Department.
8. Final Seminar presentation before Departmental Committee.

Guidelines for the award of marks in CIE: (Max. Marks: 50)

Evaluation by	**Max .Marks**	**Evaluation Criteria / Parameter**
Department Review Committee	05	Review 1
	08	Review 2
	12	Submission
Supervisor	05	Regularity and Punctuality
	05	Work Progress
	05	Quality of the work which may lead to publications
	05	Report Preparation
	05	Analytical / Programming / Experimental Skills

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Guidelines for awarding marks in SEE: (Max. Marks: 100)

Evaluation by	Max .Marks	Evaluation Criteria / Parameter
External and Internal Examiners together	20	Power Point Presentation
	40	Thesis Evaluation
	20	Quality of the project ● Innovations ● Applications ● Live Research Projects ● Scope for future study ● Application to society
	20	Viva-Voce

16EE E18

Program Specific Elective-5
ELECTRICALMACHINEDESIGN

Instruction	3 Hours per Week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course objectives:

1. To understand the design parameters of various electrical machines.
2. To analyze the electrical and mechanical characteristics of electrical machines.
3. To become familiar with CAD usage

Course Outcomes: After completion of this course, students will be able to:

1. Design the given AC electrical machine for a given power rating.
2. Calculate the various parameters required for designing.
3. Choose the proper material for a given requirement of the machine.
4. Use software tools for DC & AC machine design.
5. Acquire the knowledge of CAD

UNIT-I

Basics of Machine design aspects: Major considerations in electrical machine design, electrical engineering materials, space factor, choice of specific electrical and magnetic loadings, thermal considerations, heat flow, temperature rise, rating of machines.

UNIT-II

Design of Transformers: Sizing of a transformer, main dimensions, KVA output for single and three-phase transformers, window space factor, overall dimensions, design of cooling tank, methods for cooling of transformers.

UNIT-III

Design of Induction Motors: Sizing of an induction motor, main dimensions, length of air gap, rules for selecting rotor slots of squirrel cage machines, design of rotor bars & slots, magnetic leakage calculations, leakage reactance of poly phase machines, magnetizing current, short circuit current,.

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UNIT-IV

Design of Synchronous Machines: Sizing of a synchronous machine, main dimensions, design of salient pole machines, short circuit ratio, shape of pole face, armature design, armature parameters, estimation of air gap length, design of rotor, design of damper winding, determination of full load field mmf, design of turbo alternators.

UNIT-V

Computer aided Design (CAD): Limitations (assumptions) of traditional designs, need for CAD analysis, synthesis and hybrid methods, design optimization methods, variables, constraints and objective function, problem formulation. Introduction to FEM based machine design.

Text books:

1. A. K. Sawhney, "A Course in Electrical Machine Design", Dhanpat Rai and Sons, 1970.
2. K. M. V. Murthy, "Computer Aided Design of Electrical Machines", B.S. Publications, 2008.

Suggested Reading:

1. S. K. Sen, "Principles of Electrical Machine Design with computer programmes", Oxford and IBH Publishing, 2006.
2. K. L. Narang, "A Text Book of Electrical Engineering Drawings", SatyaPrakashan, 1969.
3. A. Shanmugasundaram, G. Gangadharan and R. Palani, "Electrical Machine Design Data Book", New Age International, 1979.

16EE E19

FACTS
(Flexible AC Transmission Systems)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To understand concepts of various FACTS devices and controllers
2. To study the various converter topologies used in FACTS
3. To study the principles of operation and control of shunt series and combined FACTS controllers

Course Outcomes: After completion of the course students will be able to:

1. Select the appropriate FACTS device/controller based on the needs of inter connected power transmission systems.
2. Analyze various converter topologies used in FACTS for harmonic reduction.
3. Demonstrate the knowledge of shunt compensators(i.e SVC,STATCOM) for the end of line voltage support and transient stability problems
4. Analyze the operation and control of GCSC, TCSC and SSSC.
5. Demonstrate the principles, operation and control aspects of UPFC for P and Q control

UNIT-I

General System Considerations and FACTS: Transmission Interconnections, Flow of Power in an AC System, Power Flow and Dynamic Stability Considerations of a Transmission Interconnection, principles of series and shunt compensation, Basic Types of FACTS Controllers, Benefits from FACTS, Application of FACTS.

UNIT-II

Voltage-Source Converters: Basic concept of Voltage-Sourced Converters, single-Phase Full-wave Bridge converter operation, single phase-leg operation, square-Wave Voltage Harmonics for a single-phase bridge, Three-phase full-wave bride converter, sequence of valve conduction process in each phase-leg,

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three-level voltage-sourced converter, Pulse-Width Modulation (PWM) converter, Generalized Technique of Harmonic Elimination and voltage control.

UNIT-III

Shunt Compensators: Objectives of Shunt Compensation, Midpoint Voltage Regulation for Line Segmentation, End of Line Voltage Support to Prevent Voltage Instability, improvement of Transient Stability, Power Oscillation Damping, Static Var Compensators, SVC and STATCOM, The Regulation Slope, Transfer Function and dynamic Performance, Transient Stability Enhancement and Power Oscillation Damping

UNIT-IV

Series Compensators: Objectives of Series Compensation, concept of series capacitive compensation, voltage stability, improvement of transient stability, power oscillation damping, GTO thyristor controlled series capacitor, Thyristor controlled series capacitor, SSSC.

UNIT-V

Combined Compensators: Introduction, Unified Power Flow Controller (UPFC), basic operating principles, independent real and reactive power flow control, control structure, basic control system for P and Q control.

Text Books:

1. Narain G. Hingorani, Laszlo Gyugyi, 'Understanding FACTS', IEEE press, 1999.
2. Y.H.Song, A.T.Johns, 'Flexible A.C.Transmission System', IEE, London, 1999

Suggested Reading:

1. KR Padiyar, 'Facts Controllers In Power Transmission and Distribution', 2nd edition, New Age Publications, 2016.
2. R. Mohan Mathur, Rajiv K. Varma, 'Thyristor-Based FACTS Controllers for Electrical Transmission Systems', Wiley Publications IEEE Press, 2002
3. Timothy J.E. Miller, 'Reactive Power Control in Electric Systems', 1982.

16EE E20

POWER SYSTEM RELIABILITY

Instruction	3Hours per week
Duration of Semester End Examination	3Hours
Semester End Examination	70Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To understand probability theory and distributions
2. To understand component reliability types and causes of failures reliability logic diagram for different configuration.
3. To Understand discrete Markov chains and continuous Markov process and the importance of reliability evaluation of repairable systems

Course Outcomes: After completion of the course, students will be able to:

1. Acquire knowledge and to apply probability theory and distribution functions to engineering applications.
2. Acquire knowledge to study and to classify types of causes of failures, reliability logic diagram for different configurations.
3. Acquire knowledge to study discrete and continuous Markov chains and process and give thrust to reliability evaluation of repairable systems.
4. Evaluate various generation and load models
5. Apply reliability analysis on a given generation and distribution system.

UNIT-I

Elements of probability theory -Probability distributions: Discrete and continuous random variables, density and distribution functions, Mathematical expectation-Mean and Variance, Binominal distribution, Poisson distribution, Normal .distribution, Exponential distribution, Weibull distribution.

UNIT-II

Reliability: Definition, Component reliability, Hazard rate, derivation of the reliability function in terms of the hazard rate. Causes of failures, types of failures.Bath tub curve, MTTR, MTBF. Reliability logic diagrams for series, parallel, series-parallel, non series-parallel configurations. Minimal cut-set and decomposition methods.

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UNIT-III

Markov Modeling: General modelling concepts, stochastic transitional probability matrix, time dependent probability evaluation and limiting state probability evaluation. Absorbing states. Continuous Markov Processes: Modelling concepts, State space diagrams, Stochastic Transitional Probability Matrix, Evaluating limiting state Probabilities. Reliability evaluation of repairable systems.

UNIT-IV

Generating System Reliability Analysis: Generation system model- capacity outage probability tables -Recursive relation for capacitive model building '-sequential addition method -unit removal- Evaluation of loss of load and energy indices. Evaluation of equivalent transitional rates of identical and nonidentical units -Evaluation of cumulative probability and cumulative frequency of nonidentical generating units -2'-level daily load representation - merging generation and load models

UNIT-V

Distribution System Reliability Analysis: Radial networks –Evaluation of Basic reliability indices, performance indices -load point and system reliability indices - customer oriented, loss and energy oriented indices. Parallel networks- inclusion of bus bar failures, scheduled maintenance -temporary and transient failures - weather effects - common mode failures -Evaluation of various indices.

Text Books:

1. Roy Billinton and Ronald N. Aallan "Reliability Evaluation of Engineering Systems", Concepts and Techniques, 2nd Edition Springer International Edition, 1992
2. Roy Billinton and Ronald N. Aallan "Reliability Evaluation of Power Systems", 2nd Edition, BS Publications, 1996.

Suggested Reading:

1. J. Endrenyi, " ReliabilityModeling in Electrical Power Systems", Wiley Inter science publications,1978.

16EE E21

SMART GRID

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To study the importance of smart grid and components of smart grid and tools for smart grid design
2. To understand the stability analysis tools for smart grid and importance of state estimation
3. To know various computing tools for smart grid design.

Course outcomes: After completion of this course, students will be able to:

1. Recognize the concept of Smart Grid communication and Measurement
2. Comprehend the concept of tools used for Smart Grid Design
3. Know the concept of Stability Analysis Tools for Smart Grid
4. Understand the concept of State Estimation
5. Understand the transmission and distribution management systems

UNIT-I:

Today's Grid versus the Smart Grid, Smart Grid communication and Measurement, Communication and measurement, Monitoring, PMU, Smart meters and Measurement Technologies: Wide area monitoring systems(WAMS),Phasor Measurement Units (PMU) ,Smart meters,Smart applications,Advanced Metering Infrastructure(AMI),GIS and Google mapping Tools ,Multiagent systems (MAS) Technology: Multiagent systems for smart Grid Implementation, Multiagent Specifications, Multi agent Technique. Micro Grid and Smart Grid Comparison

UNIT-II

Performance analysis tools : Analysis of Smart grid Design, Load flow studies: GS Method, Newtonrap son Method, Fast Decoupled Method , Distributed Load Flow Methods, Congestion management effect, contingencies and their classification : Steady state contingency analysis, Performance Indices, Sensitivity Based Approaches.

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UNIT-III

Stability Analysis Tools: Definition of stability in power system, voltage stability assessment: voltage stability and voltage collapse, Classification of Voltage Stability, static stability, Dynamic stability, Analysis Techniques for dynamic voltage stability studies, voltage stabilityassessment Techniques, Angle stability Assessment, Transient stability

UNIT-IV

State Estimation: State estimation, Formulation of Weighted Least Square Estimation (WLS),Detection And Identification Of Bad Data ,State estimation for smart grid, Dynamic state estimation, observability analysis

UNIT-V

Transmission and Distribution Management Systems: Data Sources, Energy Management System, Wide Area Applications, Visualization Techniques, Data Sources and Associated External Systems, SCADA, Customer Information System, Modeling and Analysis Tools, Distribution System Modeling, Topology Analysis, System Monitoring, Operation, Management, Outage Management System.

Text Books:

1. James Momoh, "Smart Grid Fundamentals of Design and Analysis" IEEE Press, Wiley Publications, 2012
2. Bharat Modi, Anuprakash, Yogesh Kumar, "Fundamentals of Smart grid Technology", Katson publishers, 2015 .

Suggested Reading:

1. Salman K Salman, Introduction to the Smart grid: concepts, technologies and evolution, IET publications, 2017
2. Clark W Gellings, The Smart grid: Enabling Energy efficiency and demand response, The fairmount press Inc, 2009
3. Janaka Ekanayake, Liyanage, Wu, Akihiko Yokoyama, Jenkins, Smart Grid, Wiley Publications, 2012.

16EE E22

Program Specific Elective-6
EMBEDDED SYSTEM DESIGN

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:
1. To understand the basics of embedded processing.
2. To understand the concept of Real time operating systems.
3. To understand a design of embedded architecture

Course Outcomes: After completion of this course, students will be able to:
1. Acquire the knowledge on ARM processor
2. Have knowledge on RTOS functional units
3. Have basic knowledge on embedded programming
4. Have basic knowledge on advanced embedded processors
5. Have a basic knowledge on development of embedded system

UNIT–I

Introduction to Embedded Systems: An Embedded system, Classification, processor in the system, other hardware units, structural units in a processor, processor selection for an embedded system, memory devices, memory selection for an embedded system, introduction to ARM processors.

UNIT–II

Devices and Buses: I/O devices, Serial communication using IIC and CAN buses, advanced I/O buses between the networked multiple Devices, Device drivers: Classification, Parallel port device drivers in a system, Serial port device drivers in a system.

UNIT–III

Interprocess communication and synchronization of processes, Task and Threads: Multiple processes in an application, problem of sharing data by multiple tasks and routines, Embedded programming in C++ and Java.

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UNIT – IV

Real time Operating Systems: Operating system services, Real time operating system services, interrupt routines in RTOS Environment, RTOS Task scheduling, embedded Linux internals, OS Security issues, Mobile OS.

UNIT – V

Hardware-Software Co-Design in an Embedded System: Embedded system project Management, Embedded system Design and Co-Design issues in system development process. Design cycle in system development phase for an embedded system, Emulator and ICE, Use of software tools for development of Embedded systems, Case studies of programming with RTOS (Examples: Automatic chocolate vending machine, vehicle tracking system, Smart card).

Text Books:

1. Raj Kamal, "Embedded Systems" Architecture, Programming and Design, TMH, 2006.
2. Jonathan W Valvano, "Embedded Micro Computer Systems" Real Time Interfacing, Books / cole, Thomson learning 2006.
3. Arnold S Burger, "Embedded System Design" An Introduction to Processes, Tools and Techniques by CMP books, 2007.

Suggested Readings:

1. David.E. Simon, "An Embedded Software Primer", Pearson Edition, 2009.
2. Andrew N.sloss, Dominic Symes, Chris Wright, "ARM System Developer's guide", Elsevier publications 2005.

16EE E23

ADVANCED POWER SYSTEM PROTECTION

Instruction	3 Hours Per Week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. Study the operating principles and application aspects of static relays
2. Understand the protection of bus-bars & various neutral grounding techniques.
3. Disseminate with the general principles of pilot protection and travelling wave relays.

Course Outcomes: After completion of this course, students will be able to:

1. Comprehend the basic components of static relays and their characteristics
2. Understand the operating principles of different distance relays.
3. Acquaint with the various grounding methods & bus-bar protection
4. Explicate the principles of transformer protection and auto re-closures.
5. Know various types of pilot protection schemes, their adaptability and basic principle of travelling wave relays.

UNIT-I

Static Relays: Advantages and disadvantages, Comparators, Amplitude and Phase comparison schemes, Duality between Amplitude and phase comparators, General equation for comparators for different types of relays, Static comparators, Coincidence circuits, Phase splitting methods, Hall effect comparators, Operating principles, Use of level detectors, Time delay circuits, Filters, Thyristors, Triggering circuits and DC power supplies.

UNIT-II

Static Relay Hardware: Operating principles, Static time current relays, Differential relays, Distance relays, Quadrilateral relay, Elliptical relay, Relay response, Principle of R-X diagram, Effect of arc resistance, source impedance and line length on the performance of distance relay, Power swings, Loss of synchronism and its effect on distance relays.

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UNIT-III

Bus Bar protection and Grounding: Bus bars, Differential protection. Neutral Grounding: Grounded and Underground Neutral Systems, Effects of Un grounded Neutral on system permanence. Methods of Neutral Grounding: Solid, Resistance, Reactance – Arcing Grounds and Grounding Practices.

UNIT-IV

Transformer Differential Protection: Effect of magnetizing inrush currents, Grounding transformers, Switched schemes, Auto-reclosing, Single and multi-shot auto reclosing, Single pole and three pole auto reclosing.

UNIT-V

Pilot Wire and Carrier Protection: Circulating current scheme, Balanced Voltage scheme, Translay scheme, Half wave comparison scheme, Phase comparison carrier current protection, Carrier transfer scheme, Carrier blocking scheme, Digital protection of EHV/ UHV transmission line based upon traveling wave phenomena.

Text Books:

1. Badriram and Viswakarma D.N., 'Power System Protection and Switchgear', Tata McGraw Hill, April, 2001.
2. Madhavarao T.S., 'Power System Protection Static relays with microprocessor applications', Tata McGraw Hill, 2001.
3. A.T. Johns and S.K. Salman, 'Digital protection for power systems', IEE series, 1989.
4. Stanley H Horowitz, A.G. Phadke, 'Power system relaying', 4th Edition, Wiley publications, 2014.

Suggested Reading:

1. Warrington A.R. Van C, 'Protective Relays', Vol I & II Chapman & Hall, John Wiley & Sons, 1977.
2. Bhuvanesh A OZA, Nirmal kumar C. Nair, Rashesh P Mehta, Vijay H.M., 'Power system protection and Switchgear', Tata McGraw Hill, 2010.
3. J. Lewis Blackburn, Thomas J Domin, 'Protective relaying Principles and Applications', CRC press, 2014.
4. L.P. Singh, 'Digital Protection: Protective Relaying from Electromechanical to Microprocessor', John Wiley & Sons, 1994.

16EE E24

POWER SYSTEM OPERATION AND DEREGULATION

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To understand the importance of optimal power flow and power system security.
2. To understand various methods of state estimation
3. To discuss about power system deregulation and available transfer capability of lines

Course Outcomes: After completion of this course, students will be able to:

1. Calculate the optimal power flows for the given power system
2. Carry out contingency analysis
3. Determine the state estimation of the system and difference between conventional LF and SE.
4. Understand the benefits of deregulation
5. Determine the available transfer capability of a line and know the various pricing methods in Deregulated power system.

UNIT-I:

Optimal Power Flow: Introduction, OPF formulation, OPF solution technique, Linear programming OPF, Interior point method, unit commitment solution methods, priority list method, dynamic programming method.

UNIT-II:

Power System Security: Introduction, Factors affecting power system security, Contingency analysis, AC power flow security analysis with contingency case selection, concentric relaxation, Bounding area method.

UNIT-III:

State Estimation: Introduction, Power system state estimation, Methods of Least squares, Maximum likelihood Weighted Least squares estimation, Matrix formulation, State estimation by orthogonal decomposition, detection and identification of Bad measurements, Network observability and pseudo measurements.

UNIT-IV:

Power System Restructuring: Introduction, Motivation for restructuring of power system, Electricity market entities and model, benefits of deregulation, terminology, deregulation in Indian power sector, Operations in power markets, power pools, transmission networks and electricity markets.

UNIT-V:

ATC, Transmission Open Access and Pricing: Introduction, definitions, methods of determination of ATC, ATC calculation considering the effect of contingency analysis, Transmission open access, types of services, cost components of transmission system, transmission pricing methods, Incremental cost based transmission pricing.

Text Books:

1. K.Bhattacharya, M. Bollen and J.E. Daalder Operation of Restructured Power Systems, 1 st Edition Springer Publishers 2012.
2. P. Venkatesh, B. V. Manikandan, S. Charles Raja- A. Srinivasan, "Electrical Power Systems Analysis, Security, Deregulation"– PHI, 2012.

Suggested Reading:

1. Md Shahidephpour and M. Alomoush, 'Restructured Electrical Power Systems', Marcel Dekker Inc, 2001.
2. T.K.Nagsarkar, M.S.Sukhija, Power System Analysis, Illustrated Edition, Oxford publications, 2007
3. A. J. Wood &B.F.Woollenberg- Power Generation, Operation and Control, 3rd Edition. John Wiley, 2013.

16EE E25

ELECTRICAL ESTIMATION AND COSTING

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To emphasize the estimation and costing aspects of all electrical equipment, installation and designs on the cost viability.
2. To design and estimation of wiring
3. To design overhead and underground distribution lines, substations and illumination

Course Outcomes: After completion of this course, students will be able to:

1. Understand the design considerations of electrical installations.
2. Design electrical installation estimation and costing for buildings and small industries.
3. Design electrical installation estimation and costing for commercial and small industries.
4. Design electrical installation estimation and costing for transmission and distribution systems.
5. Identify and design the various types of light sources for different applications.

UNIT-I

Electrical Wiring: Different types of wires, wiring system and wiring methods, Comparison of different types of wirings. Specifications of Different types of wiring materials, Accessories Different types of wiring appliances and tools. Domestic and industrial panel wiring. Different types of wiring circuits. I.E. rules for wiring, Electricity supply act-1948.

UNIT-II

Residential Building Electrification: General Rules guidelines for wiring of residential installation and positioning of equipments, Principles of circuit design in lighting and power circuits Procedures for designing the circuits and deciding the number of circuits, Method of drawing single line diagram. Selection of type of wiring and rating of wires and cables Load calculations and selection of size of conductor, Selection of rating of main switch Distribution board, protective

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switchgear ELCB and MCB and wiring accessories, Earthing of residential Installation.

UNIT-III

Electrification of Commercial Installation: Concept of commercial installation, Differentiate between electrification of residential and commercial installation, Fundamental considerations for planning of an electrical installation system for commercial building, Design considerations of electrical installation system for commercial building, Load calculation and selection of size of service connection and nature of supply, Deciding the size of the cables, bus bar and bus bar chambers, Mounting arrangements and positioning of switchboards, distribution boards main switch etc, Earthing of the electrical installation, Selection of type wire, wiring system and layout.

UNIT-IV

Design And Estimation of Overhead Transmission & Distribution Lines: Introduction, Typical AC electrical power system, Main components of overhead lines, Line supports. Factors governing height of pole, Conductor materials, Determination of size of conductor for overhead transmission line, Cross arms, Pole brackets and clamps, Guys and Stays, Conductors configuration spacing and clearances, Conductors configuration spacing and clearances, Span lengths, Overhead line insulators, Insulator materials, Types of insulators, Lightning Arrestors, Phase plates, Danger plates, Anti climbing devices, Bird guards, Beads of jumpers. Anti climbing devices, Beads of jumpers. Muffs, Points to be considered at the time of erection of overhead lines, Erection of supports, setting of stays, Fixing of cross arms, Fixing of insulators, Conductor erection, Repairing and jointing of conductor, Dead end clamps, Positioning of conductors and attachment to insulators Jumpers, Tee-offs, Earthing of transmission lines. Guarding of overhead lines, Clearances of conductor from ground Spacing between conductors, Testing and commissioning of overhead distribution lines, some important specifications.

UNIT-V

Design and Estimation of Substations: Introduction, Types of substations, Outdoor substation – Pole mounted type, Indoor substations – Floor mounted type.

Design and Estimation of Illumination Schemes: Introduction, Terminology in illumination, laws of illumination, various types of light sources, estimation and costing of lighting schemes.

Text Books:

1. “K. B. Raina, S. K. Bhattacharya”, “Electrical Design Estimating and Costing”, New Age International Publisher, 2010.
2. “Er. V. K. Jain, Er. Amitabh Bajaj”,”Design of Electrical Installations”, University Science Press.
3. “Gupta J. B., Katson, Ludhiana”, “Electrical Installation, estimating and costing”, S. K. Kataria and sons, 2013.
4. “Surjit Singh”, “Electrical Estimation and Costing”. Dhanpatrai & Co. second edition, 2001.

Suggested Reading:

1. Code of practice for Electrical wiring installations (System voltage not exceeding 650 volts), Indian Standard Institution, IS: 732-1983.
2. Guide for Electrical layout in residential buildings, Indian Standard Institution, IS: 4648-1968.
3. Electrical Installation buildings Indian Standard Institution, IS: 2032.
5. Code of Practice for earthling, Indian Standard Institution, IS: 3043-1966.
6. Code of Practice for Installation and Maintenance of induction motors, Indian Standard Institution, IS: 900-1965.
7. Code of Practice for electrical wiring, Installations (system voltage not exceeding 650 Volts), Indian Standard Institution, IS: 2274-1963.

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16EG O01

Open Elective- II
TECHNICAL WRITING SKILLS

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The course will introduce the students to

1. Process of communication and channels of communication in general writing and technical writing in particular.
2. Learn Technical Writing including sentence structure and be able to understand and use technology specific words.
3. Write business letters and technical articles.
4. Write technical reports and technical proposals.
5. Learn to write agenda, record minutes of a meeting, draft memos. Understand how to make technical presentations.

Course Outcomes : After successful completion of the course students will be able to

1. Communicate effectively, without barriers and understand aspects of technical communication.
2. Differentiate between general writing and technical writing and write error free sentences using technology specific words
3. Apply techniques of writing in business correspondence and in writing articles.
4. Draft technical reports and technical proposals.
5. Prepare agenda and minutes of a meeting and demonstrate effective technical presentation skills.

Unit I

Communication – Nature and process.

Channels of Communication – Downward, upward and horizontal communication. Barriers to communication.

Technical Communication – Definition, oral and written communication. Importance and need for Technical communication. Nature of Technical Communication. Aspects and forms of Technical communication. Technical communication Skills – Listening, Speaking, Reading & Writing.

Unit II

Technical Writing – Techniques of writing. Selection of words and phrases in technical writing. Differences between technical writing and general writing. Abstract and specific words. Sentence structure and requisites of sentence Construction. Paragraph length and structure.

Unit III

Business correspondence – Sales letters, letters of Quotation, Claim and Adjustment letters.

Technical Articles : Nature and significance, types. Journal articles and Conference papers, elements of technical articles.

Unit IV

Technical Reports : Types, significance, structure, style and writing of reports. Routine reports, Project reports.

Technical Proposals : Definition, types, characteristics, structure and significance.

Unit V

Mechanics of Meetings : Preparation of agenda, participation, chairing and writing minutes of a meeting. Memorandum. Seminars, workshops and conferences.

Technical Presentations : Defining purpose, audience and locale, organizing content, preparing an outline, use of Audio Visual Aids, nuances of delivery, importance of body language and voice dynamics.

Text Book :

1. Meenakshi Raman & Sangeeta Sharma, **"Technical Communications-Principles and Practice"**, Oxford University Press, Second Edition, 2012.
2. 1.M Ashraf Rizvi, **"Effective Technical Communication"**, Tata McGraw Hill Education Pvt Ltd, 2012.

Suggested Reading :.

1. Kavita Tyagi & Padma Misra, **"Basic Technical Communication"**, PHI Learning Pvt Ltd, 2012.
2. R.C Sharma & Krishna Mohan, **"Business Correspondence and Report Writing"**, Tata McGraw Hill, 2003

Web Resources:

1. https://onlinecourses.nptel.ac.in/noc18_mg13/preview
2. https://www.technical-writing-training-and-certification.com/
3. https://academy.whatfix.com/technical-writing-skills

16ME O04

INTELLECTUAL PROPERTY RIGHTS

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Objectives: Student will learn
1. Fundamental aspects of IP
2. Aspects of IPR acts.
3. Awareness of multi disciplinary audience
4. Awareness for innovation and its importance
5. The changes in IPR culture and techno-business aspects of IPR

Outcomes: At the end of the course, a student
1. Will respect intellectual property of others
2. Learn the art of understanding IPR
3. Develop the capability of searching the stage of innovations.
4. Will be capable of filing a patent document independently.
5. Completely understand the techno-legal business angle of IPR and converting creativity into IPR and effectively protect it.

UNIT-I

Overview of Intellectual Property: Introduction and the need for intellectual property right (IPR), IPR in India – Genesis and Development, IPR abroad, Some important examples of IPR. Importance of WTO, TRIPS agreement, International Conventions and PCT

Patents: Macro economic impact of the patent system, Patent and kind of inventions protected by a patent, Patent document, How to protect your inventions. Granting of patent, Rights of a patent, how extensive is patent protection. Why protect inventions by patents. Searching a patent, Drafting of a patent, Filing of a patent, the different layers of the international patent system, (national, regional and international options), compulsory licensing and licensers of right & revocation, Utility models, Differences between a utility model and a patent. Trade secrets and know-how agreements

UNIT-II

Industrial Designs: What is an industrial design. How can industrial designs be protected? What kind of protection is provided by industrial designs? How long does the protection last? Why protect industrial designs?

UNIT-III

Trademarks: What is a trademark, Rights of trademark? What kind of signs can be used as trademarks. Types of trademark, function does a trademark perform, How is a trademark protected? How is a trademark registered. How long is a registered trademark protected for? How extensive is trademark protection. What are well-known marks and how are they protected? Domain name and how does it relate to trademarks? Trademark infringement and passing off.

UNIT-IV

Copyright: What is copyright. What is covered by copyright. How long does copyright last? Why protect copyright? Related Rights: what are related rights. Distinction between related rights and copyright. Rights covered by copyright? Copy rights in computer programming.

UNIT-V

Enforcement of Intellectual Property Rights: Infringement of intellectual property rights Enforcement Measures Emerging issues in Intellectual property protection. Case studies of patents and IP Protection.

Unfair Competition: What is unfair competition. Relationship between unfair competition and intellectual property laws.

Text Books:

1. Ajit Parulekar and Sarita D' Souza, "Indian Patents Law – Legal & Business Implications", Macmillan India ltd , 2006
2. B. L.Wadehra; "Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications", Universal law Publishing Pvt. Ltd., India 2000
3. P. Narayanan, "Law of Copyright and Industrial Designs", Eastern law House, Delhi 2010

Suggested Reading:

1. W.R1 Cronish, "Intellectual Property; Patents, copyright, Trad and Allied rights", Sweet & Maxwell, 1993.
2. P. Narayanan, "Intellectual Property Law", Eastern Law Edn., 1997.
3. Robin Jacob and Daniel Alexander, "A Guide Book to Intellectual Property Patents, Trademarks, Copy rights and designs", 4/e, Sweet, Maxwell,.

16ME O08

INDUSTRIAL ADMINISTRATION AND FINANCIAL MANAGEMENT

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Objectives: Students able to learn

1. Various types of business organizations and organization structures and importance of plant location and plant layout.
2. Importance of industrial engineering techniques like method study and work measurement.
3. The significance of quality control and production planning and control
4. The importance of project management techniques
5. The total cost of a product based on elements of cost

Outcomes: At the end of the course, the students will be able to

1. Understand the role of different types of business organizations along with the need and importance of various types of layouts used in manufacturing industries
2. Apply the techniques of method study and work measurement in industry to enhance productivity
3. Understand the importance of quality control and plot the control charts
4. Apply the techniques of project management in industry
5. Calculate the total cost of the product based on its elements.

UNIT-I

Industrial Organization: Definition of an organization, types of various business organizations, organization structures and their relative merits and demerits, functions of management.

Plant location and layouts: Factors affecting the location of plant and layout, types of layouts and their merits and demerits.

UNIT-II

Work study: Definitions, objectives of method study and time study, steps in conducting method study, symbols and charts used in method study, principles of motion economy, calculation of standard time by time study and work sampling, performance rating factor, types of ratings, jobs evaluation and performance appraisal, wages, incentives, bonus, wage payment plans

UNIT-III

Inspection and quality control: Types and objectives of inspection, S.Q.C., its principles. Quality control chart and sampling plans, quality circles, introduction to ISO.

Production planning and control: Types of manufacture, types of production, principles of PPC and its function, production control charts.

UNIT-IV

Optimization: Introduction to linear programming and graphical solutions, assignment problems.

Project Management: Introduction to CPM and PERT, determination of critical path.

Material Management: Classification of materials, materials planning, duties of purchase manager, determination of economic ordering quantities, types of materials purchase.

UNIT-V

Cost accounting: Elements of cost, various costs, types of overheads, break even analysis and its applications, depreciation, methods of calculating depreciation fund, nature of financial management, time value of money, techniques of capital budgeting and methods, cost of capital, financial leverage.

Text Books:

1. Pandey I.M. , "Elements of Financial Management", Vikas Publ. House, New Delhi, 1994.
2. James C Van Horne, John M Wachowicz, Jr., "Fundamentals of Financial Management", 13/e, Prentice Hall Financial Times.
3. Khanna O.P., "Industrial Engineering and Management", Dhanapat Rai & Sons.

Suggested Reading:

1. S.N. Chary, "Production and Operations Management", 3/e, Tata McGraw Hill, 2006.
2. Paneer Selvam, "Production and Operations Management", Pearson Education, 2007.
3. Joseph Monk, "Operations Management", TMH Publishers, New Delhi, 2004.
4. Buffa Elwood S, "Modern Production /Operations Management", John Wiley Publishers, Singapore, 2002.
5. Everrete E. Adama & Ronald J. Ebert, "Production & Operations Management", 5/e, Prentice Hall of India, 2005.
6. S.D. Sharma, "Operations Research" ,Kedarnath, Ramnath & Co., Meerut, 2009.

16CS O03

IOT AND APPLICATIONS

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Programming Basics.

Course Objectives: The main objectives of this course are:

1. Impart necessary and practical knowledge of components in Internet of Things.
2. Understand working of IoT Systems.
3. Develop skills required to build IoT based systems.

Course Outcomes: On Successful completion of this course, student will be able to

1. Understand Internet of Things and its hardware and software components.
2. Interface I/O devices, sensors & communication module.
3. Remotely monitor data and control devices.
4. Develop real time IoT based projects.
5. Advance towards research based IoT.

UNIT – I

Introduction to IoT: Sensors, Types of sensors and Transducers, Actuators and Types of Actuators.

UNIT – II

Basics of Networking: Functional Components of IoT, IoT interdependencies, IoT Service oriented architecture, IoT categories, IoT gateways, IoT and associated technologies, Key technologies for IoT, IoT challenges.

UNIT – III

IoT Hardware Components: Computing (Arduino/Raspberry Pi), Communication, Sensors, Actuators, I/0 interfaces, Programming API's (for Arduino/ Raspberry Pi).

UNIT – IV

IoT Application Development: Solution framework for IoT applications-Implementation of Device integration, Data acquisition and integration, Device data storage- Unstructured data storage on cloud/local server, Authentication, Authorization of devices

UNIT – V

IoT Systems and Applications: Smart Lighting, Weather Monitoring System, Weather Reporting Bot, Forest Fire Detection, Alcohol Detection System, Smart Parking Environment., Drip-irrigation, Biological water treatment system**,** Work flow Automation in Industries, Smart Intrusion Detection System, monitoring space risks and hazardous conditions in industrial regions like underground tanks , trap door margins.

Text Books:

1. Raj and Anupama C. Raman,"The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press, 2017.
2. Jeeva Jose, "Internet of Things", Khanna Publishing House, Delhi, 2018.
3. Arshdeep Bahga and Vijay Madisetti, "Internet of Things: A Hands-on Approach", Universities Press, 2014.

Suggested Reading:

1. Dr. SRN Reddy, Rachit Tirnkral and Manasi Mishra, "Introduction to Internet of Things: A practical Approach", ETI Labs, 2018.
2. Adrian McEwen, "Designing the Internet of Things", Wiley, 2013.
3. Raj Kamal, "Internet of Things:Architecture and Design", McGraw Hill, 2017.
4. Cuno Pfister, "Getting Started with the Internet of Things", 0 Reilly Media, 2011.
5. O. Vermesan, P. Fries**s, "**Internet of Things – Converging Technologies for Smart Environments and Integrated Ecosystems", River Publishers, Series in Communications, 2013.

Online Resources:

1. Li Da Xu, Wu He, and Shancang Li, "Internet of Things in Industries: A Survey ", IEEE Transactions on Industrial Informatics, Vol. 10, No. 4, Nov. 2014.
2. Gotovtsev, Pavel M., and Andrey V. Dyakov. "Biotechnology and Internet of Things for green smart city application." 2016 IEEE 3rd World Forum on Internet of Things (WF-IoT). IEEE, 2016.
3. Yanjing, Sun, et al. "Research and design of agriculture informatization system based on IOT." Journal of Computer Research and Development 48 (2011): 316-331.
4. Somov, Andrey, et al. "Bacteria to power the smart sensor applications: Biofuel cell for low-power IoT devices." 2018 IEEE 4th World Forum on Internet of Things (WF-IoT). IEEE, 2018.
5. Han, Shuqing, et al. "Analysis of the frontier technology of agricultural IoT and its predication research." IOP Conference Series: Materials Science and Engineering. Vol. 231. No. 1. IOP Publishing, 2017.

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16CS O04

BASICS OF DATA SCIENCE USING R

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Probability and Statistics, basics of programming languages.

Course Objectives: The main objectives of this course are:

1. Understand R programming language.
2. Explore the programming skills needed to use R tool for statistical analysis of Biological data.
3. Analyze biological data.

Course Outcomes: On Successful completion of this course, student will be able to

1. Understanding the basics of R, various statistical measures, algorithms useful for data analysis.
2. Explore the programming skills needed to use R tool for biological data.
3. Analyze biological data using R tool.
4. Apply classification and clustering algorithms to bilogical data.
5. Identify and work with the technologies and resources related to bioinformatics.

UNIT-I

Basics of R: Introduction, R features, setting up and exploring R environment, loading packages, types of data objects in R, working with R data objects, Controlling work space, importing files. **Programming with R:** Variables and assignment, operators, control structures, Functions-built-in, writing own functions, package creation.

UNIT-II

Data Analysis and Graphics: Data summary functions in R, Graphics technology in R, saving graphics, additional graphics packages. **Bayesian Data Analysis**: Need of Bayesian approach, Application of Bayes rule, Priors, Likelyhood functions, evaluating the posterior, Applications of Bayesian Statistics in Bioinformatics. **Stochastic Modeling**: Stochastic process and Markov Processes,

Classification of Stochastic processes, modeling a DNA sequence with Markov Chain, Characteristics of Markov Chain.

UNIT-III

MCMC using Brugs: ABO blood type example. Gibbs sampling. **Statistical Inference:** Sampling distributions, Parameter estimation, interval estimation, bootstrapping, R packages for bootstrapping. **Hypothesis Testing**: Package ctest, Binomial test, comparing variances, Wilcoxon tests, Chi-Square test, Fisher's Exact tests, Likelihood Ratio tests.

UNIT-IV

ANOVA and Regression: ANOVA table, perforating ANOVA using R, graphical analysis of ANOVA comparison, Regression: Correlations, linear regression model, fitting and testing of regression model, generalization of the model. **Working with Multivariate Data:** Multivariate data, sample statistics, display of multivariate data, outliers and principal components. Classification of discriminate analysis- classification with two population and more than two populations, cross validation classification trees.

UNIT-V

Clustering methods: measures of dissimilarities, K-means clustering, K-Medoid clustering, Hierarchical clustering-Agglomerate and divisive. **R Packages:** Bio-conductor and Seqin R.

Data Technologies: R for Data manipulation, example, Database technologies, Bioinformatics resources on the WWW.

Text Books:

1. Kim Seefeld, Ernest Linder, "Statistics using R with Biological examples", 2007 (https://cran.r-project.org/doc/contrib/Seefeld_StatsRBio.pdf).
2. Robert Gentleman, "R Programming for Bioinformatics", 1st Edition, CRC Press, 2008.

Suggested Reading:

1. Arvil Cohhlan "A Little Book of R for Bioinformatics", Release 1.0, CC ver 3.0

Online Resources:

1. https://epdf.tips/r-programming-for-bioinformatics.html
2. https://epdf.tips/r-programming-for-bioinformatics.htmlhttps://www.cyclismo.org/tutorial/R/objectOriented.html
3. https://www.w3schools.in/r/object-oriented/

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19EEC101 **POWER SYSTEMS ANALYSIS**

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To study various methods of load-flow and types of faults in power systems
2. To Understand power system security concepts and State Estimation techniques
3. To Study voltage instability phenomena

Course Outcomes:

After completion of the course, students will be able to

1. Calculate voltage phasors at all buses, using various methods of load flow
2. Calculate fault currents in each phase
3. Rank various contingencies according to their severity
4. Estimate closeness to voltage collapse and calculate PV curves using continuation power flow
5. Distinguish between conventional load-flow and state estimation in real-time applications

UNIT-I

Load–Flow Studies: Overview of Load-Flow studies, GS, NR and FDC methods, Convergence properties, sparsity techniques, Q-max violation in constant matrix, inclusion in frequency effects, AVR in load-flow, Handling of discrete variable in Load Flow.

UNIT-II

Fault Analysis: Simultaneous faults, Open conductor faults, generalized method of fault analysis.

UNIT-III

Security Analysis: Security state diagram, Challenges for secure operation, Methods of enhancing security, Real-Time monitoring and control, Contingency Analysis, Generator shift distribution factor, Line outage distribution factor (Multiple line outages, overload index ranking), Approximations in contingency analysis.

UNIT-IV

State Estimation: Difference between LF and SE, Types of measurements, Sources of errors in measurements, Virtual and Pseudo, Measurement Observability, Tracking State, Estimator, WLS method, Bad data identification and correction.

UNIT-V

Voltage stability–Collapse: PV and QV curves, Voltage proximity indices, multiple power flow solutions, Continuation of power flow, Optimal multiplies load-flow.

Text Books:

1. J J Grainger and W D Stevenson, Power system Analysis, Mc Graw Hill 2003
2. A R Bergen and Vijay Vittal, Power system Analysis, Pearson 2009
3. L P Singh, Advanced Power system Analysis and Dynamics, New Age International, 2006

Suggested Reading:

1. G L Kusic, Computer aided power system analysis, Prentice Hall India, 1986
2. A J Wood, Power generation operation and control, John Wiley, 1994
3. P M Anderson, Faulted power system analysis, IEEE Press 1995

19EEC102 **POWER ELECTRONIC CONVERTERS**

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:
1. To understand the concepts and basic operation of transient and steady state analysis of all power electronic converters with passive and active loads.
2. To understand the operation of single phase and Three phase full–wave converters and analyse harmonics in the input current.
3. To analyze the operation of single phase Cyclo-converters, Inverters and dc–dc converters

Course Outcomes: After completion of this course, **s**tudents will be able to:
1. Give a systematic approach for transient and steady state analysis of all power electronic converters with passive and active loads.
2. Know and carry out transient and steady state analysis of different power converters of different types of loads and switching sequences.
3. Analyze power electronic devices
4. Analyze and design dc-dc and dc-ac converters.
5. Analyze and design AC regulator and cyclo converter

UNIT-I
Power Semiconductor Switched Circuits: Analysis of power semiconductor switched circuits with R, L, RL, RC loads and D.C. motor load, Battery charging circuit.

UNIT-II
Phase Controlled Rectifiers: Single-Phase and Three-Phase AC to DC converters, Single phase half controlled and fully controlled converters, operating domains of three phase full converters and semi-converters. Reactive power considerations.

UNIT-III
Non-Isolated DC-to-DC Converters (Choppers): Analysis and design of DC to DC converters, Control of DC-DC converters, Buck converters, Boost converters, Buck Boost converters, Cuck converters.

UNIT-IV
Inverters: Single phase and three phase inverters, Single phase half bridge and full bridge inverters, voltage source and current source inverters, comparison between voltage source and current source inverters, Voltage control and harmonic minimization in inverters.

UNIT-V
AC Voltage Controllers and Cyclo-Converters: AC to AC power conversion using voltage regulators, Uni-directional and Bi-directional AC voltage controllers, applications of AC voltage controllers, AC Choppers and cyclo-converters, step down and step-up cyclo converters , Consideration of harmonics, introduction to Matrix converters.

Text Books:
1. Ned Mohan, Undeland and Robbin,Power Electronics: converters, Application and design, John's Wiley and sons. Inc, Newyork.
2. M.H.Rashid,Power Electronics, Prentice Hall of India 1994.

Suggested Reading:
1. Soumitra Kumar Mandal, Power Electronics, McGraw Hill education
2. Dr. P.S. Bimbhra, Power Electronics, Khanna publications
3. M D Singh, K B Khanchandani, Power Electronics, McGraw Hill education

19MEC 103

RESEARCH METHODOLOGY AND IPR

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	2

Course Objectives:
To make the students to
1. Motivate to choose research as career, identify various sources for literature review and report writing
2. Formulate the research problem, prepare the research design and Equip with good methods to analyze the collected data
3. Know about IPR copyrights

Course Outcomes:
At the end of the course, student will be able to
1. Define research problem, review and asses the quality of literature from various sources
2. Improve the style and format of writing a report for technical paper/ Journal report, understand and develop various research designs
3. Collect the data by various methods: observation, interview, questionnaires
4. Analyze problem by statistical techniques: ANOVA, F-test, Chi-square
5. Understand apply for patent and copyrights

UNIT - I
Research Methodology: Research Methodology: Objectives and Motivation of Research, Types of Research, research approaches, Significance of Research, Research Methods verses Methodology, Research Process, Criteria of Good Research, Problems Encountered by Researchers in India, Benefits to the society in general. Defining the Research Problem: Selection of Research Problem, Necessity of Defining the Problem

UNIT - II
Literature Survey Report writing: Literature Survey: Importance and purpose of Literature Survey, Sources of Information, Assessment of Quality of Journals and Articles, Information through Internet. Report writing: Meaning of interpretation, layout of research report, Types of reports, Mechanics of writing a report. Research Proposal Preparation: Writing a Research Proposal and Research Report, Writing Research Grant Proposal

UNIT - III
Research Design: Research Design: Meaning of Research Design, Need of Research Design, Feature of a Good Design, Important Concepts Related to Research Design, Different Research Designs, Basic Principles of Experimental Design, Developing a Research Plan, Steps in sample design, types of sample designs.

UNIT - IV
Data Collection and Analysis: Data Collection: Methods of data collection, importance of Parametric, non parametric test, testing of variance of two normal population, use of Chi-square, ANOVA, Ftest, z-test

UNIT - V
Patents and Copyright: Patent: Macro economic impact of the patent system, Patent document, How to protect your inventions. Granting of patent, Rights of a patent, how extensive is patent protection. Copyright: What is copyright. What is covered by copyright. How long does copyright last? Why protect copyright? Related Rights: what are related rights? Enforcement of Intellectual Property Rights: Infringement of intellectual property rights, Case studies of patents and IP Protection

UNIT - III

Research Design: Research Design: Meaning of Research Design, Need of Research Design, Feature of a Good Design, Important Concepts Related to Research Design, Different Research Designs, Basic Principles of Experimental Design, Developing a Research Plan, Steps in sample design, types of sample designs.

UNIT - IV

Data Collection and Analysis: Data Collection: Methods of data collection, importance of Parametric, non parametric test, testing of variance of two normal population, use of Chi-square, ANOVA, Ftest, z-test

UNIT - V

Patents and Copyright: Patent: Macro economic impact of the patent system, Patent document, How to protect your inventions. Granting of patent, Rights of a patent, how extensive is patent protection. Copyright: What is copyright. What is covered by copyright. How long does copyright last? Why protect copyright? Related Rights: what are related rights? Enforcement of Intellectual Property Rights: Infringement of intellectual property rights, Case studies of patents and IP Protection

Text Books:

1. C.R Kothari, "Research Methodology, Methods & Technique"; New Age International Publishers, 2004
2. R. Ganesan, "Research Methodology for Engineers", MJP Publishers, 2011
3. Y.P. Agarwal, "Statistical Methods: Concepts, Application and Computation", Sterling Publs., Pvt., Ltd., New Delhi, 2004

Suggested Reading:

1. Ajit Parulekar and Sarita D' Souza, "Indian Patents Law – Legal & Business Implications"; Macmillan India ltd , 2006
2. B. L.Wadehra; "Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications"; Universal law Publishing Pvt. Ltd., India 2000.
3. P. Narayanan; "Law of Copyright and Industrial Designs"; Eastern law House, Delhi 2010

Discussion is an exchange of intelligence, argument is an exchange of ignorance; Discussion is to find out what is right, argument is to find out who is right.

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19EEC103 **POWER SYSTEMS LAB**

Instruction	4 Hours per week
Duration of Semester End Examination	3 Hours
CIE	50 Marks
Credits	2

Course Objectives:
1. To understand the I–V and P-V characteristics of a PV module
2. To measure the sequence reactance of synchronous machine and 3-phase transformer
3. a) To understand the characteristics of various relays
   b) To estimate efficiency, regulation and ABCD constants of 3-phase transmission line

Course Outcomes:
After completion of the course, **s**tudent will be able to:
1. Learn the measurement of sequence reactance of synchronous machine and 3-phase transformer
2. Knowledge about the relay characteristics
3. Acquire Knowledge to estimate efficiency, regulation and ABCD constants of 3-phase transmission line
4. Learn about various types of faults
5. Validate the I–V and P-V characteristics of a PV module

LIST OF EXPERIMENTS:
1. Measurement of positive, negative and zero sequence reactance of synchronous machine
2. Measurement of positive and zero sequence reactance of three-phase transformer
3. Determination of Regulation & Efficiency of a three phase transmission line
4. Determination of ABCD constants of a three phase transmission line
5. Inverse time characteristics of over current relay
6. Characteristics of static over current relay
7. Differential protection of single-phase transformer
8. Study of microprocessor based inverse current relay characteristics
9. Study of over voltage and under voltage relays
10. Study of line-to-ground, line-to-line and three-phase faults
11. Single PV module I-V and P-V characteristics with radiation and temperature changing effect.
12. I-V and P-V characteristics with series and parallel combination of modules.
13. Effect of shading and Effect of tilt angle on I-V and P-V characteristics of solar module.
14. Finding MPP by varying the resistive load by varying the duty cycle of DC-DC converter.
15. Observe the output voltage waveform of inverter in auto mode.

Note: At least **TEN** experiments should be conducted in the semester

19EEC104 POWER ELECTRONICS SIMULATION LAB

Instruction	4 Hours per week
Duration of Semester End Examination	3 Hours
CIE	50 Marks
Credits	2

Course Objectives:

1. To be acquainted with simulation of different power converters
2. To Simulate and compare the output of single-phase and three-phase converters with R, RL and RLE loads
3. To Simulate single and three-phase Inverters and their voltage control techniques

Course Outcomes:

After completion of the course, students will be able to:

1. Familiar with the usage of software for analysis of power electronic converters.
2. Analyze the performance of converters by simulation
3. Demonstrate the effects of different loads on various converters and inverters by experimentation.
4. Simulate different dc chopper circuits
5. Acquaint with the different speed control techniques of ac and dc drives.

List of Experiments:

1. Single-phase semi-converter using RL load with and without freewheeling diode.
2. Single-phase full converter using RL load with and without LC Filter
3. Single-phase full converter using RLE load with and without freewheeling diode
4. Single-phase converter with dc motor load
5. Three-phase fully controlled converter fed dc drive
6. Analysis of Buck and Buck-Boost converter
7. Chopper converter fed dc drive
8. Single-phase and Three phase IGBT inverters
9. Voltage control of an inverter using PWM technique
10. Single-phase current source inverter with RL load
11. Single-phase and three phase AC voltage controller
12. Single-phase Cyclo-converter with R & RL loads
13. Single-phase Dual converter with R & RL loads
14. Reactive power compensation using FACTS controllers

Note: At least **TEN** Experiments should be conducted in the semester

19EEC105 **POWER SYSTEM DYNAMICS**

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:
1. To develop mathematical models for Machines for stability studies
2. To study the dynamic analysis of voltage stability and factors affecting voltage stability
3. To understand the 'Low Frequency Oscillation' occurring in Power System and the phenomena of SSR oscillations in series compensated transmission system

Course Outcomes:
After completion of the course, the student will be able to
1. Acquire knowledge to model the synchronous machine to carry out system studies
2. Acquire knowledge to evaluate performance of power system from steady state stability, transient stability and voltage stability point of view
3. Acquire knowledge to model PS controllers such as: excitation system, Turbine-Governor, FACTS controllers for stability studies
4. Acquire knowledge to mitigate low frequency oscillations in power systems; improving system damping through supplementary excitation control (PSS)
5. Acquire knowledge to analyze SSR oscillations occurring in series compensated network through damping controls and its importance in power transfer and stability of the system

UNIT-I
Synchronous Machine Modeling: Per Unit System, Park's transformation, Flux linkage equations, Voltage and Current Equations, Formulation of state space equations, Equivalent circuit, Effect of damper windings, Transient and sub-transient inductance (reactance) and Time constants, Simplified models of Synchronous Machine.

UNIT-II
Stability: Definitions, Rotor angle stability, Frequency stability and Voltage stability. Power system stability: Steady state stability, small signal stability, Dynamic stability, Transient stability, Improvement of Transient stability, Swing equation for SMIB system, Determination of Critical Time and Critical angle.
Factors contributing and affecting voltage stability and minimization of voltage collapse, Dynamic analysis of voltage stability / collapse. P-V and Q-V curves

UNIT-III
System performance improvement through Controls: IEEE excitation, Power System Stabilizer and Load Models, Hydraulic Power and Governor Models

UNIT-IV
Low Frequency Oscillations: Low Frequency Oscillations and supplementary excitation controls PSS, Improving system damping transfer function of LFO studies, State equations for SMIB system, Philips – Heffron Model.
Small signal stability (LFO) of unregulated and regulated system, Stability enhancement techniques using PSS, Excitation systems and Phillips – Heffron model

Unit V
Sub Synchronous Resonance (SSR): SSR in series-compensated transmission system, SSR damping schemes, counter measures, T-G Torsional characteristics, Torsional interaction with PS controls.

Text Books:
1. P. Kundur, “Power System Stability and Control”, McGraw Hill Inc, 1994
2. J. Machowski, Bialek, Bumby, “Power System Dynamics and Stability”, John Wiley & Sons,1997
3. L. Leonard Grigsby (Ed.); “Power System Stability and Control”, Second edition, CRC Press,2007
4. V. Ajjarapu, “Computational Techniques for voltage stability assessment & control”; Springer, 2006

Suggested Reading:-
1. P. M. Anderson & A. A. Fouad “Power System Control and Stability”, Galgotia , New Delhi,1981
2. J Machowski, J Bialek& J. R W. Bumby, “Power System Dynamics and Stability”, John Wiley & Sons, 1997
3. E.W. Kimbark, “Power system stability”, Vol. I & III, John Wiley & Sons, New York 2002

Working hard for something which we don’t like is called stress!; Working hard for something which we love is called passion! It is not hard work really, it is all happy work.

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19EEC106 ADVANCED POWER ELECTRONIC CIRCUITS

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: Students will be able to:
1. Understand the operation of advanced power electronic circuit topologies.
2. Understand the load, switch and resonant converters.
3. Understand the modeling and design concepts of various DC-DC converters used in renewable

Course Outcomes: After completion of course Student will be able to:
1. Demonstrate the knowledge of DC isolated and non-isolated regulators
2. Demonstrate the knowledge of load and switch resonant converters
3. Demonstrate the knowledge resonant inverters
4. Model and design DC-DC converters for renewable energy conversion.
5. Apply the knowledge of dc-dc converters used in dc drives and renewable energy applications

UNIT-I
DC Regulators-I: Boost type APFC and control. Three phase utility inter phases and control-Buck, Boost, Buck-Boost SMPS, Topologies

UNIT-II
DC Regulators-II: Modes of operation –Push-Pull and Forward Converter Topologies - Voltage Mode Control. Half bridge, Full bridge and Fly-back Converters.

UNIT-III
Resonant Converters-I: Load Resonant Converter. Zero Voltage Switching Clamped Voltage Topologies.

UNIT-IV
Resonant Converters-II: Resonant DC Link Inverters with Zero Voltage Switching, High Frequency Link Integral Half Cycle Converter

UNIT-V
Application of DC-DC converters: Modeling and design of DC-DC Converters for various renewable energy conversion, Few power electronic circuits used in DC drives.

Text Books:
1. Rashid “Power Electronics” Prentice Hall India 2007.
2. G.K.Dubey et.al “Thyristorised Power Controllers” Wiley Eastern Ltd., 2005, 06.
3. Dewan & Straughen “Power Semiconductor Circuits” John Wiley & Sons., 1975.

Suggested Reading:
1. G.K. Dubey& C.R. Kasaravada “Power Electronics & Drives” Tata McGraw Hill., 1993
2. Cyril W Lander “Power Electronics” McGraw Hill., 2005.
3. B. K Bose “Modern Power Electronics and AC Drives” Pearson Education (Asia)., 2007
4. Abraham I Pressman “Switching Power Supply Design” McGraw Hill Publishing Company., 2001.

19EEC107 POWER ELECTRONICS LABORATORY

Instruction	4 Hours per week
Duration of Semester End Examination	3 Hours
CIE	50 Marks
Credits	2

Course Objectives:
1. To obtain and plot the characteristics and operation of different static switches
2. To understand different Converter control techniques.
3. To know various methods of speed control of electric drives.

Course Outcomes:
After the completion of this course, students will be able to:
1. Distinguish the characteristics of different controlled switches and their applications.
2. Demonstrate the effects of different loads on the performance of various phase controlled converters and choppers
3. Understand the various control techniques used in inverters.
4. Acquire the conversion principles of DC-DC and AC-AC converters
5. Observe different speed control techniques of electric drives

List of Experiments

1. V-I characteristics of SCR and measurement of latching and holding currents.
2. UJT trigger circuit for half wave and full wave control.
3. Single-phase half wave controlled rectified with R & RL load with and without freewheeling diode.
4. Single phase half controlled and full controlled bridge rectifiers with R and RL loads.
5. Three-phase half controlled and full controlled bridge rectifiers with R and RL loads.
6. Single-phase AC voltage regulator with resistive and inductive loads.
7. Analysis of chopper circuit.
8. Analysis of single-phase series-resonant inverter.
9. Analysis of single-phase bridge inverter with R and RL loads.
10. Three-phase Mc-Murray Bed-Ford inverter with R and RL loads.
11. Three-phase IGBT inverter.
12. Closed-loop control of permanent magnet dc drive.
13. Single-phase dual converter with NCC and CC mode of operation.
14. Three-phase step down cyclo-converter with R and RL loads.
15. Static rotor resistance control of slip-ring induction motor.
16. Operation of two quadrant dc drive.

Note: At least **TEN** experiments should be conducted in the semester.

With effect from the academic year 2019-2020

19EEC108 **POWER SYSTEMS SIMULATION LAB**

Instruction	4 Hours per week
Duration of Semester End Examination	3 Hours
CIE	50 Marks
Credits	2

Course Objectives:

1. To Simulate and compare the various aspects economic load dispatch and load flows.
2. To Simulate and observe stability studies and short-circuit studies
3. To Conduct experiments on modeling of Transmission line

Course Outcomes:

After completion of this course, students will be able to:

1. Validate the adaptability of economic load dispatch and load flow for a given situation by simulation results.
2. Acquire the knowledge about formation of Impedance and Admittance Matrices
3. Acquire the knowledge to analyze the Symmetrical and un-symmetrical fault currents
4. Acquire the knowledge to simulate various types of transmission models
5. Acquire the knowledge about Symmetrical and Unsymmetrical components for a given system.

List of Experiments:

1. Single Area and Two Area Load Frequency Control
2. Economic Load Dispatch in Power Systems
3. Formation of Z-Bus Matrix using Building Algorithm
4. Load Flow Studies Using Gauss-Seidel and Newton-Raphson Method
5. Transient Stability Studies
6. Short Circuit Analysis for unsymmetrical faults
7. Formation of Bus Admittance Matrix
8. Three Phase Short Circuit Analysis of Synchronous Machine
9. Unsymmetrical Fault Analysis for RLC loads
10. Step Response of Synchronous Machine
11. Determination of Symmetrical Components
12. Simulation of Ferranti Effect
13. Modeling of Transmission Lines
14. Solution of Swing Equation
15. Load flow studies of Distribution Systems

Note: At least **TEN** experiments should be conducted in the semester.

19EEC109 **MINI PROJECT WITH SEMINAR**

Instruction	: 2 Hours Per Week
Internal Marks	: 100 Marks
Credits	: 2

I. Course Objectives:

1. Motivate the students to face the challenges in which demonstration of their competence in research techniques..
2. Provide an opportunity to contribute to engineering arena in their own form.

II. General Instructions:

- Mini Project is of 14 week duration out of which one week prior reading, twelve weeks of active research and final week for presentation of their work for assessment.
- Each student will be allotted to a faculty supervisor for mentoring.

III. Methodology:

1. The student can select either mathematical modeling based / experimental investigations or numerical modeling.
2. All the investigations are clearly stated and documented with reasons / explanations.
3. The project should contain
   i. A clear statement of research objectives
   ii. Background work
   iii. Literature review
   iv. Techniques used
   v. Prospective deliverables
   vi. Benefit from this research
   vii. Detailed discussion on results
   viii. Conclusions and references

IV. Assessment:

1. 50% of the marks for oral presentation which will take place at the end of the semester.
2. Evaluation will be done by a committee consisting of supervisor, one senior faculty and Head of the department or his nominee.
3. Evaluation will be carried out based on ‘RUBRIC’ (which will be supplied by the dept.)
4. 50% of the marks for scientific report on the project.
5. Report should be written as per standard journal format. The repertoire of the report content can be taken from the department.

16EEC112 PROJECT SEMINAR

Semester Examination	: 100 Marks
Credits	: 6

Course Outcomes: After completion of the course: the student will be able to:

1. *Develop the skills of analyzing a problem, solving it by different approaches, building interactions with the other organizations.*
2. *Develop the skills of presenting a concept, independent learning and addressing the societal issues, economical outlay.*

The main objective of project seminar is to prepare the students for the project to be executed in 4th semester.

During the third semester, student will deliver a seminar on the progress of the project, which is evaluated for 100 Marks.

The seminar shall be evaluated by the Departmental Review Committee consists of Head of the Department, Programme co-ordinator and Supervisor.

The student will take up project work at the beginning of the third semester, and will continue till the end of the fourth semester.

The project work is carried out for one academic year / two semesters (i.e. 3rd and 4th semesters).

No external examination for Project Seminar.

16EEC113 Project Work & Dissertation

Internal Examination	: 100 Marks
Semester End Examination	: 100 Marks
Credits	: 12

Course Outcomes: After completion of the course the student will be able to:

1. *Acquire knowledge in conducting systematic way the literature Survey by referring to reputed journals/ textbooks etc.*
2. *Acquire knowledge in segregating /Classifying the literature survey paper: Design, Analysis, experimental etc.*
3. *Able to prepare a detailed summary of the paper as per the classification and choose the area and topic fitting in to the classification such as simulation studies, experimentation, preparing prototype etc.*
4. *Acquire knowledge to conduct simulation studies/ experimental studies and tabulate the results and compare the performance and choose the design parameter to improve the performance etc.*
5. *Acquire knowledge in writing the project work report in different chapters: Introduction, back ground, description, problem formulation, Analysis, Discussion, results and suggestions for further studies and conclusions.*

During the fourth semester, student will deliver seminar, which enables to evaluate the preparedness, sufficiency of the work carried out, results etc. On satisfactory recommendation by the Departmental Review Committee, student will prepare the report as per the guidelines issued by the department. The project is evaluated internally for 100 marks and externally for 100 marks.

18MT CO1

MATHEMATICS– I

(Common to all branches and except for Bio-Tech)

Instruction	3 L+1T Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation:	30 Marks
Credits	4

Course Objectives:

1. To solve linear system of equations using Matrix Methods.
2. To know the convergence of the Series.
3. To represent the function in series form.
4. To know the Partial Derivatives and use them to interpret the way a function of two variables behaves.
5. To learn Vector Differential Operator and its Physical interpretations on Scalars and vector functions.
6. To solve improper integrals.

Course Outcomes: On the successful completion of this course student shall be able to

1. Solve system of linear equations and identify the Eigen values and Eigen vectors in engineering problems.
2. Check the series convergence.
3. Find the evolutes of the given curves.
4. Expand and find extreme values of functions of two variables.
5. Understanding the significance of gradient, divergence and curl.
6. An ability to solve the problems and interpret in geometrical approach.

UNIT-I: Matrices:

Rank of the matrix, Echelon form, System of linear equations, Linearly dependence and independence of vectors, Eigenvalues, Eigenvectors, Properties of eigenvalues, Cayley-Hamilton theorem, Quadratic forms, Diagonalization of Matrices, Reduction of quadratic form to canonical form by linear transformation, Nature of quadratic forms.

UNIT-II: Sequences and Series:

Definition of Convergence of sequence and series. Tests for convergence of series: Comparison test, limit comparison test, D'Alembert ratio test, Raabe's test, Cauchey's n^{th} root test, logarithmic test, alternative series, absolute and conditional convergence.

UNIT-III: Calculus:

Rolle's Theorem, Lagranges Mean value theorem, Cauchy's mean value theorem (without proofs). Curvature, radius of curvature, Evolutes and involutes. Fourier series, half range sine and cosine series.

UNIT-IV: Multivariable Calculus (Differentiation):

Functions of two variables, Partial derivatives, Total differential and differentiability, Derivatives of composite and implicit functions (Chain rule), Change of variables, Jacobian, Higher order partial derivatives, Taylor's series of functions of two variables, Maximum and minimum values of functions two variables, Lagrange's multipliers method.

UNIT-V: Vector Calculus (Differentiation):

Scalar and vector fields, Gradient of a scalar field, Directional derivative, Divergence and Curl of a vector field, vector identities. Improper integrals: Beta and Gamma functions and their properties.

Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.

Suggested Reading:

1. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
2. R.K. Jain, S.R.K. Iyengar, Advanced engineering mathematics, Narosa Publications, 5th edition, 2016.
3. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/ Cole, 2005.

18CY C01

CHEMISTRY

(Common to all branches)

Instruction:	3L+1T Hours per Week
Duration of Semester End Examination:	3 Hours
Semester End Examination:	70 Marks
Continuous Internal Evaluation:	30 Marks
Credits:	4

Course Objectives

1. The aim of framing the syllabus is to impart intensive and extensive knowledge of the subject so that students can understand the role of chemistry in the field of engineering
2. This syllabus helps at providing the necessary introduction of the inorganic chemistry principles and concepts of chemical bonding involved in a comprehensive manner understandable to the students aspiring to become practicing engineers.
3. Thermodynamic and Electrochemistry units give conceptual knowledge about spontaneous processes and how can they be harnessed for producing electrical energy and efficiency of systems.
4. To teach students the value of chemistry and to improve the research opportunities knowledge of stereochemistry and organic reactions is essential.
5. New materials lead to discovering of technologies in strategic areas like defense and space research for which an insight into nano and composite materials of modern chemistry is essential.

Course Outcomes

The concepts developed in this course will aid in quantification of several concepts in chemistry that have been introduced at the 10+2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications. Quantum theory is more than 100 years old and to understand phenomena at nanometer levels; one has to base the description of all chemical processes at molecular levels. The course will enable the student to:

1. Analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
2. Rationalize bulk properties and processes using thermodynamic considerations & Ionic Equilibria.
3. List major chemical reactions that are used in the synthesis of molecules.
4. Apply the various methods used in treatment of water for domestic and industrial use.

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5. Discuss the various Engineering materials & Drug synthesis & their applications.

UNIT-I Atomic and molecular structure:

Molecular Orbital theory - atomic and molecular orbitals.Linear combination of atomic orbitals (LCAO) method. Molecular orbitals of diatomic molecules. Energy level diagrams of diatomics (H_2, He_2^+,N_2, O_2, O_2^- , CO, NO). Pi- molecular orbitals of butadiene , benzene and their aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties.

UNIT-II Use of free energy in chemical equilibria and Ionic Equilibria:

Use of free energy in chemical equilibria : Thermodynamic functions: Internal energy, entropy and free energy. Significance of entropy and free energy (criteria of spontaneity). Free energy and emf (Gibbs Helmholtz equations and its applications). Cell potentials –electrochemical series.Nernst equation and its applications.Potentiometric Acid base & Redox Titrations.Numericals.

Ionic Equilibria: Solubility product, Determination of solubility product, Applications of solubility product- Determination of solubilities of sparingly soluble salts; Predicting precipitation reactions; Precipitation of an insoluble salt; Precipitation of soluble salts ; Inorganic analysis. Numericals.

UNIT- III Stereochemistry and Organic reactions

Stereochemistry: Representations of 3 dimensional structures , Symmetry and chirality, Stereoisomers - Configurational isomers (Geometrical&Optical isomers), Conformational isomers - Newman and sawhorse representations of n-butane, enantiomers (lactic acid), diastereomers (Tartaric acid), optical activity, absolute configurations, Sequence rules for R&S notation.

Organic reactions

Types of Organic reactions:

Substitution Reactions- Electrophilic substitution (Nitration of Benzene); Nucleophilic Substitution (S_N1& S_N2) ; Free Radical Substitution(Halogenation of Alkanes)

Addition Reactions:

Electrophilic Addition – Markonikoff's rule

Nucleophilic Addition – (Addition of HCN to carbonyl compounds)

Free radical Addition - Anti Markonikoff's rule (Peroxide effect)

Eliminations-E_1 and E_2 (dehydrohalogenation of alkyl halides)

Oxidation with $KMno_4$, $K_2Cr_2O_7$; **Reduction** with $LiAlH_4$,$NaBH_4$

Cyclization (Diels - Alder reaction)

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UNIT–IV Water Chemistry:

Hardness of water – Types, units of hardness, Disadvantages of hard water, Boiler troubles - scales & sludge formation, causes and effects , Softening of water by ion exchange method and Reverse Osmosis. Specifications of potable water & industrial water. Disinfection of water by Chlorination, Ozonisation & UV radiation.

UNIT-V Engineering Materials and Drugs:

Nano materials-Introduction to nano materials and general applications, basic chemical methods of preparation- Sol gel method. Carbon nanotubes and their applications.

Composite materials- Definition, types of composites, fibre reinforced, glass fibre reinforced and carbon fibre reinforced composites and applications.

Conducting polymers- Definition, classification and applications.

Drugs-Introduction,Synthesis and uses of Aspirin (analgesic), Paracetamol (Antipyretic), Atenolol (antihypertensive).

TEXT BOOKS

1. P.C. Jain and M. Jain, “Engineering Chemistry”, Dhanpat Rai Publishing Company Ltd., New Delhi,16th edition (2015).
2. W.U. Mali, G.D.Tuli and R.D.Madan, “Selected topics in Inorganic Chemistry”, S Chand & CompanyLtd, New Delhi,reprint (2009).
3. R.T. Morrison, R.N. Boyd and S.K. Bhattacharjee, “Organic Chemistry”, Pearson, Delhi, 7thedition(2011).
4. G.L. David Krupadanam, D. Vijaya Prasad, K. Varaprasad Rao, K.L.N. Reddy and C. Sudhakar, “Drugs”, Universities Press (India) Limited, Hyderabad (2007).

SUGGESTED READINGS

1. B. H. Mahan, “University Chemistry”, Narosa Publishing house, New Delhi, 3rd edition (2013).
2. B.R. Puri, L.R. Sharma and M.S. Pathania, “Principles of Physical Chemistry”, S. Nagin Chand & Company Ltd., 46th edition(2013).
3. T.W. Graham Solomons, C.B. Fryhle and S.A. Snyder, “Organic Chemistry”, Wiley,12th edition (2017).
4. P.W. Atkins, J.D. Paula, “Physical Chemistry”, Oxford, 8thedition (2006).

18CE C01

ENGINEERING MECHANICS

Instruction:	3L+1T Hours per Week
Duration of Semester End Examination:	3 Hours
Semester End Examination:	70 Marks
Continuous Internal Evaluation:	30 Marks
Credits:	4

Course Objectives:

1. The objective of this course is to understand the resolution of forces and to obtain resultant of all force systems, to understand moment of a force and equilibrium conditions of static loads for smooth and frictional surface.
2. To obtain centroid, centre of gravity and moment of inertia for various regular and composite areas and bodies.
3. To understand the basic structural analysis, principles of virtual work and energy methods.
4. To know the basic concepts of dynamics and analysis as a particle and rigid bodies.
5. To understand the work energy principles, impulse momentum and their applications and to know the concept of simple harmonic motion and free vibration.

Course Outcomes: The students will be able to

1. Solve problems dealing with forces in plane and space force systems, draw free body diagrams to analyze various problems in equilibrium, for smooth and frictional surface.
2. Determine centroid and moment of inertia for elementary, composite areas and bodies.
3. Analyze simple trusses for forces in various members of a truss.
4. Solve problem in kinematics and kinetics of particles and rigid bodies.
5. Analyze body motion using work energy principles, impulse and momentum approach and able to apply the concepts of simple harmonic motion and free vibrations in dynamics.

Unit–I: Resolution, Resultant and Equilibrium of force system and Friction: Concepts of force, System of forces, components of forces in a plane and in space systems.Resultant of force systems.Moment of forces and its applications.Couples and its applications.Equilibrium of Force systems. Free body diagrams, equation of equilibrium of coplanar and spatial force systems. Static indeterminacy. Types of friction, Laws of friction, application of friction to a single body & connecting systems, wedge friction.

Unit–II: Centroid ,centre of gravity and moment of Inertia:
Centroid of simple figures from first principle, centroid of composite sections. Centre of gravity and its implications, Definition of Area moment of Inertia, Moment of inertia of plane section from first principles, Theorems of moment of inertia, moment of inertia of standard sections and composite sections, Mass moment of inertia of rectangular and circular plates, cylinder, cone & sphere.

Unit–III: Analysis of simple trusses, Virtual work and Energy methods:
Analysis of simple trusses using method of joints, methods of sections. Determine if a member is in tension or compression, zero force members. Virtual displacements, Principle of virtual work for particle and ideal system of rigid bodies, degrees of freedom.Conservative forces and potential energy, energy equation for equilibrium.

Unit–IV: Particle Dynamics:
Rectilinear and curvilinear translation using rectangular, normal and tangential components.Relative and constrained motion. Newton's 2nd Law, rectangular and path coordinates. Basic terms, general principles in dynamics, D' Alembert's principle and its application in plane motion and connected bodies.Instantaneous centre of rotation in plane motion and simple problems.

Unit–V: Work- Energy, Impulse-momentum and Mechanical Vibrations:
Equation of work energy for translation and fixed axis rotation, work energy principles applied to particle motion, connected systems. Introduction to linear impulse momentum, principle of conservation of linear momentum, Impact, direct and oblique. Introduction to vibration, free and forced vibrations, simple harmonic motion, simple pendulum and compound pendulum.

Text Books:

1. Reddy Vijaykumar K. and J. Suresh Kumar," Singer's Engineering Mechanics Statics and Dynamics", B. S. Publications 2011.
2. A. Nelson, "Engineering Mechanics", Tata McGraw Hill, New Delhi, 2010.

Suggested Reading:

1. Irving H. Shames, "Engineering Mechanics", 4th Edition, Prentice Hall, 2006.
2. F. P. Beer and E. R .Johnson, "Vector Mechanics for engineers, Vol. I - Statics, Vol. II - Dynamics", 9th edition, Tata McGraw Hill, 2011.
3. R. C. Hibbeler, "Engineering Mechanics: Principles of Statics and Dynamics", Pearson Press, 2006.

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18ME C01

ENGINEERING GRAPHICS AND DESIGN

Instruction	1T+4D Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation:	30 Marks
Credits	3

Course Objectives:

1. to prepare to design a system, component, or process to meet desired needs within realistic constraints.
2. to prepare the student to communicate effectively.
3. to prepare the student to use the techniques, skills, and modern. engineering tools necessary for engineering practice.
4. to get exposure to a CAD package.

Course Outcomes:

1. Introduction to engineering design and its place in society.
2. Exposure to the visual aspects of engineering design.
3. To become familiar with engineering graphics standards.
4. Exposure to solid modelling.
5. Exposure to computer-aided geometric design.
6. Exposure to creating working drawings.
7. Exposure to engineering communication.

Detailed contents

Traditional Engineering Graphics:

Principles of Engineering Graphics; Orthographic Projection; Descriptive Geometry; Drawing Principles; Isometric Projection; Surface Development; Perspective; Reading a Drawing; Sectional Views; Dimensioning & Tolerances; True Length, Angle; intersection, Shortest Distance.

Computer Graphics:

Engineering Graphics Software; -Spatial Transformations; Orthographic Projections; Model Viewing; Coordinate Systems; Multi-view Projection; Exploded Assembly; Model Viewing; Animation; Spatial Manipulation; Surface Modeling; Solid Modeling; Introduction to Building Information Modeling (BIM)

(Except the basic essential concepts, most of the teaching part can happen concurrently in the laboratory).

UNIT-1 Introduction to Engineering Drawing:
Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involute;

UNIT-2 Orthographic Projections:
Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes (without traces) ; Projections of planes inclined Planes;
Introduction to CAD package:
Listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where pplicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids.

UNIT-3 Projections of Regular Solids:
Projection of Prism, Cylinder, Pyramid and Cone : Simple position, axis inclined to one of the reference plane only. Customization & CAD Drawing: consisting of set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerancing; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles;

UNIT-4 Sections and Sectional Views of Right Angular Solids:
Sections of solids in simple position Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids.
Annotations, layering & other functions:
applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation, Computer-aided design (CAD) software modeling of parts and assemblies. Parametric and non-parametric solid, surface, and wireframe models. Part editing and twodimensional documentation of models. Planar projection theory, including sketching of perspective, isometric, multi view, auxiliary, and section views. Spatial visualization exercises. Dimensioning guidelines, tolerancing techniques; dimensioning and scale multi views of dwelling;

UNIT-5 Isometric Projections:

Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Viceversa, Conventions;

Demonstration of a simple team design project:

Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; geometric dimensioning and tolerancing; Use of solid-modeling software for creating associative models at the component and ssembly levels; (Examples of specific components to the branch of study may be included).

Text Books:

1. N.D.Bhatt, Elementary Engineering Drawing, Charotar Publishers, 2012.
2. K.L.Narayana and P.K.Kannaiah, ¯Text Book of Engineering Drawing Scitech Publications, 2011.
3. Basanth Agrawal and C M Agrawal ¯Engineering Drawing 2e ¯, McGraw-Hill Education(India) Pvt.Ltd.

Suggested Reading:

1. Shaw M.B and Rana B.C., ¯Engineering drawing Pearson, 2ndedition, 2009.
2. K.Veenugopal, ¯Engineering Drawing and Graphics + Autocad New Age International Pvt.Ltd, 2011.
3. Bhattacharya. B, ¯Engineering Graphics I. K. International Pvt.Ltd, 2009.

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18EE C01

BASIC ELECTRICAL ENGINEERING

Instruction:	3L+1T Hours per Week
Duration of Semester End Examination:	3 Hours
Semester End Examination:	70 Marks
Continuous Internal Evaluation:	30 Marks
Credits:	4

Course Objectives:

1. To understand the behavior of different circuit elements R,L & C, and the basic concepts of electrical circuit analysis.
2. To know the concepts of AC circuits, RMS value, Average value, Phasor analysis etc.,
3. To understand the basic principle of operation of Transformer and DC machines.
4. To understand the basic principle of operation of DC machines and AC machines.
5. To know about different types of electrical wires and cables, domestic and industrial wiring.
6. To understand safety rules and methods of earthing.

Course Outcomes: At the end of the course, the student will be able to

1. Acquire the concepts of Kirchhoff's laws and network theorems and able to get the solution of simple dc circuits.
2. Obtain the steady state response of RLC circuits and also determine the different powers in AC circuits.
3. Acquire the concepts of principle of operation of Transformers and DC machines.
4. Acquire the concepts of principle of operation of DC machines and AC machines.
5. Acquire the knowledge of electrical wiring and cables and electrical safety precautions.
6. Recognize importance of earthing and methods of earthing and electrical installations.

UNIT-I: DC Circuits

Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation, Superposition, Thevenin and Norton Theorems, Time-domain analysis of firstorder RL and RC circuits.

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UNIT-II: AC Circuits
Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor, Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel). Three phase balanced circuits, voltage and current relations in star and delta connections.

UNIT-III: Transformers
Construction, Working principle, EMF Equation, Ideal and Practical transformer, Equivalent circuit of Transformer, OC and SC tests on a transformer, Efficiency and Regulation, Auto transformer.

UNIT-IV: DC and AC Machines
DC Generators: Construction, Principle of operation, EMF equation, Classification, Characteristics of shunt, series and compound generators. DC Motors: Classification, Torque equation, Characteristics, Efficiency, Speed Control of Series and Shunt Motors. Three - Phase Induction Motors: Construction, Principle of operation, Torque equation, torque-slip characteristics, Power stages, speed control of induction motors.

UNIT-V: Electrical Installations
Electrical Wiring: Types of wires and cables, Electrical Safety precautions in handling electrical appliances, electric shock, first aid for electric shock, safety rules. Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Earthing, Elementary calculations for energy consumption.

Text books:

1. L. S. Bobrow, Fundamentals of Electrical Engineering, Oxford University Press, 2011.
2. E. Hughes, Electrical and Electronics Technology, Pearson, 2010.

Suggested Reading:

1. D. P. Kothari & I. J. Nagrath, ¯Basic Electrical Engineering Tata McGraw Hill, 2010.
2. V. D. Toro, ¯Electrical Engineering Fundamentals Prentice Hall India, 1989.
3. D.C. Kulshreshtha, ¯Basic Electrical Engineering McGraw Hill, 2009.
4. P.V.Prasad, S.sivanagaraju, R.Prasad, "Basic Electrical and Electronics Engineering" Cengage Learning, 1st Edition, 2013.

18EE C02

BASIC ELECTRICAL ENGINEERING LAB

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	35 Marks
Continuous Internal Evaluation:	15 Marks
Credits	1

Course Objectives:

1. To acquire the knowledge of different types of electrical elements.
2. To verify the basic electrical circuit laws and theorems.
3. To determine the parameters and power factor of a coil.
4. To calculate the time and frequency responses of RLC circuits
5. To determine the characteristics of Transformers.
6. To determine the characteristics of dc and ac machines.

Course Outcomes: At the end of the course, the students are expected to

1. Get an exposure to common electrical components and their ratings.
2. Make electrical connections by wires of appropriate ratings.
3. Understand the circuit analysis techniques.
4. Determine the parameters of the given coil.
5. Understand the basic characteristics of transformer.
6. Understand the basic characteristics of dc and ac machines.

List of Laboratory Experiments/Demonstrations:

1. Demonstration of Measuring Instruments and Electrical Lab components.
2. Verification of KCL and KVL.
3. Time response of RL and RC circuits.
4. Calculation of permittivity of a choke or coil by Wattmeter Method.
5. Verification of Thevenin's and Norton's theorems.
6. Turns ratio /voltage ratio verification of 1-Ph Transformers.
7. OC and SC tests on a given 1-Ph Transformer.
8. Observation of Excitation Phenomenon in Transformer.
9. Measurement of 3-Ph power in a balanced system (By 2- Wattmeter method).
10. Measurement of 3-Ph Energy by an Energy Meter (Demonstration of Principle).
11. Load test of DC Shunt motor.
12. Speed control of DC Shunt motor.
13. Load test of 3-Ph Induction motor.
14. Demonstration of LT Switchgear Equipment/Components.
15. Demonstration of cut - out section of Machines like DC Machine, Induction Machine etc.

Note: at least **TEN** experiments should be conducted in the semester

18CY C02

CHEMISTRY LAB

(Common to all branches)

Instruction:	3 Hours per Week
Duration of Semester End Examination:	3 Hours
Semester End Examination:	50 Marks
Continuous Internal Evaluation:	25 Marks
Credits:	1.5

Course Objectives

1. To impart fundamental knowledge in handling the equipment / glassware and chemicals in chemistry laboratory.
2. The student should be conversant with the principles of volumetric analysis and identification of organic functional groups.
3. To apply various instrumental methods to analyze the chemical compounds and to improve understanding of theoretical concepts.

Course Outcomes

The chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and engineering.

Thestudents will learn to:

1. Estimate rate constants of reactions from concentration of reactants/ products as a function of time
2. Measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water, etc
3. Synthesize a small drug molecule and Identify the organic compounds.
4. understand importance of analytical instrumentation for different chemical analysis.
5. Perform interdisciplinary research such that the findings benefit the common man.

Chemistry Lab

1. Estimation of temporary and permanent hardness of water using EDTA solution
2. Estimation of amount of chloride in water.
3. Determination of rate constant for the reaction of hydrolysis of methyl acetate.(first order)
4. Estimation of amount of HCl Conductometerically using NaOH solution.
5. Estimation of (a) amount of CH_3 COOH Conductometerically using NaOH solution. (b) amount of HCl and CH_3 COOH present in the given mixture of acids Conductometerically using NaOH solution.

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6. Estimation of amount of HCl Potentiometrically using NaOH solution.
7. Estimation of amount of Fe^{+2} Potentiometrically using $KMnO_4$ solution.
8. Distribution of acetic acid between n-butanol and water.
9. Synthesis of drug - Aspirin.
10. Organic Chemistry- Identification of Functional groups - neutral group (carbonyl groups-acetaldehyde and acetone); acidic group (benzoic acid); basic group (aniline).
11. Determination of surface tension of organic solvents (ethanol, ethyl acetate)
12. Determination of Viscosity.

TEXT BOOKS

1. J. Mendham and Thomas ,"Vogel' s text book of quantitative chemical analysis", Pearson education Pvt.Ltd. New Delhi ,6th ed. 2002.

SUGGESTED READINGS

1. Dr. Subdharani , "Laboratory Manual on Engineering Chemistry", Dhanpat Rai Publishing, 2012.
2. S.S. Dara , "A Textbook on experiment and calculation in engineering chemistry", S.Chand and Company, 9th revised edition, 2015.

18MT CO3

MATHEMATICS– II

(Common to all branches and except for Bio-Tech)

Instruction	3 L+1T Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation:	30 Marks
Credits	4

Course Objectives

1. To evaluate double and triple integrals of various functions and their significance.
2. To evaluate vector line, surface and volume integrals.
3. To know the relevant method to solve higher order differential equations.
4. To evaluate complex integration.
5. To evaluate real and definite integrals.

6. To know the methods to solve real life problems.

Course Outcomes: On the successful completion of this course student shall be able to

1. Find the areas, volumes and surface of solids revolution.
2. Use Greens, Gauss and Stoke's theorems to find the surface and volume integrals.
3. Able to solve solutions of differential equations with initial and boundary value problems.
4. Solve the problems on analytic functions, Cauchy's theorem and Cauchy's integral formula.
5. Real and complex integrals by using Cauchy's theorems.
6. Solve physical and engineering problems.

UNIT-I: Multivariable Calculus (Integration):

Applications of definite integrals to evaluate surface areas and volumes of revolutions. Double integrals, Change of order of integration, Triple integrals, Change of variables in integrals, Applications: areas and volumes, Centre of mass and Gravity (constant and variable densities).

UNIT-II: Vector Integral Calculus:

Line, Surface and Volume integrals, Green's theorem in a plane, Gauss's divergence theorem and Stoke's theorem (without proof).

First Order Ordinary Differential Equations: Exact first order differential equations , Integrating factors, Linear first order equations , Bernoulli's, Riccati's and Clairaut's differential equations ,Orthogonal trajectories of a given family of curves.

UNIT-III: Ordinarydifferential equations of higher orders:
Solutions of higher order linear equations with constants coefficients, Method of variation of parameters, solution of Euler-Cauchy equation. Ordinary point, singular point and regular singular point, Power Series solution. Legendre Polynomial of first kind (without proof), Rodrigues formula, Generating function, recurrence relations, orthogonality of Legendre polynomials, Bessel's function of first kind (without proof), recurrence relations and problems.

UNIT-IV: Complex Variables –I :
Differentiation, analytic functions, Cauchy-Riemann equations, harmonic functions, finding harmonic conjugate, elementary analytic functions (exponential, trigonometric, logarithm) and their properties; Conformal mappings, Mobius transformations and their properties. Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof),

UNIT-V: Complex Variables – II:
Liouville's theorem and Maximum-Modulus theorem (without proof); Taylor's series, Laurent's series, zeros of analytic functions, singularities, Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine. Improper real integrals with singular points on the upper half plane.

Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

Suggested Reading:

1. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
2. R.K. Jain, S.R.K. Iyengar, Advanced engineering mathematics Narosa Publications,5th edition,2016.
3. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.

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18PY C01

OPTICS AND SEMICONDUCTOR PHYSICS
(for CSE, ECE & IT)

Instruction:	3L+1T Hours per Week
Duration of Semester End Examination:	3 Hours
Semester End Examination:	70 Marks
Continuous Internal Evaluation:	30 Marks
Credits:	4

Course Objectives:

The objectives of the course is to make the student

1. Understands the fundamentals of wave nature of light.
2. Acquires knowledge of lasers.
3. Familiar with Quantum Mechanics.
4. Learns the fundamental concepts of solids.
5. Understands the basics of semiconductors.

Course Outcomes:

At the end of the course, the student will be able to

1. Demonstrate the wave nature of the light.
2. Describe the types of lasers and their applications.
3. Explain the importance of wave mechanics.
4. Demonstrate the importance of band theory of solids.
5. Identify the semiconductors for engineering applications.

UNIT-I : Wave optics:

Huygens' principle, superposition of waves and interference of light by wave front splitting and amplitude splitting; Young's double slit experiment, Newton's rings, Michelson interferometer. Farunhofer diffraction from a single slit and a circular aperture, the Rayleigh criterion for limit of resolution and its application to vision; Diffraction gratings and their resolving power.

UNIT- II : Lasers:

Einstein's theory of matter radiation interaction and A and B coefficients; amplification of light by population inversion, different types of lasers: gas lasers (He-Ne, CO2), solid-state lasers (ruby, Neodymium), dye lasers; Properties of laser beams: mono-chromaticity, coherence, directionality and brightness, laser speckles, applications of lasers in science, engineering and medicine.

UNIT- III : Wave nature of particles and the Schrodinger equation:

Introduction to Quantum mechanics, Wave nature of Particles, Time-dependent and timeindependent Schrodinger equation for wavefunction, Born interpretation, probability current, Expectation values, Free-particle wavefunction and wave-packets, Uncertainty principle.

UNIT – IV: Introduction to Solids:

Free electron theory of metals, Fermi level, density of states, Application to white dwarfs and neutron stars, Bloch's theorem for particles in a periodic potential, Kronig-Penney model, Scattering from a potential barrier and tunneling; related examples like alpha-decay, field-ionization and scanning tunneling microscope.

UNIT- V :Semiconductors:

Intrinsic and extrinsic semiconductors, Dependence of Fermi level on carrier-concentration and temperature (equilibrium carrier statistics), Carrier generation and recombination, Carrier transport: diffusion and drift, p-n junction, Metal-semiconductor junction (Ohmic and Schottky), Thermistor, Hall effect, LED, Solar cell.

TEXT BOOKS:

1. B.K. Pandey and S. Chaturvedi, *Engineering Physics*, Cengage Publications, 2012.
2. M.N. Avadhanulu and P.G. Kshirsagar, *A Text BookEngineering Physics*, S. Chand Publications, 2014.
3. M. Arumugam, *Materials Science*, Anuradha Publications, 2015.
4. S.L. Gupta and Sanjeev Gupta, *Modern Engineering Physics*, Dhanpat Rai Publications, 2011.

SUGGESTD READING:

1. R. Murugeshan and Kiruthiga Sivaprasath, *Modern Physics*, S. Chand Publications S. Chand Publications, 2014.
2. V. Rajendran, *Engineering Physics*, McGahill Education Publications, 2013.
3. P.K. Palanisamy, *Engineering Physics*, Scitech Publications, 2012.
4. V. Raghavan, *Materials Science and Engineering*, Prentice Hall India Learning Private Limited; 6th Revised edition, 2015.

18CS C01

Programming for Problem Solving
(Common to All Programs)

Instruction	3 Periods per week
Duration of Semester-End Examination	3 Hours
Semester-End Examination	70 Marks
Sessional	30 Marks
Credits	3

Course Objectives

1. Identification of computer components, Operating environments, IDEs.
2. Understanding the steps in problem solving and formulation of algorithms to problems.
3. Develop programming skills as an means of implementing an algorithmic solution with appropriate control anddata structures.
4. Develop intuition to enable students to come up with creative approaches to problems.
5. Manipulation of text data using files.

Course Outcomes: At the end of the course, students will be able to:

1. Identify the computing environments.
2. Formulate solutions to problems and represent them using algorithms/ Flowcharts.
3. Choose proper control statements and data structures to implement the algorithms.
4. Trace the programs with test the program solution.
5. Decompose a problem into modules and use functions to implement the modules.
6. Develop applications using file I/O.

UNIT -I

Introduction to computers and Problem Solving: Components of a computer, Operating system, compilers, Program Development Environments, steps to solve problems, Algorithm, Flowchart / Pseudocode with examples.

Introduction to programming: Programming languages and generations, categorization of high level languages.

Introduction to C: Introduction, structure of C program, keywords, identifiers, Variables, constants, I/O statements, operators, precedence and associativity.

UNIT – II

Introduction to decision control statements: Selective, looping and nested statements.

Functions: Introduction, uses of functions, Function definition, declaration, passing parameters to functions, recursion, scope of variables and storage classes.

Case study:

UNIT – III

Arrays: Introduction, declaration of arrays, accessing and storage of array elements, 1-dimensional array, Searching (linear and binary search algorithms) and sorting(selection and Buble) algorithms, 2-D arrays, matrix operations.

Strings: Introduction, stringsrepresentation, string operations with examples.

Case study:

UNIT – IV

Pointers: Understanding computer’s memory, introduction to pointers, declaration pointer variables, pointer arithmetic, pointers and strings, array of pointers, function pointers, array of function pointers, dynamic memory allocation, advantages and drawbacks of pointers.

Structures: Structure definition, initialization and accessing the members of a structure, nested structures, structures and functions, self- referential structures, unions and enumerated data types.

UNIT-V

Files: Introduction to files, file operations, reading data from files, writing data to files, error handing during file operations.

Preprocessor Directives: Types of preprocessor directives, examples.

Suggested Reading:

1. A K Sharma “**Computer Fundamentals and Programming**”, 2nd Edition, University Press, 2018.
2. PradeepDey and Manas Ghosh, “**Programming in C”**, Oxford Press, 2nd Edition, 2017.

References:

1. Byron Gottfried, Schaum’s”**Outline of Programming with C**”, McGraw-Hill.
2. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India.
3. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill.
4. ReemaTharaja “**Introduction to C Programming**”, Second Edition, OXFORD Press,2015.
5. https://www.tutorialspoint.com/cprogramming/index.htm.
6. https://onlinecourses.nptel.ac.in/noc18-cs10/preview.

18EG C01

ENGLISH

(Common to all branches)

Instruction	2Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation:	20 Marks
Credits	2

Course Objectives:

1. To enable the students to understand the role and importance of communication and to develop their basic communication skills in English.
2. To equip the students with basics of writing correct sentences to coherent paragraphs.
3. To equip the students with techniques of writing a précis and an essay by using accurate grammar and appropriate vocabulary.
4. To train the students to describe, define and classify processes and to draft formal reports by adhering to the proper structure.
5. To develop the reading skills and reading comprehension techniques of the students.
6. To develop the students reading, writing, grammatical, lexical and communicative competence.

Course Outcomes:

1. The students will understand the nature, process and types of communication and will communicate effectively without barriers.
2. The students will write correct sentences and coherent paragraphs.
3. The students will know how to condense passages by writing précis and write essays by using accurate grammar and appropriate vocabulary.
4. The students will demonstrate advanced writing skills by drafting formal reports.
5. The students will apply their reading techniques and analyze reading comprehension passages.
6. The students will become effective communicators and will display their advanced skills of reading and writing and use correct grammar and appropriate vocabulary in all contexts.

UNIT-IUnderstanding Communication in English:

Introduction, nature and importance of communication.Process of communication.Basic types of communication - verbal and non-verbal.Barriers to communication.Intrapersonal and interpersonal communication.Johari Window

Vocabulary & Grammar: The concept of Word Formation. Importance of proper punctuation.Articles.

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UNIT-II Developing Writing Skills I:
Types of sentences.Use of phrases and clauses in sentences.Cohesion and coherence. Paragraph writing. Organizing principles of paragraphs in documents.
Vocabulary & Grammar: Cohesive devices. Root words from foreign languages and their use in English. Prepositions.

UNIT-III Developing Writing Skills II:
Techniques for writing precisely. Précis Writing. Essay Writing.
Vocabulary and Grammar: Subject-verb agreement, Noun-pronoun agreement Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives. Redundancies, Clichés.

UNIT-IVDeveloping Writing Skills III:
Describing, Defining, Classifying, Providing examples or evidence.Writing introduction and conclusion.
Report writing – Importance, structure and elements of style of formal reports.
Vocabulary and Grammar: Misplaced modifiers. Synonyms, antonyms.

UNIT-VDeveloping Reading Skills:
The reading process, purpose, different kinds of texts.Reading comprehension. Techniques of comprehension – skimming, scanning, drawing inferences and conclusions.
Vocabulary and Grammar : Words often Confused. Standard abbreviations

Text Books:

1. Language and Life: A Skills Approach, Board of Editors, Orient Black Swan, 2017.
2. Swan Michael, Practical English Usage.OUP. 1995.

Suggested Readings:

1. Wood F.T,Remedial English Grammar, Macmillan, 2007.
2. Zinsser William,On Writing Well, Harper Resource Book, 2001.
3. Sanjay Kumar and PushpLata,Communication Skills.Oxford University Press, 2011.

18PY C02

OPTICS AND SEMICONDUCTOR PHYSICS LABORATORY
(for CSE, ECE & IT)

Instruction:	3 Hours per Week
Duration of Semester End Examination:	3 Hours
Semester End Examination:	50 Marks
Continuous Internal Evaluation:	25 Marks
Credits:	1.5

Course Objectives:

The objectives of the course is to make the student

1. Apply theoretical physics knowledge in doing experiments.
2. Understand the behavior of the light experimentally.
3. Analyze the behavior of semiconductor materials and optoelectronic devices.

Course Outcomes:

At the end of the course, the student will be able to

1. Understand the concept of errors and find the ways to minimize the errors.
2. Demonstrate interference and diffraction phenomena experimentally.
3. Understand the applications of semiconductor materials.
4. Know the working of optoelectronic devices.
5. Use LCR circuits in different applications.

Experiments:

1. Error analysis - Estimation of errors in the determination of time period of a torsional pendulum.
2. Hall effect – Determination of Hall coefficient, carrier concentration & mobility of charge carriers of given semiconductor specimen.
3. Thermistor – Determination of temperature coefficient of resistance of given thermistor.
4. Solar cell - Study of I-V characteristics of given solar cell and calculation of fill factor, efficiency and series resistance.
5. P-N junction diode – Study of V-I characteristics and calculation of resistance of given diode in forward and reverse bias.
6. Energy gap – Determination of energy gap of given semiconductor.
7. Planck's constant – Determination of Planck's Constant using photo cell.
8. I-V characteristics of LED.
9. Photodiode.
10. Laser – Determination of wavelength of given semiconductor red laser.
11. Newton's rings - Determination of wavelength of given monochromatic source.

12. Diffraction grating – Determination of wavelengths of two yellow lines of mercury light.
13. LCR circuit (Resonance).

SUGGESTED READING:

1. Engineering Physics Manual by Department of Physics, CBIT, 2016.
2. S.K. Gupta, Engineering Physics Practical, Krishna's Educational Publishers, 2014.
3. O.P. Singh, V. Kumar and R.P. Singh, Engineering Physics Practical Manual, Ram Prasad & Sons Publications, 2009.
4. Indu Prakash, Ram Krishna and A.K. Jha, A Text Book of Practical Physics, Kitab Mahal Publications, 2012.

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18CS C02

Programming for Problem Solving
(Programming Lab – I)
(Common to All Programs)

Instruction	4 Periods per week
Duration of Semester-End Examination	3 Hours
Semester-End Examination	50 Marks
Sessional	25 Marks
Credits	2

Course Objectives

1. Setting up programming environment.
2. Develop Programming skills to solve problems.
3. Use of appropriate C programming constructs to implement algorithms.
4. Identification and rectification of coding errors in program.
5. Develop applications in a modular fashion.
6. Manage data using files.

Course Outcomes:

At the end of the course students will be able to:

1. Identify and setup program development environment.
2. Implement the algorithms using C programming language constructs.
3. Identify and rectify the syntax errors and debug program for semantic errors.
4. Analyze the results to evaluate the solutionsof the problems.
5. Solve problems in amodular approach using functions.
6. Implement file operations with simple text data.

Lab experiments

1. Familiarization with programming environment.
2. Simple computational problems using arithmetic expressions.
3. Problems involving if-then-else structures.
4. Iterative problems e.g., sum of series.
5. 1D Array manipulation.
6. 2D arrays and strings.
7. Matrix problems, String operations.
8. Simple functions.
9. Recursive functions.
10. Pointers and structures.
11. Dynamic memory allocation and error handling.
12. File handling:

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Design the experiments in such a way that the students will be able to end up the solution for a real world problem that uses most of the concepts of C programming language. For example: A banking application where it uses the concepts of operators, control structures, switch case for menu, structures, functions, error handling, files etc.

Suggested Reading:

1. Pradeep Dey and Manas Ghosh, "**Programming in C"**, Oxford Press, 2nd Edition, 2017.
2. ReemaTharaja "**Introduction to C Programming**", Second Edition, OXFORD Press, 2015.

References:

1. https://www.tutorialspoint.com/cprogramming/index.htm
2. https://www.w3resource.com/c-programming/programming-in-c.php
3. https://www.w3schools.in/c-tutorial/

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18ME C02

WORKSHOP/ MANUFACTURING PRACTICE

Instruction	1T+4P Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation:	25 Marks
Credits	3

Course Objectives:

1. Give a feel of Engineering Practices & develop holistic understanding of various Engineering materials and Manufacturing processes.
2. Develop skills of manufacturing, safety, precision, quality, intelligent effort, optimization, positive & team work attitude to get things right the first time.
3. To provide basic knowledge of Steel, Plastic, Composite and other materials for suitable applications.
4. Study of Principle and hands on practice on techniques of fabrication, welding, casting, manufacturing, metrology, and allied skills.
5. To advance important hard & pertinent soft skills, productivity, create skilled manpower which is cognizant of industrial workshop components and processes and can communicate their work in a technical, clear and effective way.
6. Engineering Skill development with regard to making components, system integration and assembly to form a useful device.

Course Outcomes – (Laboratory): Student will be able to

1. Fabricate components with their own hands.
2. Get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.
3. Assembling different components, student will be able to produce small mechanisms/devices of their interest.
4. Gain practical skills of carpentry, tinsmithy, fitting, house wiring.
5. Gain knowledge of different Engineering Materials and Manufacturing Methods.
6. Understand trades and techniques used in Workshop and chooses the best material/ manufacturing process for the application.

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18EG C02

ENGLISH LAB

(Common to all branches)

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	35 Marks
Continuous Internal Evaluation:	15 Marks
Credits	1

Course Objectives:

1. To introduce students to phonetics and the different sounds in English.
2. To familiarize the students with the software and give them sufficient practice in correct pronunciation.
3. To enable students to speak English correctly with focus on stress and intonation.
4. The students will enhance their listening skills by practicing IELTS and TOEFL material.
5. To help students overcome their inhibitions while speaking in English and to build their confidence. The focus shall be on fluency rather than accuracy.
6. To help students to understand team work, role behavior and to develop their ability to discuss in groups and make oral presentations.

Course Outcomes:

1. The students will differentiate the speech sounds in English.
2. The students will interact with the software and understand the nuances of pronunciation in English.
3. The students will speak with the proper tone, intonation and rhythm and apply stress correctly.
4. The students will demonstrate their listening skills by analyzing the IELTS and TOEFL listening comprehension texts.
5. The students will speak with clarity and confidence.
6. The students will work in teams and discuss various topics and demonstrate their presentation skills through posters.

Exercises

1. **Introduction to English Phonetics**: Introduction to auditory, acoustic and articulatory phonetics, organs of speech: the respiratory, articulatory and phonatory systems.
2. **Sound system of English**: Phonetic sounds and phonemic sounds, introduction to international phonetic alphabet, classification and description of English phonemic sounds, minimal pairs. The syllable: types of syllables, consonant clusters.
3. **Word stress**: Primary stress, secondary stress, functional stress, rules of word stress.

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4. **Rhythm &Intonation** : Introduction to Rhythm and Intonation. Major patterns, intonation of English with the semantic implications.
5. **Listening skills** – practice with IELTS and TOEFL material
6. **Situational dialogues and role play –** Dialogue writing, **–** Role behavior and role enactment.
7. **Group Discussions -** Dynamics of a group discussion, group discussion techniques, body language.
8. **Public speaking –** Speaking with confidence and clarity in different contexts on various issues.
9. **Poster presentation –** Theme, poster preparation, team work and presentation.

Suggested Reading

1. T Balasubramanian. A Textbook of English Phonetics for Indian Students, Macmillan, 2008.
2. J Sethi et al. A Practical Course in English Pronunciation (with CD), Prentice Hall India, 2005.
3. PriyadarshiPatnaik. Group Discussions and Interviews, Cambridge University Press Pvt Ltd 2011.
4. ArunaKoneru, Professional Speaking Skills, Oxford University Press, 2016.

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18MT C07

APPLIED MATHEMATICS
(For ECE and EEE)

Instruction	3 L+1T Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	4

Course Objectives: This course aims to:

1. Form PDE and solve Linear and Non-Linear equations.
2. Learn the Laplace, Inverse Laplace Transform and Z-Transforms.
3. Find roots of equations, interpolation and Numerical differentiation.
4. Learn Numerical solution of ODE and Engineering problems.
5. Learn fitting of distribution and predicting the future values.

Course Outcomes: On successful completion of this course the students shall be able to:

1. Understand the methods to find solution of linear and non-linear PDE and solution of wave equation.
2. Find Laplace, Inverse Laplace and Z-Transforms and solution of engineering problems.
3. Solve Non-Linear algebraic and transcendental equations to find interpolations when tabular values are given.
4. Find solution of initial value problems of ODE.
5. Understand the Methods for analysing the random fluctuations using probability distribution and also identify the importance of principle of Least squares approximations for predictions.

UNIT-I

Partial Differential Equations: Formation of Partial Differential Equations, Solution of Linear (Lagrange's) and Non-linear PDE of First order standard forms and Charpit's Method, Solutions of PDE by method of separation of variables, solution of one dimensional wave equation and its applications.

UNIT-II

Transform Theory: Laplace Transform, Properties of Laplace Transform, Laplace transform of periodic functions. Finding inverse Laplace transform by partial fractions and residue method, solving ODEs by Laplace Transform method.Z-transforms and its basic properties, inverse Z-transform and solutions of difference equation by Z-transform.

UNIT-III

Numerical Analysis: Solution of Algebraic and transcendental equations by Bisection method, Newton-Raphson method and Regula-Falsi method. Interpolation, Newton's forward and backward difference formulae.Newton's divided difference and Lagrange's formulae.Numerical Differentiation.

UNIT-IV

Numerical Solutions of ODE: Solutions of First Order Ordinary differential equations, Taylor's series, Euler and modified Euler's methods. Runge-Kutta method of fourth order for solving first and second order equations. Milne's and Adam's predicator corrector methods

UNIT-V

Basic Statistics: Measures of Central tendency for continuous random variable, Moments, skewness and Kurtosis, Probability distributions: Normal (Gaussian), Rayleigh, Exponential and uniform distributions Correlation and regression. Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas.

Text Books:

1. P. Kandasamy, K. Thilagavathy, K. Gunavathi, "Numerical Methods", S. Chand & Company, 2nd Edition, Reprint 2012.
2. S.S. Sastry, "Introductory methods of numerical analysis", PHI, 4th Edition, 2005.
3. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 35th Edition, 2010.
4. Sheldon Ross, "A First Course in Probability", 9th Edition, Pearson publications, 2014.

Suggested Reading:

1. Erwin Kreyszig, "Advanced Engineering Mathematics", 9th Edition, John Wiley & Sons, 2006.
2. Veerarajan T, "Engineering Mathematics", Tata McGraw-Hill, New Delhi, 2008.
3. S.C.Gupta, V.K.Kappoor, "Fundamentals of Mathematical Statistics", Sultan Chand and Sons, 2014.

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18CS C05

BASICS OF DATA STRUCTURES

(Common to all Programs except CSE & IT)

Instruction	2 L Hours per Week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	20 Marks
Credits	2

Pre-requisite: Basic knowledge of programming language such as C or C++ is preferred (but not mandatory) and some mathematical maturity also will be expected.

Course Objectives: This course aims to:

1. Basic linear and non-linear data structures.
2. Analyzing the performance of operations on data structures.
3. Different sorting and searching techniques and their complexities.

Course Outcomes: Upon completion of this course, the student will be able to:

1. Understand the basic concepts of data structures.
2. Understand the notations used to analyze the performance of algorithms.
3. Choose and apply an appropriate data structure for a specified application.
4. Understand the concepts of recursion and its applications in problem solving.
5. Demonstrate a thorough understanding of searching and sorting algorithms.

UNIT-I

Introduction: Data Types, Data structures, Types of Data Structures, Operations, ADTs, Algorithms, Comparison of Algorithms, Complexity, Time- space tradeoff. **Recursion**: Introduction, format of recursive functions, recursion Vs. Iteration, examples.

UNIT-II

Linked Lists: Introduction, Linked lists and types, Representation of linked list, operations on linked list, Comparison of Linked Lists with Arrays and Dynamic Arrays.

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UNIT-III

Stacks and Queues: Introduction to stacks, applications of stacks, implementation and comparison of stack implementations. Introduction to queues, applications of queues and implementations, Priority Queues and applications.

UNIT-IV

Trees: Definitions and Concepts, Operations on Binary Trees, Representation of binary tree, Conversion of General Trees to Binary Trees, Representations of Trees, Tree Traversals, Binary search Tree.

UNIT-V

Graphs: Introduction, Applications of graphs, Graph representations, graph traversals, Minimal Spanning Trees. **Searching and Sorting**: Linear searching, binary Searching, sorting algorithms- bubble sort, selection sort, quick sort, heap sort.

Text Books:

1. Narasimha karumanchi, Data Structures and Algorithms Made Easy, CareerMonk Publications, 2017
2. S. Sahni and Susan Anderson-Freed, Fundamentals of Data structures in C,E.Horowitz, Universities Press, 2nd Edition.
3. ReemaThareja, Data Structures using C, Oxford University Press.

Suggested Reading:

1. D.S.Kushwaha and A.K.Misra, Data structures A Programming Approach with C, PHI.
2. Seymour Lipschutz, Data Structures with C, Schaums Outlines, Kindle Edition

Online Resources:

1. https://www.tutorialspoint.com/data_structures_algorithms/index.htm
2. https://www.edx.org/course/foundations-of-data-structures
3. https://sites.google.com/site/merasemester/data-structures/data-structures-1#DS

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18EC C01

ELECTROMAGNETIC THEORY AND TRANSMISSION LINES

Instruction	3 LHours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Students should have prior knowledge about circuit theory, coordinate systems and vector calculus.

Course Objectives: This course aims to:

1. The mathematical fundamentals necessary for understanding the electromagnetic theory.
2. The electrostatics and magnetics along with Maxwell's equations for EM Waves.
3. The concepts of transmission lines

Course Outcomes: Upon completion of this course, students will be able to:

1. Comprehend mathematically the coordinate systems and solve simple static Electromagnetic problems using various laws and theorems.
2. Understand Maxwell's equations in different forms (differential and integral) and apply them to diverse engineering problems.
3. Demonstrate the Electromagnetic wave properties with respect to different transmission mediums.
4. Predict the behavior of reflection and refraction of the waves in different mediums.
5. Estimate the transmission line properties, reflection and matching concepts.

UNIT-I

Review of coordinate systems, Coulomb's Law, Electric field, Electric flux, flux density and Gauss Law. Potential and Potential gradient.Laplace's and Poisson's equations.Current, Current Density and Continuity of current equation.

UNIT-II

Biot-Savart's law, Ampere's law, Magnetic flux and Magnetic flux density. Gauss law for magnetic fields, Vector magnetic potential. Boundary conditions.Time varying fields, Maxwell equations: Integral form and Point form.

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UNIT-III

Wave equations, Uniform plane waves in lossy and lossless medium. Skin Depth, Polarization, Instantaneous and average Poynting theorem and its applications. Reflection and Refraction of Plane Waves - Normal and Oblique Incidence for perfect Conductor and perfect Dielectrics, Brewster Angle, Critical Angle and Total Internal Reflection.

UNIT-IV

Transmission Lines - I: Types, Parameters, Transmission Line Equations, Primary and Secondary Constants, Characteristics Impedance, Propagation Constant, Phase and Group Velocities, Infinite Line. Impedance at any point on the transmission line.

UNIT-V

Transmission Lines - II: RF and UHF Lines, Open and short circuit lines and their significance. Properties of ë/2, ë/4 and ë/8 Lines. Distortion and distortion less transmission line, Concept of loading of a transmission line, Campbell's formula. Reflection and VSWR. Matching: Quarter wave transformer, Single Stub matching. Smith chart and its applications.

Text Books:

1. Matthew N.O. Sadiku, "Elements of Electromagnetics", 7th edition, Newyork Oxford University Press, 2018.
2. William H. Hayt Jr. and John A. Buck, "Engineering Electromagnetics", 8th edition, TMH, 2016.
3. E.C. Jordan and K.G. Balmain, "Electromagnetic Waves and Radiating Systems", 2nd edition, PHI, 2000.

Suggested Reading:

1. John D. Ryder, "Networks Lines and Fields", 2nd edition,PHI, 2015.
2. R.K. Shevgaonkar, "Electromagnetics Waves", Tata McGraw Hill India, 2005.

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18EC C02

ELECTRONIC DEVICES

Instruction	3 LHours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Students should have the knowledge of semiconductor fundamentals.

Course Objectives: This course aims to:

1. The concepts of semiconductor devices like PN junction diode, Transistor, and special diodes.
2. The applications of diodes.
3. The various configurations, characteristics of transistors – BJT, JFET & MOSFET.

Course Outcomes: Upon completion of this course, students will be able to:

1. Recall the elementary concepts of diode and relate them to special devices. Students will also be able to define the working principles of BJT, FET
2. Classify and relate the performance of different types of rectifiers. Students will be able to compare and contrast the biasing techniques, different configurations, characteristics of BJT & FET
3. Examine different non-linear wave shaping circuits and draw an inference for their outputs. Students will be able to distinguish different types of rectifying circuits and amplifier circuits and their performance parameters.
4. Choose the best configuration for the specifications.
5. Understand the flow of IC fabrication.

UNIT – I

Semiconductor Diode Characteristics: The p-n junction Diode, Energy band diagram, Current equations, I-V characteristics, Temperature dependence, Diode resistance, Transition capacitance, Diffusion capacitance, Zener diode - Regulator, Schottky diode.

UNIT – II

Diode Applications: Diode as a circuit element, Clipping and Clamping circuits, Clamping circuit theorem. Half wave, Full wave and Bridge Rectifiers - their

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operation, performance characteristics- ripple factor calculations, and analysis; Filters (L, C, LC and CLC filters).

UNIT – III

Bipolar Junction Transistor: Construction and Operation of NPN and PNP transistor, current components and current flow in BJT, Modes of transistor operation, Early effect, BJT input and output characteristics of CB, CE,CC configuration- h-parameters.

UNIT – IV

Field Effect Transistor:Junction Field Effect Transistor: The Pinch-off Voltage V_p, V-I characteristics of JFET.

MOSFETs: Enhancement & Depletion mode MOSFETs, V-I characteristics, MOSFET as resistance, Small signal models of MOS transistor, Biasing of MOSFETs, MOSFET as a switch.

UNIT – V

Elementary treatment of SCR- UJT- Diac- Triac - Tunnel diode.LED, Photodiode, Solar cell.Introduction to Integrated circuit fabrication process: Oxidation, Diffusion, Ion implantation, Photolithography, Etching, Metallization, Twin-tub CMOS process.

Text Books:

1. Millman and Halkias, " Electronic Devices and Circuits" 2nd Edition, McGraw Hill Publication, 2007.
2. Robert L. Boylestad, "Electronic Devices and Circuit Theory", 10th Edition, PHI, 2009.
3. S.K. Gandhi, "VLSI Fabrication Principles: Silicon and Gallium Arsenide", Wiley India Pvt. Ltd., New Delhi, 2nd edn. 1994.

Suggested Reading:

1. David Bell, "Fundamentals of Electronic Devices and Circuits", 5th Edition, Oxford University Press 2008.
2. Jacob Millman, Christos Halkias, Chetan Parikh, "Integrated Electronics", 2nd Edition, McGraw Hill Publication, 2009.
3. Christian Piguet, "Low Power CMOS Circuits Technology, Logic Design and CAD Tools" 1st Indian Reprint, CRC Press, 2010.

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18EC C03

NETWORK THEORY

Instruction	3 LHours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Knowledge on Elements of Electrical Engineering.

Course Objectives: This course aims to:

1. Make understand the concepts of Electric Circuits, Network Theorems and the transients.
2. Make understand the concept of steady state and applying phasor analysis to AC circuits and analyzing magnetic coupled circuits.
3. Familiarize resonant circuits, two port network parameters, concept of Passive Filters and Network Synthesis.

Course Outcomes: Upon completion of this course, students will be able to:

1. Understand the basics of electrical circuits with nodal, mesh analysis and network theorems.
2. Apply Laplace Transform for steady state and transient analysis.
3. Analyze the phasor representation for ac circuits and magnetic coupled circuits.
4. Describe resonance circuits, two port network parameters and their interconnections.
5. Synthesize various forms of electrical networks.

UNIT-I

Network Theorems: Network reduction techniques, Super Nodal and Super Mesh Analysis, Superposition, Thevenin's and Norton's theorems.Reciprocity, Maximum Power Transfer, Compensation, Millman's, Duality and Tellegen's Theorems using dependent and independent sources.

UNIT-II

Transients: Introduction, Study of initial conditions, DC transients RL, RC circuits, RLC circuits, Formulation of integral, differential equations. Circuit analysis using Laplace Transform and inverse Laplace Transform, Pole-Zero Plots, Zero Input Response, Zero State Response.

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UNIT-III

Steady State Analysis of AC Circuits: Phasor and vector representations, impedance and admittance, Average power, Apparent Power, Complex Power, Power triangle.

Coupled circuits: Concept of self, mutual inductance, co-efficient of coupling, dot convention rules and analysis of simple circuits.

UNIT-IV

Frequency Domain Analysis: Concept of complex frequency, impedance and admittance functions, Series and parallel resonance, Q-factor, selectivity, bandwidth.

Two Port Networks: Z, Y, h, g, ABCD and Inverse ABCD parameters, equivalence of two port networks. Inter connection of two port networks.

UNIT-V

Filters: Introduction to Filters and classification of Filters (Low pass, High pass, Band pass and Band stop) and their design aspects. **Network Synthesis:** Elements of circuit synthesis, Foster and Cauerforms of LC, RC and RL networks.

Text Books:

1. William H.Hayt, Jr.,Jck E. Kemmerly and Steven M.Durbin, "Engineering Circuit Analysis", 8th edition, McGraw Hill, 2013.
2. Vanvalkenberg M.E, "Network analysis", PHI, New Delhi, 3rd Edition 2002.

Suggested Reading:

1. C.L.Wadhwai, "Network Analysis and Synthesis", 4th edition, New Age Publications, 2016.
2. Sudhakar. A. and Shyammohan, S. P., "Circuits and Network", Tata McGraw-Hill New Delhi, 1994.

18EC C04

SIGNALS AND SYSTEMS

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Knowledge of Differential and Integral Calculus.

Course Objectives: This course aims to:

1. Know Signals and systems representation/classification and also the time and frequency domain analysis of continuous time signals with Fourier series, Fourier transforms and Laplace transforms.
2. Understand Sampling, time and frequency domain analysis of discrete time signals with DTFT and Z-Transforms.
3. Understand concepts of convolution and correlation integrals.

Course Outcomes: Upon completion of this course, students will be able to:

1. Define and Classify signals, systems and analyse the signals using Fourier series.
2. Understand signal spectrums and characterize the systems.
3. Assess the system stability, causality using ROC and Pole-Zero Plot.
4. Demonstrate conversion of continuous time signal to discrete time signal and obtain discrete system characteristics using DTFT and Z Transform.
5. Apply the Convolution concept to calculate the output of the system and compare the signals.

UNIT-I

Continuous Time Signals: Introduction to signals, their representations and classification. Introduction to systems and their classifications, Orthogonality of signals, Complete set of mutually orthogonal signals, Harmonic signals.

Signal Representation: Exponential Fourier series, Existence and Convergence. Symmetry conditions, Amplitude and Phase spectra. Power Spectral Density.

UNIT-II

Fourier Transforms: The direct and inverse Fourier transforms, Existence, Frequency spectrum and properties of Fourier Transforms, Fourier Transform of singularity functions and periodic signals. Energy Spectral Density, Filter characteristics of linear systems, Distortion less system, Phase delay and group delay.

UNIT-III

Signal Representation by Generalized Exponentials: The Bilateral and unilateral Laplace transforms. Region of convergence and its properties. Properties of Laplace transform, Inverse Laplace transform, Laplace transform of periodic signals.

LTI System: Impulse response, System transfer function, Stability and Causality.

UNIT-IV

Discrete Time Signals: Sampling of continuous time signals. DTS representation.Discrete Time Fourier Transform and properties.

Z–Transform: The Direct Z-Transform, Region of convergence and its properties. S–Plane and Z–Plane correspondence, Z–Transform properties. Inverse Z–Transform, Discrete LTI system: impulse response and system transfer function. Stability and Causality.

UNIT-V

Convolution: Continuous convolution, Graphical interpretation and its properties. Discrete convolution and its properties.

Correlation: Continuous correlationCross correlation, Auto correlation and properties. Discrete correlationCross correlation, Auto correlation and properties.

Text Books:

1. B.P.Lathi, "Signals, Systems and Communications", BS Publications, 3rd Edition, 2008.
2. Simon Haykin, "Signals and Systems", Wiley India, 5th Edition,2009.

Suggested Reading:

1. Alan V. Oppenheim,Alan S. Willsky,S.HamidNawad, "Signals and Systems", PHI 2nd Edition, 2015.
2. M.J. Robert, "Fundamentals of signals and systems", McGraw Hill, 2008.

18CE M01

ENVIRONMENTAL SCIENCE

Instruction	2 L Hours per Week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	—
Credits	Non Credit

Course Objectives: This course aims to:

1. Identify environmental problems arising due to engineering and technological activities and the science behind those problems.
2. Become aware about the importance of eco system and biodiversity for maintaining ecological balance
3. To identify the importance of interlinking of food chain
4. Learn about various attributes of pollution management and waste management practices.
5. To make the students contribute for capacity building of nation for arresting and/or managing environmental disasters.

Course Outcomes: Upon completion of this course, the student will be able to:

1. To define environment, identify the natural resources and ecosystems and contribute for the conservation of bio-diversity.
2. To suggest suitable remedial measure for the problems of environmental pollution and contribute for the framing of legislation for protection of environment.
3. To relate the social issues and the environment and contribute for the sustainable development.
4. To follow the environmental ethics.
5. To contribute for the mitigation and management of environmental disasters.

UNIT-I

Environmental Studies: Definition, Scope and importance, need for public awareness.

Natural resources: Use and over utilization of Natural Resources - Water resources, Food resources, Forest resources, Mineral resources, Energy resources, Land resources.

UNIT-II

Ecosystems: Concept of an ecosystem, structure and function of an ecosystem, role of producers, consumers and decomposers, energy flow in an ecosystem, food chains, food webs, ecological pyramids, Nutrient cycling, Bio-geo chemical cycles, Terrestrial and Aquatic ecosystems.

UNIT-III

Biodiversity: Genetic, species and ecosystem biodiversity, Bio-geographical classification of India, India as a Mega diversity nation. Values of biodiversity, hot-spots of biodiversity, threats to biodiversity, endangered and endemic species of India, methods of conservation of biodiversity.

UNIT-IV

Environmental Pollution: Cause, effects and control measures of air pollution, water pollution, marine pollution, soil pollution, noise pollution and Solid waste management, nuclear hazards

Environmental Legislations: Environment protection Act, Air, Water, Forest & Wild life Acts, issues involved in enforcement of environmental legislation, responsibilities of state and central pollution control boards

UNIT-V

Social Issues and The Environment: Water conservation methods: Rain water harvesting and watershed management, Environmental ethics, Sustainable development and Climate change: Global warming, Ozone layer depletion, forest fires, and Contemporary issues.

Text Books:

1. Y. Anjaneyulu, "Introduction to Environmental Science", B S Publications, 2004.
2. Suresh K. Dhameja, "Environmental Studies", S. K. Kataria& Sons, 2009.

Suggested Reading:

1. C. S. Rao, "Environmental Pollution Control Engineering", Wiley, 1991.
2. S. S. Dara, "A Text Book of Environmental Chemistry &Pollution Control", S. Chand Limited, 2006.

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18CS C06

BASICS OF DATA STRUCTURES LAB

(Common to all Programs except CSE & IT)

Instruction	2 P Hours per Week
Duration of SEE	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Pre-requisite: Knowledge on any Programming Language (C)

Course Objectives: This course aims to:

1. Design and construct simple programs by using the concepts of Data structures as abstract data type.
2. To have a broad idea about how efficiently pointers can be used in the implement of data structures.
3. To enhance programming skills and strengthen practical ability to apply suitable data structure for real time applications.

Course Outcomes: Upon completion of this course, the student will be able to:

1. Implement the abstract data type.
2. Implement linear data structures such as stacks, queues using array and linked list.
3. Understand and implement non-linear data structures such as trees, graphs and its traversal techniques.
4. Implement various kinds of searching, sorting techniques.
5. Develop the suitable data structure for real world problem.

List of Experiments

1. Implementation of operations on arrays.
2. Implementation of Stack.
3. Implementation of Queue.
4. Implementation of basic operations on Single Linked List.
5. Implementation of Searching techniques.
6. Implementation of Sorting techniques.
7. Case study like Banking System, Students Marks Management, Canteen Management etc.

Text Books:

1. Brian W Kernighan, Dennis Ritchie, C Programming Language, PH PTR, 2nd Edition.
2. Richard M Reese, Understanding and Using C Pointers, O'Reily, 2013.

Online Resources:

https://nptel.ac.in/courses/106102064/

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18EC C05

ELECTRONIC DEVICES LAB

Instruction	2 P Hours per Week
Duration of SEE	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Prerequisite: Students have the knowledge of semiconductor fundamentals.

Course Objectives: This course aims to:

1. Know V-I characteristics of diodes and special semiconductor devices.
2. Design and performance evaluation of various diodes as rectifiers.
3. Understand the characteristics of transistor in various configurations.

Course Outcomes: Upon completion of this course, students will be able to:

1. Recall the elementary concepts of diode, BJT, FET.
2. Classify and relate the performance of different types of rectifiers. Compare and contrast different configurations and characteristics of BJT & FET.
3. Distinguish different types of rectifying circuits and their performance parameters.
4. Choose the best configuration for the specifications provided.
5. Understand the behavior of various special diodes.

List of Experiments:

1. V-I Characteristics of Silicon and Germanium diodes and measurement of static and dynamic resistances.
2. Zener diode characteristics and its application as voltage regulator.
3. Clipping and Clamping Circuits.
4. Design, realization and performance evaluation of half wave rectifiers without filters and with C & ð section filters.
5. Design, realization and performance evaluation of full wave rectifiers without filters and with C & ð section filters.
6. Plotting the characteristics of BJT in Common Base configuration and measurement of h-parameters.
7. Plotting the characteristics of BJT in Common Emitter configuration and measurement of h-parameters.
8. Plotting the characteristics of BJT in Common Collector configuration and measurement of h-parameters.

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9. Plotting the characteristics of JFET in CS configurations and measurement of Transconductance and Drain resistance.
10. Characteristics of special semi-conductor devices-UJT and SCR.
11. Characteristics of LED and photo diode.
12. Characteristics of Tunnel diode.

Note: Wherever possible, Analysis and design of circuits shall be carried out using simulation tools.

Suggested Reading:

1. Robert Diffenderfer, “Electronic Devices Systems and Applications”, Cengage Learning India Private Limited,2010.
2. Paul B. Zbar, Albert P. Malvino, Michael A. Miller, “Basic Electronics, A Text - Lab Manual”, 7th Edition, TMH 2001.
3. Mahesh Jain, “Practical semiconductors data manual No.3”, BPB Publications, 1981.
4. Bharath electronics ltd, “Semiconductors data manual”, IEC Publication 134, 1969.

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18EC C06

ELECTRONIC WORKSHOP AND NETWORKS LAB

Instruction	2 P Hours per Week
Duration of SEE	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Prerequisite: Knowledge of **b**asic Electrical components, circuits and equipment.

Course Objectives: This course aims to:

1. Understand the basic Concepts of Electric Circuits and equipment like CRO, Multimeter and LCR –Q meter
2. Verify network theorems.
3. Analyse Resonant circuits, Attenuators and passive filters.

Course Outcomes: Upon completion of this course, students will be able to:

1. Measure R, L, C components using electronic equipment.
2. Analyse DC, AC circuits and verify network theorems.
3. Determinethe two port network parameters.
4. Design and verification of attenuators and filters.
5. Simulate different circuits using the simulation software.

EXPERIMENTS LIST

1. Study of RLC components, Bread board, Regulated power supply, Function generator, CRO
2. Measurement of R, L, C components using colour code, multimeter and LCR - Q Meter.
3. Practice of Soldering and de-soldering for simple circuits.
4. Verification of Superposition theorem and Tellegen's theorem.
5. Verification of Maximum power transfer theorem.
6. Verification of Reciprocity theorem.
7. Verification of Compensation theorem andMillman'stheorem.
8. Verification of Transient Response in RC, RL circuits.
9. Design and Verification of Series Resonance.
10. Design and Verification of Parallel Resonance.
11. Determination of two-port network parameters (Z,Y,h,T).
12. Design and Verification of Attenuators.
13. Design andVerification of Constant-K high-pass filter.
14. Design andVerification of Constant-K low-pass filter.

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Note: Experiments are to be simulated by using any simulation software.

Suggested Reading:

1. Thomas Petruzzellis, "Build Your Own Electronics Workshop", McGraw-Hill Companies, Inc., 2005.
2. A.M. Zungeru, J.M. Chuma, M. Mangwala , L.K. Ketshabetswe, "Handbook of Laboratory Experiments in Electronics and Communication Engineering" Vol. 2, 1st Edition, Notion press, 2017.

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18EG C03

SOFT SKILLS

Instruction	2 P Hours per Week
Duration of SEE	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Course Objectives: This course aims to:

1. Imbibe an impressive personality, etiquette, professional ethics & values, effective time management & goal setting.
2. Understand the elements of professional update & upgrade through industry exposure in a mini-live project. Understand confidence building strategies and thereby to make effective presentations through PPTs.
3. Learn what constitutes proper grooming and etiquette in a professional environment. Acquire the necessary skills to make a smooth transition from campus to corporate.

Course Outcomes: Upon completion of this course, the student will be able to:

1. Be assertive and set short term and long term goals. Also learn to manage time effectively and deal with stress.
2. Win in professional communication situations and participate in group discussions with confidence. Write abstracts.
3. Write effective resumes. Plan, prepare and face interviews confidently.
4. Adapt to corporate culture by being sensitive - personally and sensible - professionally. Draft an SOP.
5. Apply the soft skills learnt in the mini-live project, by collecting and analyzing data and making oral and written presentations on the same.

Exercise 1

Main Topics: Thinking Skills, Personality Development – Effective Time Management, setting realistic goals, self-confidence and assertiveness, stress management, moral values.
Flipped Sessions: Personal Sensitivity & Professional Sensibility (Reading & Discussion)
Writing Input: Writing to Express - Drafting & Delivering a Speech (Free Writing Exercise)

Exercise 2

Main Topics: Advanced Group Discussion with Case studies : Dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and coherence.

Flipped Sessions: Importance of Professional Updating & Upgrading (Reading & Discussions)
Writing Input: Writing with Precision - Writing Abstracts

Exercise 3

Main Topics: Interview Skills – concept and process, pre-interview planning, opening strategies, answering strategies, mock interviews. Resume' writing – structure and presentation, planning, defining the career objective, projecting ones strengths and skills.
Flipped Sessions: Mock Interviews (Video Sessions &Practice)
Writing Input: Writing to Reflect - Resume Writing

Exercise 4

Main Topic: Corporate Culture – Grooming and etiquette, communication media, academic ethics and integrity
Flipped Sessions: Corporate Culture, Etiquette & Grooming (Video Sessions & Practice through Role-play)
Writing Input: Writing to Define - Writing an effective SOP.

Exercise 5

Main Topic: Mini Project – General/Technical. Research, developing a questionnaire, data collection, analysis, written report and project seminar.Elements & Structure of effective presentation. Presentation tools – Body language, Eye-contact, Props & PPT.
Flipped Sessions: Effective Presentations (Video & Writing Sessions, Practice through Emulation)
Writing Input: Writing to Record - Writing minutes of meeting.

Suggested Reading:

1. Madhavi Apte , "A Course in English communication", Prentice-Hall of India, 2007
2. Dr. Shalini Verma, "Body Language- Your Success Mantra", S Chand, 2006
3. Ramesh, Gopalswamy, and Mahadevan Ramesh, "The ACE of Soft Skills", New Delhi: Pearson, 2010
4. Van Emden, Joan, and Lucinda Becker, "Presentation Skills for Students", New York: Palgrave Macmillan, 2004

* Flipped Class-room: Students explore the concept first and then trainer explains it, students work on their own.

Web Resources:

1. https://www.goskills.com/Soft-Skills
2. https://www.trainerbubble.com
3. https://www.skillsconverged.com

18EC C07

ANALOG CIRCUITS

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Student should have knowledge on Electronic Devices and Network Analysis.

Course Objectives: This course aims to:

1. Understand the applications of BJT & FET as a switch and an amplifier.
2. Analysis of BJT & FET in various configurations using small signal equivalent models and their frequency response.
3. Know concept of multistage, feedback amplifiers, multivibrators and power amplifier and their analysis.

Course Outcomes: Upon completion of this course, students will be able to:

1. Define the equivalent model of BJT, FET & MOSFET at low and high frequency.
2. Compare and Contrast different types of Multistage, Feedback, Power amplifiers, Multi-vibrators
3. Apply the concepts of BJT analysis in feedback amplifiers, multistage amplifiers
4. Categorize different types of feedback amplifiers, power amplifiers and Multi-vibrators.
5. Choose the best configuration for the specifications (like conversion efficiency in case power amplifiers, input and output impedance in case feedback amplifiers

UNIT-I

Biasing of Amplifiers: BJT biasing techniques, stability factors, Bias compensation techniques, Thermal runaway, Thermal stability, BJT as an amplifier and as a switch. JFET biasing-zero current drift biasing, biasing of FET, FET as an amplifier and as a switch. Biasing of MOSFETs, MOSFET as a switch.

UNIT-II

Single Stage Amplifiers: Analysis of BJT circuits using h-parameters in various configurations, their comparison (approximate and exact analysis), Millers Theorem and its duality- application circuits, frequency response. Analysis of

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FET circuits using equivalent model for various configurations and their comparison.

UNIT-III

Multi Stage Amplifiers: Multi stage amplifiers: CE-CE, CE-CB, CC-CC, Bootstrap, High frequency equivalent circuit Analysis BJT (f_T, f_a, and gain band-width product), Amplifier Frequency response, Multistage amplifiers: low frequency and High frequency analysis of RC coupled, Transformer coupled and Direct coupled amplifiers with BJT.

UNIT-IV

Feedback Circuits: Feed Back Amplifiers: The feedback concept, General characteristics of negative feedback amplifier, Effect of negative feedback on input and output impedances, Voltage and current, series and shunt feedbacks. Stability considerations.Oscillators: Positive feedback and conditions for sinusoidal oscillations, RC oscillator, LC oscillator, Crystal oscillator, Amplitude and frequency stability of oscillator.

UNIT-V

Large Signal Amplifies and Multivibrators: Large Signal Amplifiers: BJT as large signal audio amplifiers, Classes of operation, Harmonic distortion, power dissipation, efficiency calculations. Push-Pull audio power amplifiers under Class-A, Class-B operations, Heat Sinks.Analysis of Transistor Multivibrators: Bistable, Monostable and Astable circuits. Operation of regenerative comparator (Schmitt Trigger).

Text Books:

1. David Bell, "Fundamentals of Electronic Devices and Circuits", 5th Edition, Oxford University Press, 2008.
2. Millman and Halkias, "Electronic Devices and Circuits" 2nd Edition, McGraw Hill Publication, 2007.
3. Jacob MillmanHerbert TaubMillman's, "Pulse, Digital and Switching Waveforms", Third Edition, McGraw Hill Publication, 2017.

Suggested Reading:

1. Jacob Millman, Christos Halkias, Chetan Parikh, "Integrated Electronics", 2nd Edition, McGraw Hill Publication, 2009.
2. Robert L. Boylestad, "Electronic Devices and Circuit Theory", 10th Edition, PHI, 2009.
3. Donald Schilling, Charles Belove, TuviaApelewicz Raymond Saccardi, "Electronic Circuits: Discrete andIntegrated", TMH, 3rd Edition, 2012.

18EC C08

ANALOG COMMUNICATION

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: A prior knowledge of signals and systems is required.

Course Objectives: This course aims to:

1. Introduce the fundamentals of analog communication.
2. Provide the design details of various transmitters and receivers used in analog communication system.
3. Involve the students in analyzing performance of communication system by estimating noise.

Course Outcomes: Upon completion of this course, students will be able to:

1. Understand the need for modulation and various linear modulation schemes.
2. Infer the concepts of various nonlinear modulation schemes.
3. Design various transmitters and receivers.
4. Assess a random signal by computing various statistical properties.
5. Evaluate the performance of analog communication system through the estimation of noise.

UNIT – I

Linear Modulation Schemes: Need for Modulation, Double Side Band Suppressed Carrier Modulation, Balanced Modulator, Coherent Detector and Costas Detector. Conventional Amplitude Modulation, Phasor Diagram of AM, Switching Modulator, Envelope Detector.Hilbert Transform and its Properties.Single Side Band Modulation.Vestigial Side Band Modulation.

UNIT – II

Non-Linear Modulation Schemes: Angle Modulation, Frequency Modulation and Phase modulation, Concept of Instantaneous Phase and Frequency. Types of FM modulation: Narrow Band FM and Wide Band FM. FM Spectrum in Terms of Bessel Functions. Phasor Diagram of NBFM.Direct and Indirect (Armstrong's) methods of FM Generation.Foster–Seeley Discriminator for FM Detection.Introduction toPLL.

UNIT – III

Transmitters and Receivers: High Level and Low Level AM Transmitters. Principle and Operation of Tuned Radio Frequency receiver and Super Heterodyne Receivers.Selection of RF Amplifier.Choice of Intermediate Frequency. Image Frequency and its Rejection Ratio, Receiver Characteristics: Sensitivity, Selectivity, Fidelity. Double Spotting, Tracking and Alignment.Pre-emphasis and De-emphasis.

UNIT – IV

Random Process: Concept of random process, Stationarity and Ergodicity, Auto Correlation and its Properties, Power Spectral Density and its Properties. Linear System with Random inputs: Random Signal Response of Linear System, Auto Correlation of Response.

UNIT – V

Noise: Thermal Noise. White Noise and ColouredNoise.Noise Temperature. Noise in Two-Port Network: Noise Figure, Equivalent Noise Temperature and Noise Bandwidth. Noise Figure and Equivalent Noise Temperature for Cascaded Stages. S/N Ratios and Figure of Merit Calculations for AM, DSB-SC and SSB systems.Pulse Analog Modulation Schemes: Sampling of low Pass and Band Pass Signals. Types of Sampling. Pulse Modulation Schemes: PAM, PWM and PPM.

Text Books:

1. Simon Haykin, "Communication Systems",2nd Edition, WileyIndia,2011.
2. Herbert Taub, Donald L. Shilling and GoutamSaha, "Principles of Communication Systems", 3rd Edition, TMH, 2008.
3. Peyton Z. Peebles JR., "Probability Random Variables and Random Signal Principles", Tata McGrawHill, edition, 4/e, 2002.

Suggested Reading:

1. Singh, R.P. and Sapre, S.D., "Communication Systems", TMH, 2007.

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18EC C09

ANTENNAS AND WAVE PROPAGATION

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Students should have prior knowledge about Electromagnetics theory and Maxwell's equations.

Course Objectives: This course aims to:

1. The basic principles of an antenna and its parameters for characterizing its performance.
2. The fundamental concepts of various types of antennas, arrays for customizing the pattern parameters.
3. The propagation behavior of the radio wave in both troposphere and ionosphere.

Course Outcomes Upon completion of this course, students will be able to:

1. Understand the basic parameters of an antenna.
2. Extend current distribution concept in order to estimate the field patterns.
3. Appraise the concepts of broad side and end fire arrays.
4. Understand the working principle and characteristics of various antennas.
5. Study the behavior of radio waves in various modes of wave propagation.

UNIT-I

Principles of radiation, retarded potential. Isotropic, Directional and Omni-directional radiators.Basic antenna parameters: Radiation patterns, radiation intensity, far field, near field, gain and directivity, Antenna Polarization, effective aperture area and efficiency. Point sources, current distribution, Friis transmission formula.

UNIT-II

Analysis of Infinitesimal dipole, Half-wave dipole, quarter wave monopole, loop antenna and their far field patterns, calculation of radiation resistance and directivity.

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UNIT- III

Concept of Antenna Array. Uniform linear array: Broadside and Endfire arrays and calculation of directivity and beamwidth. Two element array of Infinitesimal dipole.Qualitative treatment of nonlinear arrays: Binomial and Chebyschef arrays

UNIT-IV

Qualitative treatment of Helical Antennas: Normal and Axial mode patterns, wideband characteristics. Characteristics, radiation principles and applications of Rhombic Antenna, Yagi-Udaantenna, pyramidal Horn antenna, Parabolicantenna system, Log-Periodic antenna.Microstrip antennas: Radiation mechanism, different types, advantages and disadvantages. Design of rectangular Microstrip antenna.

UNIT-V

Ground wave propagation, Space and Surface waves, Tropospheric refraction and reflection, Duct propagation.Sky wave propagation: Critical frequency, Maximum Usable Frequency (MUF) and Skip distance, Line of sight propagation.

Text Books:

1. Constantine A. Balanis, “Antenna Theory: Analysis and Design”, 4thEdition, John Wiley, 2016.
2. Edward C. Jordan and Kenneth G. Balmain, “Electromagnetic Waves and Radiating Systems”, 2ndEdition, PHI, 2001.

Suggested Reading:

1. John D. Krauss, Ronald J. Marhefka and Ahmad S. Khan, “Antennas and Wave Propagation”, 4thEdition, TMH, 2010.
2. DennisRoody and John Coolen, “Electronic Communications”, 4th Edition, Prentice Hall, 2008.

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18EC C10

CONTROL SYSTEMS

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: The student is expected to have knowledge of Laplace transform and electrical and electronic circuits.

Course Objectives: This course aims to:

1. Introduce various control systems and their equivalent mathematical models, block diagrams and signal flow graphs.
2. Familiarize students to time response analysis of different systems, frequency domain techniques to assess the stability of a system and different compensators / controllers to control a plant.
3. Introduce students to the concept of state space analysis of control system.

Course Outcomes: Upon completion of this course, students will be able to:

1. Find the transfer function of a system represented by a block diagram and signal flow graph.
2. Evaluate the time domain specifications and steady state error of a system.
3. Investigate stability of the system using different tests.
4. Compare various controllers and compensators.
5. Apply State Space Concept to analyse and design a control system.

UNIT-I

Control System Fundamentals: Classification of control systems, Open and Closed Loop control systems,Block diagram reduction and signal flow graphs, Mathematical modelling of a Mechanical system and conversion into electrical System.

UNIT-II

Time Response Analysis: Transfer function and Impulse Response, Types of Inputs, Transient Response of first and second Order System with different inputs, Time domain Specifications. Types of Systems, static error coefficients, error series, PD, PI and PID controllers.

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UNIT-III

Routh-Hurwitz criteria for stability, Root Locus Techniques, Analysis of typical systems using root locus techniques, Effect of location of roots on system response.

UNIT-IV

Frequency Response Analysis: Frequency domain specifications,Bode plot, Principle of Argument, Nyquist plot and stability criterion, Gain and Phase Margins from the Bode and Nyquist diagrams. Lead and Lag compensators.

UNIT-V

State Space Analysis: Concept of State, StateVariable, State vector and State space. State space representations of linear time invariant systems, State transition matrix, Solution of state equation, Controllability,Observabilityand Design of control systems using state variable feedback.

Text Books:

1. I.J.NagrathandM.Gopal, "Control Systems Engineering", New Age International Publishers, 5/e 2012.
2. Benjamin C. Kuo, "Automatic Control Systems", 7/e, PHI, 2010.

Suggested Reading:

1. K. Ogata, "Modern Control Engineering", EEE, 5/e, PHI, 2003.
2. Richard C. Dorf and Robert H. Bishop, " Modern Control Systems", 11/e Pearson, 2008.
3. GopalMadan, "Digital control engineering" 1/e, New age publishers, 2008.

18EC C11

DIGITAL SYSTEM DESIGN

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Knowledge ofElectronic device concepts.

Course Objectives: This course aims to:

1. Learn various techniques for logic minimization.
2. Comprehend the concepts of various combinational circuits and sequential circuits.
3. Learn the Language fundamentals of Verilog HDL, also able to simulate and synthesizevarious digital modules.

Course Outcomes: Upon completion of this course, students will be able to:

1. The Various switching algebra theorems and minimization of switching functions.
2. The design and analysis of combinational logic circuits
3. Design and analysis of different types of flip-flops and sequential circuits including FSMs.
4. The Design of various combinational and sequential logic circuits using Verilog HDL.
5. The Simulation and synthesis of digital logic design using Verilog HDL.

UNIT-I

Logic Simplification and Combinational Logic Design: Review of Boolean Algebra and De Morgan's Theorem, SOP & POS forms, Canonical forms, Introduction to Logic Gates, Ex-OR, Ex-NOR operations, Minimization of Switching Functions: Karnaugh map method, Quine –McCluskey Tabular Minimization Method. Logic function realization: AND-OR, OR-AND and NAND/ NOR realizations.

UNIT-II

Introduction to Combinational Design: Binary Adders, Subtractors and BCD adder, Code converters Binary to Gray, Gray to Binary, BCD to excess3,BCD to Seven Segment display, Decoders, Encoders, Priority Encoders, Multiplexers, Demultiplexers, Comparators Implementations of Logic Functions using Decoders and Multiplexers

UNIT-III

Sequential Logic Design:Latches,Flipflops,Difference between latch and flipflop, types of flipflops like S-R,D, T JK and Master-Slave JK FF, Edge triggered FF, flipflop conversions,set up and hold times, Ripple and Synchronous counters, Shift registers, Finite state machines, Design of synchronous FSM, Algorithmic State Machines charts. Clock generation.

UNIT-IV

Introduction to HDLs: VLSI Design flow, Basic Concepts of Verilog HDL, Data Types, System Tasks and Compiler Directives. Gate Level Modelling: Gate Types and Gate Delays. Dataflow Modeling: Continuous Assignment and Delays. Design of Stimulus Block.

UNIT-V

Behavioral Modeling: Structured Procedures, Procedural Assignments, Timing control, Conditional statements, Sequential and Parallel Blocks. Switch level Modelling. Introduction to tasks and functions.Design of Mealy and Moore state models using Verilog HDL.Introduction to Logic Synthesis.Concept of Programming using FPGA.

Text Books:

1. Morris Mano M. and Michael D.Ciletti, "Digital Design, With an Introduction to Verilog HDL", 5th edition, Pearson 2013.
2. Samir Palnitkar, "Verilog HDL,A guide to Digital design and synthesis", 2/e , Pearson Education, 2008.

Suggested Reading:

1. R.P. Jain, "Modern digital Electronics", Tata McGraw Hill, 4th edition, 2009.
2. Thomas L. Floyd, "Digital Fundamentals", Pearson, 11th edition, 2015.

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18EG M01

INDIAN CONSTITUTION

Instruction	2 L Hours per Week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	-
Credits	Non credit

Course Objectives: This course aims to:

1. The history of Indian Constitution and how it reflects the social, political and economic perspectives of the Indian society.
2. Address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indiannationalism.
3. Have knowledge of the various Organs of Governance and Local Administration.

Course Outcomes: Upon completion of this course, the student will be able to:

1. Understand the making of the Indian Constitution and its features.
2. Have an insight into various Organs of Governance - composition and functions.
3. Understand powers and functions of Municipalities, Panchayats and Co-operativeSocieties.
4. Be aware of the Emergency Provisions in India.
5. Understand the Right To equality, the Right To freedom and the Right To Liberty.

UNIT-I

Constitution of India - Introduction and salient features .Constitutional history. Directive Principles of State Policy - Its importance and implementation.

UNIT-II

Union Government and its Administration - Structure of the Indian Union: Federalism, distribution of legislative and financial powers between the Union and the States. Parliamentary form of government in India. President: role, power and position.

UNIT-III

Emergency Provisions in India - National emergency, President rule, Financial emergency

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UNIT-IV

Local Self Government - District's Administration Head: Role and Importance. Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation.Panchayati Raj: Introduction, Zilla Panchayat, Elected officials and their roles, CEO Zilla Panchayat: Position and role. Block level: Organizational Hierarchy (Different departments). Village level: Role of Elected and officials.

UNIT-V

Scheme of The Fundamental Rights & Duties: Fundamental Duties - the legal status.
Scheme of The Fundamental Rights - To Equality, to certain Freedom Under Article 19, to Life And Personal Liberty Under Article 21.

Text Books:

1. The Constitution of India, 1950 (Bare Act), GovernmentPublication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar, Framing of Indian Constitution, 1st Edition,2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis,2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis,2015.

Online Resources:

1. http://www.nptel.ac.in/courses/103107084/Script.pdf

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18EE M01

INDIAN TRADITIONAL KNOWLEDGE

Instruction	2 L Hours per Week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	-
Credits	Non credit

Course Objectives: This course aims to:

1. Get a knowledge in Indian Culture
2. Know Indian Languages and Literature and the fine arts in India
3. Explore the Science and Scientists of Medieval and Modern India

Course Outcomes: Upon completion of this course, the student will be able to:

1. Understand philosophy of Indian culture
2. Distinguish the Indian languages and literature
3. Learn the philosophy of ancient, medieval and modern India
4. Acquire the information about the fine arts in India
5. Know the contribution of scientists of different eras.

UNIT-I

Introduction to Culture: Culture, civilization, culture and heritage, general characteristics of culture, importance of culture in human literature, Indian Culture, Ancient India, Medieval India, Modern India

UNIT-II

Indian Languages, Culture and Literature:
Indian Languages and Literature-I: the role of Sanskrit, significance of scriptures to current society, Indian philosophies, other Sanskrit literature, literature of south India.
Indian Languages and Literature-II: Northern Indian languages & literature

UNIT-III

Religion and Philosophy: Religion and Philosophy in ancient India, Religion and Philosophy in Medieval India, Religious Reform Movements in Modern India (selected movements only)

UNIT-IV

Fine Arts in India (Art, Technology& Engineering): Indian Painting, Indian handicrafts, Music, divisions of Indian classic music, modern Indian music,

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Dance and Drama, Indian Architecture (ancient, medieval and modern), Science and Technology in India, development of science in ancient, medieval and modern India

UNIT-V

Education System in India: Education in ancient, medieval and modern India, aims of education, subjects, languages, Science and Scientists of Ancient India, Science and Scientists of Medieval India, Scientists of Modern India

Text Books:

1. Kapil Kapoor, Text and Interpretation: The India Tradition,ISBN: 81246033375, 2005
2. Science in Samskrit, Samskrita Bharti Publisher, ISBN-13: 978-8187276333, 2007
3. S. Narain, Examinations in ancient India, Arya Book Depot, 1993
4. Satya Prakash, Founders of Sciences in Ancient India, Vijay Kumar Publisher, 1989
5. M. Hiriyanna, Essentials of Indian Philosophy, Motilal Banarsidass Publishers, ISBN-13: 978-8120810990, 2014

Suggested Reading:

1. Kapil Kapoor, Language, Linguistics and Literature: The Indian Perspective, ISBN-10: 8171880649, 1994.
2. Karan Singh, A Treasury of Indian Wisdom: An Anthology of Spiritual Learn, ISBN: 978-0143426158, 2016.

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18EC C12

ANALOG CIRCUITS LAB

Instruction	2 P Hours per Week
Duration of SEE	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Prerequisite: Knowledge on Electronic Devices Lab and Electronic Workshop and Networks Lab.

Course Objectives: This course aims to:

1. Design and analysis of Biasing circuits and Power Amplifiers.
2. Know frequency response and behavior of various Single Stage, Multistage and Feedback amplifiers.
3. Generation of analog signals using Oscillators and Multi-vibrators

Course Outcomes: Upon completion of this course, students will be able to:

1. Define the bandwidth of single stage and multistage amplifiers using BJT and FET.
2. Compare and contrast different types of Multi-stage configurations, Feedback, Power amplifier.
3. Apply the concepts of analysis of BJT and compare the results in the lab for multi-vibrators, feedback, multistage amplifiers.
4. Categorize different types of feedback amplifiers, power amplifiers.
5. Choose the best configuration for the specifications (like conversion efficiency in power amplifiers, input and output impedance, resonating frequency and band-width).

Experiments

1. BJT and FET biasing circuits.
2. Design and frequency response of Common Emitter BJT amplifier.
3. Design and frequency response of Single stage and Multistage RC - Coupled amplifier using FET.
4. Voltage series feedback amplifier.
5. Voltage shunt feedback amplifier.
6. Current series feedback amplifier.
7. Current shunt feedback amplifier.
8. RC Phase Shift Oscillator.
9. Hartley Oscillator and Colpitts Oscillator.
10. Design of Class-B power amplifier.

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11. Design and development of Astablemultivibrator.
12. Design and development of Monostablemultivibrator.
13. Design and development of Schmitt Trigger.
14. Design and development of Voltage to Frequency converter.

Note: Wherever possible, Analysis and design of circuits should be carried out using SPICE tools.

Suggested Reading:

1. Robert Diffenderfer, "Electronic Devices Systems and Applications", Cengage Learning India Private Limited, 2010.
2. Paul B. Zbar, Albert P. Malvino, Michael A. Miller, "Basic Electronics, A Text - Lab Manual", 7th Edition, TMH 2001.

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18EC C13

ANALOG COMMUNICATION LAB

Instruction	2 P Hours per Week
Duration of SEE	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Prerequisite: Knowledge on signal analysis and its representation is required.

Course Objectives: This course aims to:

1. Generate and detect various analog and pulse modulation schemes.
2. Develop and analyze the characteristics of PLL, Mixer and Pre-Emphasis & De-Emphasis circuits.
3. Estimate the power spectral density by analyzing the spectrum of a given signal.

Course Outcomes: Upon completion of this course, students will be able to:

1. Demonstrate the generation and detection of various analog modulatedsignals.
2. Understand the sampling concept and further they can generate and detect various pulse modulatedsignals.
3. Obtain and analyze frequency response of Pre-Emphasis and De-Emphasiscircuits
4. Understand Mixer, Radio receiver and PLLcharacteristics and also compare FDM and TDM.
5. Estimate the Power spectral density of noise and Signal to Noise ratio and further able to analyze spectrums of AMand FMsignals.

List of Experiments

1. AM signals generation anddetection.
2. Generation of DSB-SC using Balancedmodulator.
3. SSB Modulation and Demodulation.
4. FM generation anddetection.
5. Frequency response of Pre-Emphasis and De-Emphasiscircuits.
6. Evaluation of Radio Receivercharacteristics.
7. Sampling of continuous time signal and its Reconstruction(PAM).
8. Frequency division Multiplexing and De-Multiplexing.
9. Time division Multiplexing and De-Multiplexing.
10. PWM Modulation and Demodulation.
11. PPM Modulation and Demodulation.

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12. Determination of PLLCharacteristics.
13. Analysis of MixerCharacteristics.
14. Spectral Analysis of AM and FM signals using Spectral Analyzer.

Suggested Reading:

1. A.M. Zungeru, J.M. Chuma, M. Mangwala , L.K. Ketshabetswe, “Handbook of Laboratory Experiments in Electronics and Communication Engineering”, Vol. 2, 1st Edition, Notion press, 2017.

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18EC C14

DIGITAL SYSTEM DESIGN LAB

Instruction	2 P Hours per Week
Duration of SEE	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Prerequisite: Digital concepts and C language concepts.

Course Objectives: This course aims to:

1. Simulate and synthesize combinational logic circuits.
2. Simulate and synthesize sequential logic circuits.
3. Learn and implement procedure for any digital design.

Course Outcomes: Upon completion of this course, students will be able to:

1. Design a Digital circuit using Verilog HDL.
2. Understand various abstraction levels of a digital design.
3. Verify the functionality of a design using Test bench.
4. Simulate and synthesize combinational logic circuits.
5. Simulate and synthesize sequential logic circuits.

Write a Verilog HDL code to Simulate and synthesize the following in Gate level, Data flow and Behavioral Modeling styles.

1. Logic Gates.
2. Arithmetic Units: Adders and Subtractors.
3. Multiplexers and De-multiplexers.
4. Encoders, Decoders, Priority Encoder and Comparator.
5. Implementation of logic function using Multiplexers and Decoders.
6. Arithmetic and Logic Unit.
7. Flip-Flops.
8. Up, Down and UP/Down Counters.
9. Sequence Detector using Mealy and Moore type state machines.
10. Implementation of SSI Circuits using FPGA.

Suggested Reading:

1. Samir Palnitkar, “Verilog HDL,A guide to Digital design and synthesis”, 2/e, Pearson Education, 2008.

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16ECC18

DIGITAL COMMUNICATION

Instruction	4 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	4

Course Objectives:

1. To make the student learn the different techniques involved in digital transmission of analog signals.
2. To give the student an understanding of the various concepts of information theory and source coding schemes.
3. To make the student know about the need for error control coding.
4. To facilitate the student to understand various methods of generating and detecting different types of error correcting codes.
5. To enable the student to interpret the performance of digital modulation schemes.
6. To make the student learn various spread spectrumtechniques.

Course Outcomes:

Upon completing this course, students will be able to:

1. Understand the concept of pulse digital modulation schemes and compare their performance.
2. Interpret the concept of information theory and apply source coding schemes.
3. Demonstrate various error control schemes.
4. Develop the encoding and decoding techniques to detect and correct the errors.
5. Evaluate the performance of digital modulation schemes with probability of error.
6. Identify and apply spread spectrum modulation techniques.

UNIT-I

Digital Transmission of Analog Signals: Elements of a digital communication system, Uniform quantization, PCM system, Bandwidth requirement of PCM system, Noise in PCM Systems, Non- uniform quantization, TDM-PCM system. Differential quantization, Differential PCM system, Delta Modulation, Noise in DM system, ADM. Comparison of PCM ,DPCM,DM and DM schemes.

UNIT-II

Information Theory: Uncertainty, Information and Entropy, Source coding: Source coding theorem, Shannon – Fano algorithm and Huffman coding. Discrete memoryless channels, Types of channels, cascaded channels, mutual information, Channel capacity, Information rate and Information capacity, Rate distortion theory.

UNIT-III

Error Control Coding: Need for error control coding, Types of transmission errors. Linear Block Codes (LBC): description of LBC, generation, Syndrome and error detection, minimum distance of a block code, error detecting capabilities and error correcting, Standard array and syndrome decoding.

Binary cyclic codes (BCC): description of cyclic codes, encoding, decoding and error correction of cyclic codes using shift registers, Convolution codes: description, encoding, decoding: Exhaustive search method and sequentialdecoding.

UNIT-IV

Digital Carrier Modulation Schemes: Optimum receiver for Binary Digital Modulation Schemes, Binary ASK, PSK, DPSK, FSK signaling schemes and their error probabilities. Introduction to MSK, Comparison of Digital Modulation Schemes. Introduction to M-ary Signaling Schemes, M-ary coherent PSK, QPSK, Synchronization methods.

UNIT –V

Spread-Spectrum Modulation: Need for spreading a code, generation and properties of PN sequence. Direct Sequence Spread Spectrum, Frequency Hopping spread spectrum systems and their applications.

Synchronization in Spread Spectrum Modulation: Acquisition and Tracking of Frequency Hopping spread spectrum and Direct Sequence Spread Spectrum systems.

Text Books:

1. Sam Shanmugham.K., "Digital and Analog Communication Systems," Wiley, 2012.
2. Simon Haykin, "Communication Systems," 4/e, Wiley India, 2011.
3. Herbert Taub, Donald L. Shilling &GoutamSaha, "Principles of Communication Systems," 4/e, Tata McGraw-Hill Education 2013.

Suggested Readings:

1. John Proakis, MassoudSalehi,"Digital Communications" 5/e , McGraw-Hill Higher Education, 2007.
2. R.P. Singh, S.D. Sapre, "Communication Systems", 2/e, Tata McGraw-Hill Education, 2008.

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16ECC19

INTEGRATED CIRCUITS AND APPLICATIONS

Instruction	4 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	4

Course Objectives:

1. To learn the concept of Op-Amp and its characteristics.
2. To impart the linear and nonlinear applications of operational amplifier.
3. To impart the theory and applications of 555 IC Timer, IC regulator and PLL.
4. To introduce the concepts of Data converters.
5. To analyze combinational and sequential circuits with ICs.
6. To introduce the concepts of memories, PLDs.

Course Outcomes:

Student will be able to:

1. Understand the basic construction, characteristics and parameters of Op-Amp.
2. Analyze the linear and nonlinear applications of Op-Amp.
3. Understand the concepts of IC555 timer, IC723 regulator and PLL.
4. Classify and describe the characteristics of different logic families
5. Design the Combinational and Sequential circuits with ICs.
6. Understand the concepts of memories, design of PLD's.

UNIT – I

Introduction to ICs: Integrated circuits classification, Integrated circuit package types, pin identification and temperature ranges.

Operational Amplifier: Op-Amp block diagram, ideal Op-Amp Characteristics, Op-Amp parameters: Input offset voltage, Output offset voltage, input offset and bias currents, Slew rate, CMRR and PSRR.

UNIT – II

Op-Amp Applications : Inverting and Non-inverting amplifiers with ideal and non-ideal Op-amps, Voltage Follower, Difference Amplifier, Summing Amplifier, ideal and practical Integrator and differentiator, Voltage to Current and Current to Voltage converters, Sample and Hold circuit. Comparator, Schmitt Trigger with and without reference voltage, Triangular waveform generator.

UNIT – III

555 Timer: Functional diagram. Modes of operation: Monostable, Astablemultivibrators, applications of 555 Timer.

Regulators: Analysis and design of regulators using IC 723.

PLL: Operation, lock range, Capture range, PLL applications: Frequency multiplier and frequency translator.

Data Converters: Specifications, DAC- Weighted Resistor, R-2R Ladder, ADC- Parallel / Comparator, Successive Approximation and Dual Slope.

UNIT – IV

Logic families: Digital IC characteristics. TTL logic family, TTL series and TTL output configurations: open collector, Totem pole, Tri state logic. MOS logic family, CMOS logic family and its series characteristics, CMOS transmission gate, CMOS open drain and high impedance outputs. Comparison of TTL and CMOS logic families.

Combinational Circuits: Design using TTL-74XX or CMOS 40XX series: Decoders, drivers for LED, Encoder, priority encoder, Multiplexer and their applications, Demultiplexer, Digital comparator, Parallel and serial binary adder, Subtractor circuits using 2's complement. Carry look-ahead adder, BCD adder.

UNIT – V

Sequential Circuits: Design using TTL-74XX or CMOS 40XX series: Synchronous and Asynchronous counters, Cascading of BCD counters, applications of counters, Shift register and applications.

Memories: Memory Terminology, ROM, RAM types, Architectures, operation and applications, Expanding word size and capacity, Introduction to PLD's, PAL and PLA.

Text Books:

1. Ramakant A. Gayakwad, "Op-Amps and Linear Integrated Circuits," 4/e, PHI, 2010.
2. Ronald J. Tocci, Neal S. Widmer& Gregory L.Moss, "Digital Systems: Principles and Applications." PHI, 10/e, 2011.

Suggested Reading:

1. K.R.Botkar, "Integrated Circuits," 10/e, Khanna Publishers, 2010.
2. Roy Chowdhury D, Jain S.B, "Linear Integrated Circuits,"4/e, New Age International Publishers, 2010.
3. Jain R.P., "Modern Digital Electornics."4/e, TMH, 2011.

16ECC20

MICROPROCESSORS AND MICROCONTROLLERS

Instruction	4 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	4

Course Objectives:

1. To understand the architecture and instruction set of 8086 microprocessor.
2. To familiarize the assembly language programming of 8086.
3. To understand the difference between assembler, emulator and debugger.
4. To understand the 8051 microcontroller concepts and applications of microcontrollers.
5. To familiarize programming aspects of 8051 both in assembly and C language.
6. To interface various peripherals to 8051 microcontroller.

Course Outcomes:

Students will be able to:

1. Understand the architecture of 8086 microprocessor and 8051 microcontroller.
2. Write an assembly language program for different applications by using instruction set of 8086 microprocessor.
3. Understand different programmable peripheral devices for a given application.
4. Distinguish between Microprocessor and Microcontroller based systems.
5. Identify and explain the operations of peripherals, typically used with interfacing microprocessors / microcontrollers.
6. Develop the microcontroller based programs for various applications.

UNIT – I

Microprocessors: Introduction to Microprocessor, 8086/8088 Architecture, pin description, Physical Memory Organization, Minimum mode 8086 system and timings, Maximum mode 8086 system and timings, Addressing modes, Instruction formats, Instruction set of 8086.

UNIT – II

Assembly language programming using 8086: Assembler directives and operators, Programs using data transfer, arithmetic, logical, branching and ASCII instructions. String processing, Stack, Interrupt Structure, Procedures and Macros, Introduction to assemblers and debugging tools. Brief overview of x86 series microprocessors.

UNIT – III

Interfacing with 8086: Semiconductor memory interfacing, Dynamic RAM interfacing, Interfacing I/O ports, PPI 8255, Modes of operation of 8255.

Special purpose programmable devices: Programmable interval timers (8253/8254), DMA controller (8257), Serial and parallel data transmission formats, Programmable communication interface (8251) USART, Programmable interrupt controller (8259).

UNIT – IV

Microcontrollers: Microprocessors vs Microcontrollers, Internal architecture of 8051 and its pin configuration, Memory organization. Addressing modes and bit addressable features. 8051 instruction set: Data transfer, arithmetic, logical and branching groups. Interrupt and I/O port structures and their operations. Basic assembly language programming with 8051.Introduction to 8051 programming in C language.

UNIT – V

8051 on-chip peripherals and their programming: Timer programming in assembly and C, serial port programming in assembly and C, Interrupt programming in assembly and C.

Interfacing with 8051: 8051 interfacing to external memory, Expansion of I/O ports - Interfacing with the PPI 8255.Interfacing ADC, 7 segment display, LCD module and Stepper motor with 8051.

Text Books:

1. Ray A.K and Bhurchandhi K.M, "Advanced microprocessor and peripherals", 3rd edition, TMH 2012.
2. Ayala K.J,"The 8051 Microcontroller Architecture, programming and Application", Penram International, 2007.
3. Mazidi M.A, Mazidi J.G and Rolin D Mckinlay, "The 8051 Microcontroller and Embedded systems using Assembly and C", 2nd edition, Pearson education 2007.

Suggested Readings:

1. Douglas V Hall, "Microprocessors and Interfacing Programming and Hardware", revised 2nd edition, THM 2007.
2. Ajay V. Deshmukh, "Microcontrollers – theory and applications", Tata McGraw-Hill Companies – 2011.

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16ECC21

CONTROL SYSTEMS

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To introduce various control systems and their equivalent mathematical models, block diagrams and signal flow graphs.
2. To familiarize with the time response analysis of different systems.
3. To introduce the system analysis using Routh-Hurwitz and root locus techniques.
4. To illustrate various frequency domain techniques for the system analysis.
5. To familiarize compensators and controllers of a control system.
6. To introduce the state space analysis of a system.

Course Outcomes:

After completion of this course, a student will be able to:

1. Find the transfer function of a system represented by a block diagram and signal flow graph.
2. Evaluate the time domain specifications and steady state error of a system.
3. Analyze the stability of a system.
4. Analyze the system in frequency domain.
5. Compare various controllers and compensators.
6. Apply State Space Concept to analyze and design a control system.

UNIT-I

Control System Fundamentals: Classification of control systems, Open and Closed Loop control systems, Block diagram reduction and signal flow graphs, Mathematical modeling of a Mechanical system and conversion into electrical System.

UNIT-II

Time Response Analysis: Transfer function and Impulse Response, Types of Inputs, Transient Response of first and second order system with different inputs, Time domain Specifications. Types of Systems, static error coefficients, error series, PD, PI and PID controllers.

UNIT-III

Stability Analysis: Routh-Hurwitz criteria for stability. Root Locus Techniques, Analysis of typical systems using root locus techniques, Effect of location of roots on system response.

UNIT-IV

Frequency Response Analysis: Frequency domain specifications,Bode plot, Principle of Argument, Nyquist plot and stability criterion, Gain and Phase Margins from the Bode and Nyquist diagrams.
Lead and Lag compensators.

UNIT-V

State Space Analysis: Concept of State, State Variable, State vector and State space. State space representations of linear time invariant systems, State transition matrix, Solution of state equation, Controllability, Observability and Design of control systems using state variable feedback.

Text Book:

1. I.J.Nagrath and M.Gopal, "Control Systems Engineering", New Age International Publishers, 5/e 2012.
2. Benjamin C. Kuo, "Automatic Control Systems", 7/e, PHI, 2010.

Suggested Reading:

1. K. Ogata, "Modern Control Engineering", EEE, 5/e, PHI, 2003.
2. Richard C. Dorf and Robert H. Bishop, "Modern Control Systems", 11/e Pearson 2008.
3. GopalMadan, "Digital control engineering", 1/e, New age publishers, 2008.

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16ECE01

COMPUTER ORGANIZATION AND ARCHITECTURE

(Elective-I)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To design and understanding of the different basic components of a computer system.
2. To understand fixed and floating point arithmetic algorithms.
3. To understand Instruction set, Instruction codes and Assembly Language.
4. To design and synthesize new and better computer architectures.
5. To understand input/output mechanisms.
6. To understand various parts of system memory hierarchy.

Course Outcomes:

At the end of the course, the student will be able to:

1. Discuss the basic structure and organization of computer system.
2. Apply fixed and floating point arithmetic algorithms.
3. Explain Instruction cycle, register transfer and micro operations.
4. Discuss about RISC/CISC architectures, pipeline and vector processing.
5. Explain Input/output organization.
6. Discuss about Memory organization and Management.

Unit - I

Data Representation and Computer Arithmetic: Introduction to Computer Organization and architecture, Fixed point representation of numbers, Digital arithmetic algorithms for Addition, Subtraction, Multiplication using Booth's algorithm and Division using restoring and non restoring algorithms, Floating point representation with IEEE standards.

Unit - II

Basic Computer Organization and Design: Instruction codes, stored program organization, Computer registers and common bus system, Computer instructions: Timing and Control, Instruction cycle, Fetch and Decode, Register reference instructions, Memory reference instructions, I/O and Interrupt: Configuration, Instructions, Program interrupt, Interrupt cycle, Micro programmed Control organization, Address sequencing, Micro instruction format.

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Unit - III

Central Processing Unit: Introduction, General register organization, Stack organization, Instruction formats, Addressing modes, Data transfer and manipulation, Program control, CISC and RISC: Features and Comparison,Pipeline and Vector Processing: Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, Basics of Vector processing and Array Processors.

Unit - IV

Input-Output Organization: Peripheral devices, I/O interface: I/O Bus and interface modules, I/O versus Memory Bus, Isolated versus memory mapped I/O, Asynchronous data transfer: Strobe control, Handshaking, Asynchronous serial transfer, Modes of Transfer: Programmed I/O, Interrupt initiated I/O, Priority interrupt: Daisy chaining, Parallel Priority interrupt, Input- Output Processor: CPU-IOP communication, I/O channel.

Unit - V

Memory Organization: Memory hierarchy, Primary memory, Auxiliary memory, Associative memory, Cache memory, mapping functions: direct, associate and set associate. Virtual memory: address mapping using pages, Page replacement, Memory management hardware: Segmented Page mapping, Memory protection.

Text Books:

1. MorisMano.M.,"Computer System Architecture," 3/e, Pearson Education, 2017.
2. Hamachar, VranesicZyonks, safeazak, "Computer Organization," 5/e, McGraw Hill, 2007.

Suggested Reading:

1. William Stallings, "Computer Organization and Architecture: Designing for performance," 7/e, Pearson Education, 2006.
2. John P.Hayes, "Computer Architecture and Organization," 3/e,TMH, 1998.

16EC C22

DIGITAL COMMUNICATION LAB

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	25 Marks
Credits	2

Course Objectives:

1. Carry out experiments on various pulse digital modulation techniques.
2. Perform different line coding techniques.
3. Conduct the experiment to identify errors in cyclic codes
4. Work on convolutional encoder and decoder for controlling the errors.
5. Execute experiments on digital carrier modulation techniques.
6. Study the characteristics of MODEM.

Course outcomes:

Upon completing this course, students will be able to:

1. Experiment with various pulse digital modulation techniques.
2. Examine different line coding techniques.
3. To detect and correct errors in cyclic codes.
4. Assess the errors in convolutional encoder and decoder.
5. Demonstrate digital carrier modulation techniques experimentally.
6. Know the importance of MODEM characteristics.

List of Experiments

1. PCM generation and detection.
2. Data formats / Line coding.
3. Linear Delta Modulation and demodulation.
4. Adaptive Delta Modulation and demodulation.
5. Error detection and correction in cyclic codes.
6. Convolutional encoder and decoder.
7. ASK generation and detection.
8. FSK generation and detection.
9. BPSK generation and detection.
10. QPSK generation and detection.
11. Minimum Shift Keying generation and detection.
12. MODEM characteristics.

Reference Book:

1. Department Laboratory Manual.

Sample Mini Projects:

1. Develop a code for different digital modulation schemes and verify through simulation.
2. Design different Line coding schemes using logic Gates

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16ECC23

INTEGRATED CIRCUITS AND APPLICATIONS LAB

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	25 Marks
Credits	2

Course Objectives:

1. Tolearn the configurations and parameters of the 741 Op-Amp.
2. To explain the circuits of linear and nonlinear applications of Op-Amp
3. To know the concepts of IC555 timer, IC723 and data converters.
4. To know the various characteristics of TTL and CMOS gates.
5. To learn combinational and Sequential circuits using digital ICS.
6. To know the difference between linear and digital ICs.

Course Outcomes: Students will be able to

1. Analyze the configurations, parameters of Op-Amp (IC741).
2. Demonstrate the circuits of Op-Amp for various applications.
3. Analyze and design the circuits using IC555 timer, IC723 and data converters.
4. Analyze the characteristics of TTL and CMOS gates
5. Analyze and design various combinational circuits using digital ICs.
6. Analyze and design various sequential circuits using digital ICs.

Lab Experiments

Part-A: **Linear IC Experiments**

1. Voltage Follower, Inverting and Non Inverting Amplifiers using Op-Amp.
2. Measurement of Op-Amp parameters
3. Arithmetic Circuits using Op-Amp
4. Waveform generation using Op-Amp.
5. Astable, Monostable multi vibrators using IC555Timer.
6. Low and High Voltage Regulators using IC723.
7. D to A Converter using R-2R ladder.

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Part-B: Digital IC Experiments

1. Measurement of various characteristic parameters of TTL and CMOS gates.
2. Logic function Implementations using Decoders.
3. Logic function Implementations usingMultiplexers
4. Binary adder and subtractor, BCD adders using ICs.
5. Design of Synchronous, Asynchronous up/down counters.
6. Shift registers and ring counter using ICs.
7. Interfacing counters with 7-segment LED display units.

General Note: At least 6 experiments from eachpart.
Reference Book: Laboratory Manual.

Mini Project cum Design Exercise(s):
To realize and design a Mini project using either linear or digital or combination of linear and digital IC's

Sample Mini Projects:

a) Design and implementation of a Digital clock.
b) Design and implementation of a Security Monitoringsystem.
c) Design and implementation of Binary Multiplier
d) Design and implementation of a Water level indicator using 555 IC
e) Design and implementation of FSK Modulator using 555 IC

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ECC24

MICROPROCESSOR AND MICROCONTROLLER LAB

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	25 Marks
Credits	2

Course Objectives:

1. To develop and understand the assembly language programming concepts of 8086 Microprocessor.
2. To understand the difference between assembler, emulator and debugger.
3. To Interface different programmable controllers to 8086 microprocessor.
4. To Interface a microcontroller to external input/output devices and perform its programming.
5. To develop and understand the embedded C programming concepts of 8051 microcontroller.
6. To control the operation of various peripherals by using 8051 microcontrollers.

Course Outcomes:

Students will be able to:

1. Write the 8086 assembly language programs on arithmetic, logical operations and DOS function calls.
2. Know about different assemblers available for programming 8086 microprocessor.
3. Understand the advantage of various debugging tools available to program 8086 microprocessor.
4. Write and test embedded C programming on interfacing modules with 8051.
5. Learn the hardware and software interaction and integration.
6. Design and develop the 8051 based embedded systems for various applications.

I. List of Experiments

1. Study and use of 8086 microprocessor trainer kit and simple programs under different addressing modes.
2. Multiplication and division programs.
3. Single byte, multi byte binary and BCD addition, subtraction.
4. Code conversion.
5. Sorting and string search.

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6. Interfacing traffic signal controller using 8086.
7. Familiarity and use of 8051 microcontroller trainer kit and simple programs under different addressing modes.
8. Timer and counter operations and programming using 8051.
9. Interfacing applications using LED, switch, relay and buzzer
10. Interfacing ADC using 8051.
11. Generation of waveforms using DAC by interfacing it with 8051.
12. Program to control stepper motor using 8051.
13. Interfacing 7-segment display using 8051.
14. Interfacing LCD using 8051.

II. Mini Project cum Design Exercise(s):

Design and realize a mini project on 8086/ 8051 based interfacing for a given specification.

(Ex: Interfacing hex keypad to 8086 through keyboard and display controller (8279), Interfacing Elevator, Interfacing Real time clock etc.)

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16ECC25

EMBEDDED SYSTEM DESIGN

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To learn the fundamentals of the embedded system design.
2. To provide in depth understanding - ARM processor fundamentals and instruction set.
3. To learn architecture details of ARM 7 microcontrollers.
4. To interface various I/O devices to ARM 7 microcontroller.
5. To understand embedded system design environment.
6. To analyze various embedded applications and debugging tools.

Course Outcomes:

Students will be able to:

1. Know the fundamentals of the embedded system design.
2. Understand the ARM architecture and its instruction set.
3. Analyze various features of ARM7 microcontroller.
4. Able to interface various I/O devices to ARM 7 microcontroller.
5. Understand the Embedded system design cycle
6. Develop and Debug various embedded system applications.

UNIT – I

Introduction to Embedded systems: Embedded systems vs General computing systems, Classifications, Applications areas, Processor embedded into a system, Processor selection for embedded system, Embedded hardware units and devices in a system, Design metrics and Challenges in embedded system design. ARM design philosophy.

UNIT – II

ARM Processor Fundamentals: Register organization, Program Status Register, Pipeline, Introduction to exceptions.

ARM Instruction set: Data processing instructions, Branch instructions, Load-Store instructions, Software interrupt instruction, Program Status Register instructions, Loading constants, and Conditional executions. Introduction to THUMB instructions: Differences between Thumb and ARM modes, Register usage.Introduction to ARM C Programming.

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UNIT – III

ARM 7 Microcontroller (LPC2148)**:** Salient features of LPC 2148, Pin description of 2148, Architectural Overview. **ARM 7**(LPC2148) **Peripherals:** Description of General Purpose Input/Output (GPIO) ports, Pin control Block. Features, Pin description, Register description and operation of PLL, Timers, PWM, Interfacing: LED, Relay, Buzzer, LCD, DAC, DC motor. Communication protocols: Brief overview on I2C, SPI, and CAN.

UNIT – IV

Embedded System Design Cycle: Embedded system design and co-design issues in system development process, Design cycle in the development phase for an embedded systems. Embedded software development tools: Host and Target machines, Linker/Locators for embedded software, Embedded software into the target system.

UNIT – V

Debugging tools and Applications: Integration and testing of embedded hardware, Testing methods, Debugging techniques, Laboratory tools and target hardware debugging: Logic Analyzer, Simulator, Emulator and In-Circuit Emulator, IDE, RTOS services, VxWorks features. Case Studies: Embedded system design for automatic vending machines and digital camera.

Text Books:

1. Raj Kamal, "Embedded Systems-Architecture, Programming and Design," 3/e, Tata McGraw Hill Education, 2015.
2. Andrew N.SLOSS, DomonicSymes, Chris Wright "ARM System Developers Guide- Designing and optimizing system software" ELSEVIER 1st Edition, 2004.
3. Steve Furber "ARM System On Chip Architecture" 2/e Pearson education, 2000.

Suggested Readings:

1. David E.Simon, "An Embedded software primer", Pearson Education,2004.
2. ARM 7 (LPC 214x) user manual from Philips semiconductors

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16ECC26

DIGITAL SIGNAL PROCESSING

Instruction	4 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	4

Course Objectives:

1. Discrete-time signals in the frequency domain using DTFT and DFT.
2. Implementation of the FFT algorithms and its applications.
3. Design digital IIR and FIR filters for the given specifications.
4. The basics of Multirate digital signal processing and its applications
5. DSP processor architecture for the efficient implementation of DSP applications.
6. Decimator and interpolator on DSP Processor.

Course Outcomes:

Students will be able to:

1. Understand the concept of DTFT and DFT for signal processing applications.
2. Implement linear filtering using FFT.
3. Design and implement FIR and IIR filters for the given specifications.
4. Interpret the concepts of Multirate digital signal processing and its applications.
5. Demonstrate the design of digital filters using DSP Processor.
6. Examine the functionality of decimator and Interpolator on DSP Processor.

UNIT-I

Discrete Fourier Transform: Overview of Discrete Time Fourier Transform (DTFT), Discrete Fourier Transform (DFT), Properties of DFT, Efficient computation of DFT-Fast Fourier Transform (FFT) algorithms: Radix-2 FFT algorithms – Decimation in Time, Decimation in Frequency algorithms, Inplace computation, bit reversal algorithm. Use of FFT algorithms in linear filtering.

UNIT-II

FIR Filter Design: Amplitude and Phase responses of FIR filters – Linear phase FIR filters – Windowing technique for design of FIR filters – Rectangular, Bartlet, Hamming, Blackman, and Kaiser Windows. Realization of digital filters-Direct form-I and II, cascade and parallel forms of IIR filters, Realization of linear phase FIR filter, Finite word length effects.

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UNIT-III

IIR Filter Design: Butterworth and Chebyshev approximation, IIR digital filter design techniques- Impulse Invariant transformation, Bilinear transform techniques, Digital Butterworth and Chebyshev filters, Spectral transformation techniques. Comparison between FIR and IIR filters.

UNIT- IV

Multirate Digital Signal Processing: Introduction -Decimation by a Factor -D, Interpolation by a Factor -I, Sampling Rate Conversion by a Rational Factor -I/D. Implementation of Sampling Rate Conversion, Multistage implementation of Sampling Rate Conversion, polyphase decomposition, Noble Identities, Application of Multirate Signal Processing.

UNIT-V

DSP Processors: Introduction, Difference between DSP and General Purpose Processor architectures, need for DSP processors. General purpose DSP processor-TMS320C67XX processor, architecture, functional units, pipelining, registers, linear and circular addressing modes, instruction set.

Text Books:

1. Alan V. Oppenheim & Ronald W. Schafer, "Digital Signal Processing," PHI, 2/e, 2010.
2. John G. Proakis&Dimtris G. Manolakis, "Digital Signal Processing Principles, Algorithms and Application," PHI, 4/e, 2012.
3. RulphChassaing, "Digital Signal Processing and Applications with the C6713 and C6416 DSK", John wiley& sons, 2005.

Suggested Reading:

1. Sanjit K Mitra,"Digital Signal Processing, A computer based approach", TMH, 3/e, 2011.
2. TarunkumarRawat, "Digital Signal Processing", First edition, Oxford, 2015.
3. Avtar Singh & S. Srinivasan, "Digital Signal Processing Implementation using DSP microprocessors", Thomson Brooks, 2/e, 2004.

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16ECC27

MICROWAVE ENGINEERING

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
redits	3

Course Objectives:

1. To understand importance of microwaves and their applications.
2. To analyze and solve wave equations for both guided waves and waveguides.
3. To learn scattering parameters which are used to characterize microwave network.
4. To understand the principle and operation of microwave sources.
5. To know various microwave solid state devices and their characteristics.
6. To understand microwave power measurement techniques.

Course Outcomes:

Students will be able to:

1. Apply the wave equations and their solutions to analyze the waves between parallel planes and waveguides.
2. Determine the scattering matrix for various microwave components.
3. Analyze the interaction of electron beam, RF field for various microwave sources.
4. Know the characteristics of IMPATT and TRAPATT diodes.
5. Understand the microwave power measurement techniques.
6. Gain the knowledge on microwave applications.

UNIT – I

Introduction to Microwaves: Microwave frequency spectrum, Advantages and Applications of Microwaves.

Guided Waves: Waves between parallel planes. TE and TM waves. Characteristics of TE and TM waves,TEM waves. Velocity of propagation, Wave impedance, Attenuation in parallel plane guides.

UNIT - II

Rectangular Waveguides: Rectangular waveguides, TM and TE waves, Impossibility of TEM wave in waveguides. Power transmission and Power Losses. Wave Impedance, Attenuation factor and Quality factor of rectangular waveguides.

Circular Waveguides: Solutions of wave equations in cylindrical coordinates, Characteristics of TM and TE modes.

Microwave Cavities - Rectangular and Circular cavity resonators, Quality factor and applications of cavity resonator.

UNIT - III

Microwave Circuits and Components: Concept of microwave hybrid circuit, Introduction to scattering parameters. Properties and S-parameters of reciprocal

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components- E and H Plane Tees, Magic Tee, Directional Coupler. Properties of Waveguide Corners, Twists and Bends.Hybrid ring.
Waveguide Attenuators - Different types, Resistive Card and Rotary Vane attenuator;
Waveguide Phase Shifters - Different types, Dielectric and Rotary Vane phase shifter.
Non reciprocal components: Ferrites – Composition and Faraday rotation; Ferrite components - Isolators, Gyrators and Circulators. S-parameters of Isolator and Circulator.

UNIT- IV
Microwave Tubes: Limitations of conventional tubes at microwave frequencies. Microwave tubes-O type and M type classifications.
O-type tubes: Two Cavity Klystron, Velocity modulation process, Bunching process. Output Power and Beam loading. Multi cavity Klystron Amplifiers. Reflex Klystron-Velocity Modulation, power output and efficiency, Electronic Admittance.
Helix TWT: Slow wave structures, Principle of operation and applications of helix TWT (qualitative treatment only).
M-type tubes: Introduction, Magnetron Oscillators, different types, ð-mode of operation, frequency pushing and pulling effects and their remedies. Cross field amplifier and BWO.

UNIT – V
Microwave Solid State Devices: Introduction, Transfer Electronic Devices- Gunn diode, RWH theory-Differential negative resistance and two valley model theory. Gunn oscillation modes.Applications of PIN and Varactor diode.
Avalanche Transit time devices: Introduction, IMPATT and TRAPATT diode – physical structure, negative resistance, power output and efficiency (qualitative treatment only).
Measurement of Power: Measurements of low, medium and high microwave power. Basic principles of Reflectometer.

Text Books:

1. E. C. Jordan & Keith G. Balmain, "Electromagnetic Waves and Radiating Systems", 2/e, Pearson Education, 2006.
2. Samuel Y. Liao, "Microwave Devices and Circuits", 3/e, Pearson Education, 2003.

Suggested Reading:

1. Rizzi P, "Microwave Devices and Circuits", 3/e, Pearson Education, 2003.
2. Annapurna Das and Sisir K Das "Microwave Engineering" 1/e, 2000, Tata McGraw-Hill.
3. Herbert J.Reich, John G.Skalnik, Philip F. Ordung, Herbert L. Krauss," Microwave Principles", East-West Pvt. Ltd. Madras.

16ECC28

WIRELESS MOBILE COMMUNICATION

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To make the student understand the wireless communication systems and features of 4G mobile standards and their comparison with 1G, 2G, 2.5G and 3G technologies.
2. To give the student an understanding of Cellular system for Mobile.
3. To enable the student to understand the Mobile radio propagation models.
4. To provide the student with an understanding of small scale fading and diversity reception.
5. To make the student to learn the salient features of various multiple access systems.
6. To make the student to learn concepts of GSM, IS-95 CDMA and OFDM

Course outcomes:

Student will be able to:

1. Compare the technology trends changing from generation to generation.
2. Design a Cellular system for Mobile communications using frequency reuse for maximum coverage,
   less interference and optimum capacity.
3. Apply the large scale path-loss and analyze small scale fading.
4. Choose an appropriate Propagation model for either Outdoor or Indoor cellular communication.
5. Categorize various multiple access techniques according to the complexity, installation cost, speed of transmission, channel properties.
6. Analyze the system specifications of either GSM or CDMA based Mobile Communication Systems and OFDM.

UNIT - I

Wireless Communication Systems: Bluetooth, Trends in Radio and Personal Communications, Comparison of 1G, 2G, 2.5G and 3G technologies. UMTS system architecture and Radio Interface; Features of 4G, WLAN.

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UNIT – II

Cellular Concept -System Design Fundamentals : Frequency reuse, channel assignment strategies, Handoff process, factors influencing handoffs, types of handoffs, Interference and system capacity, Cross talk, Enhancing capacity and cell coverage, Trunked radio system, grade of service as per Erlang's B system.

UNIT – III

Mobile Radio Propagation models: Introduction to Radio Wave Propagation, Free space propagation model, three basic propagation mechanisms, ground reflection, Diffraction practical link budget design using path loss models, Outdoor propagation models: Longley Rice model and Okumura model. Indoor propagation models, partition losses. Small scale multipath propagation: Parameters of mobile multipath channels, types of small scale fading. Diversity reception methods.

UNIT – IV

Multiple Access Techniques: Need and concept of multiple access techniques, FDMA, TDMA, SSMA, CDMA, FHMA, SDMA. OFDM in wireless communication systems. Applications of multiple access techniques.

UNIT – V

Wireless systems: GSM: Services and Features, System architecture, Radio Sub system, Channel Types, Frame structure and Signal processing. CDMA Technologies: Digital Cellular standard IS-95 Forward Channel, Reverse Channel. Introduction to CDMA 2000.

Text Books:

1. Theodore.S. Rappaport, "Wireless Communications: Principles and Practice", 2/e, Pearson Education, 2010
2. T.L.Singhal "Wireless Communication Systems", 1/e, TMH Publications, 2010.

Suggested Reading:

1. William.C.Y.Lee, "Mobile Cellular Telecommunications: Analog and Digital Systems", 2/e, Mc-Graw Hill, 2011.
2. Kernilo, Feher, "Wireless Digital Communications", PHI, 2002.

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16ITE27

DATA STRUCTURES

(Elective-II)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To familiarise with different linear and nonlinear data structures.
2. To present the concepts of time and space complexity
3. To discuss applications of various data structures.
4. To develop a base for advanced computer science study.

Course Outcomes:

Student will be able to:

1. Understand basic data structures arrays and linked lists
2. Analyse time complexity of algorithms
3. Understand the basic operations of Stacks and Queues
4. Implement basic operations on data structures
5. Understand applications of binary trees and graphs
6. Understand various kinds of searching and sorting techniques

UNIT-I

Introduction to Data Structures and Algorithms: Elementary data structure organisation, classification of data structures, operations on data structures, Abstract Data Type, Algorithms, Different approaches to designing an algorithm, Control structures used in algorithms, Time and Space Complexity, Big O Notation, Omega Notation (Ω), Theta Notation (Θ)

UNIT-II

Arrays: Introduction, Declaration of Arrays, Accessing the Elements of an Array, Storing Values in Arrays, Operations on Arrays, **Linked Lists:** Introduction, Singly Linked Lists, Circular Linked Lists, Doubly Linked Lists, Applications of Linked Lists

UNIT-III

Stacks: Introduction to Stacks, Array Representation of Stacks, Operations on a Stack, Linked Representation of Stacks, Operations on a Linked Stack, Applications of Stacks, **Queues:** Introduction to Queues, Array Representation of Queues, Linked Representation of Queues, Types of Queues, Applications of Queues

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UNIT-IV

Trees: Introduction, Types of Trees, Creating a Binary Tree from a General Tree, Traversing a Binary Tree, Applications of Trees, **Efficient Binary Trees:** Binary Search Trees, Operations on Binary Search Trees

UNIT-V

Graphs: Introduction, Graph Terminology, Directed Graphs, Bi-connected Components, Representation of Graphs, Graph Traversal Algorithms **Introduction to Searching:** Linear Search, Binary Search, Introduction to Sorting, Bubble Sort, Insertion Sort, Selection Sort, Merge Sort, Quick Sort, Radix Sort, Heap Sort, Shell Sort, Tree Sort, Comparison of Sorting Algorithms

Text Books:

1. ReemaThareja, "Data Structures Using C", Second Edition, Oxford Higher Education, 2014
2. Horowitz Ellis, SahniSartaj& Anderson-Freed Susan, "Fundamentals of Data Structures in C", Orient BlackSwan, 2008

Suggested Reading:

1. NarasimhaKarumanchi, "Data Structures and Algorithms Made Easy: Data Structures and Algorithmic Puzzles", CareerMonk Publications, 2016.
2. NarasimhaKarumanchi, "Coding Interview Questions", 3rd Edition, CareerMonk Publications, 2016
3. Yashavant P. Kanetkar, "Data Structure Through C", BPB Publications, 2003.

Web Resources:

1. NPTEL Videos Introduction to data structures and algorithms - http://nptel.ac.in/courses/106102064/1
2. https://www.cs.usfca.edu/~galles/visualization/Algorithms.html
3. https://visualgo.net/en

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16ITE25

JAVA PROGRAMMING

(Elective-III)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To understand the fundamentals of Java language which includes defining classes, invoking methods, inheritance, polymorphism, exception handling etc.
2. To solve real world problems by creating Java applications using sound OOP practices, standard class libraries and APIs.
3. To introduce event driven Graphical User Interface (GUI) programming and usage of standard class libraries.

Course Outcomes:

1. Achieve proficiency in object-oriented concepts and also learns to incorporate the same into the Java programming language.
2. Create Java application programs using sound OOP practices e.g. Inheritance, interfaces and proper program structuring by using packages, access control specifiers.
3. Understand and Implement the concepts of Exception Handling and Multithreading in java.
4. Develop the ability to solve real-world problems through software development in high-level programming language using Large APIs of Java as well as the Java standard class library.
5. Understand File, Streams, Input and Output Handling in java.
6. Create graphical user interfaces in java as well as apply the knowledge of Event Handling.

UNIT-I

Evolution of java: Java's Magic: The Bytecode, The Java Buzzwords Objects, **Overview of Java:** Simple Java Programs, Java Primitive Types, Arrays: How to create and define arrays, Basic Operators, Control statements.

Introducing Classes: Declaring objects, methods, Constructors, this keyword, Method Overloading and Constructor Overloading, Objects as parameters, Returning objects, Use of static and final keywords.

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UNIT-II

Inheritance, Packages and Interfaces: Inheritance basics, using super keyword, Method overriding, Dynamic method dispatch , Abstract classes, using final with inheritance , Introduction to Object class,

Packages: Defining, Creating and Accessing a Package, importing packages,

Interfaces : Defining and implementing interfaces, Nested Interfaces.

Strings Handling: String Constructors, Length, Operations, String Comparison, Searching for strings, Difference between String &StringBuffer classes, StringTokenizer class and Wrapper classes and conversion between Objects and primitives.

UNIT-III

Exception Handling in Java: Exception handling fundamentals, Exception types, Usage of try, catch, throw, throws and finally clauses, writing your own exception classes.

Multithreading in Java: The java Thread Model, How to create threads, Thread class in java, Thread priorities, Thread synchronization.

Generics: What are Generics? Generic classes, bounded types, Generic methods and interfaces.

UNIT-IV

Collections Framework: Overview of Collection Framework, Commonly used Collection classes – ArrayList, LinkedList, HashSet, LinkedHashSet, TreeSet, Collection Interfaces –Collection, List, Set, SortedSet, Accessing a collection via an Iteration,Storing user-defined classes in collections, Map Interfaces and Classes, Using a comparator. Legacy classes – Vector, Hashtable, The Enumeration interface.

Input/Output : How to read user input (from keyboard) using scanner class, Stream classes, InputStream, OutputStream, FileInputStream, FileOutputStream, Reader and Writer, FileReader, FileWriter cl asses. File class.

UNIT-V

GUI Design & Event Handling: Component, Container, window, Frame classes. Working with Frame windowGUI Controls, Layout Managers, Introduction to Swings, Delegation Event Model, Event Classes, Source of Events, Event Listener Interfaces, Handling button click events, Adapter classes.Writing GUI Based applications.**Database Handling in Java**: Java Database Connectivity (JDBC)

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Text Books:

1. Herbert Schildt: "Java: The Complete Reference", 8th Edition, Tata McGraw Hill Publications, 2011.
2. Cay S. Horstmann, Gary Cornell: "Core Java, Volume I—Fundamentals", 8th edition, Prentice Hall, 2008.

Suggested Reading:

1. SachinMalhotra&SaurabhChoudhary: "Programming in Java", 2nd Edition, Oxford University Press, 2014.
2. C. Thomas Wu, "An introduction to Object-oriented programming with Java", 4th edition, Tata McGraw-Hill Publishing company Ltd., 2010.
3. K. Arnold and J. Gosling, "The JAVA programming language", 3rdedition, Pearson Education, 2000.

Web Resources:

1. https://www.cse.iitb.ac.in/~nlp-ai/javalect_august2004.html.
2. http://nptel.ac.in/courses/106106147/
3. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-092-introduction-to-programming-in-java-january-iap-2010/lecture-notes/

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16ITE26

PYTHON PROGRAMMING

(Elective-III)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

This course is introduced to

1. Introduce the fundamentals of Python programming.
2. Learn how to use lists, tuples, and dictionaries in Python programs.
3. Learn how to read and write files in Python.
4. Impart usage of exception handling for error handling.
5. Familiarize python visualization.

Course Outcomes:

After completion of the course, student will be able to:

1. Understand basic data structures of python.
2. Perform operations on strings.
3. Understand the concepts of file I/O.
4. Understand exception handling in Python.
5. Plot data using appropriate Python visualization libraries.
6. Develop basic Python applications.

Prerequisites: Programming and Problem Solving (16CSC01), Programming Laboratory (16CSC02)

Unit-I

Introduction to Python Programming: Using Python, The IDLE Programming Environment, Input and Output Processing, Displaying Output with the Print Function, Comments, Variables, Reading Input from the Keyboard, Performing Calculations, More About Data Output: New line, Item Separator, Escape Characters, Formatting parameters.

Decision Structures and Boolean Logic: if, if-else, if-elif-else Statements, Nested Decision Structures, Comparing Strings, Logical Operators, Boolean Variables.

Unit-II

Repetition Structures: Introduction, while loop, for loop, Sentinels, Input Validation Loops, Nested Loops.

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Functions: Introduction, Defining and Calling a Function, Designing a Program to Use Functions, Local Variables, Passing Arguments to Functions, Global Variables and Global Constants, Value-Returning Functions Generating Random Numbers, Writing Our Own Value-Returning Functions, The math Module, Random Module, Time Module and Storing Functions in Modules.

Unit-III

Lists and Tuples: Sequences, Introduction to Lists, List slicing, Finding Items in Lists with the in Operator, List Methods and Useful Built-in Functions, Copying Lists, Processing Lists, Two-Dimensional Lists, Tuples.

Strings: Basic String Operations, String Slicing, Testing, Searching, and Manipulating Strings.

Unit-IV

Dictionaries and Sets: Dictionaries, Sets, Serializing Objects.

Recursion: Introduction, Problem Solving with Recursion, Examples of Recursive Algorithms.

Python File Input-Output: Opening and closing file, various types of file modes, reading and writing to files, manipulating directories

Unit-V

Exception Handling: What is exception, various keywords to handle exception such try, catch, except, else, finally, raise.

Regular Expressions: Concept of regular expression, various types of regular expressions, using match function

Introduction to plotting in Python – Basic Plots- Line and Scatter Plot, Histograms and plotting data contained in files.

Text Books:

1. Tony Gaddis, "Starting Out With Python", 3rd edition, Pearson, 2015.
2. Charles Dierbach, "Introduction to Computer Science using Python", Wiley, 2013.

Suggested Reading:

1. Kenneth A. Lambert, "Fundamentals of Python", Delmar Cengage Learning, 2013.
2. James Payne, "Beginning Python using Python 2.6 and Python 3", wrox programmer to programmer, 2010.
3. Paul Gries, "Practical Programming: An Introduction to Computer Science using Python", 3rd edition, 2016.
4. Clinton W. Brownley, "Foundations for Analytics with Python", 1st edition, O'Rielly Media, 2016.

Web Resources:

1. https://www.python.org/
2. https://www.coursera.org/learn/python
3. https://learnpythonthehardway.org/book/
4. https://www.coursera.org/specializations/python

16ECE05

CPLD AND FPGA ARCHITECTURES

(Elective-III)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. Familiarization and implementation of various programmable Logic devices.
2. To study various Complex Programmable Logic Devices Architectures.
3. To understand the different programming technologies.
4. To study Field programmable gate arrays and realization techniques.
5. To design different case studies with Actel FPGAs.
6. To study the design tools and ASICs.

Course Outcomes:

Students will be able to:

1. Understand the concept of programmable logic devices and differences between these devices.
2. Analyze various CPLD architectures and their programming technologies.
3. Analyze various FPGA architectures and their programming technologies.
4. Implement various logic functions on PLDs, CPLDs and FPGAs.
5. Understand the concepts of placement and routing and classifying ASICs.
6. Demonstrate VLSI tool flow for CPLDs and FPGAs.

UNIT I

Review of Logic Design: Implementation of logic functions with multiplexers. **Programmable Logic Devices**: Architectures of PROM, PLA and PAL. Implementation of MSI circuits using Programmable Logic Devices.

UNIT II

Complex Programmable Logic Devices: Introduction to CPLD Architecture of CPLD. Logic Block, I/O Block, Interconnect matrix and features of Altera max 7000 series, AMD Mach 4 and Xilinx XC-9500 CPLD.

UNIT III

Xilinx FPGAs: Introduction to FPGA, FPGA Programming Technologies. Architecture, Logic Blocks, I/O Block, Routing Architecture and features of Xilinx XC-4000, SPARTAN-II ,Virtex-II and salient features of VirtexIII to VII devices.

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UNIT IV

Altera FPGAs: Logic Block, I/O Block, Routing Architecture and features of Altera's Flex 10000 series FPGA. Anti-Fuse Programmed FPGAs: Introduction, Architecture of Actel's Act1, Act2, and Act3 FPGAs. Designing Adders, Accumulators and Counters with the ACT devices.

UNIT V

Digital Design Flow: Digital design tools for FPGAs. Digital design flow for CPLDs and FPGAs. Importance of Placement and Routing, Introduction to ASICs: Semi-Custom and Full-Custom ASICs.

Text books:

1. S. Trimberger, Edr, "Field Programmable Gate Array Technology", Springer Pub., 2011.
2. Ronald J . Tocci, Neal S. Widmer, Gregory L. Moss "Digital Systems", 10/e, Pearson academic press 2011.
3. P.K.Chan& S. Mourad, "Digital Design Using Field Programmable Gate Array", PHI, 1994.

Suggested Reading:

1. S. Brown, R.J.Francis, J.Rose, Z.G.Vranesic, "Field programmable gate array", BSP, 2007.
2. Manuals from Xilinx, Altera, AMD, Actel.

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16ECC29

EMBEDDED SYSTEM DESIGN LAB

Instruction	3 Hours per week
Semester end Examination Duration	3 Hours
Semester end Examination	50 Marks
CIE	25 Marks
Credits	2

Course Objectives:

1. To develop and understand the ARM7 C programming
2. To understand the usage of Integrated Development Environment (Keil)
3. To interface ARM7 to various input/output devices
4. To develop the programs using serial communication protocols
5. To process the analog signals using ARM7
6. To control the operation of various peripherals using ARM7 microcontroller

Course Outcomes:

Students will be able to:

1. Develop the ARM7 C programs using arithmetic, logical and branch operations
2. Understand the usage of various debugging tools available to program ARM7
3. Program ARM7 to interface various input/output modules
4. Know about the data transfer using serial communication protocols.
5. Analyze the hardware and software interaction and integration.
6. Design and develop the ARM 7 based embedded systems for various applications

List of Experiments

I. Basic ARM 7 Programming using instruction set

1. Study and use of ARM 7 Microcontroller trainer and Keil IDE
2. Programs using data manipulation and arithmetic instructions
3. Programs using logical and branch instructions
4. Sorting and String operations

II. ARM7 C programming:

5. LEDs and Switches interfacing
6. Relay and Buzzer interfacing
7. LCD interfacing
8. DAC interfacing

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9. ADC interfacing
10. DC Motor interfacing
11. 7-Segment display interfacing
12. Temperature sensor interfacing through SPI

III. RTOS programming:

13. Introduction to RTOS (VxWorks) and its basic functions.
14. RTOS Timerprogramming (VxWorks).
15. RTOS Task functionprogramming (VxWorks).

Sample Mini Projects:

Design and realize a mini project on ARM7/ARM9 for given specification.

i. UART Interfacing
ii. I2C interfacing for serial communication Application.

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16ECC30

DIGITAL SIGNAL PROCESSING LAB

Instruction	3 Hours per week
Semester end Examination Duration	3 Hours
Semester end Examination	50 Marks
CIE	25 Marks
Credits	2

Course Objectives:

1. Design of digital filters using MATLAB.
2. FFT algorithm using MATLAB.
3. Multirate signal processing using MATLAB.
4. Spectral analysis of noisy signals using MATLAB.
5. Implementation of digital filters on DSP Processor.
6. Generate LTI system response on DSP Processor.

Course Outcomes:

Students will be able to:

1. Design and analyze the digital filters using MATLAB.
2. Implement FFT algorithms for linear filtering and correlation using MATLAB.
3. Experiment with multirate techniques using MATLAB.
4. Perform spectral analysis of noisy signal using welch's method.
5. Design and Implement the digital filters on DSP processor.
6. Obtain response of a LTI system to a ramp/step input on DSP processor.

List of Experiments

(A) Experiments on signal processing using MATLAB.

1. Basic matrix operations and Generation of test signals.
2. Linear Convolution , circular convolution and Correlation
3. Discrete Fourier Transform(DFT) and Fast Fourier Transform(FFT)
4. FIR filter design using different windows
5. IIR filter design: Butter worth, Chebyshev type 1 and 2: LPF, HPF, BPF & BSF filter.
6. Spectral Analysis of noisy signal using Welch's method.
7. Interpolation and Decimation.
8. Multistage filter.

(B) Experiments on DSK and CCS

1. Study of procedure to work in real- time.
2. Solutions of difference equations.
3. Linear Convolution.

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4. Implementation of FIR filter.
5. Implementation of second order IIR filters.
6. Decimation and Interpolation.

Note:

1. Minimum of 6 from Part A and 4 from Part B is mandatory.
2. For Part "A", MATLAB with different toolboxes like Signal Processing, Signal Processing block set, and SIMULINK/ MATHEMATICA/ any popular software can be used.

References:

1. Vinay K. Ingle and John G. Proakis, "Digital Signal Processing using MATLAB", 4/e, Cengage learning, 2011.
2. B. Venkataramani and M. Bhaskar,"Digital Signal Processor architecture, programming and application", 6/e, TMH, 2006.

Sample Mini Projects:

1. Design the best IIR band pass filter to meet the given specifications:
   Pass band cut off frequencies: [500 600] Hz
   Stop band cut off frequencies: [525 675] Hz
   Pass band ripple: d" 2dB
   Stop band attenuation: e" 60dB
   Phase response: Approximately linear in pass band
   Consider Butterworth, Chebyshev, Elliptic and Bessel filters

2. Design the best low pass filter to meet the given specifications:
   Pass band cut off frequency: 1K Hz
   Stop band cut off frequency: 3K Hz
   Pass band ripple: d" 2dB
   Stop band attenuation: e" 80dB
   Group Dealy: d" 5ms
   Phase response: Approximately linear in pass band
   Consider FIR and Elliptic filters.

3. Design a three stage multirate filter to meet the given specifications:
   Pass band cut off frequency: 450 Hz
   Stop band cut off frequency: 500 Hz
   Pass band ripple: d" 3dB
   Stop band attenuation: e" 40dB
   Sampling frequency: 40 KHz
   Compare with single stage filter.
4. Consider a clean speech signal of length 5000 samples and compute the Power Spectrum. Now add 0dB random noise. Compute the power spectrum using Welch and Eigen value Estimation method and also compare with the original spectrum.

16ECC31

MICROWAVE ENGINEERING LAB

Instruction	3 Hours per week
Semester end Examination Duration	3 Hours
Semester end Examination	50 Marks
CIE	25 Marks
Credits	2

Course Objectives:

1. To understand the characteristics of Reflex Klystron Oscillator (RKO) and Gunn Oscillator.
2. To learn frequency measurement techniques using cavity wave meters.
3. To determine VSWR for various loads using slotted section.
4. To calculate power ratios at ports of various microwave components.
5. To learn measurement of impedance for various microwave loads.
6. To plot the radiation pattern for an antenna.

Course Outcomes:

Students will be able to:

1. Know the characteristics of RKO and Gunn Oscillator.
2. Understand the relation between guide wavelength, free space wavelength and cut off wavelength.
3. Measure VSWR for various loads at microwave frequencies.
4. Estimate the microwave power ratios at various ports of microwave components.
5. Calculate unknown impedance of various microwave loads.
6. Understand the measurement of radiation patterns.

List of Experiments

1. Characteristics of Reflex Klystron Oscillator- To find the mode numbers and efficiencies of different modes.
2. Characteristics of Gunn diode and Gunn diode oscillator.
3. Measurement of frequency and Guide wavelength: Verification of the relation between guide wavelength, free space wavelength and cut-off wavelength.
4. Measurement of VSWR for the given loads.
5. Measurement of impedance for horn antenna, matched load, slide screw tuner etc.
6. Characteristics of Directional coupler.
7. Characteristics of E-plane, H-plane and Magic Tee.

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8. Characteristics of Circulator.
9. Radiation pattern of horn antenna.
10. Study of various antennas like dipoles, loops, Yagi antenna, log periodic antenna and their radiation pattern.

Sample Mini Projects:

1. To design microwave components such as: Directional couplers, circulators and Hybrid junctions using Simulation software.
2. To design antenna arrays such as: Binomial, Chebyshev, using Simulation software.

References:

1. Department Laboratory Manual.
2. G.S. Raghu Vamsi, "Basic microwave techniques and Laboratory manual", 2nd Edition, New age international publishers, 2009.

16EC C32

DATA COMMUNICATION AND COMPUTER NETWORKS

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: The student must have taken a course on digital communication.

Course Objectives: This course aims to:

1. Provide a conceptual foundation for the study of data communications using the Open Systems Interconnect (OSI) model for layered architecture.
2. Understand theconcepts of switched communication networks, performance of data link layer protocols for error and flow control.
3. Study and understand the principles of network protocols, routing algorithms and internetworking, Network security, Internet applications

Course Outcomes: Upon completion of this course, students will be able to:

1. Identify different tasks of computer communications networks and protocol architectures.
2. Analyze and compare circuit switching and packet switching concepts and understand ATM network concepts and the performance of various Data link control protocols for flow control and error control.
3. Analyze the services and functions of the networks layer and recognize the different internetworking devices and their functions.
4. Understand how routing is carried out in large open networking environment and the operations of major internet routing protocols such as ICMP, ARP, OSPF and BGP.
5. Understand the importance of basic network security measures such as encryption, Authentication protocols and study standard Internet applications protocols.

UNIT – I

Introduction: Data Communication and Networking for Today's Enterprise, a Communications Model, Data Communications, Networks. The Need for Protocol Architecture and Standardization, the TCP/IP Protocol Architecture, the OSI reference Model, Line Configurations. Basic concepts of networking.Network topologies. Types of Network: LAN, MAN, WAN.

UNIT – II

Switched Communications Networks: Circuit-Switching Networks, Circuit-Switching Concepts Soft switch Architecture, Packet-Switching Principles, X.25, Frame relay. ATM Networks-Protocol Architecture, ATM Logical Connections, ATM Cells, Transmission of ATM Cells, and ATM Service Categories.

UNIT – III

Data Link Layer: Design issues, Services provided to the Network layer, framing, Error Control, Flow Control. Elementary Data Link Control protocols: Stop and Wait, Sliding Window, Go Back-N, and Selective Repeat. High-Level Data Link Control (HDLC).

MAC Sub Layer: Multiple Access Protocols: ALOHA, CSMA, Comparison of IEEE Standards IEEE 802.3, 802.4, 802.11, 802.15, 802.16.

UNIT – IV

Network Layer: Network Layer Design Issues, Routing algorithms: Shortest Path Routing, Flooding, Distance Vector Routing, Hierarchical routing, Broadcast, Multicast, Congestion Control- Congestion Control Algorithms. Quality of service.Inter-Networking. The Network Layer in Internet-IP Version 4 protocol, IP Addressing, Comparison of IPV4 and IP V6, Internet Control Protocols-ICMP, ARP, OSPF and BGP.

UNIT – V

Transport Layer: The transport Service, Elements of Transport Layer, TCP and UDP protocol header formats. **Network Security and Internet Applications:** Cryptography techniques, Authentication Protocols. Applications layer protocols: Domain Name System, SNMP, Electronic Mail, and World Wide Web.

Text Books:

1. W. Stallings, "Data and Computer Communications", eight Edition, Prentice Hall - 2007.
2. A. Tanenbaum and D. Wetherall, "Computer Networks", fifth Edition, Prentice-Hall, 2011.

Suggested Reading:

1. Behrouz A. Forouzan, "Data Communication and Networking", Fourth Edition, McGraw-Hill Forouzan Networking Series, McGraw-Hill, 2007.
2. S. Keshav, "An Engineering Approach to Computer Networking", Second Edition, AddisonWesley Professional Pearson Education, 2001.

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16EC C33

PRINCIPLES OF GNSS

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Fundamental concepts of communication are required.

Course Objectives: This course aims to:

1. Explain the basic principle of operation of GPS, GPS ephemerides and signal structure.
2. Make the students to understand various coordinate systems and highlight the effect of various errors affecting GPS signals.
3. Make the students to appreciate the significance of other GNSS systems, principle of DGPS and augmentation systems.

Course Outcomes: Upon completion of this course, students will be able to:

1. Understand the principle of operation of GPS and GPS ephemerides.
2. Analyze GPS signal structure and significance of various coordinate systems
3. Estimate the various errors and their effect on position estimation.
4. Compare other global and regional navigational systems
5. Apply DGPS principle and also analyze various augmentation systems. Use of GPS in Surveying, Mapping and Navigation.

UNIT-I

GPS Fundamentals: GPS System Segments: space, control and user segments, Principle of operation, Current status of GPS satellite constellation. Orbital Mechanics: GPS ephemeris data, algorithm for computation of satellite's position from ephemeris data. Time References: solar and sidereal days, UTC time, GPS time.

UNIT-II

GPS Signals: Legacy GPS signals: Signal structure, Operating frequencies, C/A and P-Code, Navigation message, Modernized GPS signals: list of signals and their significance. Range measurements: code and carrier measurements, User position estimation with PRN codes.

Coordinate systems: Earth Centered Earth Fixed (ECEF) coordinate system, Earth Centered Inertial (ECI) coordinate system, Geodetic coordinate system, Ellipsoid and Geoid, Regional and Global Datum, World Geodetic System (WGS-84).

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UNIT-III

GPS Error Sources: Satellite clock error, ephemeris error, Receiver clock errors, satellite and receiver instrumental bias, Multipath error, receiver measurement noise, ionospheric error and tropospheric error, Klobuchar model, ionospheric delay estimation using dual frequency measurements and UERE. Dilution of precision: HDOP, VDOP, TDOP, PDOP & GDOP.

UNIT-IV

Data Formats: RINEX Observation and Navigation Data formats
GNSS: architecture, operation and signals of other global satellite systems such as Galileo, Beidou, GLONASS and regional systems such as IRNSS, QZSS.

UNIT-V

Differential GPS (DGPS): Principle of DGPS, Types of DGPS: Local Area DGPS (LADPS), Wide Area DGPS (WADGPS). **GPS Augmentation Systems:** Principle of operation of Satellite Based Augmentation system (SBAS) and Ground Based Augmentation System (GBAS): **GNSS Applications** Surveying, Mapping, Marine, air and land Navigation, Military and Space Application.

Text Books:

1. Elliot D Kaplan and Christopher J Hegarty, "Understanding GPS principles and applications", Artech House Publishers, 2/e Boston & London 2005.
2. PratapMisra and Per Enge, "Global Positioning System Signals, Measurement and Performance", Ganga- Jamuna Press, 2/e, Massachusetts, 2010.

Suggested Reading:

1. B.Hofmann, Wellenhof, H.Lichtenegger, and J.Collins, "GPS Theory and Practice," Springer Verlog, 5/e, 2008.
2. Ahmed El-Rabbany, "Introduction to GPS", Artech House Publishers, 2/e, Boston 2006.
3. Bradford W.Parkinson and James J. Spilker, "Global Positioning system: Theory and Application",Vol.II, American Institution of Aeronautics and Astronautics Inc., Washington, 1996.

16EC C34

RADAR AND SATELLITE COMMUNICATION

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: To study this course, knowledge of Communication, Electromagnetic theory and antennas is required.

Course Objectives: This course aims to:

1. To learn the principles of operation of Radar systems.
2. To know the various types of tracking Radars.
3. To develop awareness about launching a satellite, communication system and the orbital effects of a satellite.

Course Outcomes: Upon completion of this course, students will be able to:

1. Identify various building blocks of pulse Radar, analyze its operation and predict the range performance.
2. Measure the speed and direction of moving targets in spite of blind speeds.
3. Compare various tracking Radar mechanisms.
4. Understand basic satellite construction, sub systems, launching mechanisms and its operation.
5. Analyze LOS propagation and calculate the path loss in a satellite link. Calculation of G/T and C/N ratios of a path link and understand.

UNIT-I

Introduction to Radar, Radar block diagram and operation, Radar frequencies, Applications of Radar, Prediction of range performance, minimum detectable signal, receiver noise, probability density function, SNR, Integration of Radar pulses, Radar cross-section of targets, PRF and range ambiguities, transmitter power, system losses.

UNIT-II

Doppler effect, CW Radar, FM CW Radar, multiple frequency CW radar. MTI Radar, delay line canceller, range gated MTI Radar, blind speeds, staggered PRF, limitations to the performance of MTI Radar, non-coherent MTI Radar.

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UNIT-III

Tracking Radar: Sequential lobbing, conical scan, Monopulse: amplitude comparison and phase comparison methods, Low angle tracking, tracking in range, comparison of various trackers, Radar antennas.

UNIT-IV

Orbital Mechanics and Launchers: Orbital elements, Locating the satellite with respect to the earth, sub- satellite point, look angles, Orbital effects in communication system performance, Satellite sub-systems: Attitude and Orbit control systems, Telemetry, Tracking and command control system, Power supply system, Communications subsystems (transponders), Space craft antennas.

UNIT-V

Introduction to satellite link design, considerations for design of satellite system, basic transmission theory, system noise temperature and G/T ratio, design of down link and uplink, design of satellite links for specified C/N, overall C/N for uplink and downlink.

Text Books:

1. Merril. I. Skolnik, "Introduction to Radar Systems", 3/e, MGH, 2001.
2. Timothy Pratt and Charles Bostian, "Satellite Communications", John Wiley,1986.
3. Dennis Roddy, "Satellite Communication Systems", McGraw Hill publications, 4th Edition, 2017.

Suggested Reading:

1 M. Richharia, "Satellite Communication Systems: Design Principles", MacMillan, 2/e,2003.

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16EC C35

VLSI DESIGN

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: A prior knowledge of Verilog HDL and MOS Transistor Theory.
Course Objectives: This course aims to:

1. Study the concepts of Verilog HDL, simulation and synthesis process/ concepts.
2. Learn the various characteristics of MOS transistor, process steps in IC fabrication.
3. Learn the various concepts required to obtain the digital logic layout diagrams. To know various subsystem design concepts.

Course Outcomes: Upon completion of this course, students will be able to:

1. Simulate and synthesize digital logic designs.
2. Understand characteristic behavior of MOSFET and layout design rules.
3. Analyze the process steps in IC fabrication
4. Design CMOS based logic circuits.
5. Understand the design concepts of memories and VLSI testing.

UNIT – I

Advanced Verilog HDL: Functions and tasks, Switch level Modeling, UDP, Design of Mealy and Moore state models using Verilog, Logic Synthesis, Synthesis Design flow, Gate level Netlist.

UNIT – II

Introduction to MOS Technology, Basic MOS Transistor action: Enhancement and Depletion Modes. Basic electrical properties of MOS, Threshold voltage and Body Effect.
MOS and CMOS circuit Design Process: MOS Layers, Stick diagrams, Lambda based Design rules and Layout diagrams.

UNIT – III

Process steps in IC fabrication Crystal growth and wafer preparation Czochralski process- apparatus- silicon shaping, slicing and polishing- Diffusion, Ion implantation- Annealing process- Oxidation process- Lithography- Photolithography, electron beam and x-ray lithography- Chemical vapour deposition (CVD)- epitaxial growth- reactors- metallisationand packaging.

UNIT – IV

Design of MOS inverters with different loads. Basic Logic Gates with CMOS: INVERTER, NAND, NOR, AOI and OAI gates. Transmission gate logic circuits, BiCMOS inverter, D flip flop using Transmission gates.

UNIT – V

Subsystem Design: Multiplexor, Comparator, Shifters, Programmable Logic Arrays. Memories: 1T, 3T Dynamic RAM Cell, 6T Static RAM Cell. NOR and NAND based ROM Memory Design.

Testing: Introduction to Testing, Fault models, Controllability, Observability.

Text Books:

1. Samir Palnitkar, "Verilog HDL: A guide to Digital design and synthesis", 2/e, Pearson Education, 2008.
2. Kamran Eshraghian, Douglas A. Pucknell, SholehEshraghian, "Essentials of VLSI circuits and systems", PHI, 2011.
3. Neil H E Weste, David Harris, Ayan Banerjee "CMOC VLSI Design A circuit and System Perspective", 3/e, Pearson Education, 2006.

Suggested Reading:

1. Michael D. Ciletti, "Advanced Digital Design with Verilog HDL", PHI, 2005.
2. John P. Uyemura, "Introduction to VLSI Circuits and systems", John Wiley & Sons, 2011.
3. Morris Mano M. and Michael D.Ciletti, "Digital Design with an Introduction to Verilog HDL", 5th edition, Pearson 2013.

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16EC E09

REAL TIME OPERATING SYSTEMS

(Elective-IV)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisites: Prior knowledge ofComputer Organization and Architecture is required.

Course Objectives: This course aims to:

1. Learn about the fundamental need of Real Time operating systems.
2. Understand the concepts of different RTOS.
3. Study the linux based target system design process.

Course Outcomes: Upon completion of this course, students will be able to:

1. Understand Real-time operating system requirements and applications.
2. Categorize different scheduling approaches for real time scheduler.
3. Compare different real time systems.
4. Analyze the inter task communication in RTOS.
5. Apply the linux based embedded system design process.

UNIT-I

Introduction to Operating Systems: Operating System objectives and functions, Evolution of operating systems, Developments leading to modern Operating Systems, Virtual machines, OS design consideration for multiprocessor and multicore, Overview on traditional and modern Unix OS, Differences between GPOS and RTOS

UNIT-II

Real Time System Basics: Basic model of a real time system, characteristics, applications, types of real time tasks, timing constraints, Uniprocessor Scheduling: Criteria for scheduling, scheduling algorithms: FCFS, SJF, Priority, Round Robin. **Real Time Task Scheduling:** Earliest Deadline First (EDF): Implementation, shortcoming. Rate Monotonic Algorithm (RMA): Implementation, issues associated with RMA

UNIT-III

Commercial Real Time Operating System: Time services, Features of RTOS, Unix as a RTOS, Non pre-emptive kernel, dynamic priority levels, POSIX: genesis of POSIX, Overview, Real Time POSIX standard, Priority inversion, priority ceiling and priority Inheritance protocols , a survey of contemporary RTOS: PSOS, VRTX, QNX, µC-OS-II and RT-Linux,

UNIT-IV

Introduction toVxworks: Salient Features, Multitasking, Task state transition, Task Control: Task Creation and Activation, Task Stack, Task Names and IDs, Task Options, Task Information, Task Deletion and Safety, Semaphore and message queues related functions

UNIT-V

Linux Development Process: Types of Host /Target Development and debug setup, Generic Architecture of an Embedded Linux System, System start up, Types of Boot configurations, System Memory Layout, Development Tools: Project Workspace, IDE, GNCC cross platform, selecting and configuring kernel, setting up boot loader.

Text Books:

1. William Stallings, "Operating Systems Internals and Design Principles," 7/e, Pearson Education, 2014.
2. Rajib Mall, "Real Time Systems", Pearson Education, 2/e, 2007.
3. KarimYaghmour, "Building Embedded Linux Systems" O'Reilly, 2003.

Suggested Reading:

1. Silberschatz, Galvin, Gange" Operating Systems Concepts" 8/e , Wiley Education, 2007.
2. Wind River SystemsInc.,"VxWorks Programrs Guide", 1997.

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16EC E10

SPEECH PROCESSING
(Elective-IV)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: The student should have knowledge of digital signal processing.
Course Objectives: This course aims to:
1. Provide students with the knowledge of basic characteristics of speech signal in relation to production and hearing of speech by humans.
2. Describe basic algorithms of speech analysis and pitch extraction.
3. Learn the various algorithms for speech recognition like HMM and Dynamic warping.

Course Outcomes: Upon completion of this course, students will be able to:
1. Understand the basic characteristics of speech signal in relation to production and hearing of speech by humans.
2. Analyze speech and extract features for speech applications.
3. Design the various applications like recognition, synthesis, and coding of speech.
4. Use HMM for speech recognition.
5. Implement dynamic warping technique in real time problems.

UNIT – I
Fundamentals of Digital speech processing: Discrete time signals and systems, Transform representation of signals and systems (Z-transform, FT and DFT), fundamentals of digital filters (IIR and FIR), Sampling theorem. Decimation and interpolation of sampled waveforms, Mechanism of speech production: Vocal track and physiology.

UNIT - II
Time Domain Models of Speech Processing: Time dependent processing of speech, Short –time Energy and average magnitude, short time average Zero crossing rate, Speech versus Silence Discrimination using Energy and Zero crossing, Pitch period estimation, short time auto correlation estimation, Short time average magnitude difference function, median smoothing and speech processing.

UNIT – III

Digital Representation of the Speech Waveform: Sampling speech signals, review of statistical model of speech signal, Instantaneous Quantization, Adaptive Quantization, Differential quantization. Qualitative treatment for Delta modulation and Differential PCM.Comparison of systems, LDM to PCM conversion and PCM to ADPCM conversion.

UNIT-IV

Homomorphic Speech Processing: Introduction, Homomorphic systems for convolution - properties of the complex Cepstrum, computational considerations, complex cepstrum of speech, Pitch detection, Formant estimation, The homomorphicVocoder. Introduction to Text-to-speech and Articulator speech synthesis.

UNIT-V

Linear Predictive Analysis: Solution ofthe LPC equations, Comparisons between the methods of the solutions of LPC Analysis equations, Frequency Domain interpretation of LPA, Applications of the LPC parameters Speaker recognition systems, Problems in Automatic speech recognition, Dynamic warping, Hidden Markow models, speaker Identification / verification.

Text Books

1. Rabiner L.R and Schafer R .W, "Digital Processing of Speech Signals", PHI,1978.
2. Owens F.J., "Signal Processing of Speech", Macmillan, New Electronics, 1/e,2000.

Suggested Reading:

1. Daniel Jurefsky and James H. Martin, "Speech and Language Processing", PHI, 2/e, 2003.
2. Papamchalis, "Practical Approaches to speech coding", PHI, 1987.
3. Rabinerand Bernard Gold, "Theory and Application of Digital Signal Processing", 2nd edition, PHI, 1988.

16EC E12

APPLICATIONS OF IoT IN ECE
(Elective-V)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Knowledge onProgramming and Problem Solving, Computer Organization, Embedded systems.

Course Objectives: This course aims to:

1. Provide an overview of Internet of Things, building blocks of IoT and the real-world applications.
2. Introduce Python Programming language and packages.
3. Introduce Rasberry Pi device, its interfaces and Django Framework.

Course Outcomes: Upon completion of this course, students will be able to:

1. Understand the terminology, enabling technologies and applications of IoT
2. Apply the concept of M2M (machine to machine) and describe the differences between M2M and IoT.
3. Understand the basics of Python Scripting Language which is used in many IoT devices
4. Describe the steps involved in IoT system design methodology
5. Design simple IoT systems using Rasberry Pi board with sensors, actuators and develop web applicationsusing python based framework called Django.

UNIT-I

Introduction and Concepts: Introduction to Internet of Things: Definitions and Characteristics of IoT, Physical Design of IoT: Things in IoT, IoT Protocols, Logical Design of IoT, IoT Functional Blocks, IoT Communication Models, IoT Communication APIs, IoT Enabling Technologies-Wireless Sensor Networks, Cloud Computing, Communication Protocols, IoT Levels & Deployment Templates.

UNIT-II

Domain Specific IoTs: IoT applications for Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, health and Lifestyle

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IoT and M2M: Introduction, M2M, Differences between IoT and M2M, Software Defined Networking, Network Function Virtualization.

UNIT-III

Introduction to Python: Motivation for using Python for designing IoT systems, Language features of Python, Data types: Numbers, Strings, Lists, Tuples, Dictionaries, Type Conversions, Data Structures: Control of flow-if, for, while, range, break/continue, pass, functions, modules, packaging, Python packages of Interest for IoT: JSON, XML, HTTPLib, URLLib, SMTPLib.

UNIT-IV

IoT Platforms Design Methodology: Introduction, IoT Design Methodology Steps-Purpose and Requirements Specification, Process Specification, Domain Model Specification, Information Model Specification, Service Specifications, IoT Level Specification, Functional View Specification, Operational View Specification, Device and Component Integration, Application Development, Case Study on IoT System for Weather Monitoring.

UNIT-V

IoT Physical Devices and End Points: Basic building blocks of an IoT device, Rasberry Pi-About the Rasberry Pi board, Rasberry Pi interfaces-Serial, SPI, I2C. **IoT Physical Servers and Cloud Offerings:** Introduction to cloud storage models and Communication APIs, WAMP: AutoBahn for IoT, Xivelycloud for IoT. **Python Web Application Framework:** Django Framework-Roles of Model, Template and View

Text Books:

1. ArshdeepBahga and Vijay Madisetti, "Internet of Things - A Hands-on Approach", Universities Press, 2015.
2. Tony Gaddis, "Starting out with Python", 3rd edition, Pearson, 2015.

Suggested Reading:

1. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st edition, press Publications, 2013.
2. Matt Richardson, Shawn Wallace, O'Reilly, "Getting Started with Raspberry Pi", SPD, 2014.

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16EC E13

DIGITAL IMAGE PROCESSING
(Elective-V)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: This course requires the knowledge of Digital Signal Processing.

Course Objectives: This course aims to:
1. Understand the image formation and its digital representation.
2. Learn representation of images in frequency domain and enhancement techniques.
3. Students would be able to solve the problems related to image compression and restoration.

Course Outcomes: Upon completion of this course, students will be able to:
1. Understand how images are formed, sampled and quantized.
2. Applyvarious transforms like Fourier, DCT, Haar, DWT and Hadamard Transform to different applications.
3. Apply image enhancement techniques for practical applications
4. Implement the image restoration techniques.
5. Implement image compression techniques by removing the redundancy.

UNIT – I

Elements of Digital Image Processing Systems, Digital image representation, elements of visual perception, Image sampling and Quantization, Basic Relationships between pixels.

UNIT – II

Properties and Applications of Fourier Transform: FFT, Discrete cosine transform, Hadamard transform, Haar transform, Slant transform, DWT and Hotelling transform.

UNIT – III

Spatial Enhancement Techniques: Histogram equalization, direct histogram specification, Local enhancement.Frequency domain techniques: Low pass, High pass and Homomorphic Filtering, Image Zooming Techniques.

UNIT – IV

Image Degradation model, Algebraic approach to restoration, inverse filtering, Least mean square filter, Constrained least square restoration and interactive restoration. Speckle noise and its removal techniques.

UNIT – V

Redundancies for image compression, Huffman Coding, Arithmetic coding, Bit-plane coding, loss less and lossy predictive coding. Transform coding techniques: Zonal coding and Threshold coding.

Text Books:

1. Gonzalez R.C. and Woods R.E., “Digital Image Processing” 2/e, PHI, 2005.
2. A.K.Jain, “Fundamentals of Digital Image processing”, PHI, 1989.

Suggested Reading:

1. Madhuri A, Joshi, “Digital Image Processing: An algorithmic Approach”, PHI, 2006.
2. U Qidwai, C.H.Chen, “Digital Image Processing”,CRC Press, (Taylor & Francis), YesdeePublications,First Indian Reprint 2013.

16EC C36

ADVANCED SIMULATION LAB

Instruction	3 P Hours per Week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	25 Marks
Credits	2

Prerequisite: A prior knowledge of Digital logic, Signal processing, Communication and DCCN is required.

Course Objectives: This course aims to:

1. Understand the importance and applications of virtual instrumentation and computer networks.
2. Learn the basic programming concepts in LabVIEW and Network Simulator.
3. Develop real time applications using LabVIEW.

Course Outcomes: Upon completion of this course, students will be able to:

1. Learn how to develop basic applications in the LabVIEW graphical programming environment.
2. Develop ability for programming in LabVIEW using various data structures, program structures, plotting the graphs and charts for system monitoring, processing and controlling.
3. Apply knowledge of mathematics and engineering to formulate and study or solve engineering problems, including problems at the interface of engineering.
4. Develop LabVIEW skills to engineer basic computer-based instrumentation.
5. Develop applications that are scalable, readable, maintainable and reliable.

LAB EXPERIMENTS

1. Familiarization with simulation tools: LabVIEW and Network Simulator2 (NS2).
2. Loops, Structures and Math-script in LabVIEW.
3. Implementation of Combinational circuits (Multiplexer, Demultiplexer, Decoder and Encoder, Priority Encoder) using myRIO.
4. Design of Sequential circuits (Flip flops, counters and registers).
5. Convolution and correlation of signals.

6. FIR and IIR Filter design.
7. Implementation of Analog modulation and Demodulation schemes (AM and FM) using my RIO.
8. Digital carrier modulation and demodulation schemes (ASK, FSK and PSK)
9. Time domain analysis (State variable analysis).
10. Frequency domain analysis (Nyquist and Bode plots).
11. Creation of a wired network and data transmission between the nodes with at least four nodes using NS2.
12. Creation of a wireless network and data transmission between the nodes with at least four nodes using NS2.
13. Simulation of the data transfer between the nodes using TCP/UDP using NS2.
14. Sensor data acquisition using my DAQ.
15. Voltage / Current Sweep generation using my DAQ.

Mini Project cum Design Exercises

Design and development of any one of the following applications.

a) Digital IIR Notch filter
b) Multistage design of decimator and interpolator
c) Discrete multitone transmitter and receiver
d) ALU Design using Lab VIEW
e) Universal shift registers using Lab VIEW
f) Code converters using Lab VIEW
g) Design of PLL using Lab VIEW

Suggested Reading:

1. Jeffrey Travis and Jim Kring, "Lab VIEW for Everyone: Graphical Programming Made Easy and Fun", 3rd Edition, Prentice Hall, 2007.
2. TeerawatIssariyakul and EkramHossain, "Introduction to Network Simulator NS 2", 2nd Edition, Springer, 2012.

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16ECC37

ELECTRONIC DESIGN AND AUTOMATION LAB

Instruction	3 P Hours per Week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	25 Marks
Credits	2

Prerequisite: Digital design fundamentals and synthesis & simulation concepts.
Course Objectives: This course aims to:

1. Simulate and synthesize combinational and sequential logic circuits
2. Simulate switch level modules
3. Learn implementation procedure for any design on FPGA and To study the speed, power and area constraints of FPGA/CPLD

Course Outcomes: Upon completion of this course, students will be able to:

1. Analyze simulation and synthesis reports of combinational and sequential logic circuits
2. Obtain gate level net-list and RTL diagrams
3. Implement sequence detector using FSM on FPGA
4. Design adders using UDP and Tasks & Functions.
5. Implement mini projects on FPGA/CPLD

Part A

Write VERILOG Code, Simulate and Implement the following on FPGA.

1. Code Converters.
2. Encoders, Decoders, Priority Encoder and Comparator.
3. Registers/Counters.
4. Sequence Detector using Mealy and Moore type state machines.
5. Any application of UDP.
6. Tasks and Functions.

Note:

1. All the codes should be implemented appropriately using Gate level, Dataflow and BehavioralModeling.
2. All the programs should be simulated using test benches.

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Part B

Switch Level Modeling of CMOS Circuits

1. Basic Logic Gates: Inverter, NAND and NOR.

2. Half Adder and Half Subtractor.
3. 4:1 Multiplexer.
4. 2:4 Decoder.
5. Design of inverter circuit using Simulation tool.
6. Design of NAND Gate using Simulation tool.
7. Design of NOR Gate using Simulation tool.

Mini Project: Simulation and implementation of various digital designs on FPGA.

Suggested Reading:

1. Michal D.Ciletti, "Advanced digital design with Verilog HDL", Pearson Edition, 2011.
2. Samir Palnitkar, "Verilog HDLA Guide to Digital Design and Synthesis",Pearson 2nd edition, 2003.
3. Cadence Design Systems (Ireland) Ltd., "Cadence manual", 2013.

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16EC C38

PROJECT SEMINAR

Instruction	3 P Hours per Week
Duration of SEE	—
SEE	—
CIE	50 Marks
Credits	2

The objective of 'Project Seminar' is to enable the student take up investigative study in the broad field of Engineering / Technology, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on an individual basis or two/three students in a group, under the guidance of a supervisor. This is expected to provide a good initiation for the student(s) towards R&D. The work shall include:

1. Survey and study of published literature on the assigned topic;
2. Working out a preliminary Approach to the Problem relating to the assigned topic;
3. Conducting preliminary Analysis/Modelling/Simulation/Experiment/ Design/Feasibility;
4. Preparing a Written Report on the Study conducted for Presentation to the Department;
5. Final Seminar, as oral Presentation before a departmental Committee.

Guidelines for the award of Marks:Max.

Marks: 50

Evaluation by	Max. Marks	Evaluation Criteria / Parameter
Supervisor	20	Project Status / Review
	5	Report
Department Committee	5	Relevance of the Topic
	5	PPT Preparation
	5	Presentation
	5	Question and Answers
	5	Report Preparation

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116EC E16

DSP PROCESSORS AND ARCHITECTURES
(Elective-VI)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Course on Digital Signal Processing**.**
Course Objectives: This course aims to:
1. Learn the architectural differences between DSP and General purposeprocessor.
2. Study the fixed point.
3. Study the various applications of DSPProcessors.

CourseOutcomes: Upon completion of this course, students will be able to:
1. Differentiate between DSP Processor and General Purposeprocessor.
2. Select the most appropriate processor for the given application.
3. Design and implement various signal processing algorithms using 55xx processor.
4. Interface the TMS320C55XX processor to external devices.
5. Take up research projects using DSP processors.

UNIT-I
Introduction to DSP Processors: Differences between DSP and other microprocessor architectures.Number formats- Fixed point, Floating point and block Floating point formats, IEEE-754 Floating point, Dynamic range and precision, Relation between data word size and instruction word size, Q-notation. Basic elements of real time DSP systems, DSP Hardware

UNIT-II
Fundamentals of Programmable DSPs: Multiplier and Multiplier Accumulator, Modified Bus structures and memory access in PDSPs – Multiple access memory, multiport memory, SIMD, VLIW Architectures, Pipelining, Special addressing modes in PDSPs, On-chip peripherals.

UNIT-III
Overview of TMS320C55X: Architecture of TMS320C55X Processor, Buses, Memory map, addressing modes, Instruction set, Pipeline and parallelism, Mixed C and Assembly language programming and on-chip peripherals.

UNIT-IV

Interfacing Memory and Parallel I/O Peripherals to Programmable DSP Devices: Memory space organization, External bus interfacing signals, Memory interface, Parallel I/O interface, Programd I/O, Interrupts and I/O, Direct Memory Access (DMA).Software Development tools-Code Composer Studio (CCS), C compiler, Assembler and Linker.

UNIT-V

Application Programs: Implementation of algorithms on DSP processors, Sinewave generators, Convolution, Correlation, FFT, FIR filter, IIR filter, Decimation and Interpolation and sub band coding of signals.

Text Books:

1. Sen M. Kuo and WoonSergGan, "Digital Signal Processors Architectures, Implementation and Application", Pearson Practice Hall, 2013.
2. Avatar Singh and S. Srinivasan, "Digital Signal Processing Implementations Using DSP Microprocessors", Thomson Brooks, 2012.

Suggested Reading:

1. B.Ventakaramani, M. Bhaskar, "Digital Signal Processors Architecture Programming and Applications", Tata McGraw Hill, 10th reprint, 2015.
2. RulphChassaing, "Digital Signal Processing and Application with the C6713 and C6416 DSK", A John Wiley & sons, Inc, Publication, 2005.

16EC E18

VLSI TECHNOLOGY
(Elective-VI)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: A prior knowledge of Semiconductor Properties.

Course Objectives: This course aims to:

1. Understand the procedure for preparing silicon wafer and its cleaning.
2. Know the various fabrications steps involved.
3. Learn the concepts of packaging and Testing of ICs.

Course Outcomes: Upon completion of this course, students will be able to:

1. Analyze the functions of various layers in IC fabrication.
2. Demonstrate the concepts of preparing silicon wafer from the raw material.
3. Understand and analyzation of chemical reactions in the formation of various layers.
4. Compare various lithography process steps.
5. Understand concepts of involved in packaging of VLSI circuits and testing.

UNIT-I:

Introduction: Integrated Circuits Review of history of VLSI technology progress, Silicon as the Base Material and its advantages, various Layers of ICs: Substrate, Active Layer, Oxide/Nitride Layers, Metal/Poly Silicon Layers. Functions of each of the Layers.Introduction to clean room technology.

UNIT-II

Silicon Wafer Preparation: Electronic Grade Silicon, CZ and FZ Methods of Single Crystal Growth, Silicon Shaping, Mechanical Operations, Chemical Operations.

Wafer-Cleaning Technology: Introduction, basic concepts of wafer cleaning, Wet-cleaning technology, Dry-cleaning technology.

UNIT-III

Oxide Growth: Structure of SiO_2, Growth Mechanism and Dynamics, Oxide Growth by Thermal method.

Lithography: Steps involved in Photolithography, photo resists and their characteristics, optical exposure systems contact and projection systems, steppers, X-ray Electron Beam Lithography

UNIT-IV

Etching: Chemical, Electro Chemical Plasma (Dry Etching) Reactive Plasma Etching
Ion Implantation: Range and Penetration Depth, Damage and AnnealingIon Implantation machine.
Diffusion: Constant and Infinite Source Diffusions, Diffusion Profiles and Diffusion Systems.

UNIT-V

Dielectric and Polysilicon Film Deposition Techniques: Chemical Vapour Deposition (CVD) and associated methods like LPCVD and PECVD. PVD thermal evaporation a sputtering.
Packaging and Metallization: Die, Bonding and Packaging, Testing.

Text Books:

1. J. D. Plummer, M .D. Deal and P. B. Griffin, "The Silicon VLSI Technology Fundamentals, Practice and modeling", Pearson Education 2009.
2. S.M. Sze, "VLSI Technology", McGrawhill International Editions, 2017.

Suggested Reading:

1. CY Chang and S.M. SZe ,"VLSI Technology", Tata McGraw-Hill Companies Inc. with effect from the academic year 2016-2017.
2. Stephen A, "The Science and Engineering of Microelectronic Fabrication", Campbell Oxford 2001.

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16EC E19

VOICE OVER IP

(Elective-VI)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: A prior knowledge of Data communication and computer networks is required.

Course Objectives: This course aims to:

1. Provide the switching technology, traditionally used to transport voice over the telephone system.
2. Examine the emerging trend of using packet-switching network to transport voice - especially over the Internet Protocol (IP) network.
3. Provide students the theory of "IP Telephony". Students will also get the bigger picture of how VoIP technology is changing the telecom

Course Outcomes: Upon completion of this course, the student will be able to

1. Identify architectures used in the enterprise environment and interpret the key VoIP industry protocols
2. Apply and rephrase the different protocol like SIP, H.323 and VoIP.
3. Examine the importance of QoS with regard to availability and reliability of a voice network.
4. Relate the technologies, architectures, and protocols used in the VoIP environment.
5. Familiarize with Voice over IP Benefits, Applications and Services.

UNIT I

Overview of the PSTN and Comparisons to Voice over IP: The Beginning of the PSTN, Understanding PSTN, Basics, PSTN Services and Application, Drivers Behind the Convergence Between Voice and Data Networking, Packet Telephony, New PSTN Network Infrastructure Model.

UNIT II

Basic Telephony Signaling: Signaling Overview, E&M Signaling, CAS, ISDN, QSIG, DPNSS; Signaling System 7, SS7 Network Architecture, SS7 Protocol Overview, SS7 Examples,List of SS7 Specifications.

UNIT III

IP Transport Mechanisms: An In-Depth Analysis Delay/Latency Jitter. Pulse Code Modulation, Voice Compression, Echo, Packet Loss, Voice Activity Detection, Dial-Plan Design, End Office Switch, Call-Flow Versus IP Phone Call. Voice over IP Configuration Issues: Dial-Plan Considerations, Feature Transparency.

UNIT - IV

Quality of Service: QoS Network Toolkit, Edge Functions, Traffic Policing, Backbone Networks, Rules of Thumb for QoS; IP Signaling Protocols H.323, H.323 Elements, H.323 Protocol Suite, H.323 Call-Flows, Session Initiation Protocol, SIP Overview, SIP Messages, Basic Operation of SIP, Gateway Control Protocols Simple Gateway Control Protocol, Media Gateway Control Protocol.

UNIT V

Voice over IP Benefits, Applications and Services: Key Benefits of VoIP Packet Telephony Enterprise Applications and Benefits Enterprise VoIP Case Study: B.A.N.C. Financing International. Call Centers Service Provider Calling-Card Case Study Value-Added Services Enterprise Case Study: Acme Corporation

Text Books:

1. Jonathan Davidson, James Peters, "Voice over IP Fundamentals", Cisco Press, Packet Guide to Voice over IP,2000.
2. Bruce Hartpence, "Packet Guide to Voice over IP", Oreilly Publications, 2013.

Suggested Reading:

1. Daniel Collins, "Carrier Grade Voice over IP", 2nd edition, TMH, 2002.

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16CS O10

BASICS OF MACHINE LEARNING USING PYTHON

Elective-VII (Open)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course aims to:

1. Get an idea of Machine Learning algorithms to solve real world problems.
2. Study various machine learning algorithms.
3. Analyze data using machine learning techniques.

Course Outcomes: Upon completion of this course, the student will be able to:

1. Understand the basics concepts of Machine Learning and Python.
2. Apply feature engineering techniques and visualization tools to the data.
3. Analyze the various types of data by using python based machine learning techniques.
4. Identify and evaluate various recommender systems.
5. Design solutions to real world problems using deep learning algorithms.

UNIT - I

Introduction to Machine Learning: Introduction, Machine Learning process. **Introduction to Python**: Features, sources and installation of Python, IDEs, Basics of Python, Data Structures and loops.

UNIT - II

Feature Engineering: Introduction to Features and need of feature Engineering, Feature extraction and selection, Feature Engineering Methods, Feature Engineering with Python. **Data Visualization:** Various charts, histograms, plots.

UNIT - III

Regression: Simple and multiple regressions, Model assessment, various types of errors, errors, ridge regression, Lasso regression, non-parameter regression. **Classification:** Linear classification, logistic regression, Decision Trees, Random Forest, Naïve Bayes.

UNIT - IV

Unsupervised Learning: Clustering, K-Means clustering, Hierarchical clustering. **Text Analysis:** Basic text analysis with Python, regular expressions, NLP, text classification. **Time Series Analysis**: Date and time handling, window functions, correlation, time series forecasting.

UNIT - V

Neural Network and Deep Learning: Neural network- gradient descent, activation functions, parameter initialization, optimizer, loss function, deep learning, deep learning architecture, memory, deep learning framework. **Recommender System:** Recommendation engines, collaborative filtering.

Text Books:

1. AbhishekVijavargia "Machine Learning using Python", BPB Publications, 1st Edition, 2018
2. Tom Mitchel "Machine Learning", Tata McGraWHill, 2017
3. ReemaThareja "Python Programming", Oxford Press, 2017.

Suggested Reading:

1. Yuxi Liu, Python Machine Learning by Example, 2nd Edition, PACT, 2017

Online Resources:

1. https://www.guru99.com/machine-learning-tutorial.html
2. https://www.tutorialspoint.com/machine_learning_with_python/index.htm
3. https://www.tutorialspoint.com/python/
4. https://docs.python.org/3/tutorial/
5. https://www.geeksforgeeks.org/machine-learning/

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16ME O01

ENTREPRENEURSHIP

Elective-VII (Open)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course aims to:

1. The environment of industry and related opportunities and challenges
2. Concept and procedure of idea generation
3. Elements of business plan and its procedure
4. Project management and its techniques
5. Behavioral issues and Time management

Course Outcomes: Upon completion of this course, the student will be able to:

1. Identify opportunities and deciding nature of industry
2. Brainstorm ideas for new and innovative products or services
3. Analyze the feasibility of a new business plan and preparation of Business plan
4. Use project management techniques like PERT and CPM
5. Analyze behavioural aspects and use time management matrix

UNIT-I

Indian Industrial Environment: Competence, Opportunities and Challenges, Entrepreneurship and Economic growth, Small Scale Industry in India, Objectives, Linkage among small, medium and heavy industries, Types of enterprises, Corporate Social Responsibility.

UNIT-II

Identification and Characteristics of Entrepreneurs: First generation entrepreneurs, environmental influence and women entrepreneurs, Conception and evaluation of ideas and their sources, Selection of Technology, Collaborative interaction for Technology development.

UNIT-III

Business Plan: Introduction, Elements of Business Plan and its salient features, Technical Analysis, Profitability and Financial Analysis, Marketing Analysis, Feasibility studies, Executive Summary.

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UNIT-IV

Project Management: During construction phase, project organization, project planning and control using CPM, PERT techniques, Human aspects of project management, Assessment of tax burden

UNIT-V

Behavioral Aspects of Entrepreneurs: Personality, determinants, attributes and models, Leadership concepts and models, Values and attitudes, Motivation aspects, Change behavior

Time Management: Approaches of time management, their strengths and weaknesses. Time management matrix and the urgency addiction

Text Books:

1. Vasant Desai, "Dynamics of Entrepreneurial Development and Management", Himalaya Publishing House, 1997.
2. Prasanna Chandra, "Project-Planning, Analysis, Selection, Implementation and Review", Tata Mcgraw-Hill Publishing Company Ltd. 1995.
3. S.S. Khanka, "Entrepreneurial Development", S. Chand & Co. Pvt. Ltd., New Delhi

Suggested Reading:

1. Robert D. Hisrich, Michael P. Peters, "Entrepreneurship", 5/e, Tata Me Graw Hill Publishing Company Ltd., 2005.
2. Stephen R. Covey and A. Roger Merrill, "First Things First", Simon and Schuster Publication, 1994.
3. Sudha G.S., "Organizational Behavior", National Publishing House, 1996.

16EG O02

GENDER SENSITIZATION

Elective-VII (Open)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course aims to:

1. Develop students' sensibility with regard to issues of gender in contemporary India.
2. Provide a critical perspective on the socialization of men and women.
3. Expose the students to debates on the politics and economics of work. To help students reflect critically on gender violence.

Course Outcomes: Upon completion of this course, the student will be able to:

1. Develop a better understanding of important issues related to what gender is in contemporary India.
2. Be sensitized to basic dimensions of the biological, sociological, psychological and legal aspects of gender. This will be achieved through discussion of materials derived from research, facts, everyday life, literature, and film.
3. Attain a finer grasp of how gender discrimination works in our society and how to counter it. Students will acquire insight into the gendered division of labour and its relation to politics and economics.
4. Understand what constitutes sexual harassment and domestic violence and be made aware of New forums of Justice.
5. Draw solutions as to how men and women, students and professionals can be better equipped to work and live together as equals.

UNIT-I

Understanding Gender:

Gender: Why Should We Study It? (*Towards a World of Equals*: Unit -1)

Socialization: Making Women, Making Men (*Towards a World of Equals*: Unit -2), Introduction. Preparing for Womanhood.Growing up Male.First lessons in Caste.Different Masculinities.

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UNIT-II

Gender and Biology:

Missing Women: Sex Selection and Its Consequences (*Towards a World of Equals*: Unit -4), Declining Sex Ratio. Demographic Consequences.

Gender Spectrum: Beyond the Binary (*Towards a World of Equals*: Unit -10), Two or Many? Struggles with Discrimination.

UNIT-III

Gender and Labour:

Housework: the Invisible Labour (*Towards a World of Equals*: Unit -3), "My Mother doesn't Work." "Share the Load."

Women's Work: Its Politics and Economics (*Towards a World of Equals*: Unit -7), Fact and Fiction. Unrecognized and Unaccounted work. Additional Reading: Wages andConditions of Work.

UNIT-IV

Issues Of Violence

Sexual Harassment: Say No! (*Towards a World of Equals*: Unit -6), Sexual Harassment, not Eve-teasing- Coping with Everyday Harassment- Further Reading:"*Chupulu"*.

Domestic Violence: Speaking Out (*Towards a World of Equals*: Unit -8), Is Home a Safe Place? -When Women Unite [Film]. Rebuilding Lives. Additional Reading:New Forums for Justice.Thinking about Sexual Violence (*Towards a World of Equals*: Unit -11), Blaming the Victim-"I Fought for my Life…." - Additional Reading: The Caste Face ofViolence.

UNIT-V

Gender: Co - Existence

Just Relationships: Being Together as Equals (*Towards a World of Equals*: Unit -12), Mary Kom and Onler. Love and Acid just do not Mix. Love Letters. Mothers and Fathers.Additional Reading: Rosa Parks-The Brave Heart.

Textbooks:

1. A Suneetha, Uma Bhrugubanda, DuggiralaVasanta, Rama Melkote, Vasudha Nagaraj, AsmaRasheed, Gogu Shyamala, Deepa Sreenivas and Susie Tharu "Towards a World of Equals: A Bilingual Textbook on Gender" published byTelugu Akademi, Hyderabad, Telangana State, 2015.

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Suggested Reading:

1. Menon, Nivedita. Seeing like a Feminist. New Delhi: Zubaan-Penguin Books, 2012
2. AbdulaliSohaila. “I Fought For My Life…and Won.”Available online at: http://www.thealternative.in/lifestyle/i-fought-for-my-lifeand-won-sohaila-abdulal/

Web Resources:

1. https://aifs.gov.au/publications/gender-equality-and-violence-against-women/introduction
2. https://theconversation.com/achieving-gender-equality-in-india

Note: Since it is an Interdisciplinary Course, Resource Persons can be drawn from the fields of English Literature or Sociology or Political Science or any other qualified faculty who has expertise in this field from engineering departments.

16PY O01

HISTORY OF SCIENCE AND TECHNOLOGY

Elective-VII (Open)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course aims to:

1. Enable students to understand science as a socio-cultural product in specific socio-historical contexts.
2. Expose students to philosophical, historical and sociological perspectives to look at science as a practice deeply embedded in culture and society.
3. Inculcate the scientific culture and ethics in the development of technologies.

Course Outcomes: Upon completion of this course, the student will be able to:

1. Demonstrate knowledge of broad concepts in the history of science, technology ranging over time, space and cultures.
2. Recognize the values of a wide range of methodologies, conceptual approaches and the impact of competing narratives within the history of science, technology.
3. Identify, locate and analyze relevant primary and secondary sources in order to construct evidence-based arguments.
4. Think independently and critically, using appropriate methodologies and technologies to engage with problems in the history of science, technology.
5. Demonstrate academic rigor and sensitivity to cultural and other diversity, and understanding of the ethical implications of historical and scientific enquiry within a global context.

UNIT-I

Science - The Beginning (through 599 BC): The Stone Ages, Knowledge among hunter gatherers,Agricultural Revolution and other revolutions,Civilization,Major advances.

Science in Antiquity (600 BC - 529 AD): Philosophy, a precursor to science, Hellenistic world and the Roman Empire, Other cultures of the period, major advances.

UNIT-II

Medieval Science (530 AD - 1452 AD): The decline of science in Europe , Science in China, Science and mathematics in India, Arab science, revival of science in Europe, technology revolution of the Middle ages, Major advances.

The Renaissance and the Scientific Revolution (1453 AD – 1659 AD): Renaissance, Scientific Revolution, Technology, Major advances.

UNIT-III

Scientific Method: Measurement and Communication (1660 AD – 1734): European domination, The scientific method, Major advances.

The Industrial Revolution (1735 AD – 1819 AD): Industrial Revolution, Rise of the engineer, Major Advances.

UNIT-IV

Science and Technology in the 19th Century (1820 AD – 1894 AD): philosophical basis of 19th-century science,Science and the public, Science and technology, Major advances.

Rise of Modern Science and Technology (1895 AD – 1945 AD): The growth of 20thcentury science, Newphilosophies, Quantum reality, Energy sources, Electricity: a revolution intechnology, Majoradvances.

UNIT-V

Big Science and the Post-Industrial Society (1946 AD – 1972 AD): Big science, Specialization and changing categories, Technology changes society, Major advances.

The Information Age (1973 AD – 2015 AD): Information and society, Globalization, The post-industrial society, Problems of the Information age, Major Advances

Text Books:

1. Bryan Bunch and Alexander Hellemans, "The History of Science and Technology", Houghton Mifflin Company, New York, 2004.
2. JD Bernal, "Science in History", 4 Volumes, Eklavya Publishers, 2012.

Suggested Reading:

1. "The 100 Most Influential Scientists of All Time", Edited by Kara Rogers, Britannica Educational Publishing, 2010.
2. Alberto Hernandez, "A Visual History of Science and Technology", TheRosen Publishing Group, 2016.

16CE O02

DISASTER MITIGATION AND MANAGEMENT

Elective-VIII (Open)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course aims to:

1. Equip the students with the basic knowledge of hazards, disasters, risks and vulnerabilities including natural, climatic and human induced factors and associated impacts
2. Impart knowledge in students about the nature, causes, consequences and mitigation measures of the various natural disasters
3. Enable the students to understand risks, vulnerabilities and human errors associated with human induced disasters
4. Enable the students to understand and assimilate the impacts of any disaster on the affected area depending on its position/ location, environmental conditions, demographic, etc.
5. Equip the students with the knowledge of the chronological phases ina disaster management cycle and to create awareness about the disaster management framework and legislations in the context of national and global conventions

Course Outcomes: Upon completion of this course, the student will be able to:

1. Ability to analyse and critically examine existing programs in disaster management regarding vulnerability, risk and capacity at different levels
2. Ability to understand and choose the appropriate activities and tools and set up priorities to build a coherent and adapted disaster management plan
3. Ability to understand various mechanisms and consequences of human induced disasters for the participatory role of engineers in disaster management
4. Understand the impact on various elements affected by the disaster and to suggest and apply appropriate measures for the same
5. Develop an awareness of the chronological phases of disaster preparedness, response and relief operations for formulating effective disaster management plans ~~and ability to understand various~~

participatory approaches/strategies and their application in disaster management

UNIT-I:

Introduction: Basic definitions- Hazard, Disaster, Vulnerability, Risk, Resilience, Mitigation, Management; classification of types of disaster- Natural and man-made; International Decade for natural disaster reduction (IDNDR); International strategy for disaster reduction (ISDR), National disaster management authority (NDMA).

UNIT-II:

Natural Disasters: Hydro meteorological disasters: Causes, Early warning systems- monitoring and management, structural and non-structural measures for floods, drought and Tropical cyclones; Geographical based disasters: Tsunami generation, causes, zoning, Early warning systems- monitoring and management, structural and non-structural mitigation measures for earthquakes, tsunami, landslides, avalanches and forest fires. Case studies related to various hydro meteorological and geographical based disasters.

UNIT-III:

Human Induced Hazards: Chemical disaster- Causes, impacts and mitigation measures for chemical accidents, Risks and control measures in a chemical industry, chemical disaster management; Case studies related to various chemical industrial hazards eg: Bhopal gas tragedy; Management of chemical terrorism disasters and biological disasters; Radiological Emergencies and case studies; Case studies related to major power break downs, fire accidents, traffic accidents, oil spills and stampedes, disasters due to double cellar construction in multi-storied buildings.

UNIT-IV:

Disaster Impacts: Disaster impacts- environmental, physical, social, ecological, economical, political, etc.; health, psycho-social issues; demographic aspects- gender, age, special needs; hazard locations; global and national disaster trends; climate change and urban disasters.

UNIT-V:

Concept of Disaster Management: Disaster management cycle – its phases; prevention, mitigation, preparedness, relief and recovery; risk analysis, vulnerability and capacity assessment; Post-disaster environmental response- water, sanitation, food safety, waste management, disease control; Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR Programs in India and the activities of National Disaster Management Authority.

Text Books:

1. Pradeep Sahni," Disaster Risk Reduction in South Asia", Prentice Hall, 2003.
2. B. K. Singh," Handbook of Disaster Management: techniques & Guidelines", Rajat Publication, 2008.

Suggested Reading:

1. Ministry of Home Affairs". Government of India, "National disaster management plan, Part I and II",
2. K. K. Ghosh," Disaster Management", APH Publishing Corporation, 2006.
3. http://www.indiaenvironmentportal.org.in/files/file/disaster_management_india1.pdf
4. http://www.ndmindia.nic.in/ (National Disaster management in India, Ministry of Home Affairs)
5. Hazards, Disasters and your community: A booklet for students and the community, Ministry of home affairs.

16CS O06

FUNDAMENTALS OF DBMS

Elective-VIII (Open)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: File Structures.

Course Objectives: This course aims to:

1. Learn data models, conceptualize and depict a database system using E-R diagram.
2. Understand the internal storage structures in a physical DB design.
3. Know the fundamental concepts of transaction processing techniques.

Course Outcomes: Upon completion of this course, the student will be able to:

1. Understand the find fundamental components of the DBMS.
2. Design the database schema and develop E-R model.
3. Devise queries using relational algebra and SQL.
4. Apply normalization techniques and solve problems using various Indexing techniques.
5. Understand transaction processing, Concurrency control and recovery techniques.

UNIT - I

Introduction: Database System Applications, Purpose of Database Systems, View of Data, Database Languages, Database Users and Administrators Database System Architecture, Application Architectures. **Database Design and E-R Model:** Basic concepts,Constraints, E-R Diagrams, E-R Design Issues, Extended E-R Features, Specialization and Generalization.

UNIT - II

Relational Model: Structure of Relational Databases, Database Schema, Keys, Relational Algebra, Fundamental Operations. **Structured Query Language:** Overviews, SQL Data Types, SQL Queries, Data Manipulation Language Set Operations, Aggregate Functions, Data Definition Language, Integrity Constraints, Null Values, Views, Join Expression. Index Definition in SQL.

UNIT - III

Relational Database Design: Undesirable Properties in Relational Database Design, Functional Dependencies, Trivial and Nontrivial Dependencies, Closure of Set of Functional Dependencies, Closure of Set of Attributes, Irreducible Set of Functional Dependencies, Normalization – 1NF, 2NF, and 3NF, Dependency Preservation, BCNF, Comparison of BCNF and 3NF.

UNIT - IV

Indexing: Basic concepts, Dense and Sparse Indices, Secondary Indices, Tree-Structured Indexing, Indexed Sequential Access Method (ISAM), B+ Tree Index Files. **Transaction Management:** Transaction Concept – ACID Properties, States of Transaction, Implementation of Atomicity and Durability, Serializability, Recoverability.

UNIT - V

Concurrency Control: Lock-Based Protocols, Timestamp-Based Protocols, Validation-Based Protocols, Deadlocks Handling: Deadlock Prevention, Deadlock Detection and Recovery, **Recovery System:** Failure Classification, Storage Structure, Recovery and Atomicity, Log-Based Recovery, Recovery with Concurrent Transactions.

Text Books:

1. Abraham Silberschatz, Henry F Korth, S Sudarshan, "Database System Concepts", Sixth Edition, McGraw-Hill International Edition, 2011.
2. Date CJ, Kannan A, Swamynathan S, "An Introduction to Database Systems", Eight Edition, Pearson Education, 2006.

Suggested Reading:

1. Raghu Ramakrishnan, Johnnes Gehrke, "Database Management Systems", Third Edition, McGraw Hill, 2003.
2. Ramez Elmasri, Durvasul VLN Somayazulu, Shamkant B Navathe, Shyam K Gupta, "Fundamentals of Database Systems", Fourth Edition, Pearson Education, 2006.

16EC C39

SEMINAR

Instruction	3 P Hours per Week
Duration of SEE	—
SEE	—
CIE	50 Marks
Credits	2

The goal of a seminar is to introduce students to critical reading, understanding, summarizing, explaining and preparing report on state of the art topics in a broad area of his/her specialization. Seminar topics may be chosen by the students with advice from the faculty members and the student shall read further relevant articles in the domain.

The seminar must be clearly structured and the power point presentation shall include following aspects:

1. Introduction to the field
2. Literature survey
3. Consolidation of available information
4. Summaryand Conclusions
5. References

Each student is required to:

1. Submit a one page synopsis of the seminar talk for display on the notice board.
2. Deliver the seminar for a maximum duration of 30 minutes, where the presentation should be for 20 minutes in PowerPoint, followed by Question and Answers session for 10 minutes.
3. Submit the detailed report of the seminar in spiral bound in a précised format as suggested by the department.

Seminars are to be scheduled from 3rd week to the last week of the semester and any change in schedule shall be discouraged.

For the award of sessional marks students are judged by three (3) faculty members and are based on oral and written presentations as well as their involvement in the discussions during the oral presentation.

Note: Topic of the seminar shall preferably be from any peer reviewed recent journal publications.

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Guidelines for awarding marks		
Sl No.	Description	Max Marks
1.	Contents and relevance	10
2.	Presentation skills	10
3.	Preparation of PPT slides	05
4.	Questions and answers	05
5.	Report in a prescribed format	20

16EC C40

PROJECT

Instruction	6P Hours per Week
Duration of SEE	Viva -Voce
SEE	100 Marks
CIE	50 Marks
Credits	6

The object of Project is to enable the student extend further the investigative study, either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry. This is expected to provide a good training for the student(s) in R&D work and technical leadership. The assignment to normally include:

1. In depth study of the topic assigned;
2. Review and finalization of the Approach to the Problem relating to the assigned topic;
3. Preparing an Action Plan for conducting the investigation, including team work;
4. Detailed Analysis/Modelling/Simulation/Design/Problem Solving/ Experiment as needed;
5. Final development of product/process, testing, results, conclusions and future directions;
6. Preparing a paper for Conference presentation/ Publication in Journals, if possible;
7. Preparing a Dissertation in the standard format for being evaluated by the Department.
8. Final Seminar presentation before Departmental Committee.

Guidelines for the award of marks in CIE: (Max. Marks: 50)

Evaluation by	Max. Marks	Evaluation Criteria / Parameter
Department Review Committee	05	Review 1
	08	Review 2
	12	Submission
Supervisor	05	Regularity and Punctuality
	05	Work Progress
	05	Quality of the work which may lead to publications
	05	Report Preparation
	05	Analytical / Programming / Experimental Skills

Guidelines for awarding marks in SEE: (Max. Marks: 100)

<table>
<tr><th>Evaluation by</th><th>Max. Marks</th><th>Evaluation Criteria / Parameter</th></tr>
<tr><td rowspan="4">External and Internal Examiners together</td><td>20</td><td>Power Point Presentation</td></tr>
<tr><td>40</td><td>Thesis Evaluation</td></tr>
<tr><td>20</td><td>Quality of the project
● Innovations
● Applications
● Live Research Projects
● Scope for future study
● Application to society</td></tr>
<tr><td>20</td><td>Viva-Voce</td></tr>
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19EC C102

ADVANCED DIGITAL SIGNAL PROCESSING

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: The knowledge of DSP is required.

Course Objectives: This course aims to:

1. Analyze digital IIR and FIR filters for the given specifications.
2. Understand the basic concepts of Multirate digital signal processing.
3. Learn the various parametric and non-parametric spectral estimation methods.

Course Outcomes: Upon completion of this course, students will be able to:

1. Design digital filters for the given specifications.
2. Interpret the concepts of Multirate digital signal processing.
3. Design wiener filters
4. Analyse various Power Spectral Estimation methods for random signals
5. Develop the various applications of Digital signal processing.

UNIT-I

Review of Digital Filters: FFT Algorithms, review of digital filter design and structures-Basic FIR/IIR filter design &structures, design techniques of linear phase FIR filters, IIR filters by impulse invariance, bilinear transformation, Cascaded, lattice structures and parallel realization of FIR and IIR filters.

UNIT-II

Multirate DSP: Introduction, Decimator and Interpolator, Sampling rate conversion, multistage decimator and interpolator,polyphase filters, Uniform digital filter banks, two channel Quadrature Mirror Filter bank- perfect reconstruction conditions.

UNIT-III

Linear Prediction &Optimum Linear Filters: Introduction to discrete random signals, Power Density spectrum, Ergodic process. Forward-backward linear prediction filters, solution of normal equations, AR Lattice and ARMA Lattice-Ladder Filters, FIR and IIR Wiener filters.

UNIT-IV

Power Spectrum Estimation: Estimation of Spectra from Finite-Duration Observations of Signals, NonparametricMethods for Power Spectrum Estimation-Bartlett and Welch methods. Parametric methods for Power Spectrum Estimation-Yule Walker method and Burg method. Minimum-Variance Spectral Estimation, Eigen analysis Algorithms for Spectrum Estimation, Piserenko method and MUSIC algorithm.

UNIT-V

Applications of Digital Signal Processing: Dual-Tone Multi frequency Signal Detection, Spectral analysis of sinusoidal signals, Non-stationary signals and Random signals, sub band coding of speech signals, JPEG-2000, Transmultiplexers, Introduction to wavelets.

Text Books:

1. J.G.Proakis and D.G.Manolakis, "Digital signal processing: Principles, Algorithm andApplications", 4th Edition, Prentice Hall, 2007.
2. Sanjit. K. Mitra, "Digital signal processing", 3rd edition, McGraw Hill,2006.

Suggested Reading:

1. Emmanuel Ifeachor, Barrie W.Jervis, "Digital signal Processing, A Practical Approach", 2nd edition, Pearson, 2011.
2. Roberto Cristi, "Modern Digital signal Processing", Cengage learning, 2012.

19EC C104

WIRELESS AND MOBILE COMMUNICATION

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Requires concepts of Electromagnetic theory, Antennas and Wave propagation and Digital Communication.

Course Objectives: This course aims to:
1. Facilitate the understanding of the basics of Cellular System design Fundamentals and Large scale propagation models
2. Provide the concepts of small scale fading and Equalization.
3. Build knowledge on multiple access techniques, GSM and Cellular Standards.

Course Outcomes: Upon completion of this course, students will be able to:
1. Apply frequency-reuse concept in mobile communications, and to analyse its effects on interference, system capacity, handoff techniques.
2. Analyse path loss and interference for wireless telephony and their influences on a mobile-communication system's performance.
3. Distinguish various multiple-access techniques for mobile communications and their advantages and disadvantages.
4. Analyse and design both GSM and CDMA systems functioning with knowledge of forward and reverse channel details, advantages and disadvantages of using these technologies.
5. Understanding the higher generation Cellular standards 3G, 4G & 5G.

UNIT-I

The Cellular Concept and System Design Fundamentals: Frequency reuse, Frequency management, Channel Assignment Strategies, Handoff Strategies, Co-channel Interference, Adjacent channel interference, Power control for Reducing Interference, Cell Splitting and Sectoring.

UNIT-II

Mobile Radio Propagation Large Scale Path Loss: Free space propagation model, Reflection, Ground Reflection (Two-Ray) model, Diffraction: Knife – edge

Diffraction Model, Scattering, Practical link budget design using path loss models: Log Normal Shadowing, Determination of percentage of coverage area, Outdoor propagation models: Okumura and Hata models, Indoor propagation models: Partition losses (same floor), Partition losses between floors, Signal penetration into buildings.

UNIT-III

Mobile Radio Propagation Small Scale Fading and Multipath: Impulse response model, Spread Spectrum Sliding Correlator Channel Sounding, Parameters of Mobile Multipath Channels, Types of Small-Scale Fading: Flat Fading, Frequency selective Fading, Fast Fading and Slow Fading.

UNIT-IV

Equalization: Fundamentals of Equalization, Training a Generic Adaptive Equalizer, Equalizers in Communication Receiver, Linear Equalizers, Non-Linear Equalizers: Decision Feedback Equalization (DFE), Maximum Likelihood Sequence Estimation (MLSE) Equalizer, Algorithms for Adaptive Equalization: Zero Forcing Algorithm and Least Mean Square Algorithm.

UNIT-V

Multiple Access Techniques: FDMA, TDMA and CDMA. Comparison of these technologies based on their signal separation, Advantages and Disadvantages.
GSM System: Architecture and Interfaces, Subsystems, Logical channels, HSCSD, GPRS and EDGE.
IS-95 System: Architecture, Air interface, Physical and Logical channels, Evolution of CDMA One to CDMA 2000.
Higher Generation Cellular Standards: 3G, 4G, VoLTE, UMTS, Introduction to 5G.

Text Books:

1. T.S.Rappaport, “Wireless Communications Principles and Practice”, 2nd edition, PHI,2002.
2. William C.Y.Lee, “Mobile Cellular Telecommunications Analog and Digital Systems”, 2nd edition, TMH, 1995.
3. V.K.Garg and J.E.Wilkes, “Principle and Application of GSM”, Pearson Education, 5th edition, 2008.

Suggested Reading:

1. V.K.Garg, “IS-95 CDMA & CDMA 2000”, Pearson Education, 4th edition, 2009.
2. AshaMehrotra, “A GSM system Engineering” Artech House Publishers Boston, London, 1997.

19ME C103

RESEARCH METHODOLOGY AND IPR

(Program Elective)

Instruction	2 P Hours per Week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	25 Marks
Credits	2

Course Objectives: This course aims to:

1. Motivate to choose research as career
2. Formulate the research problem, prepare the research design
3. Identify various sources for literature review and data collection report writing
4. Equip with good methods to analyze the collected data
5. Know about IPR copyrights

Course Outcomes: Upon completion of this course, students will be able to:

1. Define research problem, review and asses the quality of literature from various sources
2. Improve the style and format of writing a report for technical paper/ Journal report, understand and develop various research designs
3. Collect the data by various methods: observation, interview, questionnaires
4. Analyze problem by statistical techniques: ANOVA, F-test, Chi-square
5. Understand apply for patent and copyrights

UNIT-I

Research Methodology: Research Methodology: Objectives and Motivation of Research, Types of Research, research approaches, Significance of Research, Research Methods verses Methodology, Research Process, Criteria of Good Research, Problems Encountered by Researchers in India, Benefits to the society in general. Defining the Research Problem: Selection of Research Problem, Necessity of Defining the Problem

UNIT-II

Literature Survey Report Writing: Literature Survey: Importance and purpose of Literature Survey, Sources of Information, Assessment of Quality of Journals and Articles, Information through Internet. Report writing: Meaning of interpretation, layout of research report, Types of reports, Mechanics of writing

a report. Research Proposal Preparation: Writing a Research Proposal and Research Report, Writing Research Grant Proposal

UNIT-III

Research Design: Research Design: Meaning of Research Design, Need of Research Design, Feature of a Good Design, Important Concepts Related to Research Design, Different Research Designs, Basic Principles of Experimental Design, Developing a Research Plan, Steps in sample design, types of sample designs.

UNIT-IV

Data Collection and Analysis: Data Collection: Methods of data collection, importance of Parametric, non parametric test, testing of variance of two normal population, use of Chi-square, ANOVA, Ftest, z-test

UNIT-V

Patents and Copyright: Patent: Macro economic impact of the patent system, Patent document, How to protect your inventions. Granting of patent, Rights of a patent, how extensive is patent protection. Copyright: What is copyright. What is covered by copyright. How long does copyright last? Why protect copyright? Related Rights: what are related rights? Enforcement of Intellectual Property Rights: Infringement of intellectual property rights, Case studies of patents and IP Protection

Text Books:

1. C.R Kothari, "Research Methodology, Methods & Technique"; New Age International Publishers, 2004.
2. R. Ganesan, "Research Methodology for Engineers", MJP Publishers, 2011.
3. Y.P. Agarwal, "Statistical Methods: Concepts, Application and Computation", Sterling Publs., Pvt., Ltd., New Delhi, 2004.

Suggested Reading:

1. Ajit Parulekar and Sarita D' Souza, "Indian Patents Law – Legal & Business Implications"; Macmillan India ltd , 2006
2. B. L.Wadehra; "Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications"; Universal law Publishing Pvt. Ltd., India 2000.
3. P. Narayanan; "Law of Copyright and Industrial Designs"; Eastern law House, Delhi 2010.

19EC E103

GLOBAL NAVIGATION SATELLITE SYSTEMS

(Program Elective)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: A prior knowledge of fundamental concepts of satellite communication is required.

Course Objectives: This course aims to:

1. Explain the basic principles of various positioning techniques and introduce GPS operating principle, signal structure.
2. Make the students to understand errors affecting GNSS performance and analyze various parameters of RINEX data.
3. Make the students appreciate the significance of other GNSS systems, principle of DGPS and augmentation systems.

Course Outcomes: Upon completion of this course, students will be able to:

1. Understand GPS principle and estimate the GPS ephemerides.
2. Appreciate GPS signal structure, coordinate systems and datum.
3. Assess the performance of GNSS in the presence of various errors.
4. Analyze various GNSS parameters using observation and navigation data.
5. Compare other global and regional navigational systems and assess the performance of various augmentation systems.

UNIT-I:

GPS Fundamentals: INS, Trilateration, Hyperbolic navigation, Transit, GPS principle of operation, architecture, operating frequencies, orbits, Keplerian elements.Solar and Siderial days, GPS and UTC Time.

UNIT-II:

GPS Signals: Signal structure, C/A and P-Code, ECEF and ECI coordinate systems and WGS 84 and Indian Datums, Important components of receiver and specifications, link budget.

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UNIT-III:

GPS Error Models: Ionospheric error, Tropospheric error, Ephemeris error, Clock errors, Satellite and receiver instrumental biases, Antenna Phase center variation, multipath; estimation of Total Electron Content (TEC) using dual frequency measurements, Various DOPs, UERE. Spoofing and Anti-spoofing. : Future GPS satellites, new signals and their benefits GPS integration – GPS/GIS, GPS/INS, GPS/pseudolite, GPS/cellular.

UNIT-IV:

GPS Data Processing, DGPS and Applications: RINEX Navigation and Observation formats, Code and carrier phase observables, linear combination and derived observables, Ambiguity resolution, cycle slips, Position estimation. Principle of operation of DGPS, architecture and errors.

UNIT-V:

Other Constellations and Augmentation Systems: Other satellite navigation constellations GLONASS and Galileo IRNS System. : Relative advantages of SBAS and GBAS, Wide area augmentation system (WAAS) architecture, GAGAN, EGNOS and MSAS. Local area augmentation system (LAAS) concept.

Text Books:

1. B.HofmannWollenhof, H.Lichtenegger, and J.Collins, "GPS Theory and Practice", Springer Wien, New York, 2000.
2. PratapMisra and Per Enge, "Global Positioning System Signals, Measurements, and Performance", Ganga-Jamuna Press, Massachusetts, 2001.

Suggested Reading:

1. Ahmed El-Rabbany, "Introduction to GPS", Artech House, Boston, 2002.
2. Bradford W. Parkinson and James J. Spilker, "Global Positioning System: Theory and Applications", Volume II, American Institute of Aeronautics and Astronautics, Inc., Washington, 1996.

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19EC E112

SOFTWARE DEFINED AND COGNITIVE RADIO

(Program Elective)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: A prior knowledge of signal processing, Communication and spectral knowledge is required.

Course Objectives: This course aims to:

1. Make the students understand the difference between Superhetrodyne Radio and Software defined Radio
2. Differentiate between Cognitive Radio (CR) and SDR and study their architectures.
3. Make the students know about the CR signal processing Techniques and applications.

Course Outcomes: Upon completion of this course, students will be able to:

1. The students would learn the difference between the super hetrodyne receiver, Software Defined Radio and Cognitive Radio.
2. The different architectures of SDR and CR would be learnt by the student.
3. The various spectrum sensing methods should be understood.
4. Various signal processing techniques of CR would be known.
5. The facilities available in USRP and WARP boards are known.

UNIT-I

Introduction to SDR: What is Software-Defined Radio, The Requirement for Software-Defined Radio, Legacy Systems, The Benefits of Multi-standard Terminals, Economies of Scale, Global Roaming, Service Upgrading, Adaptive Modulation and Coding, Operational Requirements, Key Requirements, Reconfiguration Mechanisms, Handset Model, New Base-Station and Network, Architectures, Separation of Digital and RF, Tower-Top Mounting, BTS Hoteling, Smart Antenna Systems, Smart Antenna System Architectures.

UNIT-II

Basic Architecture of a Software Defined Radio: Software Defined Radio Architectures, Ideal Software Defined Radio Architecture, Required Hardware

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Specifications, Digital Aspects of a Software Defined Radio, Digital Hardware, Alternative Digital Processing Options for BTS Applications, Alternative Digital Processing Options for Handset Applications, Current Technology Limitations, A/D Signal-to-Noise Ratio and Power Consumption, Impact of Superconducting Technologies on Future SDR Systems.

UNIT-III

Signal Processing Devices and Architectures: General Purpose Processors, Digital Signal Processors, Field Programmable Gate Arrays, Specialized Processing Units, Tilera Tile Processor, Application-Specific Integrated Circuits, Hybrid Solutions, Choosing a DSP Solution. GPP-Based SDR, Non real time Radios, High-Throughput GPP-Based SDR, FPGA-Based SDR, Separate Configurations, Multi-Waveform Configuration.

UNIT-IV

Cognitive Radio: Techniques and signal processingHistory and background, Communication policy and Spectrum Management, Cognitive radio cycle, Cognitive radio architecture, SDR architecture for cognitive radio, Spectrum sensing Single node sensing: energy detection, cyclostationary and wavelet based sensing- problem formulation and performance analysis based on probability of detection versus SNR. Cooperative sensing: different fusion rules, wideband spectrum sensing- problem formulation and performance analysis based on probability of detection vs SNR.

UNIT-V

Cognitive Radio: Hardware and Applications: Spectrum allocation models. Spectrum handoff, Cognitive radio performance analysis.Hardware platforms for Cognitive radio (USRP and WARP), details of USRP board, Applications of Cognitive radio.

Text Books:

1. Peter B. Kenington,"RF and Baseband Techniques for Software Defined Radio", Artech House, Inc © 2005.
2. Eugene Grayver,"Implementing Software Defined Radio", Springer, New York Heidelberg Dordrecht London, ISBN 978-1-4419-9332-8 2013.
3. Bruce A. Fette, "Cognitive Radio Technology", Elsevier, ISBN 10: 0-7506-7952-2, 2006.

Suggesting Reading:

1. Hüseyin Arslan"Cognitive Radio, Software Defined Radio and Adaptive Wireless Systems", Springer, ISBN 978-1-4020-5541-6 (HB), 2007.

19EG A101

ENGLISH FOR RESEARCH PAPER WRITING

(Audit Course)

Instruction	2 P Hours per Week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	—
Credits	Non Credit

Course Objectives: This course aims to:

1. Understand the nuances of language and vocabulary in writing a ResearchPaper.
2. Develop the content, structure and format of writing a research paper.
3. Enable the students to produce original research papers without plagiarism.

Course Outcomes: Upon completion of this course, students will be able to:

1. Interpret the nuances of research paper writing.
2. Differentiate the research paper format and citation of sources.
3. Review the research papers and articles in a scientific manner.
4. Avoid plagiarism and be able to develop their writing skills in presenting the researchwork.
5. Create a research paper and acquire the knowledge of how and where to publish their original research papers.

UNIT-I

Academic Writing: Meaning & Definition of a research paper– Purpose of a research paper – Scope – Benefits – Limitations – outcomes.

UNIT-II

Research Paper Format: Title – Abstract – Introduction – Discussion – Findings – Conclusion – Style of Indentation – Font size/Font types – Indexing – Citation ofsources.

UNIT-III

Research Methodology: Methods (Qualitative – Quantitative) Review of Literature. Criticizing, Paraphrasing & Plagiarism.

UNIT-IV

Process of Writing a Research Paper: Choosing a topic - Thesis Statement – Outline – Organizing notes - Language of Research – Word order, Paragraphs – Writing first draft–Revising/Editing - The final draft and proof reading.

UNIT-V

Research Paper Publication: Reputed Journals – National/International – ISSN No, No. of volumes, Scopus Index/UGC Journals – Free publications - Paid Journalpublications – /Advantages/Benefits

Text Book:

1. C. R Kothari, Gaurav, Garg, Research Methodology Methods and Techniques, New Age International Publishers. 4thEdition.

Suggested Reading:

1. Day R, "How to Write and Publish a Scientific Paper", Cambridge University Press, 2006.
2. MLA "Hand book for writers of Research Papers", East West Press Pvt. Ltd, New Delhi, 7thEdition.
3. Lauri Rozakis, Schaum's, "Quick Guide to Writing Great Research Papers", Tata McGraw Hills Pvt. Ltd, NewDelhi.

Online Resources:

1. NPTEL:https://onlinecourses.nptel.ac.in/noc18_mg13/preview

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19EC C106

ADVANCED DIGITAL SIGNAL PROCESSING LAB

Instruction	4 P Hours per Week
Duration of SEE	—
SEE	—
CIE	50 Marks
Credits	2

Prerequisite: The knowledge of signal processing algorithms and MATLAB are required.

Course Objectives: This course aims to:

1. Simulation of FFT, Multirate concepts using MATLAB.
2. Spectral analysis of noisy signals using MATLAB.
3. Implementation of digitalfilters using MATLAB.

Course Outcomes: Upon completion of this course, students will be able to:

1. Implement FFT algorithms for linear filtering and correlation using MATLAB.
2. Design and realize of the digital filters using MATLAB.
3. Experiment with multirate techniques using MATLAB.
4. Perform parametric and non-parametric estimation of PSD using MATLAB.
5. Design and Implement the adaptive filters using MATLAB.

List of Experiments

1. FFT of input sequence and comparison with DFT.
2. Design of IIR Butterworth, Chebyshev type-I &II, Elliptic LPF, HPF, BPF &BSF and calculate Group delay.
3. Design of FIR LPF, HPF, BPF &BSF using windows, Multiband FIR filter and calculate Group delay.
4. State space matrix representation from difference equation
5. Solution of normal equation using Levinson Durbin
6. Decimation and Interpolation using rational factors
7. Design a multirate filter
8. Maximally decimated analysis DFT filter bank
9. Cascade and parallel realization of digital IIR filter
10. Convolution and M fold Decimation.
11. Parametric Estimation of PSD
12. Nonparametric Estimation of PSD
13. Design of Adaptive filter using LMS algorithm.

Sample Mini Projects:

1. Design the best IIR band pass filter to meet the given specifications:
   Pass band cut off frequencies: [500 600] Hz
   Stop band cut off frequencies: [525 675] Hz
   Pass band ripple: d” 2dB
   Stop band attenuation: e” 60dB
   Phase response: Approximately linear in pass band Consider Butterworth, Chebyshev, Elliptic and
   Bessel filters
2. Design a three stage multirate filter to meet the given specifications:
   Pass band cut off frequency: 450 Hz
   Stop band cut off frequency: 500 Hz
   Pass band ripple: d” 3dB
   Stop band attenuation: e” 40dB
   Sampling frequency: 40 KHz
   Compare with single stage filter.
3. Consider a clean speech signal of length 5000 samples and compute the Power Spectrum. Now add 0dB random noise. Compute the power spectrum using Welch and Eigen value Estimation method and also compare with the original spectrum.
4. Design a speech signal compression using octave filter banks and also calculate the compression ratio.

Suggested Reading:

1. Vinay K. Ingle and John G. Proakis, “Digital Signal Processing using MATLAB”, 4th edition, Cengage learning, 2011.

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19EC C108

WIRELESS AND MOBILE COMMUNICATION LAB

Instruction	4 P Hours per Week
Duration of SEE	—
SEE	—
CIE	50 Marks
Credits	2

Prerequisite: Requires concepts of Electromagnetic theory, Antennas & Wave propagation and Digital Communication.

Course Objectives: This course aims to:

1. Facilitate the experimental setup for understanding the Cellular concepts and experiments using GSM and CDMA and to learn AT commands in 3G networks and DSSS technique for CDMA to observe various spread spectrum parameters.
2. Provide the facility to learn 3. Build knowledge on concepts of software radio by studying building blocks such as Baseband and RF section.
3. Learn to compute GPS Satellite position, User position and key parameters of IRNSS using RINEX data.

Course Outcomes: Upon completion of this course, students will be able to:

1. Understand Cellular concepts, GSM and CDMA networks and to study GSM handset by experimentation with fault insertion techniques.
2. Understand of 3G communication system by means of various AT commands usage in GSM.
3. Analyze the concept of CDMA using DSSS kit and to generate various PN Codes.
4. Develop concepts of Software Radio in real time environment.
5. Estimation of GPS Satellite position, User position and key parameters of IRNSS using RINEX data.

List of Experiments:

1. Study of DSSS technique for CDMA to observe effect of PN codes, Chip rate, Spreading factor and Processing gain.
2. Study of GSM handset for various signaling and Fault insertion techniques (Major GSMhandset sections: clock, SIM card, charging, LCD module, Keyboard, User interface).

3. Study Transmitter and Receiver sections in Mobile Handset and also measure GMSK modulated signal.
4. Study various GSM AT Commands such as SMS and HTTP.
5. Study File system by AT commands in 3G network.
6. Establishing Call Setup, Estimation of Coverage area and Capacity in GSM and CDMA.
7. Develop concepts of Software radio by studying building blocks such as Baseband and RF section.
8. Develop Convolutional Encoder, Interleaver and De-Interleaver in Software Radio.
9. Study and analyse different modulation techniques in time and frequency domains using SDR Kit.
10. Estimation of GPS satellite position using RINEX data.
11. Estimation of key performance parameters of IRNSS L5 and S1 band signals.
12. Estimation of user position using GNSS Single Frequency receiver.

Suggested Reading:

1. T.S.Rappaport, "Wireless Communications Principles and Practice", 2nd edition, PHI, 2002.

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19EC C101

ADVANCED COMMUNICATION NETWORKS

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Students should have in depth knowledge of Computer Networks.

Course Objectives: This course aims to:

1. Familiarize the student with the basic taxonomy and terminology of the computer networking area.
2. Provide the student with knowledge of advanced networking concepts and techniques.
3. Provide the student with knowledge of Real Time Communications over Internet and Packet Scheduling.

Course Outcomes: Upon completion of this course, students will be able to:

1. Understand advanced concepts over Internet.
2. Design and develop protocols for Communication Networks.
3. Understand the mechanisms in Quality of Service in networking.
4. Optimize the Network Design and identify various IP addressing challenges.
5. Determine the choice of MPLS Protocols.

UNIT-I

Overview of Internet Concepts, Challenges and History: Overview of -ATM. TCP/IPCongestion and Flow Control in Internet; Throughput analysis of TCP congestion control, TCP for high bandwidth delay networks and Fairness issues in TCP.

UNIT-II

Issues of Real Time Communications over Internet: Adaptive applications, Latency and throughput, Integrated Services Model (IntServ),Resource reservation Protocol. Characterization of Traffic by Linearly Bounded Arrival Processes (LBAP), Leaky bucket algorithm and its properties.

UNIT-III

Packet Scheduling Algorithms-requirements and Choices: Scheduling guaranteed service Connections, GPS, WFQ and Rate proportional algorithms, High speed scheduler design; Theory of Latency Rate servers and delay bounds in packet switched networks for LBAP traffic; Active Queue Management - RED, WRED and Virtual clock, Control theoretic analysis of active queue management.

UNIT-IV

IP Address Lookup-Challenges: Packet classification algorithms and Flow Identification, Grid of Tries, Cross producting and controlled prefix expansion algorithm.Admission control in Internet: Concept of Effective bandwidth, Measurement based admission control; Differentiated Services in Internet (DiffServ), DiffServ architecture and framework.

UNIT-V

IPV4, IPV6, IP tunneling, IP switching and MPLS, Overview of IP over ATM and its Evolution to IP switching; MPLS architecture and framework, MPLS Protocols, Traffic Engineering issues in MPLS.

Text Books:

1. J.F. Kurose & K.W. Ross, "Computer Networking- A top down approach featuring the internet", Pearson, sixth edition, 2013.
2. Nader F. Mir, "Computer and Communication Networks", second edition, 2015.

Suggested Reading:

1. Anurag Kumar, D. Manjunath and Joy Kuri, "Communication Networking: An Analytical Approach", Morgan Kaufman Publishers, 2004.
2. Jean Wairand and Pravin Varaiya, "High Performance Communications Networks", 2nd edition, 2000.

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19EC C103

ANTENNAS AND RADIATING SYSTEMS

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Students should have prior knowledge of Electromagnetic waves.

Course Objectives: This course aims to:

1. The basic principles of an antenna and its parameters for characterizing its performance.
2. The fundamental concepts of various types of antennas, arrays for customizing the pattern parameters.
3. The concept of aperture and microstrip antennas.

Course Outcomes: Upon completion of this course, students will be able to:

1. Understand the radiation parameters of an antenna.
2. Apply the concept of current distribution to analyse the antennas.
3. Analyse the linear arrays for uniform distribution.
4. Appraise the characteristics of broad side, end fire arrays and non-uniform arrays.
5. Learn the aperture antennas using Huygen's principle, image theory and microstrip antennas.

UNIT-I

Radiation Mechanism, Fundamental Parameters of Antennas: Radiation Pattern, Radiation Power Density, Radiation Intensity, Directivity, Gain, Antenna efficiency, Beam efficiency, Bandwidth, Polarization, Input Impedance, Region separation, Antenna Temperature, Antenna vector effective length, Friis Transmission equation, Significance of current distribution.

UNIT-II

Infinitesimal dipole, Analysis of Finite length dipole, half wave dipole, Ground effects, Small Circular loop, Circular loop with non uniform current distribution.

UNIT-III

Linear Arrays: Two element array, N-Element array: Uniform Amplitude and spacing, Broadside and End fire arrays, Super directivity, planar array, Design consideration, Introduction to linear arrays with non-uniform distributions: Binomial and Tschebyscheff distribution.

UNIT-IV

Aperture Antennas: Huygen's Field Equivalence principle, Image theory, radiation equations, Rectangular Aperture. Horn Antennas: E-Plane, H-plane horns and Pyramidal horn antennas.

UNIT-V

Reflector Antennas: Plane reflector, parabolic reflector, Efficiency calculation of parabolic reflector antenna, Cassegrain reflectors.

Microstrip Antennas: Basic Characteristics, Feeding mechanisms, Rectangular Patch design using TL method and Circular Patch design using cavity model method.

Text Books:

1. Constantine A. Balanis, "Antenna Theory: Analysis and Design," 4th Edition, John Wiley, 2016
2. Edward C. Jordan and Kenneth G. Balmain, "Electromagnetic Waves and Radiating Systems," 2nd Edition, PHI, 2009
3. John D. Krauss, Ronald J. Marhefka& Ahmad S. Khan, "Antennas and Wave Propagation," 4th Edition, TMH, 2010

Suggested Reading:

1. Dennis Roody and John Coolen, "Electronic Communications", 4th Edition, Prentice Hall, 2008.
2. R.C.Johnson and H.Jasik, "Antenna Engineering hand book", Mc-Graw Hill, 1984.
3. I.J.Bhal and P.Bhartia, "Micro-strip antennas", Artech house, 1980.

19EC E111

SIGNAL INTELLIGENCE SYSTEMS
(Program Elective)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Basic knowledge of Radar, Communication and Antenna concepts are required.

Course Objectives: This course aims to:

1. Explain the concepts of electronic intelligence using the fundamentals of radar and localization techniques with necessary mathematical analysis.
2. Explain the operating principles of COMINT Systems based on various localization and position fixing techniques.
3. Provide salient features of EW Systems and Electronic Jamming.

Course Outcomes: Upon completion of this course, students will be able to:

1. Understand the operating principles of Radar and Drones.
2. Analyze the intricacies of ELINT System.
3. Estimate position of ELINT/COMINT Systems for simple cases.
4. Compare the merits and demerits of various position fixing techniques.
5. Understand the salient features of EW Systems and Electronic Jamming.

UNIT-I

Principles of RADAR and DRONES: Radar Range equation, probability of false alarm, probability of detection, Radar cross section fluctuations, Blind speed ,Pulse Repetition Frequency (PRF), Unambiguous range, Principles and Classification of Drones and their applications.

UNIT-II

Electronic Intelligent (ELINT) Systems: Electronic Intelligence Defined, The Importance of Intercepting and Analyzing Radar Signals, Limitations Due to Noise, Probability of Intercept Problems. Inferring Radar Capabilities from observed Signal Parameters, Receivers for Radar Interception. Major ELINT Signal Parameters, the Impact of LPI Radar on ELINT, Direction Finding, Instantaneous Direction Finding. Amplitude Comparison AOA Measurement, Phase Interferometers.

UNIT-III

Communication Intelligent (COMINT) Systems: Introduction, Emitter Location Estimation, Deriving the Location Covariance Matrix. Angle of Arrival Location Analysis, Time/Frequency Difference of Arrival Location Analysis. Geometric Dilution of Precision, Incorporation of Measurement Error.

UNIT-IV

Position Fixing Techniques: Position fixing algorithms: Eliminating Wild Bearings, Stansfield Fix Algorithm, Mean-Squared Distance Algorithm. Single-site location techniques: Fix accuracy, fix coverage. Time of Arrival, Time difference of Arrival: Position-Fixing using TDOA Measurements, Differential Doppler.

UNIT-V

Communication EW Systems and Techniques for Electronic Jamming: Introduction, Information warfare, Electronic warfare: Electronic support, Electronic attack, Electronic Protect. Typical EW System Configuration. Electronic attack: Introduction, Communication jamming, jammer deployment, narrow band/partial-band jamming, barrage jamming, follower jammer, jamming LPI targets. A General Description of the Basic Elements of Electronic Jamming. Mathematical Models of Jamming Signals: Fundamental Principles.

Text Books:

1. Richard G. Wiley, "ELINT: The Interception and analysis of Radar Signals", Artech House Inc., 2006.
2. Richard A. Poisel, "Introduction to Communication Electronic Warfare Systems", 2nd edition, Artech house, Inc.,2008.

Suggested Reading:

1. Sergei A. Vakin, Lev N. Shustov, Robert H. Dunwell "Fundamentals of Electronic Warfare", Artech House, Inc., 2001.

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19EC E106

INTERNET OF THINGS
(Program Elective)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Knowledge onProgramming and Problem Solving, Computer Organization and embedded systems.

Course Objectives: This course aims to:

1. Provide an overview of Internet of Things, building blocks of IoT and the real-world applications.
2. Introduce Python Programming language and packages.
3. Introduce Rasberry Pi device, its interfaces and Django Framework.

Course Outcomes: Upon completion of this course, students will be able to:

1. Understand the terminology, enabling technologies and applications of IoT
2. Learn the concept of M2M (machine to machine) and describe the differences between M2M and IoT.
3. Understand the basics of Python Scripting Language which is used in many IoT devices
4. Describe the steps involved in IoT system design methodology
5. Design simple IoT systems sing the understanding of the Rasberry Pi board and interfacing sensors, actuators and develop web applications using python based framework called Django.

UNIT-I

Introduction and Concepts: Introduction to Internet of Things, definitions and characteristics of IoT, physical design of IoT-Things in IoT, IoT Protocols, Logical Design of IoT-IoT Functional Blocks, IoT Communication Models, IoT Communication APIs, IOT Enabling TechnologiesWireless Sensor Networks, Cloud Computing, Big Data Analytics, Communication Protocols, Embedded Systems, IoT Levels & Deployment Templates.

UNIT-II

Domain Specific IoTs: IoT applications for Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, health and Lifestyle

IoT and M2M: Introduction, M2M, Differences between IoT and M2M, Software Defined Networking, Network Function Virtualization.

UNIT-III

Introduction to Python: Motivation for using Python for designing IoT systems, Language features of Python, Data types- Numbers, Strings, Lists, Tuples, Dictionaries, Type Conversions, Data Structures: Control of flow-if, for, while, range, break/continue, pass, functions, modules, packaging, file handling, data/time operations, classes, Exception handling, Python packages of Interest for IoT - JSON, XML, HTTP Lib, URL Lib and SMTP Lib.

UNIT-IV

IoT Platforms Design Methodology: Introduction, IoT Design Methodology Steps-Purpose and Requirements Specification, Process Specification, Domain Model Specification, Information Model Specification, Service Specifications, IoT Level Specification, Functional View Specification, Operational View Specification, Device and Component Integration, Application Development, Case Study on IoT System for Weather Monitoring.

UNIT-V

IoT Physical Devices and End Points: Basic building blocks of an IoT device, Rasberry Pi-About theRasberry Pi board, Rasberry Pi interfaces-Serial, SPI,I2C, Other IoT Devices-pcDuino, BeagleBone Black, Cubieboard

IoT Physical Servers and Cloud Offerings: Introduction to cloud storage models and Communication APIs, WAMP-AutoBahn for IoT, Xivelycloud for IoT

Python Web Application Framework: Django Framework-Roles of Model, Template and View

Text Books:

1. ArshdeepBahga and Vijay Madisetti, "Internet of Things - A Hands-on Approach, Universities Press", 2015.
2. Bill Lubanovic "Introducing Python: Modern Computing in Simple Packages", O'Reilly Media, Inc, USA, 2015.

Suggested Reading:

1. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st edition, Apress Publications, 2013.
2. Matt Richardson andShawn Wallace O'Reilly, "Getting Started with Raspberry Pi", SPD, 2014.

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19EC A101

VALUE EDUCATION
(Audit Course)

Instruction	2 P Hours per Week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	—
Credits	Non Credit

Course Objectives: This course aims to

1. Understand the need and importance of Values for self-development and for National development.
2. Imbibe good human values and Morals
3. Cultivate individual and National character.

Course outcomes: After completion of the Course, Students will be able to

1. Gain necessary Knowledge for self-development
2. Learn the importance of Human values and their application in day to day professional life.
3. Appreciate the need and importance of interpersonal skills for successful career and social life
4. Emphasize the role of personal and social responsibility of an individual for all-round growth.
5. Develop a perspective based on spiritual outlook and respect women, other religious practices, equality, non-violence and universal brotherhood.

UNIT-I

Human Values, Ethics and Morals: Concept of Values, Indian concept of humanism, human values; Values for self-development, Social values, individual attitudes; Work ethics, moral and non- moral behaviour, standards and principles based on religion, culture and tradition.

UNIT-II

Value Cultivation, and Self-Management: Need and Importance of cultivation of values such as Sense-of Duty, Devotion to work, Self-reliance, Confidence, Concentration, Integrity & discipline, and Truthfulness.

UNIT-III

Spiritual Outlook and Social Values: Personality and Behavior, Scientific attitude and Spiritual (soul) outlook; Cultivation of Social Values Such as Positive

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Thinking, Punctuality, Love & Kindness, Avoiding fault finding in others, Reduction of anger, forgiveness, Dignity of labour, True friendship, Universal brotherhood and religious tolerance.

UNIT-IV

Values in Holy Books : Self-management and Good health; **and internal & external Cleanliness,** Holy books versus Blind faith, Character and Competence, Equality, Nonviolence, Humility, Role of Women.

UNIT-V

Dharma, Karma and Guna: Concept of soul; Science of Reincarnation, Character and Conduct, Concept of Dharma; Cause and Effect based Karma Theory; The qualities of Devine and Devilish; Satwic, Rajasic and Tamasicgunas.

Text Books:

1. Chakroborty, S.K. "Values & Ethics for organizations Theory and practice", Oxford University Press, New Delhi, 1998.
2. Jaya Dayal Goyandaka, "Srimad Bhagavad Gita", with Sanskrit Text, Word meaning and Prose meaning, Gita Press, Gorakhpur, 2017.

19EC C105

ADVANCED COMMUNICATION NETWORKS LAB

Instruction	4 P Hours per Week
Duration of SEE	—
SEE	—
CIE	50 Marks
Credits	2

Prerequisite: Students should have in depth knowledge of Computer Networks.

Course Objectives: This course aims to:

1. Provide the student with knowledge sub-netting and routing mechanisms.
2. Provide the student with knowledge of basic routing protocols for Network design and implementation.
3. Provide the student with knowledge configuring User Datagram Protocol.

Course Outcomes: Upon completion of this course, students will be able to:

1. Identify the different types of network devices and their functions within a network.
2. Understand and build the skills of sub-netting and routing mechanisms.
3. Understand basic protocols of computer networks, and how they can be used to assist in Network design and implementation.
4. Configure a network using Linux and a mail server for IMAP/POP protocols
5. Design and configure UDP Client Server

List of Assignments:

1. Study of Networking Commands (Ping, Tracert, TELNET, nslookup, netstat, ARP, RARP) and Network Configuration Files.
2. Linux Network Configuration.
   a. Configuring NIC's IP Address.
   b. Determining IP Address and MAC Address using if-config command.
   c. Changing IP Address using if-config.
   d. Static IP Address and Configuration by Editing.
   e. Determining IP Address using DHCP.
   f. Configuring Hostname in /etc/hosts file.
3. Design TCP iterative Client and Server application to reverse the given input sentence.

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4. Design a TCP concurrent Server to convert a given text into upper case using multiplexing system call “select”.
5. Design UDP Client Server to transfer a file.
6. Configure a DHCP Server to serve contiguous IP addresses to a pool of four IP deviceswith a default gateway and a default DNS address. Integrate the DHCP server with aBOOTP demon to automatically serve Windows and Linux OS Binaries based on clientMAC address.
7. Configure DNS: Make a caching DNS client, and a DNS Proxy; implement reverseDNS and forward DNS, using TCP dump/Wireshark characterize traffic when theDNS server is up and when it is down.
8. Configure a mail server for IMAP/POP protocols and write a simple SMTP client inC/C++/Java client to send and receive mails.
9. Configure FTP Server on a Linux/Windows machine using a FTP client/SFTP clientCharacterize file transfer rate for a cluster of small files 100k each and a video file of700mb.Use a TFTP client and repeat the experiment.
10. Signaling and QoS of labeled paths using RSVP in MPLS.
11. Find shortest paths through provider network for RSVP and BGP.
12. Understand configuration, forwarding tables, and debugging of MPLS.

Suggested Reading:

1. J.F. Kurose & K.W. Ross, “Computer Networking- A top down approach featuring the internet”, Pearson, Sixth Edition, 2013.
2. Nader F. Mir, Computer and Communication Networks, second edition, 2015.

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19EC C107

ANTENNAS AND RADIATING SYSTEMS LAB

Instruction	4 P Hours per Week
Duration of SEE	—
SEE	—
CIE	50 Marks
Credits	2

Prerequisite: The knowledge of antennas is essential.

Course Objectives: This course aims to:

1. Understand the characteristics and radiation pattern of Infinitesimal antenna.
2. Simulate various antennas.
3. Study the effect of change in different parameters on antenna arrays.

Course Outcomes: Upon completion of this course, students will be able to:

1. Determine specifications, design, construct and testantenna.
2. Explore and use tools for designing, analyzing and testing antennas.
3. Apply the concept of current distribution to find the field patterns.
4. Estimate the effect of the height of the monopole antenna on the radiation characteristics.
5. Study the effect of the variation of phase difference 'beta' between the elements of the array and case studies.

List of Assignments:

1. Simulation of half wave dipoleantenna.
2. Simulation of change of the radius and length of dipole wire on frequency of resonance ofantenna.
3. Simulationofquarterwave, fullwaveantennaandcomparisonoftheir parameters.
4. Simulation of monopole antenna with and without groundplane.
5. Study the effect of the height of the monopole antenna on the radiation characteristics of theantenna.
6. Simulation of a half wave dipole antennaarray.
7. Study the effect of change in distance between elements of array on radiation pattern of dipolearray.
8. Study the effect of the variation of phase difference 'beta' between the elements of the array on the radiation pattern of the dipolearray.

Note: The above experiments are to be carried out by using any appropriate simulation software.

Suggested Reading:

1. Li Ming Yang,"HFSS antenna design", 2nd edition,Electronic Industry Press, 2014.

19EC C108

WIRELESS AND MOBILE COMMUNICATION LAB

Instruction	4 P Hours per Week
Duration of SEE	—
SEE	—
CIE	50 Marks
Credits	2

Prerequisite: Requires concepts of Electromagnetic theory, Antennas & Wave propagation and Digital Communication.

Course Objectives: This course aims to:

1. Facilitate the experimental setup for understanding the Cellular concepts and experiments using GSM and CDMA and to learn AT commands in 3G networks and DSSS technique for CDMA to observe various spread spectrum parameters.
2. Provide the facility to learn 3. Build knowledge on concepts of software radio by studying building blocks such as Baseband and RF section.
3. Learn to compute GPS Satellite position, User position and key parameters of IRNSS using RINEX data.

Course Outcomes: Upon completion of this course, students will be able to:

1. Understand Cellular concepts, GSM and CDMA networks and to study GSM handset by experimentation with fault insertion techniques.
2. Understand of 3G communication system by means of various AT commands usage in GSM.
3. Analyze the concept of CDMA using DSSS kit and to generate various PN Codes.
4. Develop concepts of Software Radio in real time environment.
5. Estimation of GPS Satellite position, User position and key parameters of IRNSS using RINEX data.

List of Experiments:

1. Study of DSSS technique for CDMA to observe effect of PN codes, Chip rate, Spreading factor and Processing gain.
2. Study of GSM handset for various signaling and Fault insertion techniques (Major GSMhandset sections: clock, SIM card, charging, LCD module, Keyboard, User interface).

19EC C109

MINI PROJECT WITH SEMINAR

Instruction	4 P Hours per Week
Duration of SEE	—
SEE	—
CIE	50 Marks
Credits	2

Course Outcomes: Students are able to:

1. Formulate a specific problem and give solution.
2. Develop model/models either theoretical/practical/numerical form.
3. Solve, interpret/correlate the results and discussions.
4. Conclude the results obtained.
5. Write the documentation in standard format.

Guidelines:

1. As part of the curriculum in the II- semester of the progarmme each students shall do a mini project, generally comprising about three to four weeks of prior reading, twelve weeks of active research, and finally a presentation of their work for assessment.
2. Each student will be allotted to a faculty supervisor for mentoring.
3. Mini projects should present students with an accessible challenge on which to demonstrate competence in research techniques, plus the opportunity to contribute something more original.
4. Mini projects shall have inter disciplinary/ industry relevance.
5. The students can select a mathematical modeling based/Experimental investigations or Numerical modeling.
6. All the investigations are clearly stated and documented with the reasons/explanations.
7. The mini-project shall contain a clear statement of the research objectives, background of work, literature review, techniques used, prospective deliverables, detailed discussion on results, conclusions and references.

Department committee: Supervisor and two faculty coordinators

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Guidelines for awarding marks (CIE):		Max. Marks: 50
Evaluation by	**Max .Marks**	**Evaluation Criteria / Parameter**
Supervisor	20	Progress and Review
	05	Report
Department Committee	05	Relevance of the Topic
	05	PPT Preparation
	05	Presentation
	05	Question and Answers
	05	Report Preparation

16ECC112

PROJECT WORK - PROJECT SEMINAR

Instruction		End Exam- Duration	-
Sessionals	100 Marks	End Exam- Marks	-

Prerequisites: A prior knowledge of subjects related to the project work is required.

Course Objectives:

The overall objective of the project seminar is to help develop an emerging field at the intersection of multi-disciplinary understandings of engineering education

1. To prepare the students for the dissertation to be executed in 4^{th} semester for the Post Graduate dissertation.
2. To explore new research from a range of academic disciplines which throws light on the questions unanswered.
3. To showcase a cutting edge research on engineering Problems.

The main objective of the Project Seminar is to prepare the students for the dissertation to be executed in 4^{th} semester. Solving a real life problem should be focus of Post Graduate dissertation. Faculty members should prepare the project briefs (giving scope and reference) at the beginning of the 3^{rd} semester, which should be made available to the students at the departmental library. The project may be classified as hardware / software / modeling / simulation. It may comprise any elements such as analysis, synthesis and design.

The department will appoint a project coordinator who will coordinate the following:

- Allotment of projects and project guides.
- Conduct project - seminars.

Each student must be directed to decide on the following aspects

- Title of the dissertation work.
- Organization.
- Internal / External guide.
- Collection of literature related to the dissertation work.

Each student must present a seminar based on the above aspects as per the following guidelines:

1. Submit a one page synopsis before the seminar talk for display on the notice board.
2. Give a 20 minutes presentation through OHP, PC followed by a 10 minutes discussion.
3. Submit a report on the seminar presented giving the list of references.

Project Seminars are to be scheduled from the 3rd week to the last week of the semester. The internal marks will be awarded based on preparation, presentation and participation.

Course Outcomes:

Upon completion of this course, the student will be able to

1. Develop and support a relevant and informed thesis, or point of view, that is appropriate for its audience, purpose, discipline, and theme.
2. Effectively incorporate and document appropriate sources in accordance with the formatting style, proper for the discipline and effectively utilize the conventions of standard written English.
3. Better understand the role that effective presentations have in public/professional contexts and gain experience in formal/informal presentation.
4. Identify and critically evaluate the quality of claims, explanation, support, and delivery in public and professional discourse, and understand the factors influencing a speaker's credibility.
5. Develop audience-centered presentations meeting concrete professional objectives and integrating ethical and legal visual aids. Deliver well-rehearsed and polished presentations meeting time requirements, content, and interactive requirements.

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16ECC113

PROJECT WORK AND DISSERTATION

Instruction	--	End Exam- Duration	--
Sessionals	100	End Exam- Marks	100

Prerequisites: A prior knowledge of subjects related to the project work is required.

Course Objectives:

The Objectives of the dissertation are to:

1. Put into practice theories and concepts learned on the programme and to provide an opportunity to study a particular topic in depth;
2. Show evidence of independent investigation;
3. Show evidence of ability to plan and manage a project within deadlines.

The students must be given clear guidelines to execute and complete the project on which they have delivered a seminar in the 3rd semester of the course.

All projects will be monitored at least twice in a semester through student's presentation. Sessional marks should be based on the grades/marks, awarded by a monitoring committee of faculty members as also marks given by the supervisor.

Efforts be made that some of the projects are carries out in industries with the help of industry coordinates.

Common norms will be established for documentation of the project report by the respective department.

The final project reports must be submitted two weeks before the last working day of the semester.

The project works must be evaluated by an external examiner and based on his comments a viva voice will be conducted by the departmental committee containing of HOD, two senior faculty and supervisor.

Course Outcomes:

On satisfying the requirements of this course, students will have the knowledge and skills to:

1. Plan, and engage in, an independent and sustained critical investigation and evaluation of a chosen research topic, relevant to environment and society
2. Systematically identify relevant theory and concepts, relate them to appropriate methodologies and evidence, apply appropriate techniques and draw appropriate conclusions
3. Engage in systematic discovery and critical review of appropriate and relevant information sources
4. Appropriately apply qualitative and/or quantitative evaluation processes to original data\ Define, design and deliver an academically rigorous piece of research.
5. Appreciate practical implications and constraints of the chosen topic.

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19EC C201

ANALOG AND DIGITAL CMOS VLSI DESIGN

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Pre-requisite: Analog and Digital design concepts.
Course Objectives: This course aims to:
1. Characteristic behavior of MOSFET, CMOSFET, FINFET, TFET, Meta Gate Technology
2. Physical design concepts.
3. Design of Analog and digital circuits.

Course Outcomes: Upon completion of this course, students will be able to:
1. Understand MOS structure and its fabrication process
2. Design combinational logic circuits and understand physical design flow concepts
3. Discuss advanced technologies and design sequential logic circuits
4. Analyze various analog amplifiers and Current mirrors
5. Illustrate the principles of Basic OPAMP design and compensation techniques.

UNIT-I

Technology Scaling and Road map, Scaling issues, Standard 4 mask NMOS Fabrication process, Review: Basic MOS structure and its static behavior, Stick diagram and Layout, Inverter: Static CMOS inverter, Switching threshold and noise margin concepts and their evaluation of dynamic behavior, Power consumption.

UNIT-II

Physical Design Flow: Floor planning, Placement, Routing, CTS, Power analysis and IR drop estimation-static and dynamic ESD protection-human body model, Machine model, Combinational logic: Static CMOS design, Logic effort, Ratioedlogic, Pass transistor logic, Dynamic logic Speed and power dissipation in dynamic logic Cascading dynamic gates, CMOS transmission gate logic.

UNIT-III

Sequential Logic: Static latches and registers, MUX based latches, Static SR flip-flops, Master-slave edge-triggered register, Dynamic latches and registers, advanced technologies: Giga-scale dilemma, Short channel effects, High–k, Metal Gate Technology.

UNIT-IV

Introduction to Analog Design, Second order effects MOS small signal model, Single Stage Amplifier: Common Source Amplifier, CS Stage with Source Degeneration , Common Drain Amplifier & Common Gate Stage (resistive load) Current Mirrors: Basic Current Mirrors, Cascode Mirrors, Special Current Mirror, Single Stage Amplifier: Common Source Amplifier with Current source load, Triode load , CM Load, Frequency response of CS stage, Source follower, Common gate stage, Gilbert cell.

UNIT-V

MOS Difference Pair (One Stage OPAMP), Operational Amplifiers: Two stage OPAMP, Fully differential amplifiers, Slew rate, PSRR, Compensation of two-stage OPAMP, op-amp based comparator, switched capacitor. Introduction to data converters-specifications.

Text Books:

1. J P Rabaey, A P Chandrakasan, B Nikolic, "Digital Integrated circuits: A design perspective", Prentice Hall electronics and VLSI series, 2nd edition 2003
2. David Johns, Ken Martin, "Analog Integrated Circuit Design", John Wiley & sons. 2004
3. Jacob Baker.R.et.al., "CMOS Circuit Design", IEEE Press, Prentice Hall, India, 2000

Suggested Reading:

1. Paul. R. Gray & Robert G. Major, "Analysis and Design of Analog Integrated Circuits", John Wiley & sons. 2004
2. Kang, S. and Leblebici, Y., "CMOS Digital Integrated Circuits, Analysis and Design", TMH, 3rdEdition 2003
3. BehzadRazavi, "Design of Analog CMOS Integrated Circuits", Tata McGrah Hill. 2002.

19EC C203

MICRO CONTROLLERS AND PROGRAMMABLE DIGITAL SIGNAL PROCESSORS

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Microprocessor and its interfacing

Course Objectives: This course aims to:

1. Learn about ARM Microcontroller architectural features
2. Understand the ARM 'C' Programming for various applications
3. Study the DSP processor fundamentals and its development tools

Course outcomes: Upon completion of this course, students will be able to:

1. Compare and select ARM processor core based on requirements of embedded application
2. Analyze various features of ARM Cortex-M3 Processor
3. Able to interface various I/O devices to ARM 7 microcontroller
4. Understand the basic architectural needs of Programmable DSPs
5. Apply small applications on DSP processor based platform

UNIT-I

Background of ARM and ARM Architecture: A Brief history, Architecture Versions, Registers, pipeline, exception, interrupts and the vector table; core extensions, introduction to ARM instruction set, Introduction to Thumb instructions, Introduction to ARM C Programming.

UNIT-II

LPC21XX Microcontroller: Salient features of LPC 21xx, Pin description, Architectural Overview. Peripherals:Description of General Purpose Input/Output (GPIO) ports, Pin control Block. Features, Pin description, Register description and operation of PLL, Timers, PWM, Interfacing: LED, Relay, Buzzer, LCD, DAC, DC motor. Communication protocols: Brief overview on I2C, SPI, and CAN.

UNIT-III

ARM Cortex-M3 Processor: The Thumb-2 Technology and Instruction Set Architecture, Programming model- Registers, Operation modes, Exceptions and Interrupts, Vector Tables, Memory Map, Applications.

UNIT-IV

Programmable DSP (P-DSP) Processors: Basic architectural features - VLIW architecture, DSP computational building blocks, Bus and Memory architecture, Address generation unit, speed issues, Fixed and Floating point data paths, Introduction to TI DSP Processor family. Introduction to FPGA based DSP system design.

TMS320C67XX: Features of C67XX Processors, Internal Architecture, Functional units and operation, Data paths, Cross paths, Control Register File.

UNIT-V

TMS320C67XX Assembly Language Instructions: Functional Units and its Instructions, Addressing modes, Fixed point Instructions, Conditional Operations, Parallel Operations, Floating point instructions.

TMS320C67XX Application Development Tools: Code composer studio (CCS), Application programs in C67XX Code development in both C and Assembly language.

Text Books:

1. Joseph Yiu, “The definitive guide to ARM Cortex-M3”, Elsevier, 2nd Edition, 2010
2. Andrew N.SLOSS, DomonicSymes, Chris Wright “ARM System Developers Guide-Desisning and optimizing system software” ELSEVIER 1st Edition 2004.
3. Avatar Singh and S. Srinivasan, “Digital Signal Processing Implementations Using DSP Microprocessors”, Thomson Brooks, 2004.

Suggested Reading:

1. B. Ventakaramani, M. Bhaskar, “Digital Signal Processes, Architecture Processing and Applications”, Tata McGraw Hill, 2002.

19ME C103

RESEARCH METHODOLOGY AND IPR

(Mandatory Course)

Instruction	2 L Hours per Week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	25 Marks
Credits	2

Course Objectives: This course aims to:

1. Motivate to choose research as career
2. Formulate the research problem, prepare the research design
3. Identify various sources for literature review and data collection report writing
4. Equip with good methods to analyze the collected data
5. Know about IPR copyrights

Course Outcomes: Upon completion of this course, students will be able to:

1. Define research problem, review and asses the quality of literature from various sources
2. Improve the style and format of writing a report for technical paper/ Journal report, understand and develop various research designs
3. Collect the data by various methods: observation, interview, questionnaires
4. Analyze problem by statistical techniques: ANOVA, F-test, Chi-square
5. Understand apply for patent and copyrights

UNIT-I

Research Methodology: Research Methodology: Objectives and Motivation of Research, Types of Research, research approaches, Significance of Research, Research Methods verses Methodology, Research Process, Criteria of Good Research, Problems Encountered by Researchers in India, Benefits to the society in general. Defining the Research Problem: Selection of Research Problem, Necessity of Defining the Problem

UNIT-II

Literature Survey Report Writing: Literature Survey: Importance and purpose of Literature Survey, Sources of Information, Assessment of Quality of Journals and Articles, Information through Internet. Report writing: Meaning of interpretation, layout of research report, Types of reports, Mechanics of writing

a report. Research Proposal Preparation: Writing a Research Proposal and Research Report, Writing Research Grant Proposal

UNIT-III

Research Design: Research Design: Meaning of Research Design, Need of Research Design, Feature of a Good Design, Important Concepts Related to Research Design, Different Research Designs, Basic Principles of Experimental Design, Developing a Research Plan, Steps in sample design, types of sample designs.

UNIT-IV

Data Collection and Analysis: Data Collection: Methods of data collection, importance of Parametric, non parametric test, testing of variance of two normal population, use of Chi-square, ANOVA, Ftest, z-test

UNIT-V

Patents and Copyright: Patent: Macro economic impact of the patent system, Patent document, How to protect your inventions. Granting of patent, Rights of a patent, how extensive is patent protection. Copyright: What is copyright. What is covered by copyright. How long does copyright last? Why protect copyright? Related Rights: what are related rights? Enforcement of Intellectual Property Rights: Infringement of intellectual property rights, Case studies of patents and IP Protection

Text Books:

1. C.R Kothari, "Research Methodology, Methods & Technique"; New Age International Publishers, 2004
2. R. Ganesan, "Research Methodology for Engineers", MJP Publishers, 2011
3. Y.P. Agarwal, "Statistical Methods: Concepts, Application and Computation", Sterling Publs., Pvt., Ltd., New Delhi, 2004

Suggested Reading:

1. Ajit Parulekar and Sarita D' Souza, "Indian Patents Law – Legal & Business Implications"; Macmillan India ltd , 2006
2. B. L.Wadehra; "Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications"; Universal law Publishing Pvt. Ltd., India 2000.
3. P. Narayanan; "Law of Copyright and Industrial Designs"; Eastern law House, Delhi 2010.

19EC E201

ADVANCED COMPUTER ORGANIZATION
(Program Elective)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Fundamentals of Computer architecture.
Course Objectives: This course aims to:
1. Learn about processor design for computer system
2. Understand the memory organization of the computer
3. Study the I/O organization and parallel computer systems

Course Outcomes: Upon completion of this course, students will be able to:
1. Analyze the computer arithmetic operations.
2. Design of control UNIT-of the computer
3. Understand the memory organization of the computer
4. Interface various I/O modules to the computer system
5. Analyze the multiprocessor environment and various buses for the computer system

UNIT–I

Processor Design: CPU Organization, Data Representation, Instruction Formats, Data Path Design: Fixed Point Arithmetic and Floating Point Arithmetic, Instruction Pipelining, Super Scalar techniques, linear pipeline processors, Super scalar and super pipeline design, Multi vector and SIMD computers.

UNIT–II

Control Unit Design: Basic Concepts: Basic control Unit-of the computer system. Hardwired Control UNIT-Design approach,Micro-Programmed Control UNIT-Design Approach, Micro program sequencer, Case studies based on both the approaches.

UNIT-III

Memory Organization: Internal memory, computer memory system overview, the memory Hierarchy, Random access memories, Cache memory, Elements of cache design, Virtual memory- protection and examples of virtual memory, Replacement Policies.

UNIT–IV

I/O Organization: Accessing I/O Devices, Programmed I-O, Interrupts, DMA, Bus Arbitration; Synchronous bus and asynchronous bus, Interface circuits, Parallel port, Serial port, standard I/O interfaces, IO Processor, PCI bus, SCSI bus, USB bus protocols.

UNIT–V

Parallel Computer Systems: Instruction Level Parallelism (ILP) – Concept and Challenges, Dynamic Scheduling, Limitations on ILP,Thread Level Parallelism, Multi-processors – Characteristics, Symmetric and Distributive Shared Memory Architecture, Vector Processors and Supercomputers.

Text Books:

1. Carl Hamacher, Vranesic, Zaky, "Computer Organization", 5th edition, MGH, 2010
2. William Stallings, "Computer Organization and Architecture designing for Performance", 7th edition, PHI, 2007.

Suggested Reading:

1. John L. Hennessy and David A. Patterson, "Computer Architecture", A quantitative Approach, 3rd Edition, Elsevier, 2005.
2. Hayes John P,"Computer Architecture and organization" 3rd Edition, MGH, 1998.

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19EC E213

VLSI TECHNOLOGY AND PHYSICAL DESIGN AUTOMATION

(Program Elective)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Basic knowledge on semiconductor physics and MOS transistors followed by analog and digital fundamentals is required.

Course Objectives: This course aims to:

1. Model passive and active devices suiting advances in IC fabrication technology.
2. Create learning, development and testing environment to meet ever challenging needs in the field of Chip Design.
3. Communicate effectively and convey ideas using innovative engineering using appropriate EDA tools

Course outcomes: Upon completion of this course, students will be able to:

1. Understanding of various fabrication process steps of VLSI technology.
2. Study automation process for VLSI system design.
3. Fundamentals of VLSI Layout and design rules.
4. Demonstrate knowledge of combinational optimization techniques.
5. Understanding of fundamentals for various physical design CAD tools.

UNIT-I

Introduction to VLSI Technology and Fabrication Process: Various layers of IC, wafer preparation and crystal growth, Oxidation, CVD, Lithography, Etching, Ion implantation, diffusion techniques.

UNIT-II

Concepts and Scope of Physical Design: Typical structures of passive and active components, CMOS fabrication process- n-Well, P-Well and Twin Tub,CMOS parasitic- Latch-up and its prevention.

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UNIT-III

Cell Concepts and Design Rules: Cell based layout design, fabrication errors, alignment sequence and alignment inaccuracy, Interconnects, contacts,vias, SCMOS design rules, lambda based design rules, stick diagrams, Hierarchical stick diagrams, layouts.

UNIT-IV

General Purpose Methods for Combinational Optimization:Partitioning, placement, discrete methods of global and local placements, routing, local and Global routing viaminimization, over the cell routing, single layer and two layer routing, clock and powerrouting.

UNIT-V;

EDA/CAD Tools: Layout editors, circuit extractors, automatic layout tools, modeling and extraction of circuit Parametersfrom physical layout, compaction, algorithms, physical automations of FPGAs.

Text Books:

1. J.D.Plummer, M.D.Deal and P.B.Griffin, "The Silicon VLSI Technology Fundamentals", Practice and modeling, Pearson Education 2009.
2. N.A. Sherwani, "Algorithms for VLSI Physical Design Automation", 2002.

Suggested Reading:

1. Modern VLSI Design (System on Chip), Woyne Wolf, Pearson Education, 2002.
2. S.H. Gerez, "Algorithms for VLSI Design Automation", 1998.

19EGA101

ENGLISH FOR RESEARCH PAPER WRITING

(Audit Course)

Instruction	2 L Hours per Week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	—
Credits	Non Credit

Course Objectives: This course aims to:

1. Understand the nuances of language and vocabulary in writing a ResearchPaper.
2. Develop the content, structure and format of writing a research paper.
3. Enable the students to produce original research papers without plagiarism.

Course Outcomes: Upon completion of this course, students will be able to:

1. Interpret the nuances of research paper writing.
2. Differentiate the research paper format and citation of sources.
3. Review the research papers and articles in a scientific manner.
4. Avoid plagiarism and be able to develop their writing skills in presenting the researchwork.
5. Create a research paper and acquire the knowledge of how and where to publish their original research papers.

UNIT-I

Academic Writing: Meaning & Definition of a research paper– Purpose of a research paper – Scope – Benefits – Limitations – outcomes.

UNIT-II

Research Paper Format: Title – Abstract – Introduction – Discussion – Findings – Conclusion – Style of Indentation – Font size/Font types – Indexing – Citation ofsources.

UNIT-III

Research Methodology: Methods (Qualitative – Quantitative) Review of Literature. Criticizing, Paraphrasing & Plagiarism.

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UNIT-IV

Process of Writing a Research Paper: Choosing a topic - Thesis Statement – Outline – Organizing notes - Language of Research – Word order, Paragraphs – Writing first draft–Revising/Editing - The final draft and proof reading.

UNIT-V

Research Paper Publication: Reputed Journals – National/International – ISSN No, No. of volumes, Scopus Index/UGC Journals – Free publications - Paid Journalpublications – Advantages/Benefits

Text Books:

1. C. R Kothari, Gaurav, Garg, Research Methodology Methods and Techniques, New Age International Publishers. 4thEdition.

Suggested Reading:

1. Day R "How to Write and Publish a Scientific Paper", Cambridge University Press, 2006.
2. MLA "Hand book for writers of Research Papers", East West Press Pvt. Ltd, New Delhi, 7thEdition.
3. Lauri Rozakis, Schaum's, "Quick Guide to Writing Great Research Papers", Tata McGraw Hills Pvt. Ltd, NewDelhi.

Online Resources:

1. NPTEL:https://onlinecourses.nptel.ac.in/noc18_mg13/preview

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19EC C205

ANALOG AND DIGITAL CMOS VLSI DESIGN LAB

Instruction	4 P Hours per Week
Duration of SEE	—
SEE	—
CIE	50 Marks
Credits	2

Prerequisite: Analog and Digital design concepts.

Course Objectives: This course aims to:

1. Understand Characteristics behavior of MOSFET.
2. Analyze performance of Differential amplifiers
3. Verify layout of basic digital circuits

Course Outcomes: Upon completion of this course, students will be able to:

1. Define the characteristics of MOSFET and design entry in the tool.
2. Understand the design specs and library files of tool.
3. Apply the concept of theory in the lab implementation.
4. Analyze power and delay calculation from the graphs.
5. Compare performance of different circuits with the simulation results.

List of Experiments:

1. Characteristics of MOSFET.
2. Calculation of rise time and fall time for CMOS inverter.
3. To build a three stage and five stage ring oscillator circuit in 0.18um and 0.13um technology and compare its frequencies and time period.
4. NMOS common source amplifier.
5. Design of Differential Amplifier.
6. Design of Operational Amplifier.
7. Draw the layout of inverter circuit.

Suggested Reading:

1. Cadence Design Systems(Ireland) Ltd., “Cadence manual”, 2013.

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19EC C206

MICRO CONTROLLERS AND PROGRAMMABLE DIGITAL SIGNAL PROCESSORS LAB

Instruction	4 P Hours per Week
Duration of SEE	—
SEE	—
CIE	50 Marks
Credits	2

Prerequisite: Programming in'C' and basics of ARM Microcontroller.

Course Objectives: This course aims to:

1. Write the ARM 'C' programming for applications
2. Understand the interfacing of various modules with ARM 7/ ARM Cortex-M3
3. Develop assembly and C Programming for DSP processors.

Course Outcomes: Upon completion of this course, students will be able to:

1. Install, configure and utilize tool sets for developing applications based on ARM processor core
2. Design and develop the ARM 7 based embedded systems for various applications
3. Develop application programs on ARM and DSP development boards both in assembly and in C
4. Design and Implement the digital filters on DSP 6713 processor.
5. Analyze the hardware and software interaction and integration.

List of Assignments:

Part A) Experiments to be carried out on ARM 7/Cortex-M3 development boards

1. Blink an LED with software delay, delay generated using the SysTick timer.
2. System clock real time alteration using the PLL modules.
3. Control intensity of an LED using PWM implemented in software and hardware.
4. Control an LED using switch by polling method, by interrupt method and flash the LED once every five switch presses.
5. UART Echo Test.
6. Take analog readings on rotation of rotary potentiometer connected to an ADC channel.
7. Temperature indication on an RGB LED.

19EC C202

EMBEDDED SYSTEM DESIGN USING RTOS

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: The prior knowledge on the basics of operating systems.

Course Objectives: This course aims to:

1. Understand the basic concepts of the UNIX operating system and POSIX Standards.
2. Know the importance of hard/soft Real-Time Systems and to familiarize the cases for tasks, semaphores, queues, pipes, and event flags.
3. Study the basics of the kernel objects and memory management in VxWorks and to know about real-time applications development tools.

Course Outcomes: Upon completion of this course, students will be able to:

1. Understand the Unix operating system and shell programming.
2. Know the standards of POSIX and its portability.
3. Illustrate the problems on scheduling in hard and soft real time systems.
4. Demonstrate the in-depth knowledge on Real Time Operating System concepts.
5. Program the real time concepts using VxWorks and know about the software development tools and RTOS comparison.

UNIT-I

Brief Review of UNIX Operating Systems: UNIX KernelFile system concepts of Process Concurrent Execution andInterrupts. Process management – forks & execution. Programming with system calls, Process Scheduling, Shell programming and filters.Portable Operating system Interface (POSIX) IEEE Standard 1003.13 and POSIX real time profile. POSIX versus traditional Unix Signals.Overheads and timing predictability.

UNIT-II

Hard versus Soft Real-Time Systems: Examples, Jobs & Processors, Hard and Soft timing constraints, Hard Real time systems, Sift real time systems. Classical Uniprocessor Scheduling algorithms RMS, Preemptive EDF, Allowing for Preemptive and Exclusion condition.

UNIT-III

Concept of Embedded operating systems, Differences between Traditional OS and RTOS, Real time system concepts, RTOS Kernel & Issues in Multitasking Task Assignment, Task switching, Foreground ISRs and Background Tasks, critical section Reentrant Functions, Inter-process Communication (IPC)IPC through Semaphores, mutex, Mailboxes, Message queues or pipes and Event Flags.

UNIT-IV

VxWorks POSIX Real Time Extensions, timeout features, Task Creation, Semaphores (Binary, Counting), Mutex, Mailbox, Message Queues, Memory Management Virtual to Physical Address Mapping.

UNIT-V

Debugging tools and cross development environment Software Logic analyzes, ICEs. Comparison of RTOS VxWorks, uC/OS-II and RT Linux for Embedded Applications.

Text Books:

1. Jane W.S.Liu,"Real Time Systems", Pearson Education, Asia, 2001.
2. Wind River Systems, "VxWorks Programrs Guide", Wind River Systems Inc.1997.
3. Jean .J.Labrose, "MicroC/OS-II", The CMP Books, 2002.

Suggested Reading:

1. Betchof, D.R., "Programming with POSIX threads", Addison Wesley Longman, 1997.
2. C.M.Krishna and G.Shin, "Real Time Systems", McGraw-Hill Companies Inc., McGraw Hill International Editions, 1997.

19EC C204

VLSI DESIGN VERIFICATION AND TESTING

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Pre-requisite: Knowledge on analog and Digital CMOS VLSI Design, C and C++ Language concepts.

Course Objectives: This course aims to:

1. The concepts of verification and testing.
2. Data types and OOPs concepts.
3. Randomization in System Verilog.

Course Outcomes: Upon completion of this course, students will be able to:

1. Familiarity of front end design and verification techniques and create reusable test environments.
2. Understanding various data types used in System Verilog
3. Demonstrating OOPs concepts
4. Make use of Randomization in System Verilog
5. Verify increasingly complex designs more efficiently and effectively

UNIT-I

Verification Guidelines: Verification Process, Basic test bench functionality, directed testing, Methodology basics, Constrained-Random stimulus, Functional coverage, test bench components, Layered test bench, Building layered test bench, Simulation environment phases, Maximum code reuse, test bench performance.

UNIT-II

Data Types: Built-in data types, Fixed-size arrays, Dynamic arrays, Queues, Associative Arrays, Linked lists, Array methods, Choosing a storage type, Creating new types with typedef, Creating user-defined structures, Type conversion, Enumerated types, Constants strings, Expression width. Proceduralstatements and routines: Procedural statements, tasks, functions and void functions, Routine arguments, returningfrom a routine, local data storage,Time values.

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UNIT-III

Basic OOPS: Introduction, think of nouns, Not verbs, your first class, where to define a class, OOP terminology, Creating new objects, Object de-allocation, Using objects, Static variables vs. Global variables, Class methods, Defining methods outside of the class, Scoping rules, Using one class inside another.

UNIT-IV

Connecting the test bench and design: Separating the test bench and design, Interface constructs, Stimulus timing, Interface driving and sampling, connecting it all together, Top-level scope Program Module interactions. System Verilog Assertions, understanding dynamic objects, Copying objects, Public vs. Local, Straying off course building a test bench.

UNIT-V

Randomization: Introduction, What to randomize, Randomization in SystemVerilog, Constraint details solution probabilities, Controlling multiple constraint blocks, Valid constraints, In-line constraints, The pre randomize and postrandomize functions, Random number functions, Constraints tips and techniques, Common randomization problems, Iterative and array constraints, Atomic stimulus generation vs. Scenario generation,Random control, Random number generators, Random device configuration.

Text Books:

1. Chris Spears, "System Verilog for Verification", Springer, 2nd Edition 2006.
2. M. Bushnell and V. D. Agrawal, "Essentials of Electronic Testing for Digital, Memory and Mixed-Signal VLSI Circuits", Kluwer Academic Publishers 2002.

Suggested Reading:

1. Writing testbenches using System Verilog By Janick Bergeron Edition: illustrated Published by Birkhäuser, 2006 ISBN 0387292217, 9780387292212
2. System Verilog for Verification: A Guide to Learning the Test bench Language Features By Chris Spear Edition: 2, Published by Springer, 2008 ISBN 0387765298, 9780387765297.

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19EC E205

LOW POWER VLSI DESIGN
(Program Elective)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Students should have the prior knowledge ofAnalog and Digital CMOS VLSI Design.

Course Objectives: This course aims to:

1. Know the sources of power dissipation and need for low power designs for emerging technologies..
2. Understand the concepts of Low power design techniques for digital circuits
3. Analyze the power dissipations of memory and processor systems and able to adopt suitable methods for power reduction.

Course Outcomes: Upon completion of this course, students will be able to:

1. Identify the sources of power dissipation in digital IC systems & understand the impact of power on system performance and reliability.
2. Characterize and model power consumption & understand the basic analysis methods.
3. Understand leakage sources and reduction techniques.
4. Interpreting Logic synthesis for low power.
5. Adopt memory and software design for low power.

UNIT-I

Technology & Circuit Design Levels: Sources of power dissipation in digital ICs, degree of freedom, recurring themes in low power, emerging low power approaches, dynamic dissipation in CMOS, effects of Vdd and Vt on speed, constraints on Vt reduction, transistor sizing and optimal gate oxide thickness, impact of technology scaling, technology innovations.

UNIT-II

Low Power Circuit Techniques: Power consumption in circuits, flip-flops and latches, high capacitance nodes, energy recovery, reversible pipelines, high performance approaches.

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UNIT-III

Low Power Clock Distribution: Power dissipation in clock distribution, single driver Versus distributed buffers, buffers and device sizing under process variations, zero skew versus Tolerable skew, chip and package co-design of clock network.

UNIT-IV

Logic Synthesis for Low Power Estimation Techniques: Power minimization techniques, Low power arithmetic components circuit design styles, adders, multipliers. Low Power Memory Design: Sources and reduction of power dissipation in memory subsystem, sources of power dissipation in DRAM & SRAM.

UNIT-V

Low Power Microprocessor Design System: power management support, architectural tradeoffs for power, choosing the supply voltage, low-power clocking, implementation problem for low power, comparison of microprocessors for power & performance.

Text Books:

1. P. Rashinkar, Paterson and L. Singh, "Low Power Design Methodologies", Kluwer Academic, 2002
2. Kaushik Roy, Sharat Prasad, "Low power CMOS VLSI circuit design", John Wiley sons, Inc., 2000.

Suggested Reading:

1. J.B.Kulo and J.H Lou, "Low voltage CMOS VLSI Circuits", Wiley, 1999.
2. Gary Yeap, "Practical low power digital VLSI design", Kluwer, 1998.
3. A.P.Chandrasekaran and R.W.Broadersen, "Low power digital CMOS design", Kluwer,1995

19EC E210

SoC DESIGN

(Program Elective)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Concept of Embedded Systems, Microprocessors, microcontrollers and ASIC.

Course Objectives: This course aims to:

1. Introduce students to various approaches of SoC design, ADLs and GNR.
2. Introduce various techniques used for Low power SoC Design
3. Demonstrate various simulation methods and synthesis techniques for SoCs.

Course Outcomes: Upon completion of this course, students will be able to:

1. Understand the concepts related to SoC like NISC, ASIP,ADL, GNR, Reconfiguration, Clock Gating, DVS etc.
2. Differentiate between various design strategies like ASIC and SOC etc.
3. Differentiate between various types of Processors like CISC, RISC, NISC and ASIP.HDL and ADL
4. Design a simple SOC for reconfigurability / low power / ASIP / NISC etc. and synthesize simple blocks using Graph Theory.
5. Simulate and synthesize the Design using various simulation models.

UNIT-1

ASIC and NISC Overview : Overview of ASIC types, design strategies, CISC, RISC and NISC approaches for SOC architectural issues and its impact on SoC design methodologies, Application Specific Instruction Processor (ASIP) concepts, NISC-NISC Control Words methodology, NISC Applications and Advantages.

UNIT-2

ADL (for ASIP and NISC) and GNR: Architecture Description Languages (ADL) for design and verification of Application Specific Instruction-set Processors (ASIP), (NISC)-design flow, modeling NISC architectures and systems, Generic

Netlist Representation -A formal language for specification, compilation and synthesis of embedded processors.

UNIT-3

Low Power SoC Design: Low power SoC design / Digital system, Low power system perspective-power gating, clock gating, adaptive voltage scaling (AVS), Static voltage scaling, Dynamic clock frequency and voltage scaling (DCFS), building block optimization, power down techniques, power consumption verification.

UNIT-4

Simulation: Different simulation modes, behavioural, functional, static timing, gate level, switch level, transistor/circuit simulation, design of verification vectors.FPGA, Reconfigurable systems, SoC related modeling of data path design and control logic, Minimization of interconnects impact, clock tree design issues.

UNIT-5

Synthesis: Role and Concept of graph theory and its relevance to synthesizable constructs, Walks, trails paths, connectivity, components, mapping/visualization, nodal and admittance graph. Technology independent and technology dependent approaches for synthesis, optimization constraints, Synthesis report analysis. HDL coding techniques for minimization of power consumption.Design of NISC for DCT application.

Text Books:

1. Michael J. Flynn and Wayne Luk, "Computer System Design: System-on-Chip". Wiley, 2011.
2. B. Al Hashimi, "System on chip-Next generation electronics", The IET, 2006.

Suggested Reading:

1. Hubert Kaeslin, "Digital Integrated Circuit Design: From VLSI Architectures to CMOS Fabrication", Cambridge University Press, 2008.
2. RochitRajsuman, "System-on- a-chip: Design and test", Advantest America R & D Center, 2000.
3. P Mishra and N Dutt, "Processor Description Languages", Morgan Kaufmann, 2008.

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19EC A101

VALUE EDUCATION
(Audit Course)

Instruction	2 P Hours per Week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	—
Credits	Non Credit

Course Objectives: This course aims to
1. Understand the need and importance of Values for self-development and for National development.
2. Imbibe good human values and Morals
3. Cultivate individual and National character.

Course outcomes: After completion of the Course, Students will be able to
1. Gain necessary Knowledge for self-development
2. Learn the importance of Human values and their application in day to day professional life.
3. Appreciate the need and importance of interpersonal skills for successful career and social life
4. Emphasize the role of personal and social responsibility of an individual for all-round growth.
5. Develop a perspective based on spiritual outlook and respect women, other religious practices, equality, non-violence and universal brotherhood.

UNIT-I

Human Values, Ethics and Morals: Concept of Values, Indian concept of humanism, human values; Values for self-development, Social values, individual attitudes; Work ethics, moral and non- moral behaviour, standards and principles based on religion, culture and tradition.

UNIT-II

Value Cultivation, and Self-Management: Need and Importance of cultivation of values such as Sense-of Duty, Devotion to work, Self-reliance, Confidence, Concentration, Integrity & discipline, and Truthfulness.

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UNIT-III

Spiritual Outlook and Social Values: Personality and Behavior, Scientific attitude and Spiritual (soul) outlook; Cultivation of Social Values Such as Positive Thinking, Punctuality, Love & Kindness, Avoiding fault finding in others, Reduction of anger, forgiveness, Dignity of labour, True friendship, Universal brotherhood and religious tolerance.

UNIT-IV

Values in Holy Books : Self-management and Good health; **and internal & external Cleanliness,** Holy books versus Blind faith, Character and Competence, Equality, Nonviolence, Humility, Role of Women.

UNIT-V

Dharma, Karma and Guna: Concept of soul; Science of Reincarnation, Character and Conduct, Concept of Dharma; Cause and Effect based Karma Theory; The qualities of Devine and Devilish; Satwic, Rajasic and Tamasicgunas.

Text Books:

1. Chakroborty, S.K. "Values & Ethics for organizations Theory and practice", Oxford University Press, New Delhi, 1998.
2. Jaya DayalGoyandaka, "Srimad Bhagavad Gita", withSanskrit Text, Word meaning and Prose meaning, Gita Press, Gorakhpur, 2017.

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19EC C207

RTL SIMULATION AND SYNTHESIS WITH PLDs LAB

Instruction	4 P Hours per Week
Duration of SEE	—
SEE	—
CIE	50 Marks
Credits	2

Prerequisites: Digital Design,Verilog HDL programming skills.

Course Objectives: This course aims to:

1. The simulation of combinational and sequential circuits.
2. FSM based designs.
3. Implementation of DFT and FFTs.

Course Outcomes: Upon completion of this course, students will be able to:

1. Use computer-aided design tools for design of complex digital logic circuits.
2. Model, simulate, verify with hardware description language (HDL).
3. Simulate and synthesis FSMS.
4. Design Fourier transforms using HDL
5. Design and prototype with programmable logic.

Design entry by Verilog,Programmable Logic Devices, Introduction to ASIC Design Flow, FPGA, SoC, Floor planning, Placement, Clock tree synthesis, Routing, Physical verification, Power analysis, ESD protection. Static Timing analysis, Meta-stability, Clock issues, Need and design strategies for multi-clock domain designs, IP and Prototyping, Design for testability.

List of Experiments:

1. Verilog implementation of 8:1 Mux/Demux, Full Adder, 8-bit Magnitude comparator,
2. Encoder/decoder, Priority encoder, D-FF, 4-bit Shift registers (SISO, SIPO, PISO, Bidirectional) 3-bit Synchronous Counters, Binary to Gray converter, Parity generator.
3. Sequence generator/detectors, Synchronous FSM – Mealy and Moore machines.
4. Vending machines - Traffic Light controller, ATM, elevator control.
5. PCI Bus & arbiter and downloading on FPGA.
6. UART/ USART implementation in Verilog.

7. Realization of single port SRAM in Verilog.
8. Verilog implementation of Arithmetic circuits like serial adder/ subtractor, parallel adder/subtractor, serial/parallel multiplier.
9. Discrete Fourier transform/Fast Fourier Transform algorithm in Verilog.

Suggested Reading:

1. Samir Palnitkar, “Verilog HDL, a guide to digital design and synthesis”, Prentice Hall 2003.
2. Doug Amos, Austin Lesea, Rene Richter, “FPGA based prototyping methodology manual”, Xilinx, 2011.
3. Bob Zeidman, “Designing with FPGAs & CPLDs”, CMP Books, 2002.

19EC C208

RTOS AND VLSI DESIGN VERIFICATION LAB

Instruction	4 P Hours per Week
Duration of SEE	—
SEE	—
CIE	50 Marks
Credits	2

Prerequisite: Basics of operating system,basics of embedded system and verification concepts.

Course Objectives: This course aims to:

1. Understand the concepts of RTOS Programming
2. Illustrate the concept of task scheduling
3. Verify layout of basic digital circuits

Course Outcomes: Upon completion of this course, students will be able to:

1. Verify a few important OOPs concepts
2. Compile and Run various design constructs using CAD tool
3. Develop self-checking test benches using SystemVerilog
4. Understand the programming concepts of RTOS
5. To analyze Multitasking, IPC and Scheduling concepts

RTOS Programming:

1. Introduction to RTOS (VxWorks) and its basic functions
2. RTOS Timer programming (VxWorks)
3. RTOS Task function programming (VxWorks)
4. Multi-tasking using round robin scheduling
5. IPC using message queues
6. IPC using semaphore
7. IPC using mail box

Verification (Mentor Graphics Tools)

1. Sparse memory
2. Semaphore
3. Mail box
4. Classes
5. Polymorphism

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6. Coverage
7. Assertions

Suggested Reading:

1. Silberschatz, Galvin, Gange" Operating Systems Concepts" 8/e , Wiley Education, 2007.
2. Wind River SystemsInc., "VxWorks Programrs Guide", 2003.

19EC C209

MINI PROJECT WITH SEMINAR

Instruction	4 P Hours per Week
Duration of SEE	—
SEE	—
CIE	50 Marks
Credits	2

Course Outcomes: Students are able to:

1. Formulate a specific problem and give solution.
2. Develop model/models either theoretical/practical/numerical form.
3. Solve, interpret/correlate the results and discussions.
4. Conclude the results obtained.
5. Write the documentation in standard format.

Guidelines:

1. As part of the curriculum in the II- semester of the Program each students shall do a mini project, generally comprising about three to four weeks of prior reading, twelve weeks of active research, and finally a presentation of their work for assessment.
2. Each student will be allotted to a faculty supervisor for mentoring.
3. Mini projects should present students with an accessible challenge on which to demonstrate competence in research techniques, plus the opportunity to contribute something more original.
4. Mini projects shall have inter disciplinary/ industry relevance.
5. The students can select a mathematical modeling based/Experimental investigations or Numerical modeling.
6. All the investigations are clearly stated and documented with the reasons/explanations.
7. The mini-project shall contain a clear statement of the research objectives, background of work, literature review, techniques used, prospective deliverables, detailed discussion on results, conclusions and references.

Department committee: Supervisor and two faculty coordinators

Guidelines for awarding marks (CIE):		Max. Marks: 50
Evaluation by	**Max. Marks**	**Evaluation Criteria / Parameter**
Supervisor	20	Progress and Review
	05	Report
Department Committee	05	Relevance of the Topic
	05	PPT Preparation
	05	Presentation
	05	Question and Answers
	05	Report Preparation

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16EC C213

PROJECT WORK -PROJECT SEMINAR

Instruction	--------	End Exam- Duration	-
Sessionals	100 Marks	End Exam- Marks	-

Prerequisites: A prior knowledge of subjects related to the project work is required.

Course Objectives:

The overall objective of the project seminar is to help develop an emerging field at the intersection of multi-disciplinary understandings of engineering education

1. To prepare the students for the dissertation to be executed in IV semester, solving a real life problem should be focus of Post Graduate dissertation
2. To explore new research from a range of academic disciplines which throws light on the questions unanswered.
3. To showcase cutting edge research on engineering from outstanding academic researchers.

Course Outcomes:

Upon completion of this course, the student will be able to

1. Develop and support a relevant and informed thesis, or point of view, that is appropriate for its audience, purpose, discipline, and theme.
2. Effectively incorporate and document appropriate sources in accordance with the formatting style, proper for the discipline and effectively utilize the conventions of standard written English.
3. Better understand the role that effective presentations have in public/professional contexts and gain experience in formal/informal presentation.
4. Identify and critically evaluate the quality of claims, explanation, support, and delivery in public and professional discourse, and understand the factors influencing a speaker's credibility.
5. Develop audience-centered presentations meeting concrete professional objectives and integrating ethical and legal visual aids. Deliver well-rehearsed and polished presentations meeting time requirements, content, and interactive requirements.

The main objective of the Project Seminar is to prepare the students for the dissertation to be executed in IV semester. Solving a real life problem should be focus of Post Graduate dissertation. Faculty members should prepare the project briefs (giving scope and reference) at the beginning of the III semester, which should be made available to the students at the departmental library. The project may be classified as hardware / software / modeling / simulation. It may comprise any elements such as analysis, synthesis and design.

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The department will appoint a project coordinator who will coordinate the following:

- Allotment of projects and project guides.
- Conduct project - seminars.

Each student must be directed to decide on the following aspects

- Title of the dissertation work.
- Organization.
- Internal / External guide.
- Collection of literature related to the dissertation work.

Each student must present a seminar based on the above aspects as per the following guidelines:

1. Submit a one page synopsis before the seminar talk for display on the notice board.
2. Give a 20 minutes presentation through OHP, PC followed by a 10 minutes discussion.
3. Submit a report on the seminar presented giving the list of references.

Project Seminars are to be scheduled from the 3rd week to the last week of the semester. The internal marks will be awarded based on preparation, presentation and participation.

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16EC C214

PROJECT WORK AND DISSERTATION

Instruction	--	End Exam- Duration	--
Sessionals	100	End Exam- Marks	100

Prerequisites: A prior knowledge of subjects related to the project work is required.

Course Objectives:

The Objectives of the dissertation are to:

1. Put into practice theories and concepts learned on the programme
2. Provide an opportunity to study a particular topic in depth;
3. Show evidence of independent investigation;
4. Combine relevant theories and suggest alternatives;
5. Enable interaction with practitioners (where appropriate to the chosen topic);
6. Show evidence of ability to plan and manage a project within deadlines

Course Outcomes:

On satisfying the requirements of this course, students will have the knowledge and skills to:

1. Plan, and engage in, an independent and sustained critical investigation and evaluation of a chosen research topic, relevant to environment and society
2. Systematically identify relevant theory and concepts, relate them to appropriate methodologies and evidence, apply appropriate techniques and draw appropriate conclusions
3. Engage in systematic discovery and critical review of appropriate and relevant information sources
4. Appropriately apply qualitative and/or quantitative evaluation processes to original data\ Define, design and deliver an academically rigorous piece of research.
5. Appreciate practical implications and constraints of the chosen topic.

The students must be given clear guidelines to execute and complete the project on which they have delivered a seminar in the III semester of the course.

All projects will be monitored at least twice in a semester through student's presentation. Sessional marks should be based on the grades/marks, awarded by a monitoring committee of faculty members as also marks given by the supervisor.

Efforts be made that some of the projects are carries out in industries with the help of industry coordinates.

Common norms will be established for documentation of the project report by the respective department.

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The final project reports must be submitted two weeks before the last working day of the semester.

The project works must be evaluated by an external examiner and based on his comments a viva voice will be conducted by the departmental committee containing of HOD, two senior faculty and supervisor.

CORE COURSES

19MB C101

MANAGEMENT AND ORGANIZATION BEHAVIOUR

Instruction	4 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation:	
Mid Session Examination	20 Marks
Case Study/Assignment/Book Review/ Group Activity/Class Participation	10 Marks
Credits	4

Course Objectives: The Objectives of this Course are:

1. To familiarize with the Fundamental principles of Management practice with emphasis on the roles and functions of Managers and to focus on the critical and challenging areas of Organizational Planning and Organizing.
2. To describe Motivation, Leadership, Communication and Controlling and to provide knowledge of Organization Behaviour concepts to understand and analyze how Organizations and the People within them work.
3. To understand the Nature of Power, Politics, Conflict, and the Negotiation process.

Course Outcomes: After Completion of the Course, Students will be able to:

1. Practice the process of Management's functions and understand how Management Evolution affects future Managers.
2. Analyze the need of Planning and Decision Making and also assess the elements of Organizational structure and evaluate their impact on Employees.
3. Evaluate Motivational strategies, Leadership styles, Communication and Controlling processes used in a variety of Organizational settings.
4. Apply Organization Behaviour Concepts to real-world problems faced by Managers.
5. Evaluate how the Power and Politics help an organization, Sources of Conflict in an Organizational setting and execute the Negotiation process to manage Conflicts and resolve disputes.

UNIT-I Introduction to Management

Management- Definition, Nature, Purpose, Evolution of Management Thought- Scientific Management, Administrative Theory, Human Relations Approach, Hawthorne experiments, Theory X, Theory Y and Theory Z, Behavioural Approach, Systems Theory. Managerial Roles, Managerial Levels, Managerial Skills, Functions of Management, Administration vs. Management, Contemporary Management Issues and Challenges.

UNIT-II Planning and Organizing

Planning – Nature, Purpose, Process, Types of Plans, Management by Objectives (MBO). Decision Making – Types of Decisions, Decision Making Process, Decision Making under Certainty, Uncertainty and Risk.

Organizing – Formal and Informal Organization, Process, Types of Organization structures, Line and Staff concepts, Span of Management – Factors, Delegation of Authority, Decentralization.

UNIT-III Leading and Controlling

Motivation- Early and Contemporary Theories of Motivation. Leadership - Leadership Behaviour and Styles. Communication - Purpose, Process, Barriers in Communication, Overcoming barriers to communication.

Controlling- Basic Control Process, Critical Control Points, Standards, and Benchmarking, Control as a Feedback System, Requirements for effective controls.

UNIT-IV Organization Behaviour

Organization Behaviour – Nature, Levels, Challenges. Individuals in Organizations- Personality and Ability. Personality- Determinants, Personality and Situation, Big Five Model of Personality, Other Organizationally Relevant Personality Traits. Ability - Cognitive Ability, Physical Ability, Emotional Intelligence. Nature. Perception - Nature, Characteristics of Perceiver, Target and Situation, Biases and Problems in Person Perception. Group Dynamics and Teams- Types of Work Groups, Group Development, Characteristics of Work Groups, Effective Work Groups and Teams.

UNIT-V Conflict and Negotiations

Nature of Power and Politics, Sources of Individual Power, Functional and Divisional Power. Organizational Politics – The use of Power. Organizational Conflict – Sources, Pondy's Model of Organizational Conflict, Negotiation: Resolving Conflict – Individual level conflict, Group level conflict and promoting Compromise.

19MB C102

MANAGERIAL ECONOMICS

Instruction	4 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation:	
Mid Session Examination	20 Marks
Case Study/Assignment/Book Review/ Group Activity/Class Participation	10 Marks
Credits	4

Course Objectives: The Objectives of the Course are:

1. To enable the Students to understand and apply the basic Economic concepts, Demand and Supply functions in Decision- making.
2. To understand various Production and Cost functions and choose the Optimal combination of Input factors.
3. To understand Price Output determination under different Market situations.

Course Outcomes: After Completion of the Course, Students will be able to:

1. Apply the basic Concepts and Economic principles in Decision-making.
2. Calculate Demand Elasticity from Demand Equations.
3. Select the Least Cost combination of inputs through Production Function.
4. Compare different Cost concepts and predict Breakeven point.
5. Apply Pricing decisions across Industries characterized by Market Structure.

Unit-I Introduction

Nature and Scope of Managerial Economics, Definition, Relation with other Disciplines, Fundamental Concepts of Managerial Economics - Opportunity Cost, Discounting Principle, Time Perspective, Incremental Cost/Reasoning, Equi-Marginal Concept. Objectives of Firm - Profit Maximization Theory, Profit Maximization by Total Revenue and Total Cost Approach, Baumol's Sales Revenue Maximization, Simon's Model of Satisfying Behaviour, Berle-Means-Galbraith Model of Corporate Power Structure, Penrose's Theory of Firm, Optimization Techniques.

Unit-II Demand and Supply Analysis

Theory of Demand, Demand Function, Law of Demand, Elasticity of Demand, Types and Significance of Elasticity of Demand, Demand Estimation - Market

Research Approaches, Need for Forecasting and Forecasting Techniques, Supply Function, Law of Supply, Elasticity of Supply.

Unit-III Production Analysis

Production Function- Law of Variable Proportions, Isoquants, Returns to Scale, Cobb Douglas and CES Production Function, MRTS, Iso-Costs, Optimal Combination of input factors, Economies and Diseconomies of Scale.

Unit-IV Cost Analysis

Concepts of Costs, Determinants of Cost functions, Cost- Output Relationship in the Short and Long run, Recent Developments in Cost Theory. Estimation of Cost Function- The Cubic Cost Function, Engineering and Survival Techniques, Breakeven Analysis.

Unit-V Market Structure and Pricing Practices

Types of Market Structure – Price-Output Determination in Perfect Competition, Monopoly. Monopolistic Competition and Oligopoly in short and long run. Pricing Methods in Practice: Price discrimination, Product Line Pricing, Skimming Pricing, Penetrating Pricing , Loss Leader Pricing, Pricing of Multiple Products, Peak load Pricing, Pricing of Innovative Products.

Essential Readings:

1. Dominik Salvatore, "Managerial Economics", 8th edition, Oxford University Press, Noida, 2014
2. P.L.Mehta., "Managerial Economics-Analysis, Problems and Cases", Sultan Chand and Sons, New Delhi, 2014.
3. V.L.Mote, S.Paul and G.S.Gupta, "Managerial Economics Concepts and Cases", 11th Edition, Tata Mc Graw Hill Pvt. Ltd., New Delhi, 49th Reprint 2010.
4. Geethika, Piyoli Ghosh, and P.R. Chaudhary "Managerial Economics", Tata McGraw Hill, New Delhi, 2015.
5. R.L.Varshney and K.L.Maheswari, "Managerial Economics", 22nd Edition, Sultan Chand and Sons, New Delhi, 2014.
6. Barry Keating and J.Holten Wilson, "Managerial Economics", 2nd Edition, Bizmantra, New Delhi, 2009.

19MB C103

FINANCIAL ACCOUNTING FOR MANAGEMENT

Instruction	4 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation:	
Mid Session Examination	20 Marks
Case Study/Assignment/Book Review/ Group Activity/Class Participation	10 Marks
Credits	4

Course Objectives: The Objectives of the Course are:

1. To understand the basic Accounting Concepts and practice Final Account applications in Business.
2. To acquaint the Students with Depreciation, Valuation of Assets and critical evaluation of Financial Statements through Ratio Analysis and Cash Flow Statements.
3. To provide knowledge on basic Principles underlying the provisions of Direct and Indirect Tax laws and develop a broad understanding of the Tax laws and Accepted tax practices.

Course Outcomes: After Completion of the Course, Student will be able to:

1. Gain knowledge on principles of Accounting and maintain Books of Accounts.
2. Prepare, analyze and interpret Financial Statements and understand Accounting Standards.
3. Familiarize on the practical aspects of Depreciation Accounting and Valuation of Assets.
4. Analyze and interpret Financial Statements through Ratio Analysis and Cash Flow Statements
5. Handle Real life situations involving Taxation and equip themselves with techniques for taking Tax-Sensitive Decisions.

Unit–I Introduction

Financial Accounting: Objectives, Accounting as a Business Information System; Parties interested in Accounting Information; Accounting Principles, Concepts and Conventions, Introduction to Book Keeping and Recording, Double Entry System, Books of Prime Entry, Subsidiary Books - Classification of Accounts-Accounting Cycle - Journal Proper, Ledger Posting, Preparation of Trial Balance, Suspense Account.

Unit- II Preparation of Final Accounts

Distinction between Capital and Revenue Expenditure - Preparation of Financial Statements -Trading, Profit and Loss account, Balance Sheet with Adjustments. Accounting Standards: Objectives, Scope, Applicability and Implementation of Accounting Standards -IAS- USGAAP International Financial Reporting Standards (IFRS).

Unit- III Valuation of Assets

Depreciation Accounting: Methods of providing Depreciation, Accounting Standards Depreciation Accounting (AS 6), Accounting for Fixed Asset-Application of AS 10.

Valuation: Basic Principles and Techniques of Valuation: DCF, Multiple Methods and Accounting Based Valuation. Asset Valuation: Earning Valuation, Cash flow Valuation. Valuation of Brands, Intangible Assets and Intellectual Property.

Unit –IV Financial Statement Analysis

Financial Statement Analysis: Ratio analysis, Rationale, Uses, Calculation and interpretation of Ratios- Liquidity Ratios- Profitability Ratios- Solvency Ratios-Leverage and Turnover ratios. Cash Flow Statement: Cash From Operations, Investment and Financing activities, Preparation of Cash Flow statement. Accounting Standards Cash Flow Statement (AS 3), Accounting Fraud and Governance.

Unit-V Corporate Taxation

Taxation: Types of Taxes: Direct Tax - Income Tax Act and Rules. Indirect Taxes - Central Excise and CENVAT - Customs Duty, Service Tax, Central Sales Tax and VAT - Primer on GST. Double Taxation Avoidance.

Essential Readings:

1. Jawaharlal and Seema Srivastava, "Financial Accounting Principles and Practices", 2nd Edition, S.Chand Publishing, 2014.
2. Aswath Damodaran, Investment Valuation: Tools and Techniques for Determining the Value of any Asset (Wiley Finance) 3rd Edition, 2012.
3. Vinod K. Singhania, Monica Singhania, Taxmann's, Student Guide to Income Tax – including Service Tax/VAT.
4. Earl K Stice and James. D. Stice, "Financial Accounting - Reporting and Analysis", Cengage Learning, 2015.
5. Marco Vulpiani, "Special Cases of Business Valuation", 1st Edition Mc Graw Hill, 2014.
6. V.S. Datey (Taxmann's), Indirect Taxes Law and Practice, 42nd Edition, 2019.

19MB C104

MARKETING MANAGEMENT

Instruction	4 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation:	
Mid-Session Examination	20 Marks
Case Study/Assignment/Book Review/ Group Activity/Class Participation	10 Marks
Credits	4

Course Objectives: The Objectives of the Course are:

1. To provide knowledge on Marketing Concepts and Principles in Theory and Practice.
2. To focus on how a Marketer can effectively utilize Segmentation, Targeting and Positioning; and the Marketing Mix elements to attract and retain the Customer.
3. To create awareness on principal factors that influence Consumers as individuals and Decision makers with an application to the Buying Decision process and focus on Contemporary issues of Marketing.

Course Outcomes: After Completion of the Course, Students should be able to:

1. Know the various Philosophies of Marketing, and apply them in different Business Scenarios.
2. Understand various Segmentation, Targeting and Positioning strategies to make their Products as Market leaders.
3. Effectively design the Marketing Mix effectively in order to achieve the Organizational goals and objectives.
4. Analyze the challenges that might influence the formulation of effective Marketing Strategies from a Consumer Behaviour perspective.
5. To understand the Contemporary issues and develop Marketing Strategies to sustain in this Competitive World.

Unit–I Introduction

Marketing, Market, Core Marketing Concepts, Marketing Management, Marketing Management Philosophies, Marketing vs. Selling, Marketing Mix, Expanded Marketing Mix, Marketing Program and Marketing Strategy, Managing Marketing effort, Marketing Environment - Micro and Macro environment, Environment scanning, Interface with other Functional areas, Models of B2B, B2C, B2G, G2C.

Unit –II Customer-Driven Strategy

Market Segmentation – Segmenting Consumer Markets, Business Markets, International Markets, requirements for effective Segmentation. Market Targeting - Evaluating Market Segments, Selecting Target Market Segments, Socially Responsible Target Marketing. Differentiation and Positioning - Positioning Maps, Choosing Differentiation and Positioning Strategy, Communicating and delivering chosen Position.

Unit-III Marketing Mix

Products, Services, Brands, New Product Development, Product Life cycle, Pricing – Factors and Strategies, Costing vs Pricing, Discounts, CAPEX vs OPEX Models. Marketing Channels, Promotion – Advertising, Public Relations, Personal Selling, Sales Promotion, Direct and Online Marketing, Digital marketing.

Unit-IV Consumer Markets

Model of Consumer Behaviour, Seven Os Structure, Factors Affecting Consumer Behaviour, Stages in the Adoption Process, Industrial Markets- Characteristic, Industrial Buyer Behaviour, Services Markets – Characteristics and Strategies.

Unit-V Extending Marketing

Creating Competitive Advantage – Competitor Analysis, Competitive Strategies, Balancing Customer and Competitor Orientations. Global Marketplace. Corporate Social Responsibility (CSR) in Marketing, Sustainable Marketing – Social Criticisms of Marketing, Consumer Actions to promote Sustainable Marketing, Business Action toward Sustainable Marketing, Contemporary Issues in Marketing.

Essential Readings:

1. Kotler, P., Armstrong, G., Agnihotri, P. K., and Haque, E., Principles of Marketing: A South Asian Perspective, 17th Edition, Pearson Education Prentice Hall of India, 2018.
2. Lamb, C., Hair, J., Sharma, D., and Mc Daniel, C., Marketing - A South-Asian Perspective, 1st Edition, Cengage Learning, 2016.
3. Ramaswamy V.S. Namakumari S, Marketing Management: The Global Perspective - Indian Context, 5th Edition, Macmillan India Ltd., 2013.
4. Kurtz and Boone, Principles of Marketing, 15th Edition, Cengage Publications, 2013.
5. Best, Roger, Market-Based Management, 6th Edition, PHI Learning Pvt. Ltd., 2013.
6. Saxena, R, Marketing Management, 4th Edition, Tata McGraw-Hill Education, 2009.

19MB C105

STATISTICS FOR MANAGEMENT

Instruction	4 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation:	
Mid Session Examination	20 Marks
Case Study/Assignment/Book Review/ Group Activity/Class Participation	10 Marks
Credits	4

Course Objectives: The Objectives of the Course are:

1. To provide an insight into Descriptive Statistics and Probability.
2. To enable the Students to decide the appropriate Sampling techniques and facilitate formulation of Hypotheses and applying the Parametric Statistical tools to test the same and also interpret the results.
3. To enable the students to apply different Forecasting techniques namely, Correlation, Regression and Time Series analysis.

Course Outcomes: After Completion of the Course, the Students will be able to:

1. Calculate Measures of Central tendency and Measures of Dispersion.
2. Apply principles of Probability and different types of Probability Distribution.
3. Articulate the appropriateness of different types of Sampling Techniques.
4. Formulate Hypotheses and test the same using appropriate Parametric tools, Chi-Square test and interpret the results.
5. Apply Forecasting techniques like Correlation, Regression or Time Series analysis and analyze the results.

Unit–I Descriptive Statistics

Statistics - An Overview, Its Applications - Descriptive Statistics: Measures of Central Tendency: Mean, Median, Mode, Measurement of Dispersion: Range and Quartile Deviation, Mean Deviation, Standard Deviation, Karl-Pearson's coefficient of Skewness and Kurtosis.

Unit-II Probability

i) Definitions and Rules of Probability. Additive and Multiplicative Law of Probability.

ii) Probability Distributions: Binomial Distribution, Poisson Distribution and Normal Distribution.

Unit-III Sampling and Estimation

Sampling theory: Sampling Procedures - Random and Non-Random Methods, Standard Error, Sampling Error. Statistical Estimations: Point and Interval Estimation, Properties of Good Estimator, Confidence Interval.

Unit-IV Inferential Statistics

i) Testing of Hypothesis: Type I and Type II Errors, Statistical Significance. Large Sample Tests- Test for One and Two Proportions, Test for One and Two Means, Test for Two Standard Deviations.
ii) Small sample tests: t- distribution- Properties and Applications, Testing for One and Two Means, Paired t- test.
iii) Analysis of Variance -One way and Two-way ANOVA (with and without interaction).
iv) Chi-square distribution: Test for goodness of fit, Test for independence of attributes.

Unit–V Correlation, Regression and Time Series

i) Correlation Analysis - Karl Pearson's Coefficient of Correlation- Spearman' Rank Correlation.
ii) Regression Analysis - Concept - Two lines of Regression - Properties of Regression Coefficients.
iii) Time Series Analysis - Trend Analysis - Free Hand Curve method - Method of Semi Averages - Method of Moving Averages - Least Squares Method.

Essential Readings:

1. S. C. Gupta, "Fundamental of Statistics", Himalaya, 2016.
2. J. K. Sharma, "Business Statistics", Pearson, 2015.
3. Levin R.I., Rubin S. David, "Statistics for Management", Pearson, 2014.
4. P N. Arora, Sumeet Arora, S. Arora , "Comprehensive Statistical Methods", S. Chand Co., 2015.
5. Beri, G C, "Business Statistics", McGraw-Hill, 2015.
6. S. P. Gupta, "Statistical Methods", Sultan Chand and Sons, 2014.

19MB C106

DIGITAL TECHNOLOGY

Instruction	3 Hour per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	3

Course objectives: The Objectives of the Course are:

1. To improve the Students Skills in Digital Enterprise and learn the process of drafting various Business Correspondence.
2. To understand the development of Digital Enterprise Transformation.
3. To enable the Students to understand the importance of Digital Enterprise and it's functioning.

Course Outcomes: After Completion of the Course, Student will be able to:

1. Enhance competence in various Verticals of Business with Digital Enterprise.
2. Understand effective Business application in various Sectors.
3. Demonstrate the ability to effectively understand the Digital Enterprise from Company Leader's Perspective.
4. Familiarize with the Autonomous functioning of IT systems.
5. Familiarize with the Overview of Enterprise IOT.

UNIT-I Digital Enterprise Introduction

Building Digital Capabilities - Digital Mastery, Creating compelling Customer experience, exploiting the power of Core Operations, Reinventing Business Models. Domains of Digital Transformation: Customers, Competition, Data, Innovation and Value.

Case: How did Starbucks disrupt with their Mobile Order and Pay Service?

UNIT-II Digital Enterprise Transformation

Building Leadership Capabilities, Crafting your Digital Vision, Engaging the Organization at Scale, Governing the Transformation, Building Technology Leadership Capabilities. Business benefits of Reference Architectures, Design Patterns and Structures. Role of Context awareness in Interactive Digital experiences, Key Architectural considerations, Conceptual Model for Context - Aware Experiences.

Case: Context-aware Digital Employee Experience.

UNIT-III Leadership Perspective

A Leader's playbook for Digital Transformation: Framing the Digital challenge, Focusing Investment, Mobilizing the Organization, Sustaining the Digital Transformation. Build Platforms not just Products.

Case: How does Netflix Automation Platform help grow its Subscribers rapidly?

UNIT-IV Autonomous Systems

Autonomous IT Systems: Introduction, Reference Architecture, Maturity Model for Autonomous IT System, Design Patterns. Turn Data into Assets, Innovate by Rapid Experimentation.

Case: Autonomous Operation of a Customer, Partner, Employee Web Platform in an Enterprise.

UNIT-V Enterprise IoT

Enterprise IoT: Overview, Phenomenon of Internet connectivity, Phases of IoT evolution, Approach to Enterprise IoT, Reference Architecture for Enterprise IoT, Maturity Model for Enterprise IoT.

1. Case: Connected Mines
2. Case: Enterprise IoT Asset Management

Essential Readings:

1. Srikanth Narasimhan, Jagadish Chundury, "Enterprise Digitization Patterns Designing, Building and Deploying Enterprise Digital Solutions", Notion Press, 2018.
2. George Westerman, Didler Bonnet, Andrew McAfee "Leading Digital Turning Technology into Business Transformation", Harvard Business Review, 2014.
3. David L. Rogers, "The Digital Transformation Playbook Rethink your business for the Digital Age", Columbia Business School, 2016.
4. Amitabh P. Mishra, Ashish Ranjan, "A Modern Play book of Digital Transfromation", Sage Publishers, 2019 Edition.
5. Lindsay Herbet, "Digtal Transformarion Build your Organization's Future for the Innovation Age", Bloomsbury Publishers, 2017 Edition.
6. Peter Weill, Stephanie L. Woerner, "What's your Digital Business Model?", Harvard Business Review, 2018.

19MB C107

BUSINESS COMMUNICATION LAB

Instruction	4 Hour per week
Duration of Semester End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	25 Marks
Credits	2

Course objectives: The Objectives of the Course are:

1. To improve the skills in Listening Comprehensions and learn the process of drafting various Business Correspondence.
2. To develop the Professional way of Presentation in different Business Situations.
3. To enable the Students to understand the importance of Social and Professional Etiquettes.

Course Outcomes: After Completion of the Course, Student will be able to:

1. Enhance Competence in various Business Communication patterns.
2. Construct effective Written messages in various Formats to Audience.
3. Demonstrate the Ability to effectively deliver Formal presentations before a variety of Audiences.
4. Communicate competently in Groups and Organizations and demonstrate Appropriate and Professional Ethical behaviour.
5. Build Strong Relationships and promote positive Atmosphere at Workplace.

Unit 1 Listening and Feedback

Listening Comprehensions - Situational Awareness and Active Listening related exercises.

Unit 2 Writing Skills

Managerial Writing - Writing Emails, WhatsApp and SMS to communicate internally and externally, Business Letters, Internal Communication through-Notices, Circulars, Memos, Agenda and Minutes. Report Writing.

Unit 3 Speaking and Presentation Skills

Types of Managerial Speeches - Speech of Introduction, Speech of Thanks, Occasional Speech, Theme Speech. Presentation for Business, Sales and Training with the aid of Verbal and Multimedia, Handling day to day meetings, Effective ways of Presenting, Participating, Leading and making Decisions – in less Critical to Critical Meetings.

Unit 4 Non Verbal Communication

Techniques to Improve Non Verbal Communication through Role plays and Management Games with focus on Gestures, Para linguistics, Proxemics, Kinesics and Artifacts.

Unit 5 Social and Professional Etiquette

Telephone Etiquette - E-mail Etiquette - Meeting Etiquettes, Cubicle Manners - Table Manners -Dress Code - Greetings.

Essential Readings:

1. Rani. D. Sudha, "A Manual for English Language Laboratories", Pearson Education, 2014.
2. E. Suresh Kumar, "A Handbook for English Language Laboratories", Foundation Books, 2009.
3. Julian Dakin, "The Language Laboratory and Language learning", Addison-Wesley-Longman Ltd, UK, 1973.
4. Lesikar R V et al., "Business Communication: Connecting in a Digital World", McGraw Hill Education, 2015.
5. Penrose, Rasberry and Myers, "Business Communication for Managers", Cengage Learning, 2007.
6. U S Rai and S M Rai, "Business Communication", Himalaya Publications, 2014.

19MB C108

STATISTICS LAB

Instruction	2 Hour per week
Duration of Semester Examination	2 Hours
Semester End Examination	35 Marks
Continuous Internal Evaluation	15 Marks
Credits	1

Course Objectives: The Objectives of the Course are:

1. To provide the Students with the knowledge to use Excel to solve a range of Statistical Problems.
2. To educate on various Parametric Tests.
3. To understand the relationship between two or more variables by using Appropriate Statistical Analysis Techniques.

Course Outcomes: After Completion of the Course, Students will be able to:

1. Apply Statistical Techniques to Data Sets, and correctly interpret the Results.
2. To Foster the Practical understanding of Parametric tests and to reveal the right inferences about a given population.
3. Perform ANOVA and interpret the Results.
4. Apply the Concept of Correlation, Simple Regression and interpret the Outcomes.
5. Apply Statistical methods to analyze Time Series Data and extract meaningful insights about the Data.

Unit-I Introduction to Descriptive Statistics

Measures of Central Tendency - Mean, Median, and Mode; Measures of Dispersion - Range, Quartile deviation, Standard Deviation and Variance, Coefficient of Variation, Population Confidence Intervals.

Unit-II Parametric Tests and Analysis of Variance

One Sample Z and T test for the Population Mean, Two samples Z and T test for the Population Mean. Chi Square Tests - Independence of Attributes. Single-Factor Experiments: One-way ANOVA.

Unit -III Correlation, Simple Regression and Time Series Analysis

Correlation Analysis: Scatter Plot, Covariance and Pearson's Correlation coefficient, r. Simple Regression analysis, Time Series analysis: Fitting a Straight Line using simple data, Forecasting methods: Moving average.

Essential Readings:

1. Glyn Davis and Branko Pecar "Business Statistics Using Excel", Oxford University Press, 2012.
2. D P Apte, "Statistical Tools for Managers using MS Excel", Excel Publications, 2012.
3. David M Levine, David. F. Stephan and Kathryn A. Szabat , "Statistics for Managers – Using MS Excel", PHI, 2015
4. Bruce Bowerman , "Business Statistics in Practice", 5th Ed., TMH, 2015.
5. Rao and Tyagi, "Research Methodology with SPSS", Shree Niwas Publications, 2009.
6. Ajai. S. Gaur, Sanjaya S. Gaur, "Statistical Methods for Practice and Research Response", 2009.

CORE COURSES

19MB C109

HUMAN RESOURCE MANAGEMENT

Instruction	4 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation:	
Mid Session Examination	20 Marks
Case Study/Assignment/Book Review/ Group Activity/Class Participation	10 Marks
Credits	4

Course objectives: The Objectives of this Course are to:

1. Provide the basic Concepts of Human Resource Management.
2. Enable the Students to understand the process of Recruitment and Selection and the Concept of Performance Management system in an Organization.
3. Understand the basics of Industrial Relations and knowledge of Labour laws and acquaint the Students with the Contemporary issues in Human Resource Management.

.**Course Outcomes:** After Completion of the Course, Students will be able to:

1. Understand and apply the knowledge of basic Concepts of Human Resource Management in Practical settings of an Organization.
2. Follow innovative practices in Recruitment and Selection.
3. Implement systematic Performance Management System in an Organisation.
4. Implement harmonious Industrial Relations and apply latest amended Labour Acts in an organization.
5. Learn new trends in Human Resource Management practices.

Unit-I Introduction

HRM - Definition, Evolution, Organization of HR department, Objectives, Scope and Functions of HRM - Role and Responsibilities of HR Manager - HR Policies and Procedures - Competitive Challenges of HRM - Competency Framework for HR Professionals - Stakeholders and Integrated Models of HRM.

Unit-II Human Resource Planning

Job Analysis- Meaning and Importance, Process, Methods of collecting Job Data, Writing Job Description and Job Specification - Job Design - Meaning, Factors, Approaches - Job Evaluation - Meaning and Methods- HR Planning - Gallagher HR Estimator - Recruitment- Yield-Ratio Analysis - Process of Selection - Types of Interview - Placement and Orientation - HRD Training Methods - Kirkpatrick and Pecuniary Utility Models of Training.

Unit-III Performance Appraisal

Performance Appraisal – Meaning, Importance and Methods - Potential Appraisal - Capacity building - Basic components of Compensation Management - Towers Perrin Model of Total Reward - Career planning - Greenhouse Career Development Model - Psychological Contract- Functions and Types.

Unit-IV Industrial Relations

Industrial Relations - Definition, Importance, Basics of Industrial Acts - Employee State Insurance Act 1948, Employee Provident Fund and Miscellaneous Act 1952, Industrial Disputes Act 1947, The Payment of Gratuity Act 1972 - Dunlop's IR Model – Quality of Work Life - Grievance Management - Collective Bargaining – Negotiations and Assertiveness Skills – Worker's Participation in Management – Absence Management – Brad factor.

Unit-V Contemporary Issues in Human Resources Management

Introduction to Change Management - HR Outsourcing, Work Life Integration - Introduction to International HRM, Strategic HRM in a Changing Environment - HRIS: Three Levels - Diversity Management - Succession Planning - Inter -personal Relations in the Workplace - Expanding Professional and Personal Networks - HR Research.

Essential Readings:

1. Gary Dessler, "Human Resources Management", Pearson, 2015.
2. Decenzo, "Human Resources Management", Wiley, 2015.
3. Michael Armstrong, "Human Resource Management", Kogan Page, 2015.
4. David Lepak, Mary Gower, "Human Resource Management", Pearson, 2015.
5. Arun Monappa, Ranjeet Nambudiri, Patturaja Selvaraj, "Industrial Relations and Labour Laws", McGraw-hill, 2015.
6. John P. Kotter, "Leading Change", Harvard Business School Press, 2015.

19MB C110

FINANCIAL MANAGEMENT

Instruction	4 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation:	
Mid Sessional Examination	20 Marks
Case Study/Assignment/Book Review/ Group Activity/Class Participation	10 Marks
Credits	4

Course Objectives: The Objectives of the Course are:

1. To develop a broad understanding of the Concept of Finance functions and Time value of money, significance of Capital Budgeting techniques for the feasibility of Projects.
2. To gain knowledge about Theories of Capital Structure, Concept of Cost of Capital, and Dividend decisions.
3. To give insights about the importance of Working Capital Management and the tools to manage it.

Course Outcomes: After Completion of the Course, Students will be able to:

1. Understand the Concept of Finance function and judge the Time Value of money in terms Annuity and Present Values.
2. Assess the feasibility of Projects using Capital Budgeting Techniques.
3. Apply the Capital Structure Theories to construct the best Capital mix for better Market Value of the Firm.
4. Implement the Dividend decisions in the interest of the Stakeholders.
5. Assess Working Capital requirements and apply the Tools to manage it.

Unit-I Finance Function

Nature and Scope of Financial Management: Finance function, Goals of Finance - Profit Maximizing vs Wealth Maximization. Risk- Return trade off. Time Value of Money - Future value, Present Value: Single Cash flows, Annuity, Multi period Compounding (simple problems).

Unit-II Investment Decision

Capital Budgeting: Nature, Significance, Investment Decision process. Evaluation Techniques: Traditional - Payback method, Improvement in Traditional Payback, ARR and DCF Techniques - NPV, IRR, Profitability Index. Capital budgeting under Risk and Uncertainty: Risk adjusted Discount Rate, Certainty Equivalents, Probability Tree Approach. (Problems and cases), Projection Selection under Capital Rationing (theory).

Unit-III Financing Decision

Sources of Finance: Concept of Leverage - Operating Leverage, Financial Leverage, Combined Leverage. EBIT - EPS Analysis.

Capital Structure Theories: Net Income approach, Net Operating Income approach, Traditional view and MM hypothesis.

Cost of Capital: Concept and Importance, Measurement of important Costs: Cost of Debt, Cost of Preference Capital, Cost of Equity Capital, Cost of External Equity, Cost of Retained Earnings, Weighted Average Cost of Capital. (Problems and Cases).

Unit-IV Dividend Decisions

Forms of Dividend, Dividend Theories: Relevance theory of Dividend: Walter's Model- Gordon's Model, Irrelevance Theory of Dividend: MM Hypothesis. Dividend policies of Indian Companies (Problems and Cases).

Unit-V Working Capital Management

Concept of Working Capital, Determinants of Working Capital, Estimation of Working Capital requirements, Working Capital Policy. Management of Current Assets: Cash Management, Receivables Management and Inventory Management (Problems and Cases).

Essential Readings:

1. I. M. Pandey, "Financial Management", 11th Ed. Vikas Publishing House, New Delhi 2015.
2. Khan, M. Y. and Jain P. K "Financial Management: Text, Problems and Cases", 6th Edition, Tata McGraw Hill Pub. Co. Ltd New Delhi, 2011.
3. Brigham, E. F. and Ehrhardt. M. C., "Financial Management Theory and Practice", 15th Ed., Cengage Learning, USA, 2015.
4. Jonathan Berk, Peter DeMarzo, Ashok Thampy, "Financial Management", 3rd Ed. Pearson Education Limited, UK, 2010.
5. Vishwanath S.R., "Corporate Finance: Theory and Practice", 2nd Ed. Response books, Sage Publications Ltd, New Delhi, 2007.
6. Prasanna Chandra, "Financial Management Theory and Practice" 9th Edition, Mc Graw Hill, New Delhi, 2015.

19MB C111

BUSINESS RESEARCH METHODS

Instruction	4 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	20 Marks
Case Study/Assignment/Book Review/ Group Activity/Class Participation	10 Marks
Credits	4

Course Objectives: The Objectives of this Course are:

1. To provide understanding of the Concepts of Business Research Process, Ethics in Business Research and relevance of Research Designs used in Business Research.
2. To identify and select various Sources of Data, Sampling Methods and Methods of Qualitative and Quantitative Data Analysis and also to introduce Non-Parametric Tests.
3. To provide Students with a working knowledge of the basic Concepts underlying the most important Multivariate Techniques and guidance on how to prepare a Research Proposal and write a Quality Research Report.

Course Outcomes: After Completion of the Course, Students will be able to:

1. Gain knowledge on the Concepts of the Business Research and able to do critical Review of Literature and understand the importance of Ethics in Research.
2. Critically think, compare and contrast various Research Designs.
3. Analyze the similarities and differences between various Sampling Designs and Measurement Scales and make a Decision about how best to use them.
4. Apply and interpret the Quantitative and Qualitative data and different types of Non-Parametric Statistical Techniques.
5. Classify and select Multivariate Techniques so as render appropriate solutions to the Business problems and attain the Organizational Goals and effectively draft a Research Proposal and communicate Research findings by preparing a Quality Research Report.

UNIT-I Introduction

Business Research - Meaning and Importance. Research Process - Overview. Review of Literature - Identifying, Accessing and Managing sources of Information and scholarly Literature. Research Gaps. Research Design - Introduction and Types - Exploratory, Descriptive and Causal Designs. Ethics in Business Research.

UNIT-II Data Collection and Sampling

Data Collection Methods - Primary and Secondary Sources. Design of Questionnaire. Sampling Procedure - Characteristics of a Good sample - Types of Sampling Designs and Sample size determination. Concept of Measurement and Scaling – Nominal, Ordinal, Interval and Ratio
Scales, Rating scales -Thurston's, Likert's, Guttmann's, Semantic differential. The characteristics of Good Measures - Validity, Reliability and Practicality. Selecting a Measurement Scale

UNIT-III Data Processing and Analysis

Introduction to the analysis of Quantitative and Qualitative Data - Nature and Types of Data Analysis Methods. Non-parametric Statistics in Research - McNemar, Sign Test - One and Two samples, Run test, Wilcoxon Matched pairs test, Mann-Whitney test, Kolmogorov - Simronov D test, Kruskal –Wallis tests. Data Representation: Tabulation and Graphical presentation of Data.

UNIT-IV Multi -Variate Analysis

Structural and Functional Methods- Factor Analysis, Cluster Analysis, Discriminate Analysis, Conjoint Analysis, Multi-Dimensional Scaling. Structural Equation Modelling (SEM) - Overview. Multiple Regression (Numerical with two Independent Variables).

UNIT-V Research Proposal and Report Writing

Research Proposal - Purpose, Nature and Evaluation - Content and Format. Report Writing and Presentation - Introduction - Types of Research Report. Format and Evaluation of the Research Report. Academic Writing and Referencing - Plagiarism.

Essential Readings:

1. Donald R Cooper, Pamela S Schindler and J. K Sharma "Business Research Methods", 11 Ed., TMH, 2017.
2. J. K. Sharma, "Business Statistics - Problems and Solutions", 2nd Ed., Pearson Education, 2011.
3. Deepak Chawla and Neena Sondhi "Research Methodology - Concepts and Cases", Vikas Publications, 2018.
4. William G. Zikmund et al., "Business Research Methods", Cengage Learning, 2012.
5. Alan Bryman and Emma Bell, "Business Research Methods", OUP Oxford, 2015.
6. Saunders Mark, Philip Lewis and Adrian Thornhill," Research Methods for Business Students", 7th Ed., Pearson, 2015.

19MB O112

OPERATIONS RESEARCH

Instruction	4 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation:	
Mid Session Examination	20 Marks
Case Study/Assignment/Book Review/ Group Activity/Class Participation	10 Marks
Credits	4

Course Objectives: The Objectives of this Course are:

1. To familiarize Students with the basic Concepts, Models and Statements of the Operations Research Theory.
2. To use Quantitative Methods and Techniques for effective Decision - Making; Model Formulation and applications used in solving Business Decision Problems.
3. To solve Linear Programming Problems using appropriate Optimization Techniques, interpret the results obtained and translate Solutions into directives for Decision Making.

Course Outcomes: After Completion of the Course, Students will be able to:

1. Analyze any real life system with limited constraints and depict it in a model form and convert the Problem into a Mathematical Model.
2. Solve the Transportation and Assignment Problems.
3. Select the best Strategy using Decision Making Methods under Risk and Uncertainty and Game Theory.
4. Use CPM and PERT Techniques, to Plan, Schedule, and Control Project activities.
5. Understand different Queuing situations and find the Optimal solutions using Models for different situations and evaluate the Simulation Models.

Unit-I Introduction

Operation Research, Definitions, Evolution, Scope and Applications in Business. Linear Programming: Models, Assumptions of LPP, Formulation, Graphical Method, Simplex Method, Big-M Method. Formulation of Dual to Primal.

Unit-II Transportation and Assignment

Transportation Problem, Initial Solution Methods, North-West Corner Method, Least Cost Method (LSM) and Vogel's Approximation Method, Degeneracy, Unbalanced TP. Optimality Test - Stepping Stone Method and MODI Method. Assignment Problem, Hungarian Method, Unbalanced problems, Restricted AP. The Travelling - Salesman problem.

Unit-III Statistical Decision Theory and Game Theory

Decision Theory, Criteria for Decision Making under Risk and Uncertain Environments, Concept of Utility, Expected Monetary Value, EVPI Utility as a Concept of Decision Making. Game theory, Zero Sum Game, Saddle point, Pure strategies, Mixed strategies, Dominance, Graphical Method for (mx2) and (2xn) games.

Unit-IV Project Management by Network Analysis

Network fundamentals - Scheduling the Activities - PERT Vs CPM - Three Time estimates - beta Distribution - Identifying Critical Path - Probability of completing the Project within Scheduled time, Critical Path Method – Optimization of Project parameters - Crashing.

Unit-V Queuing Theory and Simulation

Queuing Theory - Concepts of Queue/Waiting Line - General structure of a Queuing system - Operating characteristics of Queues, Probabilistic Queuing model - Single Channel Queuing model - Poisson arrival and Exponential service times with infinite Population. Simulation: Process of Simulation, Applications of Simulation to different Management Problems.

Essential Readings:

1. Richard .I. Levin, David. S. Rubin "Quantitative Approaches to Management", Mc Graw Hill International Book Co., 1992.
2. Barry Render, Ralph M. Stair, Jr., Michael E. Hanna "Quantitative Analysis for Management", Pearson Education, 2017.
3. J. K.Sharma, "Business Statistics - Problems and Solutions" Pearson, 2011.
4. S. D. Sharma, "Operations Research", Kedar Nath Ram Nath and Co., 2010
5. Kanthi Swarup, Gupta Pk, Man Mohan, Sultan Chand and Sons, 2014.
6. Gupta Prem Kumar, Operations Research, S Chand, 7th ed., 2014.

19MB O113

OPERATIONS MANAGEMENT

Instruction	4 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation:	
Mid Session Examination	20 Marks
Case Study/Assignment/Book Review/ Group Activity/Class Participation	10 Marks
Credits	4

Course Objectives: The Objectives of this Course are:

1. To provide an understanding on the Process Planning, Design, Process Layout, Types of Production systems and to comprehend the different ways of measuring Productivity.
2. To develop Skills necessary to understand Work study and know the Techniques to Manage Inventory.
3. To provide knowledge on managing Quality and ways Total Quality Management facilitates Organizational effectiveness.

Course Outcomes: After Completion of the Course, Students will be able to:

1. Apply knowledge of basic Concepts of Operations Management for developing processes and improving Operational Performance.
2. Apply Scheduling and Sequencing techniques to minimize total Elapsed Time.
3. Identify key activities and develop methods of doing a Work or Job and set Standard Time to finish the same.
4. Apply Quantitative techniques to manage Materials or Inventory
5. Gain knowledge on Total Quality Management and to effectively implement the conventional Quality techniques in an Organisation.

Unit–I Introduction

Introduction to Operations Management - The Historical evolution of Operations Management - Scope of Operations Management - Interface between the Operation Systems and Systems of other Functional areas. Process Planning and Process Design, Ergonomic Considerations, Production Planning and Control: Basic functions of Production Planning and Control, Production Cycle. Types of Production Systems - Project, Job Shop, Assembly, Batch and Continuous flow. Productivity- Measuring Productivity - Ways of improving Productivity. Recent Trends in Operations.

Unit-II Scheduling and Control of Production Operations

Aggregate Planning, Master Production Schedule (MPS), Operations Scheduling, Product Sequencing: Sequencing of Products in Multi- Product Multi - Stage situations by using Johnson Rule and CDS method. Capacity Planning - Determinants of Plant Capacity, Capacity Planning Strategies and Line Balancing. Plant Location and Layout: Factors influencing Location, Different types of Layouts. Maintenance Management: Objectives, Preventive and Breakdown Maintenance, Failure Concept, Reliability, Replacement Policies. Information System for Maintenance Management.

Unit-III Work Study

Work Study - Method Study and Work Measurement - Objectives of Work Study - Relationship of Time and Motion Study to Work Study - Basic Work Study procedure - Various techniques in Method Study for identifying the most appropriate method. Work measurement - its uses and different methods, computation of allowance and Standard Time.

Unit-IV Materials and Inventory Management

Objectives of Materials Management - Materials Requirement Planning [MRP-I], Manufacturing Resource Planning [MRP-II] - Sources of Supply of Materials - Selection, Evaluation and Performance of Suppliers. Vendor Rating, Make or Buy decisions. Value Analysis: Aims, Procedure, Advantages and Application areas. Inventory Control - Need for Inventory, EOQ Model, and Economic Production Quantity Model.

Unit-V Quality Management

Quality - Need for Quality, Quality Gurus, Quality Awards, Bureau of Indian Standards, International Organization for Standardization. Quality Dimensions - Product and Service. Concept of TQM, Evolution of TQM - TQM Framework - Conventional vs. Total Quality Management. Quality Costs.

Essential Readings:

1. Stevenson J. William, "Operations Management", 11th Ed., Tata McGraw-Hill, 2012.
2. Panneerselvam K, "Production and Operations Management", 3rd Ed., Prentice Hall India Learning Private Limited, 2012.
3. Dale H. Besterfield, Carol Besterfield - Michna, Glen H Besterfield and Mary Besterfield - Sacre, "Total Quality Management", 3rd Ed., PHI, 2006.
4. Robert S. Russel, Bernard W III Taylor, "Operations Management", 7th Ed., Hoboken, Wiley, 2011.
5. Lee J., Krajewski, "Operations Management", 9th Edition, PHI, 2009.
6. Everett. Adam, Jr. and Ronald J. Elbert, "Production and Operations Management Concepts", 5th Ed, Prentice-Hall, 2006.

19MB O114

BUSINESS ANALYTICS

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation:	
Mid Session Examination	20 Marks
Case Study/Assignment/Book Review/ Group Activity/Class Participation	10 Marks
Credits	3

Course Objectives: The Objectives of this Course are:

1. To provide in-depth knowledge of handling Data and Business Analytics tools that can be used for Decision-making in an Organization.
2. To familiarize Students on Data Warehousing Concepts, Data Mining Techniques and understand relationships between the underlying Business Processes of an Organization.
3. To provide knowledge on Prescriptive Analytics and its Models and to understand the various applications of Business Analytics on different Domains.

Course Outcomes: After Completion of the Course, Students will be able to:

1. Have a clear idea about the basic Concepts of Business Analytics in an Organization.
2. Analyze the role of Business Analytics in Decision Making.
3. Gaining knowledge on Data Warehousing and Data Mining Concepts.
4. Distinguish between Descriptive, Predictive and Prescriptive Analytics.
5. Understand the usefulness of Business Analytics in various Functional areas of an Organization.

Unit-I Introduction

Introduction to Analytics, Data Science, Big Data. Applications of Analytics in different Domains. Business Analytics - Challenges from Outside and Within, BASP (Business Analytics Success Pillars) framework, Analyst's Role in the BA Model - Three Requirements the Analyst Must Meet.

Unit-II Descriptive Analytics

Data Warehousing - Introduction, Characteristics, Data Marts, Meta Data, Data Warehouse Architecture, Data Extraction, Transformation and Load Processes in a Data Warehouse Business Reporting and Business Performance Measurement and Visual Analytics.

Unit-III Predictive Analytics

Data Mining - Introduction, Characteristics, and Data Mining Process. Text Mining - Introduction, Text Analytics, Applications and Sentiment Analytics and Applications. Web Mining - Introduction, Web Analytics.

Unit-IV Prescriptive Analytics

Prescriptive Analytics - Introduction, Prescriptive Models - Simulation, Heuristic, Automated Decision Systems and Expert Systems, Knowledge Management.

Unit-V Future of Big Data

Big Data: Definition. Big Data Technologies - Hadoop, R, Python, Machine Learning and Artificial Intelligence. Data Scientist, Applications of Analytics in different Domains. Fundamentals of Marketing Analytics, Finance Analytics, HR - Analytics and Supply Chain Analytics.

Essential Readings:

1. Ramesh Sharada, Dursun Delen, Efraim Turban, "Business Intelligence and Analytics", 10th Ed., Pearson, 2014.
2. Jean Paul Isson, Jesse S.Harriot, "Win with Advanced Business Analytics" 1st Ed., Wiley, 2012.
3. Gert H.N. Laursen, Jesper Thorlund, "Business Analytics for Managers" John Wiley and Sons, Inc.2010.
4. R N Prasad, Seema Acharya, "Fundamentals of Business Analytics", Wiley, 2011.
5. Sahil Raj, "Business Analytics", Cengage Learning, 2015.
6. U.Dinesh Kumar, "Business Analytics", Wiley, 2017.

19MB C115

LOGISTICS AND SUPPLY CHAIN MANAGEMENT

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation:	
Mid Session Examination	20 Marks
Case Study/Assignment/Book Review/ Group Activity/Class Participation	10 Marks
Credits	3

Course Objectives: The Objectives of the Course are:

1. To facilitate the Students to plan a Career in Business to get benefited from a clear understanding of the field of Logistics and Supply Chain Management.
2. To focus on the role of Logistics in the success of Supply Chain of an Organization.
3. To elucidate how Warehousing and Transportation contribute for the success of any Supply Chain, also to expound the role of other Functional areas for an effective Supply Chain.

Course Outcomes: After Completion of the Course, Students will be able to:

1. Equip with the Concepts of Supply Chain Management to set their Business successfully.
2. Learn the Strategic importance of good Supply Chain Design, Planning and Operation and also able to understand how Supply Chain can be a Competitive Advantage of a Firm.
3. Understand how to manage the Logistics for the success of an Organization.
4. Relate the importance of managing Warehousing and Transportation in a good Supply Chain. Also to make Strategic Decision through Alliances, Collaborations and Benchmarking practices.
5. Integrate various Functional areas in order to have an effective Supply Chain.

Unit-I Introduction

Introduction to Supply Chain Management (SCM) - Concept, Evolution, Objectives, Importance and Function of SCM, Conceptual Framework of SCM, Process view of Supply Chain , Supply Chain Strategies, Drivers and Metrics of Supply Chain. Strategic Fit, Achieving Strategic Fit and Obstacles.

Unit-II Logistics Management
Logistics Management, Inbound, Internal and Outbound Logistics in SCM, Logistics Organization, Development of Integrated Logistics Strategy, 3PL, 4PL, Reverse Logistics. Role and Importance of Inventory in SC, JIT, VMI, Outsourcing. SEZ in India, Dry Ports in India, Custom House Agent (CHA) ICDS.

Unit-III Transportation and Warehousing
Transportation in Supply Chain, Transportation Formats, Modes of Transportation, Transportation Performance factors, Modes of Transport, Fleet Management, Multi model transport, Containerization, Vehicle Scheduling and Routing, Milk run and Cross docking. Warehousing- Types of Warehouses, Warehousing Operations, Warehouse Management systems, RFID/CRM.

Unit-IV Strategic Issues in Supply Chain
Strategic Partnerships, Alliances and Collaborative advantage, Strategic relationships in-logistics, Bullwhip effect, Benchmarking - Issues and Problems, Types, Methods, Process, Lean Manufacturing, Agile Manufacturing. Laws related to Transport in India.

Unit-V Supply Chain Interface
SC Network Design, Distribution Network in Supply Chain, Factors influencing Design, Models in Distribution Network, Supply Chain Integration - Internal and External, Role of IT and HR in SCM, Retailing and SCM, Green Supply Chain Management

Essential Readings:

1. Chandrasekaran. N, "Supply Chain Management Process, System and Practice", Oxford, second Impression, 2012.
2. B. Rajashekar and G.V.R.K. Acharyulu, "Logistics and Supply chain Management", Excel Books, 2009.
3. K. Shridhara Bhat, "Logistics and Supply Chain Management", 1st Ed. Himalaya Publishing House, 2016.
4. Sunil Chopra, Peter Meindl and D.V.Karla, "Supply Chain Management, Strategy, Planning and Operations", 5th Ed., Pearson, 2013.
5. Shah, J, "Supply Chain Management, Text and Cases", 2nd Ed., Pearson, 2011.
6. Crandall, Richard E and others, "Principles of Supply Chain Management", CRC Press, 2010.

19MB C117

STRATEGIC MANAGEMENT

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation:	20 Marks
Case Study/Assignment/Book Review/ Group Activity/Class Participation	10 Marks
Credits	3

Course Objectives: The Objectives of the Course are:

1. To understand the role of Strategy and Environmental analysis in Business Decision Making
2. To provide insights on various Strategies, Practices, Competitiveness and Sustainability.
3. To help the Students develop their Skills for applying the Concepts in solving real time problems in Domestic and Global scenarios.

Course Outcomes: After Completion of the Course, Students will be able to:

1. Investigate and understand the Business scenarios nationally and internationally.
2. Appraise and analyze the contemporary issues and challenges faced in Business
3. Craft and formulate the Strategies for real-time Business problems.
4. Integrate and apply the learned skills to implement Strategies from holistic and multi-functional perspectives.
5. Analyze and Evaluate real life situations for Self, Organizational and Societal sustainability.

Unit-I Introduction

Introduction to Strategic Management, Purpose of Business, Crafting and Executing Strategies, Strategic Intent, Developing Strategic Model, Choices of Strategy, Strategic Capability and Core competencies of Business, Phases of Strategic management, Strategic Decision Making.

Unit-II Strategic Analysis and Formulation

Environmental Scanning, SWOT & PESTEL Framework, Different Tools and Techniques for analyzing Strategies, Porters Five Force Framework, Organic Model of Strategic Planning, Real-time Strategy Planning, Strategic Formulation, Competitive Analysis, Strategy Development Processes.

Unit-III Strategies for Business

Types of Strategies- Offensive, Defensive, Exit and Entry barriers, Industry Life Cycle States and Strategies, Tailoring Strategy for Leaders, Challengers, Followers, weak and crisis Businesses, The Five Generic Competitive Strategies, Red and Blue Ocean Strategies, Grand Strategies.

Unit-IV Strategic Implementation

Impact and Issues of Culture, leadership, Resource Allocation, Staffing, Directing and Organizational Values on Strategic Implementation, Operationalizing and Institutionalizing strategy, Strategies for competing in International Markets, Managing Conflicts, Managing Strategic Change.

Unit-V Strategic Evaluation and Control

Strategic Evaluation, The Balanced Scorecard, Measuring Performance, Strategic control-Types, Strategic Information System, Issues in Managing Technology, Strategic issues in Entrepreneurial Ventures, small Businesses, Not-for-Profit Organizations, Sustainability and Sustainable Development.

Essential Readings:

1. Thomas L. Wheelen, J. David Hunger, Strategic Management and Business Policy-Towards Global Sustainability, Pearson Education, 13th edition, 2012.
2. Gerry Johnson, Kevan Scholes, Richard Whittington, Exploring Corporate Strategy, Prentice Hall, 8th edition, 2008.
3. Hitt and Ireland el al., Strategic Management: A South Asian Perspective, Cengage Learning, 9th edition, 2013
4. Fred R. David, Strategic Management: Concepts and Cases, Prentice Hall, 13th Edition, 2011.
5. Arthur A.Thompson Jr, Strickland A.J., John E.Gamble and Arun K.Jain, Crafting and Executing Strategy, McGraw Hill Education Private Limited, New Delhi, 2012.
6. W. Cham Kim, Renee Mauborgne, The Blue Ocean Strategy Reader, Harvard Business Review Press, 2017.

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19MB E101

INVESTMENT MANAGEMENT

Instruction	4 hours per Week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	20 Marks
Case Study/Assignment/Book Review/ Group Activity/Class Participation	10 Marks
Credits	4

Course Objectives: The objectives of the course are:

1. To provide in-depth analysis of various investment opportunities including fixed income securities.
2. To demonstrate fundamental and technical analysis along with common stock valuation.
3. To provide an insight into portfolio theories and evaluation.

Course Outcomes: After completion of the course, students will be able to:

1. Classify various investment options with risk and return calculations.
2. Evaluate the bonds and strategies to manage them.
3. Choose the investment option with the help of fundamental and technical analysis.
4. Measure the value of common stocks by applying various approaches.
5. Construct the portfolio using various models.

Unit-I Introduction

Concept, Investment Decision Process; Real vs. Financial assets; Sources of investment- information; Investment vs. Speculation; Factors to be considered in investment decision. The concept and Measurement of Risk and Return (Individual and Portfolio) - Range, Standard Deviation and Co-Efficient of Variation, Ex-ante and ex-post returns. Risk return trade-off. (Simple Problems).

Unit-II Fixed Income Securities

Fixed Income Securities Features and types of debt instruments, Types of bonds- Euro bonds, Foreign bonds and Global bonds, Gold Bonds, Bond indenture, factors affecting bond yield. Bond yield measurement - Current yield, holding period return, YTM, AYTM and YTC. Bond duration- Macaulay's duration and modified Macaulay's duration. Bond convexity. Bond portfolio management strategies - active and passive. (Problems and Cases).

Unit-III Fundamental and Technical Analysis

Approaches to Investment analysis- Fundamental Analysis- Economy, Industry and Company analysis - Factors, Technical Analysis. - Dow theory, charts, moving averages, Relative strength index, Efficient Market Hypothesis, Japanese candle stick method. (Problems and Cases).

Unit – IV Common Stocks- Analysis and Valuation

Common Stocks - Analysis and Valuation Basic Features of Common Stock, Approaches to valuation- Balance sheet model, dividend capitalization models; earnings capitalization models; Security Market Indexes, their uses; computational procedure of Sensex and Nifty. (Problems and Cases).

Unit – V Portfolio Theory and Evaluation

Portfolio Theory and Evaluation Concept of portfolio. Portfolio return and risk. Harry Markowitz's Portfolio theory, construction of optimal portfolio, Single-index model. Capital market theory: Introduction of risk-free asset, Capital Market Line (CML). Capital asset pricing model (CAPM): Security Market Line (SML). Arbitrage Pricing Theory (APT): The Law of one price, two factor arbitrage pricing. Introduction to Mutual Funds. Performance measures - Sharpe's reward to variability index, Treynor's reward to volatility index, Jensen's differential index, Fama's decomposition of returns. (Problems and Cases).

Essential Readings:

1. Charles P.Jones, "Investments Principles and Concepts", 12th edition, Wiley India edition. 2016.
2. Prasanna Chandra, "Investment Analysis and Portfolio Management",5th edition, McGraw Hill India, 2017.
3. Punithavathy Panidan, "Securities Analysis and Portfolio Management",2nd Edition, Vikas Publications, 2012.
4. V.K.Bhalla , "Investment Management", 17th edition, S.Chand Publications, 2016.
5. Donald E. Fischer, Ronald .J.Jordan and A K Pradhan, "Security Analysis and Portfolio Management", 7th edition, Pearson Education, 2018.
6. Alexander. G.J, Sharpe.W.F and Bailey, J.V, "Fundamentals of Investments", 3rd edition, PHI, 2001.

19MB E102

FINANCIAL MARKETS AND SERVICES

Instruction	4 hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation:	20 Marks
Case Study/Assignment/Book Review/ Group Activity/Class Participation	10 Marks
Credits	4

Course Objectives: The Objectives of the Course are:
1. To make the Students understand the structure and functions of the Financial Markets, Financial Instruments and Financial Market Intermediaries.
2. To equip the Students with various patterns of Trading and Settlement and Financial Services.
3. To provide insights into Insurance Services and Claims Management.

Course Outcomes: After Completion of the Course, Students will be able to:
1. Have a comprehensive overview on Financial Markets and Instruments.
2. Understand the Trading and Settlement activities.
3. Acquire Knowledge on various Financial Services and the Regulatory Framework.
4. Enhance knowledge on various types of Insurance Services.
5. Gain insights on Claims Management Procedures.

Unit-I Introduction
Structure of Indian Financial System, Role of Financial System in Economic Development, Financial Markets: Money Market, Capital Markets, Commodities Market and FOREX Market- an Overview. Stock Exchanges: Functions, Listing and Formalities. Role of SEBI in India. Financial Instruments: Commercial Paper, Certificate of Deposit, Treasury Bills, Commercial Bills, Gilt-edged Securities, Equity Shares, Preference Shares, Debentures, Warrants and Convertibles, ADRs and GDRs, Mutual Funds.

Unit-II Trading and Settlement
Demat account, Patterns of Trading and Settlement, Speculations- Types of Speculations, Activities of Brokers, Broker Charges, Settlement Procedure. Financial Intermediaries: Merchant Bankers, Underwriters, Bankers to an Issue, Registrars and Share Transfer Agents, Debenture Trustees, Portfolio Managers. Role of NSDL and CDSL. Credit Rating Agency: Functions, the ABCs of rating scales, Global Credit Rating Agencies.

Unit-III: Financial Services
Concept, Nature, Scope and Functions of Financial Services. Types of Financial Services: Hire Purchase, Consumer Credit, Factoring and Forfeiting, Housing Finance, Venture Capital and Lease Financing. Growth of financial services in India. Regulatory Framework of Financial Services. Contemporary issues in Financial Markets and Services.

Unit-IV Insurance Services
Introduction to Insurance: Terminology, Procedure, Various methods of calculating Premium, factors affecting Premium calculations. Principles of Insurance, Concept of Corporate Insurance: Fire, Marine, Machine and Electronic Equipment, Motor Vehicle, Money in transit and Burglary, Fidelity, Directors and Officers Insurance Policy. Basic concepts of Life and General insurance. Types of Insurers, Functions of Insurers: Production, Underwriting, Rate Making. Reinsurance.

Unit-V Claims Management
Managing Claims and Losses: Understanding procedures and calculating Receivables amount, Causes for short settlement and procedures to reduce, Grievance redressal and legal aspects. Organizing and controls for Risk Management, Purchase of Insurance Policies and Services, Cost Optimization, Insurance as a tool for Risk Management. Banc-Assurance. Role of Insurance Regulatory Development Authority.

Essential Readings:

1. Sandeep Goel, "Financial Markets, Institutions and Services", PHI Learning, 2018.
2. Bhole, L.M., "Financial Institutions and Markets: Structure, Growth and Innovations", McGraw-Hill, New Delhi, Fourth Edition, 2008.
3. Emmett J. Vaughan; Therese M. Vaughan, "Fundamentals of Risk and Insurance", Wiley, India Edition, 11th Edition 2013.
4. M Y Khan, "Financial Services", McGraw Hill Education (India), Eighth Edition, 2015.
5. Bharati V. Pathak, "The Indian Financial System- Markets, Institutions and Services", Second Edition, Pearson Education.
6. Mishra M.N., "Life Insurance, Administration and Management", Sultan Chand and Co., New Delhi, 22nd Edition, 2016.

19MB E103

PERFORMANCE AND COMPENSATION MANAGEMENT

Instruction	4 hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation:	20 Marks
Case Study/Assignment/Book Review/ Group Activity/Class Participation	10 Marks
Credits	4

Course Objectives: The Objectives of the Course are:

1. To develop an understanding of the concept of Performance Management and the importance of the various Performance Assessment techniques.
2. To discuss the importance of Performance Metrics and benchmarking in improving Individual and Organizational Performance.
3. To introduce the concept and methods of designing compensation system.

Course Outcomes: After Completion of the Course, Students will be able to:

1. Effectively design the process of Performance Management system.
2. Efficiently identify an appropriate Performance Appraisal method at their workplace as an HR Professional.
3. Decide the standard performance benchmarks to influence the Performance of Organizational members.
4. Influence the Stakeholders of Compensation and also integrate compensation with other HR initiatives in line with Organizational realities.
5. Formulate new set of Compensation system and manage the various Employee Benefits in the Organisations.

Unit-I Introduction

Definition, Performance Appraisal to Performance management. Objectives of Performance Management. Process of Performance Management. Performance planning and Role clarity. KPAs - Performance Targets. Trait, Behaviour and Results approaches to measuring Performance. The impact of HRM practices on Performance.

Unit-II Performance Management Systems

Assessment Centre - Psychometric tests: Aptitude or Ability tests and Personality Tests. Role Play- Self-appraisal - 360 Degree appraisals- Rating- less appraisals for the future of Performance Management System (PMS). Critical incidents methods. Attribution theory- Causal matrix. Alternative models for Assessing Performance.

Unit-III Performance Bench marking

Diagnosis and Performance improvement - Performance Measures Pyramid - Direction of trouble shooting with Behavior model- Mager and Pipes trouble shooting model- European Foundation for Quality Management (EFQM) Excellence model- Diagnostic and Process bench marking. Outcome Metrics- Economic Value Added (EVA). Building a High Performance culture-Ethics in Performance Management.

Unit-IV Strategic Compensation Management Concepts

Concept of Compensation- Exploring and defining the Compensation- Job Evaluation approach to Compensation- Compensation dimensions- Role of Compensation in Organization- factors influencing Compensation- Aligning Compensation Strategy with HR Strategy and Business Strategy- New trends in Compensation Management.

Unit-V Designing Compensation System - Employee Benefits Management

Traditional Pay System and Modern Pay Systems- Pay for Performance, Competency Based Pay, Equity Based Rewards, Team Rewards- Reward Strategy and Psychological Contract- Law relating to Compensation-International Compensation- Executive Compensation, Benefits Administration, Employee Welfare and Working conditions- Statutory and Voluntary measures.

Essential Readings:

1. Michael Armstrong, Armstrong's Handbook of Performance Management: An Evidence-Based Guide to Delivering High Performance, Kogan Page, 2012.
2. A S Kohli, T Deb, Performance Management, Oxford Higher Education, 2008.
3. Joseph J. Martocchio, Strategic Compensation: A Human Resource Management Approach, Pearson Ed, 2018.
4. Bhattacharyya, Performance Management Systems and Strategies, Pearson Ed, 2011.
5. A.M. Sharma, Performance Management systems, HPH, 2010.
6. Henderson, Compensation Management in a Knowledge Based World, Pearson Ed, 2007.

19MB E104

TRAINING AND DEVELOPMENT

Instruction	4 hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation:	20 Marks
Case Study/Assignment/Book Review/ Group Activity/Class Participation	10 Marks
Credits	4

Course Objectives: The Objectives of the Course are:

1. To develop an understanding of the Concept and Importance of Training and Development.
2. To discuss the practice of Training and Development in the modern Organizational setting.
3. To familiarize Students with the tools and techniques involved in the implementation and evaluation of Training, besides giving an overview of emerging training trends.

Course Outcomes: After Completion of the Course, Students will be able to:

1. Get familiarized with how to do Training and Development Programmes and recall its importance.
2. Efficiently conduct Needs Assessment and design the Training Programme as per the demands of the Industry requirements
3. Make use of an appropriate Training and Developments method so as to contribute to the Organizational Success.
4. Identify the suitable mechanism for the implementation of the Training and Development Programmes.
5. Choose right mechanism to evaluate the Training and Development methods initiated and understand the emerging Training and Development trends in the Organizations.

Unit- I Introduction

Training and Development- Concepts, The role of Training in the Organizations, Essentials of Management Development Programmes, Field areas of Employee Training, Importance and Benefits of Training and Development, Structure of Training Organizations, A Training Process Model, Training Practices in Modern Organizations.

Unit- II Needs Assessment and Designing the Programme

Understanding the Why, When and Where aspects of Training Need Analysis (TNA), The Framework for Conducting a TNA- Organizational, Operational and Person Analysis, Outcomes of TNA- Training and Non Training Needs, Approaches to TNA- Proactive and Reactive Approaches.

Organizational constraints, developing Objectives- Identifying and writing a Good Learning Objectives. Facilitation of Learning and Training Transfer, Design theory- Elaboration and Gagne- Briggs Theories, Outcomes of the Design.

Unit-III Methods of Training and development

Overview of On-the Job and off-the Jobs methods, Matching methods with Outcomes, Important Training Methods- Lectures and Demonstration, Computer-Based Training, Games and Simulations, Sensitivity Training method, Teaching Aids for Training- selecting appropriate Training Aid, Principles of using Audio-visual Aids- Static and Dynamic media, Management Development Implications, Training for Executive-Level Management.

Unit-IV Implementation and Evaluation

Integrated Instructional Strategy- Content, Method of instruction, Facilities- Training room and the off-site Training facilities, Material and Equipment and Trainers, The Strategy. Implementation- Dry Run, Pilot Program, Tips for Trainers for Effective Implementation.

Rational for evaluation, Resistance to Training Evaluation, Types of Evaluation, Evaluation Design Issues.

Unit-V Emerging Training and Development Trends
Future Global Trends and Perspectives in Training and Development, Trend setting elements for Training and Development- Globalization, Priority differences of Countries and Companies, In-house v/s Training Outsourcing, Consultation Movement, Advancements in Appraisal Technique, E-learning, Cyber Training Programmes, Harnessing the Advancement in Training Technology.

Essential Readings:

1. P.Nick Blanchard, James W. Thacker, A.Anand Ram, "Effective Training, Systems, Strategies and Practices" Pearson, 2013.
2. Raymond A Noe, Amitabh Deo Kodwani, "Employee Training and Development" McGraw Hill, 2018.
3. Rolf Lynton, Uday Pareek, "Training for Development" Sage India, 2011.
4. Rishipal, "Training and Development Methods", S. Chand and Company Ltd, 2011.
5. Jean Barbazette, Managing the Training Function For Bottom Line Results: Tools, Models and Best Practices", Pfeiffer, 2008.
6. Dipak Kumar Bhattacharyya, "Training and Development: Theories and Applications", Sage Publications, 2015.

19MB E105

PRODUCT AND BRAND MANAGEMENT

Instruction	4 hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation:	20 Marks
Case Study/Assignment/Book Review/ Group Activity/Class Participation	10 Marks
Credits	4

Course Objectives: The Objectives of the Course are:

1. To provide an understanding of New Products, explore New Product ideas, new Product Development and the Strategies for Product Portfolio planning of a conglomerate.
2. To familiarize the Students understand the Brand Image, Brand Identity, Brand Equity, Branding Decisions and Brand Audit.
3. To develop the understanding of Brands with Consumer Behaviour, Brand Architecture and its Strategies.

Course Outcomes: After Completion of the Course, Students will be able to:

1. Easily comprehend New Product Development Process and its Models, and learn to create actionable focus to successfully manage the Product.
2. Design the Product Portfolio Strategies for a conglomerate, manage and amplify existing products.
3. Analyze the Branding Strategies, Brand Purpose- Managing Brand Reputations.
4. Understand and conduct the measurement of Brand Equity and Brand Performance, design Brand Architecture Strategies in real life situation.
5. Learn the Contemporary Issues and analyze Future Trends.

Unit-I Introduction

Product, Policy, objectives, Product Mix concepts - Product Line, Product Length, Product Depth, Product Breadth, Product Mix decisions, Packaging, Product Modification and Deletion. New Product Development: Innovation and Diffusion of product. New Product Development (NPD) - Process, Models.

Unit-II New Product Development Process

New Product Introduction, Growth Strategies Intensive, Interactive, Diversification strategies. Product Portfolio analysis BCG, GE, Ad little. Shell International. Idea generating device. Role of R & D. Product Maps, Market Maps and Joint Space Maps-Perceptual and Preference mapping. Idea- Screening. Product Concept generation, concept selection, and Concept Testing, Design for manufacturing, Product Prototype and Product Recalls.

Unit-III Brand Management- Knowledge, Identity and Positioning

Brand vs commodity, understanding Brands, benefits of Branding, Brand Attributes, Branding Decisions, Brand Awareness and Consumer Brand knowledge, Brand Image, Brand Identity, Brand associations, Establishing P.O.P and P.O.D, Brand Personality, Brand Extension, Line extensions Brand Licensing, Franchising and Global Branding, Brand Positioning- Strategies and Repositioning Straddle Positioning and Brand Mantra.

Unit-IV Crafting, Measuring and Managing Brand Equity

Creating Brand Equity, models of Brand equity – Brand Asset Valuator, Aaker model, Brandz and Brand Resonance, measuring Brand Equity, Building Brand Equity, Tracking Valuation Managing Brand Equity- Brand worth, Reinforcement, Revitalization and Brand Crisis.

Unit-V Brand Architecture Strategies

Introduction to Brand Architecture Strategies and its designing, Brand - Product Matrix, Breadth and depth of Branding Strategy, Brand Architecture systems, Brand Hierarchy, Branding policies.

Essential Readings:

1. Moore William L., Pessemier Edgar, Product Planning and Management: Designing and Delivering value, McGraw-Hill, Inc., 1993.
2. Ulrich K T, Eppinger D Steven, Goyal Anitha, Product Design and Development, Tata McGraw Hill, 6th edition, 2010.
3. Tapan K. Panda, Product and Brand Management, Oxford University Press, 1st edition 2016.
4. Aaker D, Building Strong Brands. The Free Press. Simon and Schuster. New York, 2012.
5. Dr. Anandan, Product Management, Tata McGraw Hill, 2nd edition, 2010.
6. Kapferer, J N, The New Strategic Brand Management: Creating and Sustaining Brand Equity Long Term. Kogan Page, 4th edition, 2008.

19MB E106

INTEGRATED MARKETING COMMUNICATION AND DIGITAL MARKETING

Instruction	4 hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation:	20 Marks
Case Study/Assignment/Book Review/ Group Activity/Class Participation	10 Marks
Credits	4

Course Objectives: The Objectives of the Course are:

1. To make the Students understand the basic Concepts of Integrated Marketing Communication, Planning and Evaluating Marketing Communications Strategies and Executions.
2. To provide a comprehensive understanding of Brand Promotion, Audience engagement, Public Relations and Strategic Communications.
3. Understand the importance of Digital and Social Media Marketing and its applications.

Course Outcomes: After Completion of the Course, Students will be able to:

1. Understand the process of creating valuable Brand and how to engage Consumers via Integrated Marketing Communications.
2. Analyze the important issues when planning and evaluating Marketing Communications Strategies and Executions.
3. Develop an effective Integrated Marketing Communication Process.
4. Evaluate the knowledge in Marketing Communication which ensures that they make the correct decision in Communications, Advertising and Digital Marketing in real scenario.
5. Examine the applications of Digital and Social Media Marketing in the Globalized market.

Unit-I Introduction

Integrated Marketing Communications, Recent Trends in the Market, Understanding the Marketing Process, Decisions for Effective Communications Campaign, Building Customer Based Brand Equity, Brand Loyalty, Successful Marketing Communications Campaign, Choosing Marketing Communications Agency, Structure of an Advertising Agency.

Unit-II IMC Planning Process

Consumer Information Processing, Steps of Effective Communications, Communications Objectives, How Advertising works – AIDA and Hierarchy of Effects Models, Consumer Approach to Buying Process: FCB Grid, Determining Marketing Communications Budget, Relationship between Communications Budget and Sales.

Unit-III Marketing Communications Mix

Theoretical Approaches to Advertising Design, Message Strategies - Cognitive, Affective and Conative, Advertising Appeals- Emotional, Fear, Humor, Rationality, Sex, Scarcity, Executional Frameworks- Animation, Slice of Life, Dramatization, Informative, Testimonial, Authoritative, Demonstration, Fantasy. Sales Promotions, Public Relations, Direct Marketing, Event Management, Sponsorship and Cause Related Marketing, Alternative Marketing, Crisis Management, Trade Fair and Exhibitions.

Unit-IV Digital Marketing

Digital Marketing - Components, Benefits, Plan, Skills required for Digital Marketing, Digital Marketing Platforms and Strategies, Trends, Search Engine Optimization and Content Marketing.

Unit-V Social Media

Social Media Marketing – Social Networking with Facebook, LinkedIn, Blogging as a social medium, Microblogging with Twitter, Social Sharing with YouTube, Social media for Customer Reach, Acquisition and Retention. Evaluation of an Integrated Marketing Communications Campaign.

Essential Readings:

1. Terence A. Shimp, J. Craig Andrews, Advertising, Promotion, and other aspects of Integrated Marketing Communications, 9e, Cengage, 2016.
2. Kruti Shah and Alan D'Souza, Advertising and Promotions – An IMC Perspective, Tata Mcgraw Hill, 2013.
3. Michael Miller, B2B Digital Marketing, 1e, Pearson, 2014.
4. Seema Gupta, Digital Marketing, Mc Graw Hill, 2018.
5. Belch George E; Belch Michael; Purani Keyoor, Advertising and Promotion- An Integrated Marketing Communications Perspective, Mc Graw Hill, 9th edition, 2013.
6. Jerome M.Juska, Integrated Marketing Communications- Advertising and Promotion in a Digital World, Routledge, 2017.

SCHOOL OF MANAGEMENT STUDIES
CBIT
Hyderabad

19MB E107

BUSINESS DATA MINING

Instruction	4 hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation:	20 Marks
Case Study/Assignment/Book Review/ Group Activity/Class Participation	10 Marks
Credits	4

Course Objectives: The Objectives of the Course are:

1. To familiarize the students to understand the concepts of Data Mining and Preprocessing of Data.
2. To provide insights on Association Rule Mining and Clustering.
3. To demonstrate the application of Logistic Regression and Sentiment Analytics to solve Business Problems.

Course Outcomes: After Completion of the Course, Students will be able to:

1. Understand the concepts of Data Mining and Data Preprocessing.
2. Extract and represent the knowledge from data by Preprocessing and Visualization
3. Establish the Association among frequently purchased items and categorize the dataset into different clusters.
4. Understand the concept of classification problems and their applications across different sectors.
5. Apply sentiment analytics to various real time business applications.

Unit-I Introduction

Data Mining: Kinds of data that can be mined- Database Data, Data Warehouses, Transactional Data, Other Kinds of Data; Major Issues in Data Mining- Mining Methodology, User Interaction, Efficiency and Scalability, Diversity of Database Types, Data Mining and Society

Unit-II Data Preprocessing

Data Preprocessing: An Overview- Reasons to process the data, Major Tasks in Data Preprocessing; Data Cleaning- Missing Values, Noisy Data, Data Cleaning as a Process; Data Reduction- Principal Component Analysis, Histograms, Clustering, Sampling, Data Cube Aggregation; Data Transformation and Data Discretization- Data Transformation by Normalization, Discretization by Binning, Discretization by Histogram Analysis.

Case Study: Handling Missing Values in Melbourne Housing Price Data.

Unit-III Association Rule Mining and Clustering

Mining Association Rules- Item sets, Association Rules, Generating Rules Efficiently; Metrics for Association Rule Mining- Support, Confidence and Lift; Pros and Cons of Association Rule Mining.

Clustering- Finding Similarities Using Distances- Euclidean Distance and Other Distance Metrics; K- Means Clustering and Hierarchical Clustering; Comparing Clusters Created by K-Means and Hierarchical Clustering

Case Study III.1: Market Basket Analysis of Groceries Dataset

Case Study III.2: Mall Customer Clustering

Unit-IV Classification Problems- I- Logistic Regression

Overview of Classification; Binary Logistic Regression; Classification- Encoding Categorical Features, Building Logistic Regression Model, Printing Model Summary, Predicting on Test Data; Measuring Accuracies- Creating Confusion Matrix, Receiver Operating Characteristic (ROC) and Area Under the Curve; Finding Optimal Classification Cut-off -Youden's Index and Cost- Based Approach.

Case Study: Predicting Employee Attrition on HR Attrition Dataset.

Unit-V Sentiment Analytics Using Naïve Bayes Algorithm
Exploring the Dataset; Text Preprocessing- Bag-of-Words Model, Creating Count Vectors, Displaying Document Vectors, Removing Low Frequency Words, Removing Stop Words, Creating Count Vectors, Distribution of Words across Different Sentiment.
Using Naïve Bayes Model for Sentiment Classification
Using n-Grams for Sentiment Classification
Case Study: Sentiment Analytics on Sentiments Expressed by Users of Zomato

Essential Readings:

1. Szabo, Gungar Polatkan, Oscar Boykin, Chalkiopoulos, "Social Media Data Mining and Analytics", 3rd Ed., Wiley, 2019.
2. Ian H. Witten, Eibe Frank, Mark A. Hall, Christopher J. Pal, "Data Mining: Practical Machine Learning Tools and Techniques", 4th Ed., Elsevier, 2017.
3. Megan Squire, "Mastering Data Mining with Python – Find patterns hidden in your data", 1st Ed., PACKT Publishing, 2016.
4. Florin Gorunescu, "Data Mining: Concepts, Models and Techniques", Vol 12, Springer, 2011.
5. Luis Torgo, "Data Mining with R: Learning with Case Studies", 2nd Ed., CRC Press, 2011.
6. Jiawei Han, Jian Pei, Micheline Kamber, "Data Mining: Concepts and Techniques", 3rd Ed., Elsevier, 2010.

19MB E108

R - PROGRAMMING

Instruction	4 hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation:	20 Marks
Case Study/Assignment/Book Review/ Group Activity/Class Participation	10 Marks
Credits	4

Course Objectives: The Objectives of the Course are:
1. To Understand R programming and related eco-system of libraries and packages.
2. To demonstrate usage of R as standard Programming Language.
3. To familiarize students with how various statistics can be collected and conduct analytics on large datasets.

Course Outcomes: After Completion of the Course, Students will be able to:
1. Understand the basics of R and extend the functionality using add-on packages
2. Identify and apply different ways of storing information and visualization
3. Extract data from dataset and apply loop and control statements
4. Analyze data using various data manipulation tasks on the dataset.
5. Apply the knowledge of R for data Analytics on real life applications.

Unit-I Introduction
Getting R: Downloading R, R Version, Installing, The R Environment: Command Line Interface, RStudio, Revolution Analytics RPE, R Packages: Installing Packages, Loading Packages.
Basics of R: Basic Math, Variables, Data Types, Vectors, Calling Functions, Function Documentation, Missing Data

Unit-II Advanced Data Structures
Advanced Data Structures: data frames, Lists, Matrices, Arrays, Reading Data into R: Reading CSVs, Excel Data, Reading from Databases, Data from Other Statistical Tools, R Binary Files, Data Included with R, Extract Data from Web Sites Statistical Graphics: Base Graphics, ggplot2

Unit-III Functions
Writing R Functions: Hello, World!, Function Arguments, Return Values, do call Control Statements: if and else, switch, ifelse, Compound TestsLoops: for Loops, while Loops, Controlling Loops

Unit-IV Group Manipulations
Group Manipulations: Apply Family, aggregate, plyr, data.table, Data Reshaping: cbind and rbind, Joins, reshape2Manipulating Strings: paste, sprintf, Extracting Text, Regular Expressions

Unit-V Basic Statistics
Basic Statistics: Summary Statistics, Correlation and Covariance, T-Tests, ANOVA, Linear Models: Simple Linear Regression, Multiple Regression, Logistic regression

Essential Readings:

1. Dr.Bharathi Mothwani, "Data Analytics with R", 2nd Ed., Wiley Publishers, 2019.
2. Jared P. Lande, "R for Everyone - Advanced Analytics and Graphics", 2nd Ed., Addidion Wesley, 2018.
3. Sandip Rakshit, "R Programming For Everyone", 3rd Ed., Mcgraw hill Publishers, 2017.
4. Tilman M.Davis, "The Book of R:First course in Programming and Statistics", 3rd Ed., William Pollock publishers, 2016.
5. Hadley Wickham and Garrett Grolemund, "R for Data Science", 4th Ed.,O Reilly, 2015.
6. Roger d. Peng, "R Programming for Data science", 3rd Ed., Lulu .com publishers, 2012.

19MB E109

TRANSPORT MANAGEMENT

Instruction	4 hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation:	20 Marks
Case Study/Assignment/Book Review/ Group Activity/Class Participation	10 Marks
Credits	4

Course Objectives: The Objectives of the Course are:

1. To familiarize various concepts of Transport management
2. To provide in depth knowledge related to various aspects of Transportation.
3. To empower with necessary skills in different modes of Transportations.

Course Outcomes: After Completion of the Course, Students will be able to:

1. Understand various concepts of Transport management.
2. Classify different modes in Transport management.
3. Apply their knowledge in various processes of Transport management.
4. Analyze different types of fright preparations in Transport management.
5. Plan and organize various systems and procedures in Fleet management.

Unit-I Introduction to Transportation

History of Transportation- Global and India, Role of Transportation in Logistics, Commerce and Industry. Principles and Practices, Scope and relationship with other logistics providers-E-commerce, 2PL, 3PL, 4PL and 5PL. Modes of Transportation – Road, Rail, Air, Ocean, Inland transportation, Multi Modal Transportation, RoRo. Process of Transportation.

Unit II Modes of Transportation

Road transport- registration of vehicle, insurance, fitness, owners of vehicle, vendorship, functions of transport organization/ truck broking agency, Different types of permits.
Air transportation- domestic/international cargo, air cargo agents/consolidators, CHAs.
Ocean transport- sea fright, liners, containers, LCL/FCL, Discounted rates.
Rail Transportation- Train racks, SLR, VPU, Express cargo trains, Private goods trains, CFS.
Refrigerated transportation, Pipe line transportation.

Unit-III Operations in Transportation

Transportation Network- Domestic and International. Process of Booking- Documents verification, Way bill (RR/LR), Acceptance of material, Preparation of consignment note, marking and labeling. Stocking, Dispatch procedure. Hub operations- Inbound, sorting/stocking, Outbound procedures. Delivery procedure- receiving, stocking, last leg/mile delivery.

Unit- IV Fright Management

Factors affecting transportation rates, fright structure, various types of rates- FTL, LTL, Sundry, express cargo transportation, liner fright rates, air cargo rates, rail cargo rates. Contractual rates, effect of fuel rates volatility on contractual rates, seasonal effects on fright rates. Effects of rates during calamities. Freight Rates- Time for Payment- Lien for freight.

Unit V Fleet Management

Planning and Resourcing: Need for Planning, Fleet management , Main types of road freight transport, Route survey and route planning, Vehicle routing and scheduling issues, Data requirements, Manual methods of vehicle routing and scheduling, Computer routing and scheduling, Periodical maintenance of fleet, SOP for vehicle maintenance, Information system applications, Integration of GPS. Long Haul, Coordination with terminals.

19MB E110

DISTRIBUTION AND WAREHOUSE MANAGEMENT

Instruction	4 hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	20 Marks
Case Study/Assignment/Book Review/ Group Activity/Class Participation	10 Marks
Credits	4

Course Objectives: The Objectives of the Course are:

1. To provide indepth knowledge in various functions of Warehouse management and Inventory Management.
2. To deliver knowledge on various Distribution methods.
3. To educate on minimizing total physical effort and distribution Cost of Goods.

Course Outcomes: After Completion of the Course, Students will be able to:

1. Apply their knowledge on Warehousing location, design, and operations.
2. Understand of various Inventory management systems and control.
3. Analyze different techniques to manage warehouse efficiency.
4. Make use of various techniques for optimum capacity utilization of shipping and packing.
5. Plan and select appropriate warehouse facilities management

Unit-I Introduction to Warehousing

Introduction - Warehousing, Distribution-Distribution methods-Warehouse Design- factors of warehouse design; Warehouse Location, Warehouse Operations - Warehouse Layout - Functions - Centralized and Decentralized -Warehouse operations and Storage Systems - Warehousing Cost Analysis .

Unit-II Inventory Management

Concepts - Role in Supply Chain -Role in Competitive Strategy - Functions - Types - Cost -Inventory control Models – Economic Lot size, EOQ, Economic Batch Quantity [EBQ], ROL -Reorder Level, P model, Q model, MRP, ABC analysis, Just in Time (JIT). Modern methods Kanban, DRP and ERP. FIFO, LIFO, Weighted average method. Interface between Sales and Production with SCM- Make to Stock (MTS), Make to Order (MTO), Assembly to Order (ATO), Configured to Order (CTO), Engineer to Order (ETO)

Unit-III Managing Warehouse Efficiency

Order picking - Picking methods-pick path - Measuring Warehouse Efficiency - Warehouse Workforce design and development - cross docking. Warehousing Operations: warehousing operations- inbound process, outbound processes, Functions of Warehouse- break-bulk, cross docking, order mixing, Risk management

Unit-IV Shipping and Packing

Optimum capacity utilization- Container optimization-Container loading and void fill-Weigh checking-Automated loading-Dock management-packaging-types-cost- and labelling functions and design- ASRS and their Operations – Bar Coding-Technology & Applications in Logistics Industry - RFID Technology & Applications

Unit-V Warehouse Facilities Management

Material Handling Systems - Types of Material Handling Equipment -Modern Warehousing - Types of Conveyors - Refrigerated Warehouses; Centralized and Decentralized Storage Systems: MHEs Safety & Security: types of warehousing hazards, protections taken against warehousing hazards, manual and automated MHEs in warehouse, legal requirements for ensuring a safe workplace; IT interface and Warehousing Management Systems (WMS).

Essential Readings:

1. David Lowe, "Lowe's Transport Manager's and Operator's Handbook"49th Edition, Kogan Page limited, 2019
2. MB. Stroh, "A Practical Guide to Transportation and Logistics", 3rd edition, Logistics Network Inc, 2006.
3. Krishnaveni Muthiah, "Logistics Management and World Sea borne Trade", 1st Edition, Himalaya Publishing House, 2018.
4. S Jaya Krishana, Transportation Management- Imperatives and Best Practices, ICFAI University Press, 2007.
5. B Rajashekar and G.V. R. K. Acharyulu, "Logistics and Supply Chain Management", Excel Books, 2009.
6. Alan Rushton, Phil Croucher and Peter Baker, "Logistics and Distribution Management:Understanding the Supply Chain", 5th edition, 2014.

19MBE111

FINANCIAL RISK MANAGEMENT

Instruction	4 hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation:	20 Marks
Case Study/Assignment/Book Review/ Group Activity/Class Participation	10 Marks
Credits	4

Course Objectives: The Objectives of the Course are:

1. To make the Students understand the various facets of Risk Management.
2. To provide indepth the concept of Derivatives and its various types.
3. To familiarise the Students about Forwards, Futures, Swaps and Options.

Course Outcomes: After Completion of the Course, Students will be able to:

1. Understand the measures and differentiate between different types of Risks that an Organization faces.
2. Have a comprehensive view about types of Derivatives and their Trading and Settlement.
3. Evaluate Forwards and Futures Contracts and Hedging Strategies.
4. Comprehend the computational aspects of Swaps and the associated Risk.
5. Evaluate various Option Trading Strategies and select the suitable one for the given situation.

Unit-I Introduction to Risk Management

Concept, Nature, Source, Measurement, Identification and Evaluation of Risk. Types of Risk. Possible Risk Events, Risk Indicators, Risk Management Process- Pre-requisites and fundamentals. Misconceptions of Risk. An Integrated Approach to Corporate Risk Management. Management of Interest Rate Risk, Credit Risk and Exchange Rate Risk. Non-Insurance methods of Risk Management- Risk Avoidance, Loss Control, Risk Retention and Risk Transfer.

Unit-II Derivatives

Development and Growth of Derivative Markets, Types of Derivatives, Uses of Derivatives, Types of Traders- OTC and Exchange Traded Securities- Types of Settlement- Fundamental linkages between Spot and Derivative Markets, The Role of Derivatives Market, Uses and Misuses of Derivatives.

Unit–III Forward and Futures

Forwards: Definition- Features and pay-off profile of Forward Contracts. Valuation of Forward contracts. Forward contracts to manage Commodity Price Risk, Interest Rate Risk and Exchange Rate Risk.

Features: Definition- Specifications of Futures Contract - Margin Requirements- Marking to Market- Basis and Convergence of Future price and Spot price. Valuation of Future Contracts- Types of Futures Contracts- Securities, Stock Index Futures, Currencies and Commodities- Hedging Strategies- Hedge ratio. Difference between Forwards and Futures Contracts.

Unit-IV Swaps

Concept and Nature- Evolution of Swap Market- Features of Swaps- Major Types of Swaps: Interest Rate Swaps- Currency Swaps- Commodity Swaps- Equity Index Swaps. Credit Risk in Swaps- Credit Swaps- using Swaps to Manage Risk- Pricing and Valuing Swaps.

Unit-V Options
Definition- Exchange Traded Options, OTC Options – Specifications of Options – Call and Put Options- American and European Options – Intrinsic Value and Time Value of Options – Option payoff, Options on Stock Indices and currency. Option Pricing Models: The Binominal Option Pricing Model (BOPM): Assumptions and problems - single and two period models. The Black and Scholes Option Pricing Model (BSOPM): Assumptions and problems.

Essential Readings:

1. John C. Hull &SankarshanBasu, "Options, Futures and Other Derivatives", 10th Ed, Pearson Education, 2017.
2. S.K.Mishra, "Derivatives and Risk Management",2nd Ed., Everest Publishing House,2010.
3. Paul Hopkins, Kogan Page, "Fundamentals of Risk Management", 4th Ed., Institute of Risk Management, 2017.
4. Jean-Philippe Bouchaud and Mark Potters, "Theory of Financial Risk and Derivative Pricing", 2nd Ed. Cambridge press, 2009.
5. David. A. Dubofsky& Thomas. W. Miller, Jr., "Derivatives Valuation and Risk Management", Oxford University Press, 2003.
6. R. Madhumathi, M. Ranganatham, "Derivatives and Risk Management", Pearson Education, 2012.

19MBE112

PROJECT APPRAISAL AND FINANCING

Instruction	4 hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation:	20 Marks
Case Study/Assignment/Book Review/ Group Activity/Class Participation	10 Marks
Credits	4

Course Objectives: The Objectives of the Course are:

1. To provide basic knowledge of Project Planning in addition to the ideas for Generation and Screening of the projects.
2. To deliver varied aspects of Projects in terms of Market, Demand, Technical and Financial.
3. To illustrate the Structure of Financial Institutions in India and Human Aspects of Project Management.

Course Outcomes: After Completion of the Course, Students will be able to:

1. Have a comprehensive view on project Planning and analysis along with ideas for generation and screening of the projects.
2. Understand the important facets of Market, Demand and Financial Analysis of the projects.
3. Understand the Feasibility Analysis and Find out the cash flows of the project.
4. Incorporate Risk Sensitivity, Scenario Analysis and Simulation Analysis for Managing Risk in the project appraisal decision.
5. Analyze projects in the Public Domain with special reference to Social Cost Benefit Analysis and understanding Corporate Governance in India.

Unit-1 Introduction to Project Planning

Levels of Decision Making- Key Issues in major Investment Decisions- Interface between Strategic Planning and Capital Budgeting. Generation of Ideas – Monitoring the environment - Corporate Appraisal - Preliminary Screening - Project rating index - Sources of positive NPV -Qualities of a Successful Entrepreneur.

Unit-2 Market Analysis and Demand Analysis

Market and demand analysis: Process. Technical Analysis: Manufacturing Process and technology - Study of Material Inputs and Utilities – Product Mixes - Plant Capacity - Location and Site - Machinery and Equipment - Structures and Civil Works - Project Charts and Layouts- Schedule of the project Implementation.

Unit-3 Financial Analysis

Financial Analysis: Estimation of cost of project and means of financing - Estimates of Sales and Production - Cost of production - Working Capital requirement and its financing - estimates of working results –Projected cash flow statement - Projected balance sheet. Project cash flows: Basic principles of measurement of cash flows - Components of the cash flow streams - Viewing a project from different points of view - Definition of cash flows by Financial Institutions and Planning Commission - Biases in Cash Flow estimation.

Unit-4 Project Risk Analysis
Source and Measure of Risk - Sensitivity Analysis - Scenario Analysis, Simulation analysis–Managing risk - Selection of Project - Risk Analysis in practice. Special Decision Situations: Choice between Mutually Exclusive Projects of unequal life - Optimal Timing Decision - Determination of Economic Life - inter-relationships between Investment and Financing aspects.

Unit-5 Project Management and Corporate Governance
Project Management: Structure of Financial Institutions in India. Rationale for Social Cost Benefit Analysis (SCBA) – UNIDO Approach - Little and Mirle Approach. Forms of Project Organization - Project Planning, Project Control, Human aspects of Project Management - Prerequisites for successful Project Implementation.
Corporate Governance: Introduction - Major Corporate Governance Failures- Need for Corporate Governance in India, Theories of Corporate Governance - Agency Theory, Stewardship Theory, and Stakeholder Theory – Convergence- Problems of Governance in Companies.

Essential Readings:

1. Prasanna Chandra, "Projects: Planning, Analysis, Selection, Financing, Implementation and Review", McGraw-Hill Education, 8th edition, 2015.
2. Bob Tricker, "Corporate Governance Principles, Policies, and Practices", Oxford University Press, 2015.
3. Choudhary S., "Project Management", Mc-Grawhill, 2006.
4. Desai, Vasant, "Project Management", Himalaya Publishing House, 2006.
5. Machiraju, H.R.: "Introduction to Project Finance", Vikas Publishing House.
6. N. Balasubramanian, "Corporate Governance and Stewardship", TMH, 2012.

19MBE113

LEADERSHIP AND TEAM MANAGEMENT

Instruction	4 hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation:	20 Marks
Case Study/Assignment/Book Review/ Group Activity/Class Participation	10 Marks
Credits	4

Course Objectives: The Objectives of the Course are:

1. To educate the students about the process and dynamics of leadership.
2. To instill into them the qualities, values and ethics of leadership.
3. To introduce them to the concepts underlying in Teams and Managing Teams.

Course Outcomes: After Completion of the Course, Students will be able to:

1. Display expertise and other qualities of an effective leader.
2. Appreciate the importance of being a capable and an ethical leader.
3. Facilitate decision making as a team member and as a leader.
4. Understand the basic concepts and importance of Team Dynamics.
5. Display knowledge in the Process of Managing Teams.

Unit: I Design Leadership self and Perceptions of Leaders and Leadership

Designing and Leadership, designing your Leadership by building your core, 3 Ps for Leadership Journey, Misconceptions about Leaders and Leadership, Characteristics and Traits of Effective Leaders, Skills and Expertise of Effective Leaders.

Unit: II Designing Leadership Capacity and Ethical Actions

New Challenges need New Leadership, New Leadership Skills in Demand, Designing Personal Leadership Brand.

Values and Ethical Actions- The key concepts of ethics, the roots of moral development, the ethical challenges of leadership, Designing your Ethical Leadership (The BASE Model).

Unit: III Design Thinking, Brain Leading and Decision- Making

Brain Leading in Six Dimensions, Design Thinking for Your Leadership Toolbox.

Decision- Making- Problems faced by Leaders in Decision-Making, Decision-Making as a Team, Designing Approach to Decision-Making (The SOLVE Model of Decision-Making), Barriers to Decision-Making.

Unit: IV Introduction to Dynamics of Teams

Teams- What and Why, Team Roles-Belbin Theory of Team Roles, Margerison and Dick McCann Theory of Team Roles, Team Role Orientations, Types of Teams, Building and Creating Trust. Impact of Millennial Generation in Organizations, Holocracy.

Unit V Managing the Teams

Engaging the Team-Purpose, Involvement and Appreciation, Importance of Team Engagement. Steps for Creating Accountability in Teams, Brent and Beech Four Approaches to Influencing the Teams. Key Facilitating Skills of a Team Leader, Coaching the Team- Sir John Whitmore's Grow Model of Team Coaching. Challenging Behaviors of Team Members, Dealing with Challenging Behaviors.

Essential Readings:

1. Anthony Middlebrooks, Scott J Allen, Mindy S Mcnutt, James L Morrison, "Discovering Leadership - Designing Your Success", SAGE Publications, Inc; 1 edition, 2018.
2. Mike Brent, Fiona Elsa dent, "The Leadership of Teams- How to Develop and Inspire High-Performance Teamwork", Bloomsbury Publishing, 1st edition, 2017.
3. All India Management Association (AIMA), "Leaders on Leadership- Insights from Corporate India", 1st ed., Sage Publications, 2012.
4. Radhakrishnan Pillai, D.Sivanandan, "Chanakya's 7 Secrets of Leadership", 1st ed, Jaico Publishing House, 2014.
5. Simon Sinek, "Leaders Eat Last- Why Some Teams Pull Together and Others Don't", 2nd Edition, Penguin Publishing, 2017.
6. Tom Rath, Barry Conchie, "Strength Based Leadership- Great Leaders, Teams and why People Follow", 1st Edition, Simon & Schuster India, 2009.

19MBE114

INTERNATIONAL HUMAN RESOURCE MANAGEMENT

Instruction	4 hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation:	20 Marks
Case Study/Assignment/Book Review/ Group Activity/Class Participation	10 Marks
Credits	4

Course Objectives: The Objectives of the Course are:

1. To educate the students about the process and dynamics of International HRM.

2. To motivate them to take up International Assignments in their careers.

3. To prepare them to accept and face the Challenges of International Assignments.

Course Outcomes: After Completion of the Course, Students will be able to:

1. Describe the basic concepts of International HRM.

2. Identify the importance of HRM transfer across the Globe.

3. Demonstrate Expertise in Staffing and HRD in International Perspective.

4. Examine the dynamics of careers and mobility in Global Assignments.

5. Develop knowledge in compensation and Emerging Issues of International HRM.

Unit-I Globalisation and Human Resource Management
Introduction to Globalisation, Evolution of Global HRM, Global vs Domestic HRM, Mapping Global HRM Organisational Culture and Global HRM- Cultural Context, Institutional Context, Convergence-Divergence or Equilibrium, Multinational Enterprise Structure, Global HR and Control Mechanisms in MNEs, Organising Global HRM, Role of Global HR Manager.

Unit-II Transfer of HRM across Boundaries
Why Firms transfer practices, Factors influencing transfer of HR Practices, Local affiliate response to transfer, Diffusion of Practices and Knowledge Transfer, HRM in International Joint Ventures, Mergers and Acquisitions-Critical HRM issues at different Stages of M&A, Cultural Differences in Integration Strategies, HRM in Joint Ventures.

Unit-III Global Staffing
Approaches to Global Staffing, Global Recruitment and Selection, Selecting Expatriates, Global Staffing Systems.
Global Human Resource Development- Global Management Development, Overseas Experience and Global Management Development, Training for International Assignments, Trends in Global Training and Development.

Unit-IV International Mobility and Global Careers
Global Careers, Global Assignment Types, Adjustment to the Foreign Culture, Predictors of Adjustment, Adjustment and Other Challenges in Alternate Assignment Types, Repatriation, Designing a Global Mobility Program, Beyond Repatriate Retention.

Unit-V Global Performance Management and Compensation
Performance Management in Global Context, Compensation in a Global Context, Compensation of Expatriates and Other International Assignees.
Emerging Issues in Global HRM
Introduction, Changing Environment of Global HRM, Global HRM Challenges.

Essential Readings:

1. David C. Thomas, Mila B. Lazarova, "Essentials of International Human Resource Management- Managing People Globally", Sage Publications, USA, 2014.
2. P. Subba Rao, "International Human Resource Management", Himalaya Publishing House, 2015.
3. Peter J Dowling, Marion Festing, Allen D.Engle. Sr, "International Human Resource Management", 7th edition, Cengage Learning, 2018.
4. P.L.Rao, "International Human Resource Management – Text and Cases" Excel Books.
5. Michael Dickmann, Chris Brewster and Paul Sparrow, "International Human Resource Management-Contemporary HR Issues in Europe", 3rd Edition, Routledge Taylor & Francis Group, New York and London, 2016.
6. Kate Hutchings and Helen De Cieri, "International Human Resource Management- From Cross Cultural Management to Managing a Diverse Workforce", 1st Edition, Routledge Taylor & Francis Group, New York and London, 2016.

19MBE115

CONSUMER BEHAVIOUR

Instruction	4 hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation:	20 Marks
Case Study/Assignment/Book Review/	
Group Activity/Class Participation	10 Marks
Credits	4

Course Objectives: The Objectives of the Course are:

1. To give the perspective of Consumers, their Buying Behaviour patterns and address the importance of environmental influences on volatile Consumer Behaviour.
2. To get the students acquainted with the concepts of Consumer Motivation, Personality, Perception and its implication that help them in obtaining knowledge on individual determinants of Consumer Behaviour.
3. To enable students to understand the consumer decision making process and gain insights about the models of Consumer Behaviour comprehensively.

Course Outcomes: After Completion of the Course, Students will be able to:

1. Understand the concepts to be applied to Marketing strategy.
2. Analyze the environmental factors affecting Consumer Buying Behaviour and learn the impact of socio-cultural settings on the consumption behaviour.
3. Develop the Marketing Strategies by applying the dynamics that influence consumers in taking decisions.
4. Analyze the challenges that might influence the formulation of effective Marketing Strategies from a Consumer Behaviour perspective.
5. Evaluate the dynamics of Human behaviour and the basic factors that influence the Consumer Decision Process.

Unit-I Introduction

Introduction, Definition, Customers and Consumers, Consumer Behavior and its Applications, Evolution of Consumer Behaviour, Market Research and Consumer Behaviour, Market Segmentation and Positioning, Consumer Behaviour Model.

Unit-II Environmental Influences on Consumer Behaviour

Culture – Definition, Characteristics, Cross-Cultural understanding of Consumer Behaviour; Subcultures – Nature. Social Class – Process of Social Stratification, Nature, Measurement and Categorization, Social Class and Consumer Behaviour. Social Groups – Group, Classification of Groups, Group Properties, Reference Groups- Nature. Family – Significance, Family Life Cycle, Family Purchasing Decisions. Personal Influence and Diffusion of Innovations – Nature and Significance, Communication and Influence Flow, Opinion Leadership, Adoption and Diffusion of Innovations.

Unit-III Individual Determinants of Consumer Behaviour

Personality and Self-Concept- Personality Theories and Applications, Personality and Marketing, Self-Concept and Consumer Behaviour; Motivation and Involvement - Nature and Role of Motives, Dimensions of Involvement. Information Processing - Information Acquisition, Perceptual Encoding, Marketing Implications. Learning and Memory - Characterizing Learning, Classifying Learning, Characteristics of Memory Systems, Retrieval of Information. Attitudes – Characteristics, Functions, Sources of Attitude Development, Attitude Theories and Models.

Unit-IV Consumer Decision Processes

Problem Recognition- Types, Situations, Results, Marketing Implications. Search and Evaluation – Information Search Process, Information Evaluation Process, Marketing Implications. Purchasing Processes – Choosing a Store, In-Store Purchasing Behaviour, Nonstore Purchasing Processes, Purchasing Patterns. Post Purchase

Behaviour – Postpurchase behavior, Product Disposition.

Unit-V Models of Consumer Behaviour
Traditional Models of Consumers-Microeconomic Model, Macroeconomic Model. Contemporary Models – Nicosia Model, Howard-Sheth Model, Engel-Kollat-Blackwell- Model, Sheth Family Decision Making Model, Bettman's Information Processing Model, Sheth-Newman-Gross Model of Consumption Values

Essential Readings:

1. Loudon, L. D., & Albert, J. Della Bitta, "Consumer Behaviour", Tata Mcgraw Hill, 4th edition, Reprint 2017.
2. Schiffman and Kannik, Consumer Behaviour. Pearson Edition, 11th edition, 2015.
3. Black-well, R.Miniard PW and Engel, Consumer Behaviour. Thompson learning, 2010.
4. Kumar Dinesh," Consumer Behaviour. Oxford publication, 1st edition, 2015.
5. Solomon, M. R., Consumer behaviour: buying, having, and being. Pearson Education India, 11th edition, 2015.
6. Leon G. Schiffman, J. Wisenblit and S. Ramesh Kumar, Consumer Behavior, Pearson Education, 12th edition, 2018.

19MBE116

SERVICES AND RETAIL MARKETING

Instruction	4 hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation:	20 Marks
Case Study/Assignment/Book Review/ Group Activity/Class Participation	10 Marks
Credits	4

Course Objectives: The Objectives of the Course are:

1. To familiarize with characteristics of services, retail marketing concepts and make them understand the concepts of services and retail industry and provide insight into the marketing mix for services and service quality.
2. To educate on strategies to deal with characteristics of services and concept of services marketing triangle.
3. To create awareness on retail formats, theories and discuss the issues relating to merchandise management, emerging concepts.

Course Outcomes: After Completion of the Course, Students will be able to:

1. Understand overview of services and retail and its significance.
2. Understand concepts of service, challenges in delivering quality services and retail industry trends.
3. Apply suitable marketing mix for various services and develop strategies to deal with characteristics of services.
4. Design unique retail formats considering the need of the customers.
5. Analyze consumer evaluations of retail offerings and apply retail concepts to real situations and formulate retail marketing strategies for the success of retail industry.

Unit-I Introduction

Service Sector – Indian Scenario and Global Issues, Services Concepts- Scope of Goods and Services, Goods-Services continuum, 4Is of Services, Goods and Services Categorization, Industrial Services.

Retailing - Meaning, Evolution, Functions, Types, significance of retail industry, Organized vs Unorganized retailing, Retailing in India- Scenario, Factors affecting Retailing in India, Retailing Opportunities in India.

Unit- II Service marketing Mix and Service Quality

Services Marketing Mix: Product, Pricing, Place, Promotion, People, Physical evidence and Process. Service Quality- Dimensions of Quality, Understanding Quality Management. Measuring Service Quality.

Unit- III Strategies for Service Marketing

Overview, Strategies for dealing with Intangibility, Inventory, Inconsistency and Inseparability. Loyalty, Switching, Intention to Stay, TAM (Technology Adoption Model). Service Marketing Triangle- External Marketing, Internal Marketing, Interactive Marketing.

Unit-IV Retail Marketing

Retail formats, Retail Pricing Strategies, role of franchising in retail, Technology in retail, Factors affecting retail. Retail Pricing - The concept of retail pricing and the factors affecting price, elements of retail price, developing a pricing strategy, adjustment to retail price. CRM in retailing. E-tailing-Issues and Challenges.

Unit-V Merchandise Management

Sources of Merchandise, Merchandise Presentation Techniques, Category Management, Store Layout and Visual Merchandising – Fundamental of Store Design, Types of Display Areas, Space Planning, Point of Purchase, Retail Operations – Controlling Store Operations, Customer Service – Gathering Customer Information, Understanding Customer, Service offered, Customer Evaluation, Building a Sustainable Advantage, Customer Complaints, Retail Selling – Qualities required for Retail Selling, The Selling Process.

Essential Readings:

1. Rampal M. K and Gupta S. L, "Services Marketing Concepts, Applications and Cases", Galgotia Publishing Company – New Delhi, 2008.
2. S.M.JHA, "Services Marketing", HPH, Mumbai, 2009.
3. AJLamba, "The Art of Retailing", TMH, 2009.
4. Lovelock, Chatterjee, "Services Marketing People, Technology Strategy", Pearson Ed., 2011.
5. Levy and Weitz, "Retailing", TMH, 2009.
6. David Gilbert, "Retail Marketing Management", 2nd edition, Pearson Education, 2003.

19MB E117

MACHINE LEARNING AND ARTIFICIAL INTELLIGENCE

Instruction	4 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	20 Marks
Case Study/Assignment/Book Review/ Group Activity/Class Participation	10 Marks
Credits	4

Course Objectives: The Objectives of the Course are:

1. To understand the various Machine Learning Algorithms.
2. To familiarize various Classification Techniques and Recommender Systems.
3. To get the students acquainted with the concepts of different searching techniques of AI systems.

Course Outcomes: After Completion of the Course, Students will be able to:

1. Understand complexity of Machine Learning algorithms.
2. Apply common Machine Learning algorithms in solving the business problems.
3. Differentiate various Machine Learning solutions
4. Understand the fundamental principles of intelligent systems.
5. Evaluate the various search mechanisms and design a Chatbot.

Unit–I Machine Learning
What is Machine Learning; Types of Machine Learning Algorithms- Supervised, Unsupervised and Reinforcement Learning.
Supervised Learning- K Nearest Neighbors, Random Forest and Boosting
Case Study: Predicting Employee Churn Using KNN, RF and Boosting.

Unit-II Recommender Systems Using Machine Learning
User Based Similarity- Calculating Cosine Similarity Between Users, Filtering Similar Users, Challenges with User Based Similarity. Item Based Similarity- Calculating Cosine Similarity between Movies, Finding Most Similar Movies. Matrix Factorization
Case Study: Application of Recommender System using Netflix Movie Recommender Data.

Unit-III Decision Tree Classification
Introduction to Decision Tree; Building Decision Tree Classifier using Gini Criteria; Measuring Test Accuracy; Displaying the Tree; Building Decision Tree Classifier using Entropy Criteria; Finding Optimal Criteria; Maximum Depth of the Tree and Benefits and Disadvantages of Decision Tree
Case Study: Applying Decision Tree Classification on German Credit Data.

Unit- IV Artificial Intelligence
Introduction- Meaning and Foundations of AI, History of AI. Intelligent Agents- Agents and Environments, Concept of Rationality, Nature of Environments, The Structure of Agents, AI: The present and Future.

Problem Solving-I: Solving Problems by Searching- Problem Solving Agents, Searching for Solutions, Uninformed Search Strategies, Informed Search Strategies, Heuristic Functions.

Unit-V Problem Solving
Beyond Classical Search- Local Search Algorithms and Optimization Problems, Beyond Classical Search, Adversarial Search, Constraint Satisfaction Problems, Chatbot –Introduction, Characteristics and its importance.

Essential Readings:

1. Wei- Meng Lee, "Python Machine Learning", Weily, 3rd Ed., 2019.
2. Rich, Knight, Nair, "Artificial Intelligence", Tata McGraw Hill, 3rd Ed., 2017.
3. Tom M. Mitchell, "Machine Learning", McGraw Hill, 4th Ed., 2017.
4. Russell, Norvig, "Artificial Intelligence: A Modern Approach", Pearson Education, 2nd Ed., 2015.
5. Paul Deitel, Harvy Deitel, "Python for Programmers- with introductory AI Case Studies", Pearson Education, 1st Ed., 2019.
6. Puneet Mathur, "Machine Learning Applications Using Python: Cases Studies from Healthcare, Retail, and Finance", Apress, 1st Ed., 2019.

19MB E118

CLOUD COMPUTING

Instruction	4 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation:	20 Marks
Case Study/Assignment/Book Review/ Group Activity/Class Participation	10 Marks
Credits	4

Course Objectives: The Objectives of the Course are:

1. To impart the basics of cloud computing for business management.

2. To illustrate and explore the benefits of cloud storage and its applications, usage by managers.

3. To enable students explore cloud computing driven real time systems.

Course Outcomes: After Completion of the Course, Students will be able to:

1. Understand the characteristics and models in Cloud computing.

2. Asses Cloud services applications and the challenges associated with Cloud Computing.

3. Apply various cloud services and deployment models and virtualization techniques for business.

4. Analyze the concepts of cloud storage and demonstrate their use.

5. Evaluate various cloud programming models and apply them in virtual office management.

Unit–I Introduction to Cloud Computing

Evolution - Cloud Computing, Hardware, Internet and Software, Virtualization. Cloud service Attributes: Access to the cloud, Cloud Hosting, Information technology support. Characteristics of Cloud Computing: Rapid Elasticity, Pay per use, Independent Resource Pooling, Network Access, Web Services on Cloud

Unit-II Cloud Services Applications

Cloud Delivery Models- Infrastructure-as-a-Service, Platform-as-a-Service, Software-as-a-Service. Cloud Categories: Public Cloud, Private Cloud, Hybrid Cloud, Community Cloud. Applications – Online Planning and Task Management –Event Management – CRM. Cloud Service Development tools - Word Processing, Databases, Storing and File Sharing on Cloud

Unit-III Cloud Computing For Managers

Centralizing Email Communications – Collaborating on Schedules - To-Do Lists, Contact Lists. Online Community development, Online collaboration tools for Projects, Cloud Computing for Business

Unit-IV Cloud Management

Privacy and its relation to Cloud-based Information Systems. Security in the Cloud: Data Security and Control, Provider Loss, Subpoenaed Data, Lack of Provider Security, Encryption. Common Standards in the Cloud, End-User Access to the Cloud Computing, Legal and Ethical dimensions, Cloud Pricing Models.

Unit–V Virtual Office Management

Web-based communication tools, Web Mail Services, Web Conference Tools, Social Networks and Groupware, collaborating via blogs and Wikis, IBM, Amazon Ec2, Google Apps for Business

Essential Readings:

1. John W. Rittinghouse and James F. Ransome, "Cloud Computing Implementation, Management and Security", CRC Press, Taylor & Francis Group, Boca Raton London, 2010.
2. Kumar Saurahb, "Cloud Computing – Insights into new era infrastructure", Wiley India, 2nd Edition.
3. Michael Miller, "Cloud Computing: Web-Based applications That Change the Way You Work and Collaborate Online", Que Publishing, 2009
4. Haley Beard, "Cloud Computing Best Practices for Managing and Measuring Processes for Ondemand Computing, Applications and Data Centers in the Cloud with SLAs", Emereo Pty Limited, July 2008.
5. Alfredo Mendoza, "Utility Computing Technologies, Standards, and Strategies", Artech House INC, 2007.
6. Bunker and Darren Thomson, "Delivering Utility Computing", John Wiley and Sons Ltd, 2006.

19MBE119

E-COMMERCE LOGISTICS

Instruction	4 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation:	20 Marks
Case Study/Assignment/Book Review/ Group Activity/Class Participation	10 Marks
Credits	4

Course Objectives: The Objectives of the Course are:

1. To explain the various concepts of E-commerce logistics.
2. To familiarize with various operations and warehousing technologies in E-Commerce Logistics.
3. To provide application knowledge on network design and automation in E-Commerce Logistics.

Course Outcomes: After Completion of the Course, Students will be able to:

1. Understand E-commerce and E-commerce logistics and its terminologies.
2. Understand and choose appropriate fulfillment centre for e-commerce logistics.
3. Applying various techniques in e-commerce logistics warehousing and consignment movement process.
4. Build suitable warehouse network design and application of automated technologies in handling of consignment.
5. Utilizing various technologies associated with E-commerce logistics.

Unit I History of E- commerce Logistics
The Evolution of Logistics and supply chain from Direct to Store models to E-Commerce, Meaning – functions and special characteristics of E-commerce, E-commerce in India, E-commerce and its technological aspects, overview of developments in information technology and e-commerce: Scope of E commerce, benefits and limitations of E-commerce. Role of Logistics in E- commerce, emergence of E-commerce logistics specialists.

Unit II E-Commerce and Fulfilment centres

Understanding E-Commerce fulfilment centres, definition and process, Faster order fulfil filament process, Real time decision support, Difference between distribution centre and fulfilment centre, Mega e-fulfilment centres, Strategies in E-commerce fulfilment, In-house order fulfilment, Managing inventory with outsourced fulfilment centre, end to end E-commerce logistics, E-commerce retail logistics

Unit-III Operations in E- Commerce Logistics

Inventory management, Parcel hubs/sortation centres warehousing, packaging, labelling, private labelling and manufacturing, white libelling, billing, shipping, payment collection, return, and exchange. Operating models: The marketplace model, Inventory-led model, Fulfilled by e-retailer drop ship model; Capacity and load matching, Track and tracing of consignments, managing on time deliveries. Dynamic Logistics alliance/integration in e-commerce.

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Unit-IV Network and warehouse design

Distribution global network, retail distribution network, direct store delivery, automation in distribution, automated picking technology, distribution centre design, implementation of warehouse management systems, science of warehouse slotting optimization, grocery/industrial distribution. Robot in fulfilment operations, ASRS, yard management, network locations, E-commerce retail logistics activities, First mile logistics Fulfilment, Line haul management.

Unit-V Logistics solutions for E-commerce

Logistics solutions for e- commerce, demand planning, tracking, pre-shipping, last mile delivery-COD- managing returns, dedicated customer support,3rd party shipping carrier, subscription model Order, Invoice management system, Omni channel e-commerce, POS (Point of Sales) e commerce integration system, Emerging trends in Voice commerce, E-commerce SEO, Seamless interface with existing SCM or ERP system logistics, E- commerce and consumer buying habits.

Essential Readings:

1. Paul T Sudhakar, "Logistics in E-Commerce Business", 1st edition, Create space Independent Publication, 2017.
2. Deborah L. Bayles, "E-commerce logistics and fulfilment: Delivering the goods", 1st edition, Prentice Hall, 2000.
3. P. T. Joseph, "E-Commerce: An Indian Perspective", 5th edition, PHI Learning, 2015.
4. Deryn Graham, "E-logistics and E-supply Chain Management: Applications for Evolving Business", Business Science Reference, 2013.
5. Geunes, J., Akçali, E., Pardalos, P., Romeijn, H.E., and Shen, Z.-J.M. (Eds.), "Applications of Supply Chain Management and E-Commerce Research" Springer, 2005.
6. Janice Reynolds, "Logistics and Fulfilment for e-business", 1st edition, CRC Press, 2001.

19MBE120

INTERNATIONAL LOGISTICS

Instruction	4 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	20 Marks
Case Study/Assignment/Book Review/ Group Activity/Class Participation	10 Marks
Credits	4

Course Objectives: The Objectives of the Course are:

1. To provide insights of International logistics operations.
2. To impart knowledge of International fright structure.
3. To focus on different types of containers and its transportation.

Course Outcomes: After Completion of the Course, Students will be able to:

1. Understand various terminologies of global logistics.
2. Analyze various shipping methods in Air and Ocean transport.
3. Apply knowledge in various systems and procedures of international trade.
4. Choose appropriate international insurance and packing methods.
5. Categorize fright structure in international logistics.

Unit I Introduction

Global supply chain – its importance in a Global economy – Stages in International Development - export / import, Terms and conditions of purchase of sales, method of payment, etc.), Quality considerations (e.g. ISO9000, industry quality specifications, etc, Security issues.). Role of Clearing Agent, Role of IATA and TIACA in Air Cargo Industry, International Air Transport; Exim policies.

Unit II Modes of International Transportation

Types and Terminology- Features, Advantages and Disadvantages of using sea mode, Classification of ships, Shipping Methods, S wage in Ship, Major Sea-routes around the world, Parties and Perils Associated with Sea Mode; Maritime Risks, Marine Insurance. Air cargo industry, International Air Transportation, Models in Air cargo planes.

Unit III Containerization in International Trade

Containerization and Chartering Containerization: Genesis, Concept, Classification, Benefits and Constraints; Inland Container Depot (ICD): Roles and Functions, CFS, Export Clearance at ICD; CONCOR; ICDs under CONCOR; Chartering: Kinds of Charter, Charter Party, and Arbitration. Export and Import procedure in India, Transport Documents, Mate Receipt, Bill of Lading - features and types, Air-way Bill.

Unit-IV Insurance Regulation and Packing

International insurance- risk management, Insurance and transportation liability regimes- marine insurance policies-coverage under a marine cargo insurance policy – airfreight policy- Lloyd's principles, Baltic exchange, UN convention on liner code of conduct. INCOTERMS 2013; Packing requirements (i.e. regulatory, preservation of cargo types of containers, packing materials, etc.

Unit V Fright Structure in International Trade

Freight Structure and Role of intermediaries: Principles of Freight Rates, Linear Freight Structure, Tramp Freight Structure, Ocean Freight- Types of Sea Freight, Calculation. Air Cargo Tariff Structure- Air Freight Classification, Air Freight Calculation, Factors Affecting Air Freight Rates, Air Freight Consolidation of Cargo Tariff Structure; Shipping Agents, Freight Brokers, Freight Forwarders Stevedores.

Essential Readings:

1. Krishnaveni Muthaiah, "Logistics Management and World Sea borne trade", 1st edition, Himalaya Publishing House, 2018.
2. Kent N. Gourdin, "Global Logistics Management, a competitive Advantage for the 21st Century",2nd edition, Blackwell Publishing, 2006.
3. Khurana P.K., Export management, 12th edition, Cyber Tech Publication, 2019.
4. Cherunilam F., International Trade and Export Management, 21st edition, Himalaya Publication, 2019.
5. Donald J. Bowerson, "Logistic and Supply Chain Management" 5th edition, Prentice Hall of India, 2009.
6. Paul Murphy, Donald Wood, "Contemporary Logistics", 12th edition, Prentice Hall, 2017.

OPEN ELECTIVE

19MB O101

BUSINESS E NVIRONMENT

Instruction	4 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation:	
Mid Session Examination	20 Marks
Case Study/Assignment/Book Review/ Group Activity/Class Participation	10 Marks
Credits	4

Course Objectives: The Objectives of the Course are:

1. To familiarize Students with various aspects of Business Environment factors along with detailed discussion on Planning and Industrial policies, mechanism of Fiscal Policy and Monetary Policy.
2. To provide an understanding about the changes in the Growth of National Income, Concept of Inflation in India.
3. To understand the Concept of WTO Agreements and its Implications, EXIM Policies, FEMA on various MNCs activities.

Course Outcomes: After Completion of the Course, Students will be able to:

1. Analyze the Macro environmental factors that influence the Business activities, role of Planning Commission and NITI Aayog in building Indian Economy.
2. Understand the issues related to the Industrial Policy and Regulation and their Amendments.
3. Analyze the Union Budget, Fiscal Policy, Monetary Policy and Banking system and its impact on Business Operations.
4. Understand the changes in various Economic Growth factors including National Income, Poverty measurement, Unemployment and Inflation and its influence on Indian Economy.
5. Apply Trade, EXIM Policies and FEMA Act for Organization Stability and Sustainability.

Unit-I Introduction

Colonialism and development of the Indian Economy - Digital Economy : Business Environment - Meaning, Importance, Environmental Factors, Planning in India-Planning Commission- NITI Aayog - Liberalization and Planning, Industrial

Policy and Regulatory Structure - Industrial Policy - Industrial Licensing Policy, Made in India.

Unit-II Economic Development

Five Year Planning- Industrial Policy 1991, New Industrial Policy, Startups, MSME, Small Scale Industries (SSI) - Industrial Finance - Foreign Direct Investment (FDI) - Modes - India's Inflow and Outflow.

Unit-III Economic Policies

Fiscal Policy- Latest Union Budget - Reforms Undertaken - Role of Government. Monetary Policy - Basic Concepts, Monetary Policy in the 21st Century - Banking Sector Reforms. Role of Regulatory Institutions in Indian Financial system - RBI and SEBI, Capital Market Institutions - Stock Indices- Derivatives Market - Global and Indian Scenario.

Unit-IV Economic Growth

National Income - Concepts, Foreign Trade and Balance of Payment, Poverty in India, Unemployment in India, Inflation, Human Development Index, Rural Development - Schemes, Problems of Economic Growth.

Unit-V Domestic and International Trade Policy

Evolution of International Financial System, Global Recession and Developing Economies: Policy Changes and Issues - Sector wise Trade Policies: Recent Developments GATT - WTO - Agreements and Implications. EXIM Policies and FEMA: India's New EXIM Policy - Legal Framework - Initiatives, FEMA - Indian Multinational Companies - Role in World Economy.

Essential Readings:

1. Justin Paul, "Business Environment: Text and Cases", 3rd Ed, TMH, 2012.
2. Gaurav Datt and Ashwani Mahajan, "Indian Economy", 72nd Ed, S.Chand, 2016.
3. V.K Puri and S.K Misra" Indian Economy" Himalaya Publishing House, 2014.
4. Amory Lovins, L. Hunter Lovins, Paul Hawken, Forest Reinhardt, Robert Shapiro, Joan Magretta, Harward Business Review on Business Environment, Harvard Business School press, 2000.
5. Francis Cherunilam "Business Environment: Text and Cases", HPH, 2012.
6. K.Ashwathappa "Essentials of Business Environment: Text, Cases and Exercises" HPH, 2011.

19MB O102

CORPORATE SOCIAL RESPONSIBILITY

Instruction	4 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation:	
Mid-Session Examination	20 Marks
Case Study/Assignment/Book Review/ Group Activity/Class Participation	10 Marks
Credits	4

Course Objectives: The Objectives of this Course are to:

1. Understand the importance of Historical evidence in exploring the Concept of CSR and analyze the different dimensions of CSR.
2. Understand the various Forms, Models and Theories of CSR and the role of the major Institutions in CSR.
3. Understand the efforts to measure Sustainability and how CSR will evolve in the future.

Course Outcomes: After Completion of the Course, Students will be able to:

1. Demonstrate knowledge of the role and importance of CSR in Organisations.
2. Apply Models and Theories to suggest the organizations the required CSR initiatives.
3. Comprehend the different ways to measure how Corporations affect Society and the Environment.
4. Examine the extent to which Business can meet the Challenges of Sustainable Development.
5. Evaluate how CSR is being practiced in various Organisations.

UNIT-I Introduction

Concept of CSR, Corporate Philanthropy, Corporate Citizenship, Evolution and Development of CSR, CSR Strategy, Arguments in Favour and Against CSR, Drivers of CSR, Dimensions and Importance of CSR, Corporate Governance and Corporate Social Responsibility.

UNIT-II CSR Models and Theories

Forms of CSR - Economic Responsibility, Legal Responsibility, Ethical Responsibility, Philanthropic Responsibility. Models of CSR - Philanthropic model, Ethical model, Statist model, Liberal model, Stakeholder model. Theories of CSR - Fiduciary Capitalism Theory, Stakeholder Theory, Social Contract Theory, Feminist Theory.

UNIT-III CSR Framework

Role of various Institutions in CSR – Role of Government, Educational Institutions, Media. Creating CSR Framework, Framework for rating CSR, International framework for Corporate Social Responsibility. CSR Legislation in India and the World.

UNIT-IV CSR and Development

Business and Inclusive growth, Standards and Indices for CSR, Sustainability and its Challenges, Strategies Business tool for Sustainable Development, Global CSR- CSR and development in Developing countries, CSR practice in India: A study with a Global contrast. Ethical Management and CSR.

UNIT-V CSR Trends and Opportunities

Current trends and opportunities in CSR, Environment Protection and CSR, CSR Case Studies with reference to India - Failures and Success, Future for CSR, Contemporary Issues in CSR.

Essential Readings:

1. Madhumita Chatterji, "Corporate Social Responsibility", Oxford University Press, 2015.
2. S.S.Khanka, "Business Ethics and Corporate Social Responsibility", S.Chand, 2014.
3. William B, Werther, Strategic Corporate Social Responsibility: Stakeholders in a Global Environment , Sage Publications, 2010.
4. Andrew Crane, Dirk Matten, Laura Spence, "Corporate Social Responsibility: Readings and Cases in a Global Context, 2007.
5. Subhasis Ray, S. Siva Raju, "Implementing Corporate Social Responsibility: Indian Perspectives", Springer, 2014.
6. K.S.Ravichandran, Corporate Social Responsibility-Emerging Opportunities and Challenges In India, Lexis Nexis, 2016.

19MB O103

BUSINESS LAW AND ETHICS

Instruction	4 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation:	
Mid Session Examination	20 Marks
Case Study/Assignment/Book Review/ Group Activity/Class Participation	10 Marks
Credits	4

Course Objectives: The Objectives of this Course are:

1. To give an Overview of Legal issues that they deal within their Professional and Personal life and to provide knowledge on General Contracts, Special Contracts and Negotiable Instruments.
2. To discuss the formation of Company, Process, and Dissolution and to educate on the rights of consumers and Redressal mechanism.
3. To provide understanding the significance of Ethical conduct for Business and Community.

Course Outcomes: After Completion of the Course, the Students will be able to:

1. Understand the Legal principles of Business Law; apply such principles of Law to Problems associated with Businesses and Business transactions.
2. Understand Special Contracts and reflect on Current Legal issues; and how to use various Negotiable Instruments for various Business transactions.
3. Understand the various provisions of Companies Act.
4. Claim the rights as a Consumer and know the Redressal Mechanism.
5. Enhance the Skills to recognize and resolve Ethical issues in Business.

Unit- I Introduction

Definition, Contract and Agreement, Essential Elements of a Valid Contract, Classification of Contracts. Offer and Acceptance - Legal Rules, Communication of Offer, Acceptance and Revocation. Consideration - Need, Legal Rules, Stranger to a Contract, Contract without Consideration. Capacity to Contract. Free consent - Coercion, Undue Influence, Misrepresentation, Fraud, Mistake. Performance of Contract. Remedies for Breach of Contract - Quasi Contracts - Kinds, Quantum Meruit.

Unit – II Special Contracts

Special Contracts: Indemnity and Guarantee - Contract of Indemnity, Contract of Guarantee, Distinction between Contract of Indemnity and Guarantee, Bailment and Pledge - Classification of Bailment, Duties and Rights of Bailor and Bailee, Termination of Bailment, Pledge, Bailment vs. Pledge, Rights and Duties of Pawnee and Pawnor, Pledge by Non-Owners. Contract of Agency - Creation of Agency, Classification of Agents, Relations of Principal and Agent, Principal with Third Party, Delegation of Authority, Termination of Agency. Sale of Goods Act - Distinction between Sale and Agreement to Sell. Conditions and Warranties-Express and Implied, Caveat Emptor. Negotiable Instruments Act: Characteristics, Types, Essential elements and distinctions between Promissory Note, Bill of Exchange, and Cheques - Types of Crossing.

Unit-III Companies Act

Definition of Company - Characteristics - Classification of Companies - Formation of Company - Memorandum and Articles of Association - Prospectus - Shareholders Meetings - Board Meetings - Law relating to Meetings and Proceedings - Company Management - Qualifications, Appointment, Powers, and Legal position of Directors - Board - M.D and Chairman - their powers, Prevention of Oppression and Mismanagement, Winding-up of a Company.

Unit-IV Consumer Protection Act

Consumer Protection Law: Introduction to Consumer Protection Law in India, Rights of Consumers, Consumer Councils - Central and State Councils, Redressal Machinery - National Commission, State Commission, District Forum.

Unit-V Business Ethics

Ethical and Value Based Considerations – Need and Justification – Business Ethics and Efficiency – Social Responsibility of Business – Fair and Just cooperation among Owners, Managers, Workers and Customers – Fair Market Wages – Integrity and Ethical consideration in Business Operations – Indian Value system and its relevance in Management.

Essential Readings:

1. N.D. Kapoor, "Elements of Mercantile Law", Sultan Chand and Co., 2018.
2. K.R. Bulchandani, "Business Law for Management", 6th Ed, HPH, 2014.
3. Richard T DeGeorge, Business Ethics, 7th Ed., Pearson, 2014.
4. PPS Gogna, "A Text Book of Company Law", 6th Ed., S. Chand, 2014.
5. Satish B. Mathur, "Business Law", Tata Mc Graw Hill, 2010.
6. Akhileshwar Pathak, "Legal Aspects of Business", 6th Ed., Tata McGraw Hill. 2014.

19MB O104

E-BUSINESS

Instruction	4 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation:	
Mid Sessional Examination	20 Marks
Case Study/Assignment/Book Review/ Group Activity/Class Participation	10 Marks
Credits	4

Course Objectives: The Objectives of the Course are:

1. To provide the basics of Electronic Commerce and understand Mobile Commerce Market.
2. To educate on the Current and emerging Business Models.
3. To focus on the need for security in e-commerce and to know various types of e-services.

Course Outcomes: After Completion of the Course, Students will be able to:

1. Gain a Comprehensive understanding of the E-Commerce landscape and Mobile Commerce.
2. Gain an understanding on how innovative use of the E-Commerce can help developing Competitive Advantage.
3. Develop an understanding on the various types of Online Payment Systems.
4. Understand the Concepts of e-business Payments and Security.
5. Gain knowledge on types of e-services and to discuss Legal issues.

Unit I Introduction

Electronic Commerce and Physical Commerce, The Digital phenomenon, Different types of e-commerce Electronic Commerce Framework, Advantage and Disadvantages of e-commerce, Growth of the Internet, Emergence of the World Wide Web, Transition to e-commerce in India, e-commerce Opportunities for Industries. Mobile Commerce - Overview of the Market and Leveraging Applications.

Unit II Consumer and Business-Oriented e-commerce

Consumer-Oriented e-commerce: Traditional retailing, e-retailing, benefits and features of e-retailing, Key success factors, Models of e retailing. Developing a Consumer-oriented e-commerce system: The emergent Business Model as the basis of e-commerce system development. Process-oriented e-commerce Development approach. Steps in the Development methodology. The PASS Model. Business-oriented e-commerce - Features of B2B e-commerce, Business Models.

Unit III Electronic Payment Systems

Introduction to Payment Systems, Electronic Cash: Blind signature, Payment by e-cash over the Internet. Smart Cards and Electronic Payment Systems, e-check: Deposit-and-Clear, Cash-and-Transfer, Lockbox, Direct fund transfer. Risks associated in Electronic Payment Systems. Designing electronic Payment systems.

Unit IV Network Security and Firewalls

Client-Server Network Security, Emerging Client-server Security threats, Firewalls and Network Security, Data and Message security, Encrypted documents and Electronic mail. Digital Signatures, Security Protocols for Web Commerce.

Unit V E-Services and Legal and Privacy Issues

Categories of E-services, Web-enabled services, E-banking, E-stock trading, E-investing, E-education. Match making services: Travel services, E-employment, E-jobs. Information selling on the Web, E-entertainment. Auctions and other specialized services: C2C auction sites and B2B auctions.

Legal, Ethics and Privacy issues- Protection needs and methodology- Consumer protection, Cyber laws, Contracts and Warranties, Taxation and Encryption policies.

Essential Readings:

1. Henry Chan, Raymond Lee, Tharam Dillon, Elizabeth Chang, "E-Commerce: Fundamentals and Applications", Wiley; 1st edition 2007.
2. Ravi Kalakota, Andrew B. Whinston, "Frontiers of Electronic Commerce", Pearson, 2011.
3. P.T. Joseph, S.J. "E-Commerce: An Indian Perspective", PHI Learning, 5th edition, 2015.
4. Harvey M.Deitel, Paul J.Deitel, Kate Steinbuhler, e-business and e-commerce for managers, Pearson, 2011.
5. Bharat Bhasker, Electronic Commerce - Framework, Technologies and Applications, 4th edition McGraw Hill Education, 2017.
6. Sanjay Mohapatra, "E-Commerce Strategy- Text and Cases", 1st edition, Springer US, 2013.

19MB O105

BANKING MANAGEMENT

Instruction	4 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation:	
Mid Session Examination	20 Marks
Case Study/Assignment/Book Review/ Group Activity/Class Participation	10 Marks
Credits	4

Course Objectives: The Objectives of the Course are:

1. To provide Conceptual and Practical understanding of Banking Industry and Monetary Policy implications.
2. To make Students proficient in Management of various Lending functions and educate them in Credit Delivery and Monitoring and Managing.
3. To equip the Students with latest trends, Regulations and Innovations in Banking arena.

Course Outcomes: After Completion of the Course, Student will be able to:

1. Understand Banking system and get insight on overview of Banking.
2. Enrich Knowledge on Banks Monetary Policy - Implication and analyze Financial Statements.
3. Develop a clear understanding and knowledge about the Lending functions of Banks.
4. Understand the importance of Credit Delivery and monitoring as well as how a Bank manages Credit Risk.
5. Comprehend on Banking Regulatory framework increase learning on new Innovations in Banking Products and Services.

Unit -I Introduction

Banking: Evolution of Banking in India – Origin, Nationalization, Reforms of Banking sector. Types of Banking: Universal Banking, Wholesale Banking, Private Banking, Retail Banking; Role of Banks in the development of Economy, RBI: Origin and Growth – Functions. Monetary Policy: Central Bank tools to regulate Money Supply- Policy rates, Monetary Ratios, Application of Monetary policy tools in India. Banks Financial statements: Basic Concepts - Bank Liabilities, Assets and Income statement. Analysing Banks Financial Statements, CAMELS, Ratings, Key Performance indicators.

Unit -II Sources and Uses of Bank Funds

Sources of Bank Funds, Deposits, Deposit Insurance in India, Pricing, Deposit Services, Need, Approaches to Deposit Pricing, Bank Liabilities - Non Deposit sources. Features of Bank Credit, Types of lending, Steps in assessment of Credit Worthiness of a Prospective borrower, Credit process and Financial appraisal for Credit Decisions, Different types of Loans and their features, Loan Pricing- The Basic Model, Pricing Fixed and Floating Rate Loans, Hedging, Matched funding, and Price leadership model, Cost-Benefit Loan Pricing, Customer Profitability Analysis.

Unit - III Credit Delivery and Monitoring

Modes of Credit Delivery - Cash Credit, Working Capital Demand Loan, Overdrafts, Bills finance and Pricing of Loans. Legal aspects of Lending - Secured and Unsecured Loans and Types of Securities. Credit Monitoring - Need for Credit Review, Triggers of Financial Distress - Models of Financial Distress - The Altman's Z score and other Models. Rehabilitation Process.

Unit - IV Managing Credit Risk

Basic Concepts - Expected and Unexpected Loss, Elements of Credit Risk, Credit Risk of Portfolio. Credit Risk Models - Basic Model and Modelling Credit Risk. Managing Credit Risk-Estimating PD, EAD and LGD, Need for the Credit Risk Models - Best Practice Industry Model Credit Migration Approaches- Credit Migration Approach used by Credit Metrics, Calculation of Portfolio Risk and Credit Migration Approach Used by Credit Portfolio View. Option pricing Approach - KMV Model.

Unit -V Regulation and Innovations in Banking System

Regulation of Bank Capital: Need to regulate, Concept of Economic Capital, Regulatory Capital, Basel Accords I, II and III - Implementation, Criticism. NPA's:- Gross and Net concept of NPA's, Causes, Implications and Recovery of NPA's. Banking Innovations: Need, Core Banking solutions, Retail Banking- Products and Services - Nature, Scope, Future and Strategies, Plastic Money and E-Money, National Electronic Funds Transfer, RTGS, ATM, Mobile Phone Banking, Net Banking and Security Issues in E-Banking. Cyber Security and Frauds. Mergers and Acquisitions in Banks.

Essential Readings:

1. Padmalatha Suresh and Justin Paul, "Management of Banking and Financial Services", 3rd Edition, Pearson Education, 2016.
2. Peter. S. Rose and Sylvia. C. Hudgins, "Bank Management and Financial Services", 8th Edition, Tata McGraw Hill, 2014.
3. K. Sriharsha Reddy and R.Nageswar Rao, "Banking and Insurance, 1st Edition, Paramount Publishing House, 2013.
4. Vasant Desai, "Banks and Institutional Management", 2nd Edition, Himalaya Publishing House, 2010.
5. "Bank Financial Management", IIBF, Macmillan 2010.
6. Vijayaragavan Iyengar, "Introduction to Banking", Excel Books, 2009.

19MB O106

CUSTOMER RELATIONSHIP MANAGEMENT

Instruction	4 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	20 Marks
Case Study/Assignment/Book Review/ Group Activity/Class Participation	10 Marks
Credits	4

Course Objectives: The Objectives of this Course are:

1. To understand the Concepts and Principles of CRM and its Changing role.
2. To educate Students on the Strategic, Operational and Analytical Customer Relationship Management.
3. To enable Students to understand how to manage Customer Relationship.

Course Outcomes: After Completion of the Course, the Students will be able to:

1. Analyze the Relationship theory from the perspective of the Customer and the Organization.
2. Develop and evaluate Strategic CRM decisions.
3. Formulate Operational CRM Decisions.
4. Develop and Assess Analytical CRM Decisions.
5. Evaluate CRM Implementation Strategies.

Unit-I Introduction

Definition, CRM Constituencies, Commercial and not-for-profit contexts of CRM, Models of CRM, Understanding Relationships – Relationship, Relationship quality, Relationships with Customers and Suppliers, Customer Lifetime value, Customers Satisfaction, Loyalty and Business Performance, Relationship Management Theories, Managing the Customer Lifecycle - Customer Acquisition, Managing the Customer Lifecycle- Customer Retention and Development.

Unit-II Strategic CRM

Customer Portfolio Management (CPM) - Portfolio, Customer, Basic Disciplines of CPM, CRM in the Business-to-Business context, Customer Portfolio Models, Additional Customer Portfolio Management Tools, Strategically significant Customers, Seven Core Customer Management Strategies. Delivering Customer Experienced Value - Understanding Value, Customers Experience Value, Modelling

Customer - Perceived Value, Sources of Customer Value, Customization, Value through Marketing Mix. Managing Customer Experience - Concepts, Customer Experience Management vs. Customer Relationship Management.

Unit-III Operational CRM

Sales Force Automation (SFA) - Meaning, SFA eco-system, SFA adoption, SFA and Sales Performance. Marketing Automation - Benefits. Service Automation - Customer Service, Modelling Service Quality, Customer Service Excellence certification, Service Automation, benefits from Service Automation.

Unit-IV Analytical CRM

Developing and Managing Customer related databases - Corporate Customer - Related data, Structured and Unstructured Data, Customer - Related Database, Data Integration, Data Warehousing, Data Marts, Knowledge Management. Using Customer - Related Data - Analytics for CRM Strategy and Tactics, Analytics throughout the Customer Lifecycle, Analytics for Structured and Unstructured data, Big Data Analytics, Analytics for Structured Data.

Unit-V CRM Implementation

Develop the CRM Strategy, Build CRM Project foundations, Needs Specification and Partner selection, Project Implementation, Performance Evaluation.

Essential Readings:

1. Francis Buttle and Stan Maklan, "CRM: Concepts and Technologies", 3rd Ed., Routledge, 2015.
2. Alok Kumar Rai, "Customer Relationship Management: Concepts and Cases", 2nd Ed., PHI, 2013.
3. Jagdish N. Sheth, Atul Parvatiyar and G.Shainesh, "Customer Relationship Management", "Emerging Concepts, Tools and Application", 1st Ed., Tata Mc Graw Hill, 2017.
4. Dilip Soman and Sara N- Marandi, "Managing Customer Value: One Stage at a Time" 1st Edition, World Scientific Publishing, 2009.
5. Ken Burnett, "The Handbook of Key "Customer Relationship Management", Pearson Education, 2005.
6. Mukesh Chaturvedi, AbinavChaturvedi, "Customer Relationship Management - An Indian Perspective", 2nd Edition, Excel Books, 2008.

19MB SD101

PERSONALITY DEVELOPMENT

Instruction	2 Hour per week
Duration of Semester End Examination	2 Hours
Semester End Examination	35 Marks
Continuous Internal Evaluation	15 Marks
Credits	1

Course Objectives: The Objectives of this Course are:

1. To develop Inter-Personal Skills and be an effective Goal-oriented team player.
2. To develop Professionals with Idealistic, Practical and Moral Values along with Communication and Problem Solving Skills.
3. To re-engineer attitude and understand its influence on behavior.

Course Outcomes: After Completion of the Course, the Students will be able to:

1. Enhance Holistic development and improve their Employability Skills.
2. Conduct themselves in a Professional manner while interacting with the people.
3. Balance Emotions to get Success.
4. Work under Stress and in tough Business Environments.
5. Measure individuals' Mental Capabilities and Behavioural style.

Exercise-1 Self Analysis and Creativity

SWOT Analysis, Who am I, Attributes, Importance of Self Confidence, Self Esteem.

Out of box thinking, Lateral Thinking.

Exercise-2 Attitude and Habits

Factors influencing Attitude, Challenges and Lessons from Attitude, Etiquette. Forming Good Habits, Grooming Men and Grooming Women.

Exercise-3 Motivation and Attitude Building

Factors of Motivation, Self talk, Intrinsic and Extrinsic Motivators.

Emotional, Informational, Behavioral factors that determine our Attitude, Types of Attitude, Steps for building Positive Attitude, Assertiveness, Factors of Motivation, Self-talk, Intrinsic and Extrinsic Motivators.

Exercise-4 Goal Setting

Wish List, SMART Goals, Blue print for Success, Short Term, Long Term, Life Time Goals. Time Management. Value of Time, Diagnosing Time Management, Weekly Planner to do list, Prioritizing work. Extempore.

Exercise-5 Psychometric Analysis

Types, How to measure, Preparation

Essential Readings:

1. OG Mandino, University of Success, A Bantam Book I August 1982.
2. Napoleon Hill, "Law of Success" Tribeca Books, 1928 and 2018.
3. Carnegie Dale, "How to Win Friends and Influence People", New York: Simon and Schuster, 1998.
4. Stephen R. Covey "The 7 Habits of Highly Effective People: Powerful Lessons in Personal Change", 25th Edition, Turtleback books, 2013.
5. Thomas A Harris, "I am ok, You are ok" , New York-Harper and Row, 1972.
6. Napoleon Hill, Think and Grow Rich: The Original, Official Publication of The Napoleon Hill Foundation.

4 Semesters in R-19

19MB SD102

CAREER GUIDANCE

Instruction	2 hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	-
Credits	Non Credit

Course Objectives: The Objectives of the course are:

1. To familiarize the students on the concept and skills required to achieve Career goals.
2. To make them understand the effective ways to prepare for a job.
3. To help students have better Career Planning and development.

Course outcomes: After completion of the course, students will be able to:

1. Decide on a career goal and draft a feasible plan to achieve it.
2. Demonstrate the soft skills that are required for effective functioning of an Organization.
3. Exhibit good employability skills that are expected from the Industry.
4. Design a Proper Career development Strategy that helps to achieve individual and Organizational goals.
5. Manage Career with required professionalism and work ethics.

Unit- I: Introduction
Career Goals and Plans-Benefits of Career Planning-Essential Career Skills- Interpersonal Skills - Networking-Creative Thinking-Problem Solving-Negotiation & Conflict Resolution- Stress Management- Tips for Successful Career Planning.

Unit – II: Job Preparation
Sources of Occupation Information- Resume Building- Writing Resume and Cover Letter. The Art of Participation in Group Discussions- Psychometric Analysis- Strategies to be Successful in an Interview- Mock Sessions.

Unit –III: Career Development
Career Development-Career Growth Benefits from E-Learning- Career Planning within a Corporate Setting and while Switching a Company- Career Management-Professionalism in the Workplace- Succeeding with Mentor-Work Ethics.

Essential Readings:

1. Barun K.Mitra, "Personality Development and Soft Skills", Oxford University Press, 2nd Edition, 2016.
2. M.S. Rao, "Soft Skills: Enhancing Employability, Connecting campus With Corporate", Wiley (Dreamtech Press), 1st Edition, 2019.
3. Mellisa Hume, "Career Guidance for Now and for the Future", Balboa Press, 1st Edition, 2014.
4. Niles, S. & Harris-Bowlsbey, J. Career development interventions in the 21st century. (4th ed.). Upper Saddle River, NJ: Pearson, 2013.
5. Bill Gothard, Phil Mignot, Melvyn Ruff, Career Guidance in context, Sage Publications, 2012.
6. Richard N. Bolles, What Color Is Your Parachute? 2020 A Practical Manual for Job-Hunters and Career Changers, Ten Speed Press, 2019.

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Essential Readings:

1. Frazelle, "World Class Warehousing & Material Handling", 2nd edition, Tata McGraw-Hill, 2016.
2. Gwynne Richards, "Warehouse Management" 3rd edition, Kogan Page, 2017.
3. P Gopal Krishnan and Abid Haleem, "Hand book of Materials Management", 2nd edition, PHI learning, 2019.
4. Gopalakrishna, P. and Shandilya M.S., "Stores Management and Logistics", 1st edition, S.Chand & Co, 2013.
5. Arnold, "Introduction Materials Management", 7th edition, Pearson Education, 2011.
6. Satish K. Kapoor and Purva Kansal, Basics of Distribution Management - A Logistical Approach, 1st Edition, Prentice Hall, 2004.

SCHOOL OF MANAGEMENT STUDIES CBIT Hyderabad

19MBC119

ENTREPRENEURIAL DEVELOPMENT

Instruction	3 hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation:	20 Marks
Case Study/Assignment/Book Review/ Group Activity/Class Participation	10 Marks
Credits	3

Course objectives: The Objectives of the Course are:

1. To sensitize the students about the concept and functions of entrepreneur with particular reference to Self-Employment and its process.
2. To educate on how to identify the Business Opportunities and to equip the Students with process of Project Formulation and Appraisal
3. To create awareness on how to raise funds from the appropriate institutional sources under suitable schemes and enable the Students to understand the role of Venture capitalists in Entrepreneurship Development.

Course Outcomes: After Completion of the Course, Students will be able to:

1. Understand the concept of entrepreneurship and its close relationship with Economic Development of a Country.
2. Identify the business opportunities and procedures to comply with.
3. Formulate, Execute and Evaluate Feasible project design.
4. Make use of the support rendered by Institutional Finance.
5. Identify the appropriate agencies for Venture Capital funding.

Unit-I Entrepreneurial Development Perspective

Concepts of Entrepreneurship Development, Evolution of the concept of Entrepreneur, Functions of an Entrepreneur, Theories of Entrepreneurship, Entrepreneur Vs. Intrapreneur, Entrepreneur Vs. Entrepreneurship, Entrepreneur Vs. Manager, Attributes and Characteristics of a successful Entrepreneur, Role of Entrepreneur in Indian economy and developing economies with reference to Self-Employment Development, Entrepreneurial Culture.

Unit-II Creating Entrepreneurial Venture

Business Planning Process, Environmental Analysis - Search and Scanning- Identification of Problems and Opportunities- Various Sources of Business opportunities. Entrepreneurship Development Programmes (EDPs) - Meaning and Types. Basic Government Procedures to be complied with. Role of Central Government and State Government in promoting Entrepreneurship.

Unit-III Project Management

Project: Concept and Classification- Project Identification, Project Formulation, Common errors in Project Formulation- Project Report, Project Appraisal- Technical, Financial, Marketing, Personnel and Management Feasibility.

Unit-IV Institutional Finance

Estimating and Financing the Funds requirements- Institutional Finance to Entrepreneurs- Need and Importance, Institutional finance from IDBI, IFCI, LIC, UTI, NABARD, SFCs, SIDCs EXIM Bank. Role of NSIC, SSIB, SSICs for Entrepreneurship development. Schemes offered by various Commercial Banks.

Unit-V Start-up and Venture Capital

Start-up Basics - Opportunity, Ideation, Customer Discovery, Market Analysis. Business Incubation centres. Venture Capital Financing Concept and features. Structure and regulatory framework of venture capital financing in India. Investment process and evaluation- Structuring venture capital financing. Exit Strategies of Venture capitalist.

Essential Readings:

1. E.Gordon and K. Natarajan, "Entrepreneurship Development", HPH, 2017.
2. Vasanth Desai, "Dynamics of Entrepreneural Development and Management", S. Chand and Co. Ltd, 2013.
3. S.S. Khanka, "Entrepreneurship Development", S. Chand and Co. Ltd, 2007.
4. Coulter, "Entrepreneurship in Action", PHI, 2005.
5. David H. Hott, "Entrepreneurship New Venture Creation, PHI, 2016.
6. Amit Kumar Dwivedi, "Cases In Entrepreneurship " Bookwell Publications, 2014.

18MT CO1

MATHEMATICS– I

(Common to all branches and except for Bio-Tech)

Instruction	3 L+1T Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation:	30 Marks
Credits	4

Course Objectives:

1. To solve linear system of equations using Matrix Methods.
2. To know the convergence of the Series.
3. To represent the function in series form.
4. To know the Partial Derivatives and use them to interpret the way a function of two variables behaves.
5. To learn Vector Differential Operator and its Physical interpretations on Scalars and vector functions.
6. To solve improper integrals.

Course Outcomes: On the successful completion of this course student shall be able to

1. Solve system of linear equations and identify the Eigen values and Eigen vectors in engineering problems.
2. Check the series convergence.
3. Find the evolutes of the given curves.
4. Expand and find extreme values of functions of two variables.
5. Understanding the significance of gradient, divergence and curl.
6. An ability to solve the problems and interpret in geometrical approach.

UNIT-I: Matrices:

Rank of the matrix, Echelon form, System of linear equations, Linearly dependence and independence of vectors, Eigenvalues, Eigenvectors, Properties of eigenvalues, Cayley-Hamilton theorem, Quadratic forms, Diagonalization of Matrices, Reduction of quadratic form to canonical form by linear transformation, Nature of quadratic forms.

UNIT-II:Sequences and Series:

Definition of Convergence of sequence and series. Tests for convergence of series: Comparison test, limit comparison test, D'Alembert ratio test, Raabe's test, Cauchey's n^{th} root test, logarithmic test, alternative series, absolute and conditional convergence.

UNIT-III: Calculus:

Rolle's Theorem, Lagranges Mean value theorem, Cauchy's mean value theorem (without proofs). Curvature, radius of curvature, Evolutes and involutes ,
Fourier series, half range sine and cosine series.

UNIT-IV: Multivariable Calculus (Differentiation):

Functions of two variables, Partial derivatives, Total differential and differentiability, Derivatives of composite and implicit functions (Chain rule), Change of variables, Jacobian, Higher order partial derivatives, Taylor's series of functions of two variables, Maximum and minimum values of functions two variables, Lagrange's multipliers method.

UNIT-V: Vector Calculus (Differentiation):

Scalar and vector fields, Gradient of a scalar field, Directional derivative, Divergence and Curl of a vector field, vector identities. Improper integrals: Beta and Gamma functions and their properties.

Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. B.V. Ramana, Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.

Suggested Reading:

1. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
2. R.K. Jain, S.R.K. Iyengar, Advanced engineering mathematics Narosa Publications, 5th edition, 2016.
3. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/ Cole, 2005.

I/c HEAD
Dept. of Chemical Engineering
Chaitanya Bharathi Institute of Technology
Gandipet, Hyderabad-75.

18PY C05

PHYSICS
(for Chemicaland Bio-Tech)

Instruction:	3L+1T Hours per Week
Duration of Semester End Examination:	3 Hours
Semester End Examination:	70 Marks
Continuous Internal Evaluation:	30 Marks
Credits:	4

Course Objectives:
The objectives of the course is to make the student
1. Learns the basic concepts of wave nature of light and acquires knowledge of lasers and fibre optics.
2. Understands the general concepts of electromagnetism.
3. Familiar with fundamental ideas of Quantum Mechanics.

Course Outcomes:
At the end of the course, the student will be able to
1. Demonstrate the wave nature of the light and describe the types of lasers and optical fibres and their applications.
2. Develop the concepts related to electromagnetic behavior.
3. Demonstrate the important concepts of Quantum Mechanics.

UNIT-I: Optics
Diffraction: Introduction to interference and example; concept of diffraction, Fraunhoferand Fresnel diffraction, Fraunhofer diffraction at single slit, double slit, and multiple slits;diffraction grating, characteristics of diffraction grating and its applications.
Polarisation: Introduction, polarisation by reflection, polarisation by double refraction, scattering of light, circular and elliptical polarisation, optical activity.

UNIT-II: Fibre Optics: Introduction, optical fibre as a dielectric wave guide: total internal reflection, numerical aperture and various fibre parameters, losses associated with opticalfibres, step and graded index fibres, pulse dispersion, applications of optical fibres.

UNIT-III: Lasers: Introduction to interaction of radiation with matter, principles and working of laser: population inversion, pumping, various modes, threshold population inversion, types of laser: solid state, semiconductor, and gas; applications of lasers.

UNIT-IV: Electromagnetism and Magnetic Properties of Materials:
Laws of electrostatics, electric current and the continuity equation, laws of magnetism. Ampere's Faraday's laws. Maxwell's equations. Polarisation,

permeability and dielectricconstant, polar and non-polar dielectrics, internal fields in a solid, Clausius-Mossotti equation, applications of dielectrics. Magnetisation, permeability and susceptibility, classification of magnetic materials,ferromagnetism, magnetic domains and hysteresis, applications.

UNIT-V: Quantum Mechanics:

Introduction to quantum physics, black body radiation, explanation using the photon concept, photoelectric effect, Compton effect, de-Broglie hypothesis, wave-particle duality, Born's interpretation of the wave function, verification of matter waves, uncertainty principle, Schrodinger wave equation, particle in box.

TEXT BOOKS:

1. B.K. Pandey and S. Chaturvedi, *Engineering Physics*, Cengage Publications, 2012.
2. M.N. Avadhanulu and P.G. Kshirsagar, *A Text BookEngineering Physics*, S. Chand Publications, 2014.
3. M. Arumugam, *Materials Science*, Anuradha Publications, 2015.
4. S.L. Gupta and Sanjeev Gupta, *Modern Engineering Physics*, Dhanpat Rai Publications, 2011.

SUGGESTD READING:

1. R. Murugeshan and Kiruthiga Sivaprasath, *Modern Physics*, S. Chand Publications S. Chand Publications, 2014.
2. V. Rajendran, *Engineering Physics*, McGahill Education Publications, 2013.
3. P.K. Palanisamy, *Engineering Physics*, Scitech Publications, 2012.
4. V. Raghavan, *Materials Science and Engineering*, Prentice Hall India Learning Private Limited; 6th Revised edition, 2015.

I/c HEAD
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Chaitanya Bharathi Institute of Technology
Gandipet, Hyderabad-75.

18CS C01

Programming for Problem Solving
(Common to All Programs)

Instruction	3 Periods per week
Duration of Semester-End Examination	3 Hours
Semester-End Examination	70 Marks
Sessional	30 Marks
Credits	3

Course Objectives

1. Identification of computer components, Operating environments, IDEs.
2. Understanding the steps in problem solving and formulation of algorithms to problems.
3. Develop programming skills as an means of implementing an algorithmic solution with appropriate control anddata structures.
4. Develop intuition to enable students to come up with creative approaches to problems.
5. Manipulation of text data using files.

Course Outcomes: At the end of the course, students will be able to:

1. Identify the computing environments.
2. Formulate solutions to problems and represent them using algorithms/ Flowcharts.
3. Choose proper control statements and data structures to implement the algorithms.
4. Trace the programs with test the program solution.
5. Decompose a problem into modules and use functions to implement the modules.
6. Develop applications using file I/O.

UNIT -I

Introduction to computers and Problem Solving: Components of a computer, Operating system, compilers, Program Development Environments, steps to solve problems, Algorithm, Flowchart / Pseudocode with examples.

Introduction to programming: Programming languages and generations, categorization of high level languages.

Introduction to C: Introduction, structure of C program, keywords, identifiers, Variables, constants, I/O statements, operators, precedence and associativity.

UNIT – II

Introduction to decision control statements: Selective, looping and nested statements.

Functions: Introduction, uses of functions, Function definition, declaration, passing parameters to functions, recursion, scope of variables and storage classes

Case study:

UNIT – III

Arrays: Introduction, declaration of arrays, accessing and storage of array elements, 1-dimensional array, Searching (linear and binary search algorithms) and sorting(selection and Buble) algorithms, 2-D arrays, matrix operations.

Strings: Introduction, stringsrepresentation, string operations with examples.

Case study:

UNIT – IV

Pointers: Understanding computer's memory, introduction to pointers, declaration pointer variables, pointer arithmetic, pointers and strings, array of pointers, function pointers, array of function pointers, dynamic memory allocation, advantages and drawbacks of pointers.

Structures: Structure definition, initialization and accessing the members of a structure, nested structures, structures and functions, self- referential structures, unions and enumerated data types.

UNIT-V

Files: Introduction to files, file operations, reading data from files, writing data to files, error handing during file operations.

Preprocessor Directives: Types of preprocessor directives, examples.

Suggested Reading:

1. A K Sharma "**Computer Fundamentals and Programming**", 2nd Edition, University Press, 2018.
2. PradeepDey and Manas Ghosh, "**Programming in C"**, Oxford Press, 2nd Edition, 2017.

References:

1. Byron Gottfried, Schaum's"**Outline of Programming with C**", McGraw-Hill.
2. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India.
3. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill.
4. ReemaTharaja "**Introduction to C Programming**", Second Edition, OXFORD Press, 2015.
5. https://www.tutorialspoint.com/cprogramming/index.htm.
6. https://onlinecourses.nptel.ac.in/noc18-cs10/preview.

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18EG C01

ENGLISH

(Common to all branches)

Instruction	2Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation:	20 Marks
Credits	2

Course Objectives:

1. To enable the students to understand the role and importance of communication and to develop their basic communication skills in English.
2. To equip the students with basics of writing correct sentences to coherent paragraphs.
3. To equip the students with techniques of writing a précis and an essay by using accurate grammar and appropriate vocabulary.
4. To train the students to describe, define and classify processes and to draft formal reports by adhering to the proper structure.
5. To develop the reading skills and reading comprehension techniques of the students.
6. To develop the students reading, writing, grammatical, lexical and communicative competence.

Course Outcomes:

1. The students will understand the nature, process and types of communication and will communicate effectively without barriers.
2. The students will write correct sentences and coherent paragraphs.
3. The students will know how to condense passages by writing précis and write essays by using accurate grammar and appropriate vocabulary.
4. The students will demonstrate advanced writing skills by drafting formal reports.
5. The students will apply their reading techniques and analyze reading comprehension passages.
6. The students will become effective communicators and will display their advanced skills of reading and writing and use correct grammar and appropriate vocabulary in all contexts.

UNIT-IUnderstanding Communication in English:
Introduction, nature and importance of communication.Process of communication. Basic types of communication - verbal and non-verbal. Barriers to communication. Intrapersonal and interpersonal communication.Johari Window.
Vocabulary &Grammar: The concept of Word Formation. Importance of proper punctuation.Articles.

UNIT-II Developing Writing Skills I:

Types of sentences.Use of phrases and clauses in sentences.Cohesion and coherence. Paragraph writing.Organizing principles of paragraphs in documents.

Vocabulary & Grammar: Cohesive devices. Root words from foreign languages and their use in English. Prepositions.

UNIT-III Developing Writing Skills II:

Techniques for writing precisely. Précis Writing. Essay Writing.

Vocabulary and Grammar: Subject-verb agreement, Noun-pronoun agreement Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives.Redundancies, Clichés.

UNIT-IVDeveloping Writing Skills III:

Describing, Defining, Classifying, Providing examples or evidence.Writing introduction and conclusion.

Report writing – Importance, structure and elements of style of formal reports.

Vocabulary and Grammar: Misplaced modifiers. Synonyms, antonyms.

UNIT-VDeveloping Reading Skills:

The reading process, purpose, different kinds of texts.Reading comprehension. Techniques of comprehension – skimming, scanning, drawing inferences and conclusions.

Vocabulary and Grammar : Words often Confused. Standard abbreviations

Text Books:

1. Language and Life: A Skills Approach, Board of Editors, Orient Black Swan, 2017.
2. Swan Michael,Practical English Usage. OUP. 1995.

Suggested Readings:

1. Wood F.T,Remedial English Grammar, Macmillan, 2007.
2. Zinsser William,On Writing Well, Harper Resource Book, 2001.
3. Sanjay Kumar and PushpLata,Communication Skills.Oxford University Press, 2011.

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18PY C08

PHYSICS LABORATORY
(for Chemicaland Bio-Tech)

Instruction:	3 Hours per Week
Duration of Semester End Examination:	3 Hours
Semester End Examination:	50 Marks
Continuous Internal Evaluation:	25 Marks
Credits:	1.5

Course Objectives:

The objectives of the course is to make the student

1. Apply theoretical physics knowledge in doing experiments
2. Understand the behavior of the light experimentally
3. Analyze the behavior of magnetic and dielectric materials

Course Outcomes:

At the end of the course, the student will be able to

1. Understand the concept of errors and find the ways to minimize the errors.
2. Demonstrate interference and diffraction phenomena experimentally.
3. Understand the applications of magnetic and dielectric materials.
4. Know the working of lasers and optical fibres.
5. Distinguish between polarized and unpolarized light.

Experiments

1. Polarimeter – Determination of specific rotation of glucose.
2. Malus's law – Verification of Malus's law.
3. Double refraction – Determination of refractive indices of O-ray and E-ray of given calcite crystal.
4. Single slit diffraction – Determination of wavelength of given monochromatic source.
5. Diffraction Grating – Determination of wavelengths of two yellow lines of mercury light.
6. Double slit diffraction.
7. Fibre optics – Determination of NA and power losses of given optical fibre.
8. Newton's rings – Determination of wavelength of given monochromatic source.
9. Laser – Determination of wavelength of given semiconductor red laser.
10. Dielectric constant – Determination of dielectric constant of given PZT sample.
11. B-H curve – Determination of hysteresis loss of given specimen.
12. Planck's constant – Determination of Planck's Constant using photo cell
13. M & H values.

14. Error analysis – Estimation of errors in the determination of time period of a torsional pendulum.

SUGGESTED READING:

1. Engineering Physics Manual by Department of Physics, CBIT, 2016.
2. S.K. Gupta, Engineering Physics Practical, Krishna's Educational Publishers, 2014.
3. O.P. Singh, V. Kumar and R.P. Singh, Engineering Physics Practical Manual, Ram Prasad & Sons Publications, 2009.
4. Indu Prakash, Ram Krishna and A.K. Jha, A Text Book of Practical Physics, Kitab Mahal Publications, 2012.

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18CS C02

Programming for Problem Solving
(Programming Lab – I)
(Common to All Programs)

Instruction	4 Periods per week
Duration of Semester-End Examination	3 Hours
Semester-End Examination	50 Marks
Sessional	25 Marks
Credits	2

Course Objectives

1. Setting up programming environment
2. Develop Programming skills to solve problems.
3. Use of appropriate C programming constructs to implement algorithms.
4. Identification and rectification of coding errors in program.
5. Develop applications in a modular fashion.
6. Manage data using files.

Course Outcomes:

At the end of the course students will be able to:

1. Identify and setup program development environment.
2. Implement the algorithms using C programming language constructs.
3. Identify and rectify the syntax errors and debug program for semantic errors.
4. Analyze the results to evaluate the solutionsof the problems.
5. Solve problems in amodular approach using functions.
6. Implement file operations with simple text data.

Lab experiments

1. Familiarization with programming environment.
2. Simple computational problems using arithmetic expressions.
3. Problems involving if-then-else structures.
4. Iterative problems e.g., sum of series.
5. 1D Array manipulation.
6. 2D arrays and strings.
7. Matrix problems, String operations.
8. Simple functions.
9. Recursive functions.
10. Pointers and structures.
11. Dynamic memory allocation and error handling.
12. File handling:

Design the experiments in such a way that the students will be able to end up the solution for a real world problem that uses most of the concepts of C programming language. For example: A banking application where it uses the concepts of operators, control structures, switch case for menu, structures, functions, error handling, files etc.

Suggested Reading:

1. Pradeep Dey and Manas Ghosh, "**Programming in C"**, Oxford Press, 2nd Edition, 2017
2. ReemaTharaja "**Introduction to C Programming**", Second Edition, OXFORD Press,2015

References:

1. https://www.tutorialspoint.com/cprogramming/index.htm
2. https://www.w3resource.com/c-programming/programming-in-c.php
3. https://www.w3schools.in/c-tutorial/

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18ME C02

WORKSHOP/ MANUFACTURING PRACTICE

Instruction	1T+4P Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation:	25 Marks
Credits	3

Course Objectives:

1. Give a feel of Engineering Practices & develop holistic understanding of various Engineering materials and Manufacturing processes.
2. Develop skills of manufacturing, safety, precision, quality, intelligent effort, optimization, positive & team work attitude to get things right the first time.
3. To provide basic knowledge of Steel, Plastic, Composite and other materials for suitable applications.
4. Study of Principle and hands on practice on techniques of fabrication, welding, casting, manufacturing, metrology, and allied skills.
5. To advance important hard & pertinent soft skills, productivity, create skilled manpower which is cognizant of industrial workshop components and processes and can communicate their work in a technical, clear and effective way.
6. Engineering Skill development with regard to making components, system integration and assembly to form a useful device.

Course Outcomes – (Laboratory): Student will be able to

1. Fabricate components with their own hands.
2. Get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.
3. Assembling different components, student will be able to produce small mechanisms/devices of their interest.
4. Gain practical skills of carpentry, tinsmithy, fitting, house wiring
5. Gain knowledge of different Engineering Materials and Manufacturing Methods.
6. Understand trades and techniques used in Workshop and chooses the best material/ manufacturing process for the application.

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18EG C02

ENGLISH LAB

(Common to all branches)

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	35 Marks
Continuous Internal Evaluation:	15 Marks
Credits	1

Course Objectives:

1. To introduce students to phonetics and the different sounds in English.
2. To familiarize the students with the software and give them sufficient practice in correct pronunciation.
3. To enable students to speak English correctly with focus on stress and intonation.
4. The students will enhance their listening skills by practicing IELTS and TOEFL material
5. To help students overcome their inhibitions while speaking in English and to build their confidence. The focus shall be on fluency rather than accuracy.
6. To help students to understand team work, role behavior and to develop their ability to discuss in groups and make oral presentations.

Course Outcomes:

1. The students will differentiate the speech sounds in English.
2. The students will interact with the software and understand the nuances of pronunciation in English.
3. The students will speak with the proper tone, intonation and rhythm and apply stress correctly.
4. The students will demonstrate their listening skills by analyzing the IELTS and TOEFL listening comprehension texts.
5. The students will speak with clarity and confidence.
6. The students will work in teams and discuss various topics and demonstrate their presentation skills through posters.

Exercises

1. **Introduction to English Phonetics**: Introduction to auditory, acoustic and articulatory phonetics, organs of speech: the respiratory, articulatory and phonatory systems.
2. **Sound system of English**: Phonetic sounds and phonemic sounds, introduction to international phonetic alphabet, classification and description of English phonemic sounds, minimal pairs . The syllable: types of syllables, consonant clusters.

3. **Word stress**: Primary stress, secondary stress, functional stress, rules of word stress.
4. **Rhythm &Intonation** : Introduction to Rhythm and Intonation. Major patterns, intonation of English with the semantic implications.
5. **Listening skills** – practice with IELTS and TOEFL material
6. **Situational dialogues and role play –** Dialogue writing, **–** Role behavior and role enactment.
7. **Group Discussions -** Dynamics of a group discussion, group discussion techniques, body language.
8. **Public speaking –** Speaking with confidence and clarity in different contexts on various issues.
9. **Poster presentation –** Theme, poster preparation, team work and presentation.

Suggested Reading

1. T Balasubramanian. A Textbook of English Phonetics for Indian Students, Macmillan, 2008.
2. J Sethi et al. A Practical Course in English Pronunciation (with CD), Prentice Hall India, 2005.
3. PriyadarshiPatnaik. Group Discussions and Interviews, Cambridge University Press Pvt Ltd 2011.
4. ArunaKoneru, Professional Speaking Skills, Oxford University Press, 2016.

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18MT CO3

MATHEMATICS– II

(Common to all branches and except for Bio-Tech)

Instruction	3 L+1T Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation:	30 Marks
Credits	4

Course Objectives

1. To evaluate double and triple integrals of various functions and their significance.
2. To evaluate vector line, surface and volume integrals.
3. To know the relevant method to solve higher order differential equations.
4. To evaluate complex integration.
5. To evaluate real and definite integrals.
6. To know the methods to solve real life problems.

Course Outcomes: On the successful completion of this course student shall be able to

1. Find the areas, volumes and surface of solids revolution.
2. Use Greens, Gauss and Stoke's theorems to find the surface and volume integrals.
3. Able to solve solutions of differential equations with initial and boundary value problems.
4. Solve the problems on analytic functions, Cauchy's theorem and Cauchy's integral formula.
5. Real and complex integrals by using Cauchy's theorems.
6. Solve physical and engineering problems.

UNIT-I: Multivariable Calculus (Integration):

Applications of definite integrals to evaluate surface areas and volumes of revolutions. Double integrals, Change of order of integration, Triple integrals, Change of variables in integrals, Applications: areas and volumes, Centre of mass and Gravity (constant and variable densities).

UNIT-II: Vector Integral Calculus:

Line, Surface and Volume integrals, Green's theorem in a plane, Gauss's divergence theorem and Stoke's theorem (without proof).

First Order Ordinary Differential Equations: Exact first order differential equations, Integrating factors, Linear first order equations, Bernoulli's, Riccati's and Clairaut's differential equations, Orthogonal trajectories of a given family of curves.

UNIT-III: Ordinary differential equations of higher orders:
Solutions of higher order linear equations with constants coefficients, Method of variation of parameters, solution of Euler-Cauchy equation. Ordinary point, singular point and regular singular point, Power Series solution. Legendre Polynomial of first kind (without proof), Rodrigues formula, Generating function, recurrence relations, orthogonality of Legendre polynomials, Bessel's function of first kind (without proof), recurrence relations and problems.

UNIT-IV:Complex Variables –I :
Differentiation, analytic functions, Cauchy-Riemann equations, harmonic functions, finding harmonic conjugate, elementary analytic functions (exponential, trigonometric, logarithm) and their properties; Conformal mappings, Mobius transformations and their properties. Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof),

UNIT-V: Complex Variables – II:
Liouville's theorem and Maximum-Modulus theorem (without proof); Taylor's series, Laurent's series, zeros of analytic functions, singularities, Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine. Improper real integrals with singular points on the upper half plane.

Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

Suggested Reading:

1. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
2. R.K. Jain, S.R.K. Iyengar, Advanced engineering mathematics Narosa Publications,5th edition,2016.
3. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.

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18CY C01

CHEMISTRY

(Common to all branches)

Instruction:	3L+1T Hours per Week
Duration of Semester End Examination:	3 Hours
Semester End Examination:	70 Marks
Continuous Internal Evaluation:	30 Marks
Credits:	4

Course Objectives

1. The aim of framing the syllabus is to impart intensive and extensive knowledge of the subject so that students can understand the role of chemistry in the field of engineering.
2. This syllabus helps at providing the necessary introduction of the inorganic chemistry principles and concepts of chemical bonding involved in a comprehensive manner understandable to the students aspiring to become practicing engineers.
3. Thermodynamic and Electrochemistry units give conceptual knowledge about spontaneous processes and how can they be harnessed for producing electrical energy and efficiency of systems.
4. To teach students the value of chemistry and to improve the research opportunities knowledge of stereochemistry and organic reactions is essential.
5. New materials lead to discovering of technologies in strategic areas like defense and space research for which an insight into nano and composite materials of modern chemistry is essential.

Course Outcomes

The concepts developed in this course will aid in quantification of several concepts in chemistry that have been introduced at the 10+2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications. Quantum theory is more than 100 years old and to understand phenomena at nanometer levels; one has to base the description of all chemical processes at molecular levels. The course will enable the student to:

1. Analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
2. Rationalize bulk properties and processes using thermodynamic considerations & Ionic Equilibria.
3. List major chemical reactions that are used in the synthesis of molecules.
4. Apply the various methods used in treatment of water for domestic and industrial use.
5. Discuss the various Engineering materials & Drug synthesis & their applications.

UNIT-I Atomic and molecular structure:
Molecular Orbital theory - atomic and molecular orbitals. Linear combination of atomic orbitals (LCAO) method. Molecular orbitals of diatomic molecules. Energy level diagrams of diatomics (H_2, He_2^+,N_2, O_2, O_2^- , CO, NO). Pi- molecular orbitals of butadiene , benzene and their aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties.

UNIT-II Use of free energy in chemical equilibria and Ionic Equilibria:
Use of free energy in chemical equilibria : Thermodynamic functions: Internal energy, entropy and free energy. Significance of entropy and free energy (criteria of spontaneity). Free energy and emf (Gibbs Helmholtz equations and its applications). Cell potentials –electrochemical series.Nernst equation and its applications. Potentiometric Acid base & Redox Titrations. Numericals.
Ionic Equilibria: Solubility product, Determination of solubility product, Applications of solubility product- Determination of solubilities of sparingly soluble salts; Predicting precipitation reactions; Precipitation of an insoluble salt; Precipitation of soluble salts ; Inorganic analysis. Numericals.

UNIT- III Stereochemistry and Organic reactions
Stereochemistry: Representations of 3 dimensional structures , Symmetry and chirality, Stereoisomers - Configurational isomers (Geometrical&Optical isomers), Conformational isomers - Newman and sawhorse representations of n-butane, enantiomers (lactic acid), diastereomers (Tartaric acid) , optical activity, absolute configurations , Sequence rules for R&S notation.
Organic reactions
Types of Organic reactions:
Substitution Reactions- Electrophilic substitution (Nitration of Benzene) ; Nucleophilic Substitution(S_N1& S_N2) ; Free Radical Substitution(Halogenation of Alkanes).
Addition Reactions:
Electrophilic Addition – Markonikoff's rule.
Nucleophilic Addition – (Addition of HCN to carbonyl compounds).
Free radical Addition - Anti Markonikoff's rule (Peroxide effect).
Eliminations-E_1 and E_2 (dehydrohalogenation of alkyl halides).
Oxidation with $KMno_4$, K_2 Cr_2O_7; **Reduction** with $LiAlH_4$, $NaBH_4$
Cyclization (Diels - Alder reaction)

UNIT–IV Water Chemistry:
Hardness of water – Types, units of hardness, Disadvantages of hard water , Boiler troubles - scales & sludge formation , causes and effects , Softening of water by ion exchange method and Reverse Osmosis. Specifications of potable water & industrial water. Disinfection of water by Chlorination, Ozonisation & UV radiation.

UNIT-V Engineering Materials and Drugs:

Nano materials-Introduction to nano materials and general applications, basic chemical methods of preparation- Sol gel method. Carbon nanotubes and their applications.

Composite materials- Definition, types of composites, fibre reinforced, glass fibre reinforced and carbon fibre reinforced composites and applications.

Conducting polymers- Definition, classification and applications.

Drugs-Introduction, Synthesis and uses of Aspirin (analgesic), Paracetamol (Antipyretic), Atenolol (antihypertensive).

TEXT BOOKS

1. P.C. Jain and M. Jain, "Engineering Chemistry", Dhanpat Rai Publishing Company Ltd., New Delhi,16th edition (2015).
2. W.U. Mali, G.D.Tuli and R.D.Madan, "Selected topics in Inorganic Chemistry", S Chand & Company Ltd, New Delhi,reprint (2009).
3. R.T. Morrison, R.N. Boyd and S.K. Bhattacharjee, "Organic Chemistry", Pearson, Delhi, 7th edition(2011).
4. G.L. David Krupadanam, D. Vijaya Prasad, K. Varaprasad Rao, K.L.N. Reddy and C. Sudhakar, "Drugs", Universities Press (India) Limited, Hyderabad (2007).

SUGGESTED READINGS

1. B. H. Mahan, "University Chemistry", Narosa Publishing house, New Delhi, 3rd edition (2013).
2. B.R. Puri, L.R. Sharma and M.S. Pathania, "Principles of Physical Chemistry", S. Nagin Chand & CompanyLtd.,46th edition(2013).
3. T.W. Graham Solomons, C.B. Fryhle and S.A. Snyder, "Organic Chemistry", Wiley,12th edition (2017).
4. P.W. Atkins, J.D. Paula, "Physical Chemistry", Oxford, 8th edition (2006).

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18CE C01

ENGINEERING MECHANICS

Instruction:	3L+1T Hours per Week
Duration of Semester End Examination:	3 Hours
Semester End Examination:	70 Marks
Continuous Internal Evaluation:	30 Marks
Credits:	4

Course Objectives:

1. The objective of this course is to understand the resolution of forces and to obtain resultant of all force systems, to understand moment of a force and equilibrium conditions of static loads for smooth and frictional surface.
2. To obtain centroid, centre of gravity and moment of inertia for various regular and composite areas and bodies.
3. To understand the basic structural analysis, principles of virtual work and energy methods.
4. To know the basic concepts of dynamics and analysis as a particle and rigid bodies.
5. To understand the work energy principles, impulse momentum and their applications and to know the concept of simple harmonic motion and free vibration.

Course Outcomes: The students will be able to

1. Solve problems dealing with forces in plane and space force systems, draw free body diagrams to analyze various problems in equilibrium, for smooth and frictional surface.
2. Determine centroid and moment of inertia for elementary, composite areas and bodies.
3. Analyze simple trusses for forces in various members of a truss.
4. Solve problem in kinematics and kinetics of particles and rigid bodies.
5. Analyze body motion using work energy principles, impulse and momentum approach and able to apply the concepts of simple harmonic motion and free vibrations in dynamics.

Unit–I: Resolution, Resultant and Equilibrium of force system and Friction:
Concepts of force, System of forces, components of forces in a plane and in space systems. Resultant of force systems. Moment of forces and its applications.Couples and its applications.Equilibrium of Force systems. Free body diagrams, equation of equilibrium of coplanar and spatial force systems. Static indeterminacy. Types of friction, Laws of friction, application of friction to a single body & connecting systems, wedge friction.

Unit–II: Centroid ,centre of gravity and moment of Inertia:
Centroid of simple figures from first principle, centroid of composite sections. Centre of gravity and its implications, Definition of Area moment of Inertia, Moment of inertia of plane section from first principles, Theorems of moment of inertia, moment of inertia of standard sections and composite sections, Mass moment of inertia of rectangular and circular plates, cylinder, cone & sphere.

Unit–III: Analysis of simple trusses, Virtual work and Energy methods:
Analysis of simple trusses using method of joints, methods of sections. Determine if a member is in tension or compression, zero force members. Virtual displacements, Principle of virtual work for particle and ideal system of rigid bodies, degrees of freedom.Conservative forces and potential energy, energy equation for equilibrium.

Unit–IV: Particle Dynamics:
Rectilinear and curvilinear translation using rectangular, normal and tangential components.Relative and constrained motion. Newton's 2nd Law, rectangular and path coordinates. Basic terms, general principles in dynamics, D'Alembert's principle and its application in plane motion and connected bodies.Instantaneous centre of rotation in plane motion and simple problems.

Unit–V: Work- Energy, Impulse-momentum and Mechanical Vibrations:
Equation of work energy for translation and fixed axis rotation, work energy principles applied to particle motion, connected systems. Introduction to linear impulse momentum, principle of conservation of linear momentum, Impact, direct and oblique. Introduction to vibration, free and forced vibrations, simple harmonic motion, simple pendulum and compound pendulum.

Text Books:

1. Reddy Vijaykumar K. and J. Suresh Kumar," Singer's Engineering Mechanics Statics and Dynamics", B. S. Publications 2011.
2. A. Nelson, "Engineering Mechanics", Tata McGraw Hill, New Delhi, 2010.

Suggested Reading:

1. Irving H. Shames, "Engineering Mechanics", 4th Edition, Prentice Hall, 2006.
2. F. P. Beer and E. R .Johnson, "Vector Mechanics for engineers, Vol. I - Statics, Vol. II - Dynamics",
9th edition, Tata McGraw Hill, 2011.
3. R.C. Hibbeler, "Engineering Mechanics: Principles of Statics and Dynamics", Pearson Press, 2006.

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18ME C01

ENGINEERING GRAPHICS AND DESIGN

Instruction	1T+4D Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. to prepare to design a system, component, or process to meet desired needs within realistic constraints.
2. to prepare the student to communicate effectively.
3. to prepare the student to use the techniques, skills, and modern engineering tools necessary for engineering practice.
4. to get exposure to a CAD package.

Course Outcomes:

1. Introduction to engineering design and its place in society.
2. Exposure to the visual aspects of engineering design.
3. To become familiar with engineering graphics standards.
4. Exposure to solid modelling.
5. Exposure to computer-aided geometric design.
6. Exposure to creating working drawings.
7. Exposure to engineering communication.

Detailed contents

Traditional Engineering Graphics:

Principles of Engineering Graphics; Orthographic Projection; Descriptive Geometry; Drawing Principles;

Isometric Projection; Surface Development; Perspective; Reading a Drawing; Sectional Views;

Dimensioning & Tolerances; True Length, Angle; intersection, Shortest Distance.

Computer Graphics:

Engineering Graphics Software; -Spatial Transformations; Orthographic Projections; Model Viewing; Coordinate Systems; Multi-view Projection; Exploded Assembly; Model Viewing; Animation; Spatial Manipulation; Surface Modeling; Solid Modeling; Introduction to Building Information Modeling (BIM)

(Except the basic essential concepts, most of the teaching part can happen concurrently in the laboratory).

UNIT-1 Introduction to Engineering Drawing:

Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic.

sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involute;

UNIT-2 Orthographic Projections:

Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes (without traces) ; Projections of planes inclined Planes;

Introduction to CAD package:

Listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids.

UNIT-3 Projections of Regular Solids:

Projection of Prism, Cylinder, Pyramid and Cone : Simple position, axis inclined to one of the reference plane only. Customization & CAD Drawing: consisting of set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerancing; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles;

UNIT-4 Sections and Sectional Views of Right Angular Solids:

Sections of solids in simple position Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids.

Annotations, layering & other functions:

applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation, Computer-aided design (CAD) software modeling of parts and assemblies. Parametric and non-parametric solid, surface, and wireframe models. Part editing and twodimensional documentation of models. Planar projection theory, including sketching of perspective, isometric, multi view, auxiliary, and section views. Spatial visualization exercises. Dimensioning guidelines, tolerancing techniques; dimensioning and scale multi views of dwelling;

UNIT-5 Isometric Projections:
Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Viceversa, Conventions;
Demonstration of a simple team design project:
Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; geometric dimensioning and tolerancing; Use of solid-modeling software for creating associative models at the component and assembly levels; (Examples of specific components to the branch of study may be included).

Text Books:

1. N.D.Bhatt, Elementary Engineering Drawing, Charotar Publishers, 2012.
2. K.L.Narayana and P.K.Kannaiah, Text Book of Engineering Drawing Scitech Publications, 2011.
3. Basanth Agrawal and C M Agrawal – Engineering Drawing 2e –, McGraw-Hill Education(India) Pvt.Ltd.

Suggested Reading:

1. Shaw M.B and Rana B.C., –Engineering drawing Pearson, 2ndedition, 2009.
2. K.Veenugopal, –Engineering Drawing and Graphics + Autocad New Age International Pvt.Ltd, 2011.
3. Bhattacharya. B, –Engineering Graphics I. K. International Pvt.Ltd, 2009.

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18EE C01

BASIC ELECTRICAL ENGINEERING

Instruction:	3L+1T Hours per Week
Duration of Semester End Examination:	3 Hours
Semester End Examination:	70 Marks
Continuous Internal Evaluation:	30 Marks
Credits:	4

Course Objectives:

1. To understand the behavior of different circuit elements R,L & C, and the basic concepts of electrical circuit analysis.
2. To know the concepts of AC circuits, RMS value, Average value, Phasor analysis etc.,
3. To understand the basic principle of operation of Transformer and DC machines.
4. To understand the basic principle of operation of DC machines and AC machines.
5. To know about different types of electrical wires and cables, domestic and industrial wiring.
6. To understand safety rules and methods of earthing.

Course Outcomes: At the end of the course, the student will be able to

1. Acquire the concepts of Kirchhoff's laws and network theorems and able to get the solution of simple dc circuits.
2. Obtain the steady state response of RLC circuits and also determine the different powers in AC circuits.
3. Acquire the concepts of principle of operation of Transformers and DC machines.
4. Acquire the concepts of principle of operation of DC machines and AC machines.
5. Acquire the knowledge of electrical wiring and cables and electrical safety precautions.
6. Recognize importance of earthing and methods of earthing and electrical installations.

UNIT-I: DC Circuits

Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation, Superposition, Thevenin and Norton Theorems, Time-domain analysis of firstorder RL and RC circuits.

UNIT-II: AC Circuits

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor, Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel). Three phase balanced circuits, voltage and current relations in star and delta connections.

UNIT-III: Transformers

Construction, Working principle, EMF Equation, Ideal and Practical transformer, Equivalent circuit of Transformer, OC and SC tests on a transformer, Efficiency and Regulation, Auto transformer.

UNIT-IV: DC and AC Machines

DC Generators: Construction, Principle of operation, EMF equation, Classification, Characteristics of shunt, series and compound generators. DC Motors: Classification, Torque equation, Characteristics, Efficiency, Speed Control of Series and Shunt Motors. Three - Phase Induction Motors: Construction, Principle of operation, Torque equation, torque-slip characteristics, Power stages, speed control of induction motors.

UNIT-V: Electrical Installations

Electrical Wiring: Types of wires and cables, Electrical Safety precautions in handling electrical appliances, electric shock, first aid for electric shock, safety rules. Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Earthing, Elementary calculations for energy consumption.

Text books:

1. L. S. Bobrow, Fundamentals of Electrical Engineering, Oxford University Press, 2011.
2. E. Hughes, Electrical and Electronics Technology, Pearson, 2010.

Suggested Reading:

1. D. P. Kothari & I. J. Nagrath,–Basic Electrical Engineering Tata McGraw Hill, 2010.
2. V. D. Toro, –Electrical Engineering Fundamentals Prentice Hall India, 1989
3. D.C. Kulshreshtha, –Basic Electrical Engineering McGraw Hill,2009
4. P.V.Prasad, S.sivanagaraju, R.Prasad, –Basic Electrical and Electronics Engineering Cengage Learning,1st Edition, 2013.

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18EE C02

BASIC ELECTRICAL ENGINEERING LAB

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	35 Marks
Continuous Internal Evaluation:	15 Marks
Credits	1

Course Objectives:

1. To acquire the knowledge of different types of electrical elements.
2. To verify the basic electrical circuit laws and theorems.
3. To determine the parameters and power factor of a coil.
4. To calculate the time and frequency responses of RLC circuits.
5. To determine the characteristics of Transformers.
6. To determine the characteristics of dc and ac machines.

Course Outcomes: At the end of the course, the students are expected to

1. Get an exposure to common electrical components and their ratings.
2. Make electrical connections by wires of appropriate ratings.
3. Understand the circuit analysis techniques.
4. Determine the parameters of the given coil.
5. Understand the basic characteristics of transformer.
6. Understand the basic characteristics of dc and ac machines.

List of Laboratory Experiments/Demonstrations:

1. Demonstration of Measuring Instruments and Electrical Lab components.
2. Verification of KCL and KVL.
3. Time response of RL and RC circuits.
4. Calculation of permittivity of a choke or coil by Wattmeter Method.
5. Verification of Thevenin's and Norton's theorems.
6. Turns ratio /voltage ratio verification of 1-Ph Transformers.
7. OC and SC tests on a given 1-Ph Transformer.
8. Observation of Excitation Phenomenon in Transformer.
9. Measurement of 3-Ph power in a balanced system (By 2- Wattmeter method).
10. Measurement of 3-Ph Energy by an Energy Meter (Demonstration of Principle).
11. Load test of DC Shunt motor.
12. Speed control of DC Shunt motor.
13. Load test of 3-Ph Induction motor.
14. Demonstration of LT Switchgear Equipment/Components.
15. Demonstration of cut - out section of Machines like DC Machine, Induction Machine etc.

Note: at least **TEN** experiments should be conducted in the semester

18CY C02

CHEMISTRY LAB

(Common to all branches)

Instruction:	3 Hours per Week
Duration of Semester End Examination:	3 Hours
Semester End Examination:	50 Marks
Continuous Internal Evaluation:	25 Marks
Credits:	1.5

Course Objectives

1. To impart fundamental knowledge in handling the equipment / glassware and chemicals in chemistry laboratory.
2. The student should be conversant with the principles of volumetric analysis and identification of organic functional groups.
3. To apply various instrumental methods to analyze the chemical compounds and to improve understanding of theoretical concepts.

Course Outcomes

The chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and engineering.

Thestudents will learn to:

1. Estimate rate constants of reactions from concentration of reactants/ products as a function of time
2. Measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water, etc
3. Synthesize a small drug molecule and Identify the organic compounds.
4. understand importance of analytical instrumentation for different chemical analysis.
5. Perform interdisciplinary research such that the findings benefit the common man.

Chemistry Lab

1. Estimation of temporary and permanent hardness of water using EDTA solution
2. Estimation of amount of chloride in water.
3. Determination of rate constant for the reaction of hydrolysis of methyl acetate. (first order)
4. Estimation of amount of HCl Conductometerically using NaOH solution.
5. Estimation of (a) amount of CH_3 COOH Conductometerically using NaOH solution. (b) amount of HCl and CH_3 COOH present in the given mixture of acids Conductometerically using NaOH solution.
6. Estimation of amount of HCl Potentiometrically using NaOH solution.
7. Estimation of amount of Fe^{+2} Potentiometrically using $KMnO_4$ solution.

8. Distribution of acetic acid between n-butanol and water.
9. Synthesis of drug - Aspirin.
10. Organic Chemistry- Identification of Functional groups - neutral group (carbonyl groups-acetaldehyde and acetone); acidic group (benzoic acid); basic group (aniline)
11. Determination of surface tension of organic solvents (ethanol, ethyl acetate)
12. Determination of Viscosity.

TEXT BOOKS

1. J. Mendham and Thomas ,"Vogel' s text book of quantitative chemical analysis",Pearson education Pvt.Ltd. New Delhi ,6th ed. 2002.

SUGGESTED READINGS

1. Dr. Subdharani , "Laboratory Manual on Engineering Chemistry", DhanpatRai Publishing, 2012.
2. S.S. Dara , "A Textbook on experiment and calculation in engineering chemistry", S.Chand and comnpany, 9th revised edition, 2015.

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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)
Model Curriculum (with effect from 2019-20)
B. TECH (Chemical Engineering)

SEMESTER–III

S.No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1	18MT C 05	Mathematics-III	3	1	-	3	30	70	4
2	18CH C 01	Technology of Surface Coatings and Oils	3	1	-	3	30	70	4
3	18CH C 02	Chemical Engineering Thermodynamics-I	3	1	-	3	30	70	4
4	18CH C 03	Numerical methods in Chemical Engineering	3	1	-	3	30	70	4
5	18CH C 04	Material and Energy Balance computations	3	1	-	3	30	70	4
6	18EG M 01	Indian constitution	2	-	-	2	-	50	Non credit
7	18EE M 01	Indian traditional knowledge	2	-	-	2	-	50	Non credit
PRACTICALS									
8	18CH C 05	Numerical methods in Chemical Engineering Lab	-	-	2	2	15	35	1
9	18CH C 06	Technology of Surface Coatings and Oils Lab	-	-	2	2	15	35	1
Total			19	05	4	-	180	520	22

L: Lecture T: Tutorial D: Drawing P: Practical
CIE - Continuous Internal Evaluation SEE - Semester End Examination

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18MT C 05

MATHEMATICS-III

Instruction	3L+1T Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	4

Course Objectives: This course helps the students to understand the

1. To form PDE and to find its solution.
2. To solve wave and heat equations.
3. To learn the Laplace and Inverse Laplace transforms for solving engineering problems.
4. To learn Fourier transform and Z-transforms for solving engineering problems.
5. Learning the basic concepts of probability and Statistical Analysis.

Course Outcomes: At the end of the course, the students will be able to

1. Solve Linear and Non-Linear PDE's.
2. Solve One-Dimension Wave and Heat equations and Two Dimension Laplace equation.
3. Find Laplace transform and inverse Laplace transform and can solve Linear Differential equations.
4. Find the solutions of various Transforms.
5. Find moments of discrete and continuous random variables as well as familiar with distribution.

UNIT-I: Partial Differential Equations
Formation of Partial Differential Equations, Solution of First Order Linear Partial Differential Equations by Lagrange's Method, Solution of First Order Non-linear Partial Differential Equation by Standard types and Charpits Method.

UNIT-II: Applications of Partial Differential Equation
Solution by Method of Separation of Variables, Solution of One dimensional Wave equation, One dimensional Heat equation, Two dimensional Laplace equation and its related problems.

UNIT-III: Laplace Transform
Laplace Transform of standard functions, Linearity property, change of scale property. Shifting theorems, Laplace Transform of Periodic Function, Unit step function and Unit impulse function. Transforms of derivatives, Transforms of

integrals, Multiplication by t^n and division by t. Inverse Laplace Transform properties, Inverse Laplace Transform by partial fractions and Convolution theorem, Applications of Laplace Transform (Solution of Linear Differential Equations).

UNIT-IV: Fourier Transforms and Z-Transforms

Fourier Transforms: Fourier integral theorem (statement), Complex form of Fourier integrals. Fourier transforms, Inverse Fourier Transforms, Fourier Sine and Cosine transforms, Inverse Fourier Sine and Cosine Transforms. Properties of Fourier transforms: Linear property, change of scale property, shifting property and Modulation theorem.

Z-Transforms: Z-transforms of standard functions, linearity property, damping rule, shifting theorems, multiplication by 'n', initial and final value theorems. Inverse Z-Transform: Inverse Z-transform by Convolution theorem, partial fractions. Z-transform application to difference equations.

UNIT-V: Basic Statistics

Random variable, discrete probability distribution and continuous probability distribution. Expectation, Addition theorem and Multiplication theorem of expectation, properties of variance, Poisson distribution (Mean, variance, MGF & CGF), Normal distribution (Mean, variance, MGF & CGF), Properties of Normal distribution, Areas of under normal curve. Correlation and regression.

Text Books:

1. Erwin kreyszig, "Advanced Engineering Mathematics", 9th Edition, John Wiley & Sons, 2006.
2. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 35th Edition, 2000.
3. Sheldon Ross, "A First Course in Probability", 9th Edition, Pearson publications, 2014.

Suggested Readings:

1. S. J. Farlow, "Partial Differential Equations for Scientists and Engineers", Dover Publications, 1993.
2. Ian Snedon, "Elements of Partial Differential equations", McGraw Hill, 1964.
3. S.C.Gupta, V.K.Kappoor, "Fundamentals of Mathematical Statistics", Sultan Chand and Sons, 2014.

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18CH C 01

TECHNOLOGY OF SURFACE COATING AND OILS

Instruction	3L+1T Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	4

Course Objectives: This course helps the students to understand the

1. To give fundamental concepts in paints (including industrial paints and domestic paints)
2. Basic properties, uses of main ingredients like pigments, extenders, binders, solvents.
3. To know more about paint application systems (both air drying paints and stoving paints of liquid paints and power paints).
4. To impart knowledge on special coatings
5. To familiarize about sources, types and composition of oils and fats.

Course Outcomes: At the end of the course, the students will be able to

1. Identify the suitable paints for domestic and Industries.
2. Study more about specific paint manufactures.
3. Know main ingredients of paints, their manufacturers and properties.
4. Analyze the types of special paints and their application
5. Analyze the various properties of fats and oils to determine their use in food, soap and other industries

UNIT-I

Major components of surface coatings. Fundamentals of film formation, Classification of Paints: Air drying paints, stoving paints, their properties and uses. Liquid paints & powder paints, their properties & uses. Pigments: Importance of pigments - their basic properties, uses & their applications. Manufacture of Pigments: Titanium di-oxide, red lead.

UNIT-II

Extenders: Importance, properties & significance. Manufacture of Extenders: Blanc fixe, China clay, Gypsum, Mica & talc. Solvents: Importance, uses & their properties, Manufacture of solvents: Turpentine, Alcohols- Methyl Alcohol, Ethyl Alcohol, n-Propyl Alcohol.

UNIT-III

Manufacture of Paints: Distempers- Manufacture, properties & uses. Powder Paints-Manufacture, properties & uses. Enamel - Manufacture, properties &

uses. Application methods of paints: Air drying paints, industrial liquid stoving paints & industrial stoving powder paints. Brush application, Roller coating, spray application, electrostatic spray application.

UNIT-IV

Special Coatings: Importance, Significance & their applications. Powder Coatings, Water soluble coatings, aluminium coatings, water proof coatings, heat resistant coatings, automobile coatings, fire retardant coatings, space, air craft coatings, swimming pool coatings and Anti Micro growth Paints (Marine Paints).

UNIT-V

Introduction of Oils, Fats & Waxes, essential oils, their sources and composition. Types of Oils, Hydrogenation, Esterification and Interesterification, Saponification, Halogenation.

Text Books:

1. W.M. Morgans, "Outline of Paint Technology", Edward Arnold Publishers, London, 1990
2. R. Lambourne & T A Strivens, "Paint & Surface coatings", Second edition, 1999
3. Ed. D Swern, "Bailey's Industrial Oils and Fats Products", Wiley Inter Science publication, N.Y. John Wiley and Sons ,6th Edition, 2006

Suggested Readings:

1. Patton Temple, "C Pigment Flow & Pigment Dispersion", Wiley Inter science, 1979
2. Swaraj Paul, " Surface Coatings science and technology" , 1995
3. M M Chakrabarty , "Chemistry and Technology of Oils and Fats", Allied Publishers Pvt.Ltd., 1st Edition, 2007
4. O P Narula, "Treatise on fats,Fatty acids and Oleochemicals", Vol I and II, Industrial Consultants (India), 1994

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18CH C 02

CHEMICAL ENGINEERING THERMO DYNAMICS-I

Instruction	3L+1T Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	4

Course Objectives: This course helps the students to understand the

1. Basic thermodynamic laws and principles
2. Concept of energy conservation through the study of the first and second laws of thermodynamics
3. Concept of entropy and its importance in energy conversion
4. Identify, formulate and solve chemical engineering problems involving various types of systems and processes
5. Application of Thermodynamics to flow process

Course Outcomes: At the end of the course, the students will be able to

1. Understand the relation between the measurable nature of P, V, T and the un-measurable nature of H, U, A, G.
2. Use equations of state, correlations and tables for estimation of thermodynamic properties of real gases
3. Understand and analyze processes involving ideal gases, such as isothermal, isobaric, isentropic, cyclic
4. Apply energy balances to open and closed systems and to evaluate the thermodynamic efficiency of nozzles, compressors, turbines
5. Analyze steam power cycles; refrigeration cycles, and liquefaction

UNIT – I The First Law and Other Basic Concepts: Joule's Experiments - Internal Energy - Formulation of the first law of the thermodynamics - the thermodynamic state and state functions - Enthalpy - The steady state flow processes; equilibrium - the phase rule - The Reversible process - Constant V and constant P processes and heat capacity. Volumetric Properties of Pure Fluids: PVT behavior of pure substances, the Ideal gas, virial equations and their use in the calculation of P-V-T Properties; use of Cubic equations of state (Van der Waals and Redlich-Kwong), generalized correlations for gases

UNIT– II Second law of thermodynamics: Statement of the second law, heat engines, thermodynamic temperature scales, thermodynamic temperature and ideal-gas scale, entropy, entropy changes of an ideal gas, mathematical statement of the second law, the third law of thermodynamics, entropy from the microscopic view point.

UNIT – III Thermodynamic properties of fluids; Relationships among thermodynamic properties for a homogenous phase of constant composition; Maxwell relations, Residual properties; Two-phase systems. Thermodynamic diagrams; generalized property correlations for gases

UNIT – IV Conversion of Heat into Work by Power Cycles: Steam power plants; Carnot cycles; Rankine cycle; Otto cycle, Diesel cycle

Refrigeration and Liquefaction: the vapor - compression cycle; comparison of Refrigeration cycles; the choice of refrigerant; absorption refrigeration; the heat pump; various processes for liquefaction.

UNIT – V Thermodynamics of Flow Processes: Energy balances for steady state flow process; Application of thermodynamics to flow processes-pumps, compressors and turbines; calculation of ideal work and lost work for flow processes

Text Books:

1. Introduction to Chemical Engineering Thermodynamics (in SI units) by J M Smith and H C Van Ness and M M Abbott, 7th edition, Mc-Graw Hill International Edition, 2005

Suggested Readings:

1. A Textbook of Chemical Engineering Thermodynamics by K.V. Narayanan, PHI Pvt. Ltd., 2001
2. Chemical Engineering Thermodynamics by Y V C Rao, Universities Press, 1997
3. M J Moran, H N Shapiro, D D Boettner and M B Bailey, Principles of Engg. Thermodynamics, 8th Edition, Willey, 2018.

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18CH C 03

NUMERICAL METHODSIN CHEMICAL ENGINEERING

Instruction	3L+1T Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	4

Course objectives: This course helps the students to understand the

1. Error analysis for various numerical methods
2. Appropriate numerical methods to solve non-linear algebraic and transcendental equations and linear system of equations
3. Appropriate numerical methods to approximate a function
4. Appropriate numerical methods to solve an ordinary differential equation
5. Various techniques to solve Partial differential equations

Course outcomes: At the end of the course, the students will be able to

1. Perform an error analysis for a given numerical method
2. Solve a linear system of equations and non-linear algebraic or transcendental equation using an appropriate numerical method
3. Calculate a definite integral and evaluate a derivative at a value using an appropriate numerical method
4. Solve an Ordinary differential equation using an appropriate numerical method
5. Solve partial differential equations using an appropriate numerical method

UNIT-I

Introduction, Approximation and concept of Error and Error Analysis: Taylor series expansion, Truncation error. Round-off error vs. Chopping-off error. Propagation of Error.

Linear Systems and Equations Matrix representation, Calculation of Eigen Values and Eigen vectors, Solution by Cramer's rule; Iterative Method— Jacobi iteration; Gauss-Seidel Method,

Chemical Engineering Examples: Material and energy balance problems involving at least 3 simultaneous equations

UNIT-II

Non-linear Algebraic Equations (single and multi variable) Bisection, Newton-Raphson and Secant methods, Multivariate Newton's method

Chemical Engineering Examples: Equation of state (van der Waals, Beattie-Bridgeman, etc.), Friction factor equation etc.

UNIT-III

Interpolation and Approximation: Newton's polynomials and Lagrange polynomials, spline

Interpolation, linear regression, polynomial regression, least square regression.

Chemical Engineering Examples: Free settling velocity of particles, Arrhenius Equation, Specific heat w.r.to temperature etc.

Numerical integration: Trapezoidal rule, Simpson's rule, integration with unequal segments, quadrature methods, Chemical engineering problems involving numerical differentiation and integration- Rayleigh's equation, Rate equation

UNIT-IV

Ordinary Differential Equations: Euler method, Runge-Kutta method, Adaptive Runge-Kutta method, Explicit Adams-Bashforth technique, Implicit Adams-Moulton technique, Predictor-Corrector technique.

Initial and boundary value problems: Orthogonal Collocation, shooting techniques

Chemical Engineering Examples: Rate equation, Steady-state material or energy balance equations etc.

UNIT-V

Solution of partial differential equations: Introduction to Partial Differential Equations, Classification of partial differential equations (PDE's), solution of PDEs by Finite difference techniques, implicit and explicit methods, Cranks Nicolson Method.

Chemical Engineering Examples: unsteady-state one dimensional heat conduction/diffusion equations

Text Books:

1. Numerical Methods for Engineers, Gupta S.K.; 3rd Ed; New Age International, 1995.
2. Numerical Methods for Engineers, Chapra S.C. and Canale R.P.; 5th Ed; McGraw Hill, 2006.
3. Numerical Methods, M. K. Jain, S. R. K. Iyengar, and R. K. Jain, 6th New Age International Publishers, New Delhi, 2012.

Suggested Readings:

1. Introductory Methods of Numerical Analysis, S. S. Sastry, 4th Ed, PHI Learning Pvt. Ltd., 2005
2. Introduction to Numerical Methods in Chemical Engineering, Pradeep Ahuja, PHI Learning Pvt. Ltd., 2010

18CH C 04

MATERIAL AND ENERGY BALANCE COMPUTATIONS

Instruction	3L+1T Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	4

Course Objectives: This course will help the students to understand the

1. Basis for all further chemical engineering courses that are part of the curriculum.
2. Basic calculations of process engineering.
3. Material balance calculations for with and without chemical reactions.
4. Analysis methods for identifying vapors and liquids
5. Energy balance calculations and its importance.

Course outcomes: At the completion of this course, students will be able to

1. Develop mastery over process calculations relevant to chemical engineering processes
2. Handle elementary flow-sheeting, material and energy balance calculations without and with chemical reactions,
3. Understand different concepts like recycle, bypass and purge.
4. Familiarize with equations of state and properties of gases and liquids, including phase transition
5. Write the energy balance equations for different unit operations

UNITI

Basic concepts- Introductory concepts of units, physical quantities in chemical engineering, dimensionless groups, "basis" of calculations. Mass and volume relations.

UNITII

Material Balance: Introduction, Solubility, dissolution and crystallization (single solute systems) – Solving material balance problems without chemical reaction. Unit operations like absorption, distillation, evaporation, crystallization, leaching, and extraction, drying and mixing units under steady state conditions.

UNIT–III

Material Balance with Chemical Reaction: Material Balance with chemical reaction, Concept of stoichiometry and mole balances, examples, including combustion-Proximate and ultimate analysis of coal and analysis of flue gas. Material balances for by-pass, recycle and purge Operations.

UNIT – IV

Gases, Vapours and Liquids: Equations of state, Vapour pressure, Clausius-Clapeyron equation, Cox chart, Duhring's plot, Raoult's law. Humidity and Saturation, humid heat, humid volume, dew point, humidity chart and its use.

UNIT – V

Energy balance: Heat capacity, sensible and latent heat – Heat balances in operations involving phase change – Heat balance over heat exchangers, dryers and simple evaporation systems / Heat balances calculation in processes without chemical reaction- Heat of reaction, Heat of formation, Heat of combustion- Heat balance in reactions, Adiabatic reaction, temperature of products-Heating values of fuels.

Text Books

1. Himmelblau, D. M., Riggs, J. B. "Basic Principles and Calculations in Chemical Engineering", Eighth Ed., Pearson India Education Services, 2015.
2. Bhatt, B. I., Vora, S. M., "Stoichiometry", Fourth Edition, Tata McGraw Hill Publishing Company Ltd, 2004.

Suggested Readings:

1. Felder, R. M.; Rousseau, R. W., "Elementary Principles of Chemical Processes", Third Edition, John Wiley & Sons, 2000
2. Hougen, O. A., Watson, K. M., Ragatz, R. A., " Chemical Process Principles, Part-I Material & Energy Balances", Second Edition, CBS Publishers & Distributors, 2004
3. Venkataramani, V., Anantharaman, N., Begum, K. M. Meera Sheriffa, "Process Calculations" , Second Edition, Prentice Hall of India, 2015.
4. Sikdar, D. C., "Chemical Process Calculations", Prentice Hall of India, 2013.

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18EG M 01

INDIAN CONSTITUTION

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	50 Marks

Course Objectives: This course will help the students to understand the

1. The history of Indian Constitution and how it reflects the social, political and economic perspectives of the Indian society.
2. Address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. Have knowledge of the various Organs of Governance and Local Administration.

Course outcomes: At the completion of this course, students will be able to

1. Understand the making of the Indian Constitution and its features.
2. Have an insight into various Organs of Governance - composition and functions.
3. Understand powers and functions of Municipalities, Panchayats and Co-operative Societies.
4. Be aware of the Emergency Provisions in India.
5. Understand the Right To equality, the Right To freedom and the Right To Liberty.

Unit-I

Constitution of India - Introduction and salient features . Constitutional history. Directive Principles of State Policy - Its importance and implementation.

Unit II

Union Government and its Administration - Structure of the Indian Union: Federalism, distribution of legislative and financial powers between the Union and the States.

Parliamentary form of government in India. President: role, power and position.

Unit III

Emergency Provisions in India - National emergency, President rule, Financial emergency

Unit IV

Local Self Government - District's Administration Head: Role and Importance. Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation.

Panchayati Raj: Introduction, Zilla Panchayat, Elected officials and their roles, CEO Zilla Panchayat: Position and role. Block level: Organizational Hierarchy (Different departments). Village level: Role of Elected and officials.

Unit V

Scheme Of The Fundamental Rights & Duties: Fundamental Duties - the legal status.

Scheme Of The Fundamental Rights - To Equality, to certain Freedom Under Article 19, to Life And Personal Liberty Under Article 21.

Suggested Readings:

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar, Framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

Online Resources:

1. http://www.nptel.ac.in/courses/103107084/Script.pdf

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18EE M 01

INDIAN TRADITIONAL KNOWELDGE

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	50 Marks

Course Objectives:

1. To get a knowledge in Indian Culture
2. To Know Indian Languages and Literature and the fine arts in India
3. To explore the Science and Scientists of Medieval and Modern India

Course Outcomes: After completion of this course, students will be able to:

1. Understand philosophy of Indian culture
2. Distinguish the Indian languages and literature
3. Learn the philosophy of ancient, medieval and modern India
4. Acquire the information about the fine arts in India
5. Know the contribution of scientists of different eras.

UNIT-I

Introduction to Culture: Culture, civilization, culture and heritage, general characteristics of culture, importance of culture in human literature, Indian Culture, Ancient India, Medieval India, Modern India

UNIT-II

Indian Languages, Culture and Literature:

Indian Languages and Literature-I: the role of Sanskrit, significance of scriptures to current society, Indian philosophies, other Sanskrit literature, literature of south India.

Indian Languages and Literature-II: Northern Indian languages & literature

UNIT-III

Religion and Philosophy: Religion and Philosophy in ancient India, Religion and Philosophy in Medieval India, Religious Reform Movements in Modern India (selected movements only)

UNIT-IV

Fine arts in India (Art, Technology& Engineering): Indian Painting, Indian handicrafts, Music, divisions of Indian classic music, modern Indian music, Dance and Drama, Indian Architecture (ancient, medieval and modern), Science and Technology in India, development of science in ancient, medieval and modern India

UNIT-V

Education system in India: Education in ancient, medieval and modern India, aims of education, subjects, languages, Science and Scientists of Ancient India, Science and Scientists of Medieval India, Scientists of Modern India

Text Books:

1. Kapil Kapoor, Text and Interpretation: The India Tradition, ISBN: 81246033375, 2005
2. Science in Samskrit, Samskrita Bharti Publisher, ISBN-13: 978-8187276333, 2007
3. S. Narain, Examinations in ancient India, Arya Book Depot, 1993
4. Satya Prakash, Founders of Sciences in Ancient India, Vijay Kumar Publisher, 1989
5. M. Hiriyanna, Essentials of Indian Philosophy, Motilal Banarsidass Publishers, ISBN-13: 978-8120810990, 2014

Suggested Readings:

1. Kapil Kapoor, Language, Linguistics and Literature: The Indian Perspective, ISBN-10: 8171880649, 1994.
2. Karan Singh, A Treasury of Indian Wisdom: An Anthology of Spiritual Learn, ISBN: 978-0143426158, 2016.

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18CH C 05

NUMERICALMETHODSINCHEMICALENGINEERING LAB

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

List of Experiments

1. Introduction to use of computers for numerical calculations (1 practical turn)
2. Solution of linear algebraic equations using Gauss elimination, Gauss-Siedel etc. (2 practical turns)
3. Solution of a non-linear equations using bracketing and Newton-Raphson method (2 practical turns)
4. Interpolation and Approximation(2 practical turns)
5. Numerical integration(2 practical turns)
6. Euler method (1 practical turn)
7. Runge-Kutta methods for ODEs (2 practical turns)
8. Solution of system of ODEs using simple methods (1 practical turn)
9. Solution of simple PDEs (2 practical turns)

Text Books:

1. Numerical Methods for Engineers, Gupta S.K.; New Age International, 1995
2. Numerical Methods for Engineers, Chapra S.C. and Canale R.P.; 5th Ed; McGraw Hill 2006

Suggested Readings:

1. Introductory Methods of Numerical Analysis, S. S. Sastry, 4th Ed, PHI Learning Pvt. Ltd., 2005
2. Introduction to Numerical Methods in Chemical Engineering, Pradeep Ahuja, PHI Learning Pvt. Ltd., 2010

18CH C 06

TECHNOLOGY OF SURFACE COATINGS AND OILS LAB

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

List of Experiments

1. Preparation of panels for painting (power coating or liquid paints)
2. Powder particles size analyser
3. Determination of apparent viscosity of paints (only liquid paints)
4. Determination of resistance to scratching under a specified load
5. of a dried film of paint
6. Measurement of paint film thickness using dry film thickness gauge (finish paint)
7. Determination of flexibility and adhesion of the paints (as per 101 BS 3960 m and size ¼ inch)
8. Determination of impact resistance of the painted panel
9. Measurement of hardness of magnesium phosphate coating or zinc phosphate coating
10. Measurement of gloss of painted film at 45 degree angle
11. Determination of drying consistency of different paints
12. Determination of coverage or spreading capacity of different paints
13. Salt Spray Test (only for Powders)
14. Determination of Acid value of given samples
15. Determination of percentage of free fatty acid present in the given
16. sample and its acid value
17. Determination of Iodine value of given sample
18. Determination of saponification value of given oil samples

Text Books:

1. Industrial Hand Books
   a). Berger Protection Protective Coatings – Product Data Manual
   b). Goodlass Nerolac Paints Product Data Manual
2. ICI Paints Quality Manual Book
3. A text book of oil and fat analysis By Cocks & Reid
4. Modern Technology in Oils and Fats Industry, Vol-II, OTAI (NZ)

SEMESTER–IV

S.No	Course Code	Title of the Course	Schemeof Instruction			Scheme of Examination			Credits
			Hours per week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1	18CSC05	Basics of Data Structures	2	-	-	3	20	50	2
2	18CHC07	Chemical Engineering Thermodynamics-II	3	1	-	3	30	70	4
3	18CHC08	Fluid mechanics	3	1	-	3	30	70	4
4	18CHC09	MaterialScience	3	-	-	3	30	70	3
5	18MEC09	Principlesofmanagement	3	-	-	2	30	70	3
6	18CEM01	Environmentscience	2	-	-	2	-	50	Non credit
PRACTICALS									
7	18EGC03	Softskillslab	-	-	2	2	15	35	1
8	18CSC06	BasicsofDatastructures	-	-	2	2	15	35	1
Total			16	02	04	-	170	450	18

L: Lecture T: Tutorial D: Drawing P: Practical
CIE - Continuous Internal Evaluation SEE - Semester End Examination

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18CS C 05

BASICS OF DATA STRUCTURES

Instruction	2 Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	20 Marks
Credits	2

Course Objectives: This course will help the students to understand the

1. Basic linear and non-linear data structures.
1. Analyzing the performance of operations on data structures.
2. Different sorting and searching techniques and their complexities.

Course outcomes: At the completion of this course, students will be able to

1. Understand the basic concepts of data structures.
2. Understand the notations used to analyze the performance of algorithms.
3. Choose and apply an appropriate data structure for a specified application.
4. Understand the concepts of recursion and its applications in problem solving.
5. Demonstrate a thorough understanding of searching and sorting algorithms.

UNIT-I

Introduction: Data Types, Data structures, Types of Data Structures, Operations, ADTs, Algorithms, Comparison of Algorithms, Complexity, Time- space tradeoff. Recursion: Introduction, format of recursive functions, recursion Vs. Iteration, examples.

UNIT-II

Linked Lists: Introduction, Linked lists and types, Representation of linked list, operations on linked list, Comparison of Linked Lists with Arrays and Dynamic Arrays.

UNIT-III

Stacks and Queues: Introduction to stacks, applications of stacks, implementation and comparison of stack implementations. Introduction to queues, applications of queues and implementations, Priority Queues and applications.

UNIT-IV

Trees: Definitions and Concepts, Operations on Binary Trees, Representation of binary tree, Conversion of General Trees to Binary Trees, Representations of Trees, Tree Traversals, Binary search Tree.

UNIT-V

Graphs:Introduction, Applications of graphs, Graph representations, graph traversals, Minimal Spanning Trees.
Searching and Sorting: Linear searching, binary Searching, sorting algorithms-bubble sort, selection sort, quick sort, heap sort.

Text Books:

1. Narasimhaarumanchi, Data Structures and Algorithms Made Easy, Career Monk Publications, 2017
2. S. Sahni and Susan Anderson-Freed, Fundamentals of Data structures in C,E.Horowitz, Universities Press, 2nd Edition.
3. ReemaThareja, Data Structures using C, Oxford University Press, 2014.

Suggested Readings:

1. D.S.Kushwaha and A.K.Misra, Data structures A Programming Approach with C, PHI, 2011.
2. Seymour Lipschutz, Data Structures with C, Schaums Outlines Series, 1st Ed, 2001.

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18CH C 07

CHEMICALENGINEERINGTHERMODYNAMICS-II

Instruction	3L+1T Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	4

Course Objectives: This course will help the students to understand the

1. Concepts of fugacity, activity coefficient, vapor-liquid equilibrium and reaction equilibrium
2. Concepts of partial molar properties and chemical potential
3. Phase Rule and Various models used to determine the activity coefficients.
4. Generate Vapor- Liquid equilibrium (VLE) in form of T-X-Y or P-X-Y for binary mixtures
5. Concepts of chemical reaction equilibrium

Course outcomes: At the completion of this course, students will be able to

1. Calculate partial molar, residual and excess properties
2. Calculate Fugacity and Fugacity Coefficients for miscible binary Mixtures and also pure species
3. Determine the activity coefficients using various models
4. Generate equilibrium data for VLE
5. Determine equilibrium constant and composition of product mixture at given temperature and pressure

UNIT-I

Criterion of phase equilibrium; Ideal solutions and use of Raoult's Law to generate P-X-Y and t-x-y diagrams for ideal solutions; flash calculations for ideal solutions; non ideal behavior, partial properties; Gibb's – Duhem equation; fugacity and fugacity coefficient for pure components and for species in solution; calculations of fugacity coefficient using generalized correlation; the excess Gibbs energy; Lewis – Randall rule – activity coefficients from vapor-liquid equilibrium (VLE) data

UNIT-II

The nature of Phase equilibrium: the phase rule, Duhem's theorem; description of phase diagrams; low pressure VLE from correlation of data – equations of Margules, van Laar, Wilson, UNIQUAC, UNIFAC; dew-point and bubble – point calculations; flash vaporization calculations; ideal solute behavior based on Henry's law.

UNIT–III

Solution thermodynamics: fundamental residual – property relation and fundamental excess – property relation; evaluation of partial properties and property changes of mixing;

Phase Equilibria: equilibrium and stability; stability requirement for binary vapor-liquid equilibrium; Liquid-Liquid Equilibria; Vapor-Liquid-Liquid Equilibria; Solid-Liquid Equilibria; Solid-Gas Equilibria

UNIT-IV

Applications of equations of state; thermodynamic property calculations for fluid mixtures using the generalized correlation's based on the viral equation of state; properties of fluid mixtures using Redlich-Kwong equation of state and Pitzer's correlation's; VLE and flash calculations using the Redilich –Kwong equation of state

UNIT-V

Chemical reaction equilibrium; reaction co-ordinate; equilibrium criteria for chemical reactions; equilibrium constant and the effect of temperature; temperature and pressure effects on conversion; calculation of equilibrium conversion for single reactions in homogenous and heterogeneous systems; Duhem's theorem for reacting systems; simple examples of multi-reaction equilibrium.

Text Books:

1. Introduction to Chemical Engineering Thermodynamics (in SI units) by J M Smith and H C Van Ness and M M Abbott, 7th Edition, Mc-Graw Hill, 2005

Suggested Readings:

1. S.Sandler, "Chemical, Biochemical and Engineering Thermodynamics" , 4th edition, Wiley, India, 2006.
2. A Textbook of Chemical Engineering Thermodynamics by K.V. Narayanan, PHI Pvt. Ltd., 2001
3. Chemical Engineering Thermodynamics by Y V C Rao, Universities Press, 1997

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18CH C 08

FLUID MECHANICS

Instruction	3L+1T Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	4

Course Objectives: This course will help the students to understand the

1. Fluid flow phenomena for incompressible and compressible fluids.
2. Conservation of momentum principles to fluid flow.
3. Flow in Pipes, Channels and flow past immersed bodies.
4. Concepts of Compressible Fluids and Non Newtonian fluids
5. Fluidization phenomena and methods for transporting the fluids

Course outcomes: At the completion of this course, students will be able to

1. Differentiate different types of fluids.
2. Identify equipments to be used to measure fluid flow based on their properties.
3. Design the piping for flow of fluids under different conditions useful for industry.
4. Calculate the energy losses during the transport of fluids through pipes.
5. Deicide the types of pumps for different fluids under different conditions such as toxic, acidic, slurry type.

UNIT-I

Fluid Flow Phenomena and Fluid Statics: Definition of fluid, shear rate and shear stress, Newtonian and Non-Newtonian fluids, Time dependent flow, viscosity and momentum flux, compressible, incompressible, real and ideal fluids, viscosities of gases and liquids, Laminar and Turbulent flows, Reynolds experiment, Boundary layers, Hydrostatic equilibrium, U-tube manometer, inclined manometer and two fluid manometer and inverted manometer.

UNIT-II

Basic Equations of Fluid Flow: path lines, stream lines and stream tube, mass balance–equation of continuity, one dimensional flow, mass velocity, differential momentum balance- equations of motion, coquette flow, macroscopic momentum balances, momentum of stream and momentum correction factor, layer flow with free surface. Mechanical energy equation-Bernoulli equation- corrections for effects of solid boundaries, kinetic energy correction factor, corrections for fluid friction, pump work in Bernoulli equation.

UNIT-III

Incompressible Flow in Pipes and Channels and Frictional Losses: Shear stresses and skin friction, fanning friction factor, flow in noncircular channels, laminar flow of Newtonian and Non-Newtonian fluids, velocity distribution, Hagen-Poiseuille equation, Turbulent flow, universal velocity distribution, Roughness, Moody’s friction factor chart. Pipes and valves, fittings. Friction losses due to sudden expansion and contraction, Effects of fittings and valves, form frictional losses in the Bernoulli Equation. Dimensional analysis and Buckingham ð - theorem and Rayleigh theorem its applications and limitations.

UNIT–IV

Compressible Fluids and Non Newtonian fluids (with Differential Pressure estimation) Flow past immersed bodies and Fluidization: Motion of particles through fluids – Free settling and hindered settling, Potential flow, vortisity. Differential analysis: mass and momentum balances, Navier-Stokes equation, Unidirectional flow, Viscous flow, Stokes law, Skin drag and pressure drag and drag coefficient, Flow through packed beds of solids – Kozeny- Carman equation, Burke-Plummer equation and Ergun equation. Boundary layer theory, Blasius solution, Boundary layer separation, Drag and lift force on immersed body.

UNIT – V

Transportation and Metering of Fluids: Centrifugal and Positive Displacement Pumps, Characteristics of pumps, selection and design of pumps, suction lift and cavitation, NPSH, Flow meters- Venturi meter, orifice meters, Pitot tube, Rota meters and Notches and Weirs, Compressors and blowers.

Text Books

1. W. L. McCabe, J. C. Smith and P.Harriott , Unit Operations of Chemical Engineering, 7th Ed., Tata-McGraw Hill Chemical Engineering Series, New Delhi, 2005.
2. C.J.Geankopolis, “Transport processes and unit operations”, 3rd Ed., Prentice Hall Publishers, USA, 1993.

Suggested Readings:

1. James O. Wilkes, “Fluid Mechanics for Chemical Engineers with Microfluids and CFD”, 2nd Ed., University of Michigan, Prentice Hall Intl., 2006.
2. Kurmi, R.S., “Hydraulics, Fluid Mechanics and Hydraulic Machines”, 20th Ed., S. Chand and Company Pvt.Ltd., New Delhi, 2014.

18CH C 09

MATERIAL SCIENCE

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course will help the students to understand the

1. Basic introduction to different classes of materials relevant to engineering in general and chemical engineering in particular.
2. Significance of different properties for selecting material under different combinations of process conditions.
3. Concept of Semi crystalline and Bio materials.
4. Concept of Nano composite materials
5. Experimental techniques for material characterization.

Course outcomes: At the completion of this course, students will be able to

1. Identify the different classes of materials relevant to engineering
2. Apply the basic fundamentals of engineering for material selection based on their properties
3. Select semi-crystalline materials and bio materials.
4. Select materials for Nano composites.
5. Characterize material using different experimental techniques.

UNIT – I Introduction to Engineering Materials:

Classification – metals, non-metals, alloys; Ferrous metals and alloys - types of steels like mild, carbon and stainless steel, common grades of steel – 304 and 316; Non-Ferrous metals and alloys of Aluminium, Copper and Nickel; Criteria for material selection.

UNIT – II General Properties of Engineering Materials:

Mechanical Properties: Stress-strain diagram, Elastic, Plastic, Anelastic and Viscoelastic behavior. Creep, Fatigue and Fracture strengthening mechanisms. Thermal Properties: Conductivity, Expansion, Protection, Diffusivity, Stresses and Shock resistance. Optical Behavior: Light & electro-magnetic spectrum, Luminescence, stimulated emission of Radiation, Lasers, Optical fibres.

UNIT-III

Semi-crystalline materials: Classification, structure and configuration of ceramics, polymers,
copolymers, liquid crystals and amphiphiles

Non-crystalline/amorphous materials: Silicates, glass transition temperature, viscoelasticity.

Biomaterials: Interaction of materials with bioenvironment, concept of biocompatibility. Need for biomaterials, significant types – inert, surface active and resorbable materials. Their advantages, properties, uses.

UNIT-IV

Polymer nano-composite materials: Nanocomposites, role of reinforcement-matrix interface strength on composite behaviour. Corrosion, Degradation and Recycling

UNIT-V

Introduction to experimental techniques: XRD, NMR, PSA, etc. for material characterization highlighting links between molecular structure and macroscopic properties

Text Books

1. William D. Callister, David G, Rethwisch Materials Science and Engineering: An Introduction, Wiley Publisher, 2002.

2. V. Raghavan Materials Science and Engineering: A First Course, 5th Ed., Prentice Hall India, 2004.

Suggested Readings:

1. S. Upadhyaya and A. Upadhyaya, Material Science and Engineering, Anshan Publications, 2007.
2. B. S. Mitchell An Introduction to Materials Engineering and Science for Chemical and Materials Engineers, John Wiley & Sons, 2004.

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18ME C 09

PRINCIPLES OF MANAGEMENT

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: To make the students to

1. Understand basic fundamentals and insights of management
2. Understand the nature and purpose of planning
3. Gain the knowledge about the frame work of organizing
4. Understand the essence and significance of directing
5. Recognize the importance of controlling and its outcomes

Course Outcomes: At the end of the course, student will be able to understand

1. Identify and evaluate the principles of management
2. Demonstrate the ability to have an effective and realistic planning
3. Identify the nature and the type of organization
4. Apply the tools and techniques of directing
5. Explain and evaluate the necessity for controlling and further refinement of an organization.

UNIT-I

Management: Definition of management**,** science or art, manager vs entrepreneur; managerial roles and skills;. Evolution of management, Basic management theories by FW Taylor, Henry Fayol, Types of Business Organizations, sole proprietorship, partnership, company, public and private enterprises; Organization culture and environment; Current trends and issues in management

UNIT-II

Planning: Nature and purpose of Planning, types of Planning, objectives, setting objectives, policies, Strategic Management, Planning Tools and Techniques, Planning plant location and layout, Decision making steps & processes.

UNIT-III

Organizing: Nature and purpose of Organizing, formal and informal organization, organization structure, types, line and staff authority, departmentalization, delegation of authority, centralization and decentralization, job design, human resource management, HR planning, Recruitment selection, Training & Development, Performance Management, Career planning and Management

UNIT-IV

Directing: Individual and group behavior, motivation, motivation theories, motivational techniques, job satisfaction, job enrichment, leadership, types & theories of leadership, effective communication.

UNIT-V

Controlling: system and process of controlling, budgetary and non-budgetary control techniques, use of computers and IT in management control, productivity problems and management, control and performance, direct and preventive control, reporting.

Text Books:

1. S.P. Robins and M. Couiter, "Management", 10/e., Prentice Hall India, 2009.
2. JAF Stoner, RE Freeman and DR Gilbert, "Management", 6/e., Pearson Education, 2004.

Suggested Readings:

1. P.C. Tripathy & P.N. Reddy, "Principles of Management", Tata McGraw Hill, 1999
2. Harold Koontz and Cyril O'Donnell "Principles of Management'', Tata McGraw Hill, 2017

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18CE M 01

ENVIRONMENTAL SCIENCE

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	50 Marks

Course Objectives: To enable the student:

1. Identify environmental problems arising due to engineering and technological activities and the science behind those problems.
2. Become aware about the importance of eco system and biodiversity for maintaining ecological balance
3. To identify the importance of interlinking of food chain
4. Learn about various attributes of pollution management and waste management practices.
5. To make the students contribute for capacity building of nation for arresting and/or managing environmental disasters.

Course Outcomes: At the end of the course, the student should have learnt

1. To define environment, identify the natural resources and ecosystems and contribute for the conservation of bio-diversity.
2. To suggest suitable remedial measure for the problems of environmental pollution and contribute for the framing of legislation for protection of environment.
3. To relate the social issues and the environment and contribute for the sustainable development.
4. To follow the environmental ethics.
5. To contribute for the mitigation and management of environmental disasters.

UNIT–I:

Environmental Studies: Definition, Scope and importance, need for public awareness.

Natural resources: Use and over utilization of Natural Resources - Water resources, Food resources, Forest resources, Mineral resources, Energy resources, Land resources.

UNIT–II:

Ecosystems: Concept of an ecosystem, structure and function of an ecosystem, role of producers, consumers and decomposers, energy flow in an ecosystem, food chains, food webs, ecological pyramids, Nutrient cycling, Bio-geo chemical cycles, Terrestrial and Aquatic ecosystems.

UNIT–III:

Biodiversity: Genetic, species and ecosystem biodiversity, Bio-geographical classification of India, India as a Mega diversity nation. Values of biodiversity, hot-spots of biodiversity, threats to biodiversity, endangered and endemic species of India, methods of conservation of biodiversity.

UNIT–IV:

Environmental Pollution: Cause, effects and control measures of air pollution, water pollution, marine pollution, soil pollution, noise pollution and Solid waste management, nuclear hazards

Environmental Legislations: Environment protection Act, Air, Water, Forest & Wild life Acts, issues involved in enforcement of environmental legislation, responsibilities of state and central pollution control boards

UNIT–V:

Social issues and the environment: Water conservation methods: Rain water harvesting and watershed management, Environmental ethics, Sustainable development and Climate change: Global warming, Ozone layer depletion, forest fires, and Contemporary issues.

Text Books:

1. Y. Anjaneyulu, “Introduction to Environmental Science”, B S Publications, 2004.
2. Suresh K. Dhameja, “Environmental Studies”, S. K. Kataria& Sons, 2009.

Suggested Readings:

1. C. S. Rao,” Environmental Pollution Control Engineering”, Wiley, 1991.
2. S. S. Dara, “A Text Book of Environmental Chemistry &Pollution Control”, S. Chand Limited, 2006

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18EG C 03

SOFT SKILLS LAB

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Course Objectives: The course will introduce the students to:

1. Imbibe an impressive personality, etiquette, professional ethics & values, effective time management & goal setting.
2. Understand the elements of professional update & upgrade through industry exposure in a mini-live project. Understand confidence building strategies and thereby to make effective presentations through PPTs.
3. Learn what constitutes proper grooming and etiquette in a professional environment. Acquire the necessary skills to make a smooth transition from campus to corporate.

Course Outcomes: After successful completion of the course the students will be able to

1. Be assertive and set short term and long term goals. Also learn to manage time effectively and deal with stress.
2. Win in professional communication situations and participate in group discussions with confidence. Write abstracts.
3. Write effective resumes. Plan, prepare and face interviews confidently.
4. Adapt to corporate culture by being sensitive - personally and sensible - professionally. Draft an SOP.
5. Apply the soft skills learnt in the mini-live project, by collecting and analyzing data and making oral and written presentations on the same.

Exercise 1

Main Topics: Thinking Skills, Personality Development – Effective Time Management, setting realistic goals, self confidence and assertiveness, stress management, moral values.

Flipped Sessions: Personal Sensitivity & Professional Sensibility (Reading & Discussion)

Writing Input: Writing to Express - Drafting & Delivering a Speech (Free Writing Exercise)

Exercise 2

Main Topics: Advanced Group Discussion with Case studies : Dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and coherence.

Flipped Sessions: Importance of Professional Updating & Upgrading (Reading & Discussions)

Writing Input: Writing with Precision - Writing Abstracts

Exercise 3

Main Topics: Interview Skills – concept and process, pre-interview planning, opening strategies, answering strategies, mock interviews. Resume' writing – structure and presentation, planning, defining the career objective, projecting ones strengths and skills.

Flipped Sessions: Mock Interviews (Video Sessions & Practice)

Writing Input: Writing to Reflect - Resume Writing

Exercise 4

Main Topic: Corporate Culture – Grooming and etiquette, communication media, academic ethics and integrity

Flipped Sessions: Corporate Culture, Etiquette & Grooming (Video Sessions & Practice through Role-play)

Writing Input: Writing to Define - Writing an effective SOP.

Exercise 5

Main Topic: Mini Project – General/Technical. Research, developing a questionnaire, data collection, analysis, written report and project seminar. Elements & Structure of effective presentation. Presentation tools – Body language, Eye-contact, Props & PPT.

Flipped Sessions: Effective Presentations (Video & Writing Sessions, Practice through Emulation)

Writing Input: Writing to Record - Writing minutes of meeting.

Suggested Readings:

1. Madhavi Apte , "A Course in English communication", Prentice-Hall of India, 2007
2. Dr. Shalini Verma, "Body Language- Your Success Mantra", S Chand, 2006
3. Ramesh, Gopalswamy, and Mahadevan Ramesh, "The ACE of Soft Skills", New Delhi: Pearson, 2010
4. Van Emden, Joan, and Lucinda Becker, "Presentation Skills for Students", New York: Palgrave Macmillan, 2004

* Flipped Class-room: Students explore the concept first and then trainer explains it, students work on their own.

Web Resources:

1. https://www.goskills.com/Soft-Skills
2. https://www.trainerbubble.com
3. https://www.skillsconverged.com

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18CS C 06

BASICS OF DATA STRUCTURES LAB

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Course Objectives: This course will help the students to understand the

1. Design and construct simple programs by using the concepts of Data structures as abstract data type.
2. To have a broad idea about how efficiently pointers can be used in the implement of data structures.
3. To enhance programming skills while improving their practical knowledge in data structures.
4. To strengthen the practical ability to apply suitable data structure for real time applications.

Course outcomes: At the completion of this course, students will be able to

1. Implement the abstract data type.
2. Implement linear data structures such as stacks, queues using array and linked list.
3. Understand and implement non-linear data structures such as trees, graphs and its traversal techniques.
4. Implement various kinds of searching, sorting techniques.
5. Develop the suitable data structure for real world problem.

LIST OF EXPERIMENTS

1. Implementation of operations on arrays.
2. Implementation of Stack.
3. Implementation of Queue.
4. Implementation of basic operations on Single Linked List.
5. Implementation of Searching techniques.
6. Implementation of Sorting techniques.
7. Case study like Banking System, Students Marks Management, Canteen Management etc.

Text Books

1. Brian W Kernighan, Dennis Ritchie, C Programming Language, PH PTR, 2nd Edition.
2. Richard M Reese, Understanding and Using C Pointers,O'Reily , 2013.

Web Links

https://nptel.ac.in/courses/106102064/

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Scheme of Instruction and Syllabi
of
Choice Based Credit System (CBCS) of

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OF
FOUR YEAR DEGREE COURSE
IN

CHEMICAL ENGINEERING

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY(TM)
(An Autonomous Institution)
Affiliated to OU; All U.G. and 5 P.G. Programmes (Civil, CSE, ECE, Mech. & EEE)
Accredited by NBA; Accredited by NAAC - 'A' Grade (UGC); ISO Certified 9001:2015
Chaitanya Bharathi P.O, CBIT Campus, Gandipet, Kokapet (V),
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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

Choice Based Credit System (with effect from 2018-19)

B.Tech (Chemical Engineering)

SEMESTER -V

S.N	Course Code	Title of the Course	Scheme of Instruction		Scheme of Examination			
			Periods per week		Duration in Hours	Maximum Marks		Credits
			L/T	P/D		CIE	SEE	
THEORY								
1.	16CH C11	Chemical Reaction Engineering - II	4	--	3	30	70	4
2.	16CH C12	Mass Transfer Operations – I	4	--	3	30	70	4
3.	16CH C13	Process Instrumentation	3	--	3	30	70	3
4.	--	Elective-II	3	--	3	30	70	3
5.	--	Elective-III	3	--	3	30	70	3
PRACTICALS								
6.	16CH C14	Mechanical Unit Operations Lab	--	3	3	25	50	2
7.	16CH C15	Process Heat Transfer Laboratory	--	3	3	25	50	2
Elective-II Labs.								
8.	16CH E 06	Surface Coating Technology Lab.	--	3	3	25	50	2
	16CH E07	Technology Of Vegetable Oils And Fats Lab.	--	3	3	25	50	2
Total			**17**	**9**	**--**	**225**	**500**	**23**

L: Lecture, T: Tutorial, D: Drawing, P: Practical

SNO	ELECTIVE-II Course Code	Title of Elective –II Course
1	16CH E 02	Surface Coating Technology
2	16CH E 03	Technology of Vegetable Oils and Fats

SNO	ELECTIVE-III Course Code	Title of Elective –III Course
1	16CH E 04	Corrosion Engineering
2	16CH E 05	Mineral Processing Technology

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16CH C 12

CHEMICAL REACTION ENGINEERING - II

Instruction	4L Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	4

Course Objectives:

1. To understand various models in non-ideal reactors.
2. To understand properties of solid catalysts.
3. Develop rate laws for reactor design based on reaction data from a reactor or set of reactors in heterogeneous systems.
4. To understand concepts of catalysts deactivation.
5. To develop kinetics for solid – fluid and fluid – fluid reactions.

Course Outcomes: On successful completion of this module, students should be able to

1. Predict conversions in non-ideal reactors using various models.
2. Understand phenomena for catalytic activity and determine various properties of catalysts.
3. Describe the steps in a catalytic mechanism, derive a rate law theoretically and the effects of pore diffusion.
4. Derive rate equations and other kinetics parameters of catalytic reactions from experimental data.
5. Analyze performance of catalysts when deactivating.
6. Understand the concepts of fluid-fluid and fluid particle reaction kinetics.

UNIT - I

Analysis of Non ideal Reactors - Basic concepts, Compartment models - hints, suggestions and possible applications. Dispersion number from C and F curves, Conversion using dispersion and tanks in series models for the first order irreversible reaction.

UNIT - II

Solid Catalysts - Adsorption, adsorption isotherms, surface area, void volume and solid density, pore volume distribution. Theories of heterogeneous catalysis,

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classification of catalysts, catalyst preparation, promoters and inhibitors.(to the extent covered in J.M. Smith only).

UNIT - III

Solid Catalyzed Reactions - Introduction; Development of rate expressions from L- H - H - W models for reaction $A + B \rightarrow R + S$ under adsorption, surface reaction and desorption controlling condition. Pore diffusion resistance combined with surface kinetics (Single cylindrical pore, first order reaction) Porous catalyst particles. Experimental methods for finding rates.

UNIT - IV

Catalyst deactivation- Mechanisms of catalyst deactivation, the rate and performance equations: The rate equation from experiment, determining the rate for batch solid in contact with fluid in batch, mixed flow and plug flow modes for independent deactivation. Effect of pore diffusion resistance.

UNIT - V

Kinetics of fluid - fluid reactions: The rate equation for straight mass transfer of A (absorption). The general rate equation and the rate equation for reaction with mass transfer.

Kinetics of fluid-particle reactions: selection of a model, PCM, SCM, comparison of models with real situations. Shrinking core model for spherical particles of unchanging size: Diffusion through gas film controls, Diffusion through ash layer controls, chemical reaction controls. Rate of reaction for shrinking spherical particles.

Text Books:

1. Octave Levenspiel, Chemical Reaction Engineering, John Wiley & Sons - Third edition, 1999.
2. J M Smith, Chemical Engineering kinetics, McGraw - Hill, Third Edition, 1981.

Suggested Reading:

1. H Scott Fogler, Elements of Chemical reaction Engineering, Prentice - Hall, Fourth edition, 2005.
2. Gavhane, Chemical Reaction Engineering-II, Nirali Prakashan.

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16CH C 12

MASS TRANSFER OPERATIONS – I

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	70 Marks
Sessionals	30 Marks
Credits	4

Course Objectives: This course help the students to understand

1. The rate equations
2. Mass transfer coefficients,
3. Interphase Mass transfer
4. Humidity, Enthalpy of Vapor-gas Mixture(Air- water vapor)
5. Various unit operations viz., absorption, humidification, drying.

Course Outcomes: At the end of the course, the students will be able to

1. Write rate equations for any mass transfer operations.
2. Calculate the mass transfer coefficients using different corelations.
3. Calculate the resistances offered by gas-phase and liquid phase.
4. Design Absorber/Stripper by equilibrium method to find the number of theoretical Stages.
5. Design Cooling towers(able to find the height of packed bed required).
6. To find the total time required in in-direct heating tray dryers.

UNIT - I

Diffusion and Mass Transfer – Mass transfer operations & their applications. Molecular diffusion –Fick's first law – steady state molecular diffusion in binary mixtures of gases, liquids and solids – Determination of diffusivity in gases by Stefan-Maxwell method: estimation of diffusion coefficients in binary mixtures of liquids and gases by correlation.

Eddy diffusion – Basic concepts of mass transfer theories – Film mass transfer coefficients for the cases of equimolar counter diffusion and diffusion of one component (A) in stagnant component (B) - Correlation's for mass transfer coefficients and Reynolds & Colburn analogies.

UNIT - II

Interphase Mass Transfer – overall mass transfer coefficients – Two resistance theory – Gas phase and liquid phase controlled situations. Gas – liquid contact: Description of Continuous and stage wise contact equipment, packing for packed

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columns – Liquid distribution. Mass transfer coefficients in packed columns, Flooding in packed and plate columns, Ideal stage, Murphree, Point and Overall column efficiency, Comparison of packed and plate columns.

UNIT - III

Absorption and Stripping: counter current and co-current isobaric absorption and stripping of single component – Operating Lines – Minimum flow rates – Determination of number of plates – absorption factor.Determination of number of transfer units and height of a continuous contact packed absorbers. Kremser – Brown equation for tray towers and packed towers.

UNIT - IV

Humidification: Vapour, gas mixtures – Humidity and relative saturation. Dew point adiabatic saturation and wet bulb temperatures – psychrometric charts – Enthalpy of gas vapor mixtures.Humidification and Dehumidification – Operating lines and design for water cooling tower . Equipments of Water- Cooling towers and Spray chambers.

UNIT - V

Drying:Equipments for Drying, moisture contents of solids – equilibrium, bound and unbound moisture.Design conditions – Rate of batch drying under constant drying conditions – Mechanism of batch drying – total time for batch drying.

Text Books:

1. R.E. Treybal, "Mass Transfer operations", 3rd Edition, McGraw Hill Book Co., 1981

Suggested Reading:

1. Christie John Geonkoplis "Transport Processes and Separation Process Principles", 4th edition. PHI, New Delhi., 2009.
2. J Coulson and Richardson,"Fluid Flow, Heat and Mass Transfer", Volume 1, 6th Edition, Pergoman Press, 2009.

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16CH C 13

PROCESS INSTRUMENTATION

Instruction	3 hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	3

Course Objectives: This course helps the students to understand the:

1. Fundamental elements of industrial instruments and their characteristics.
2. Different types of temperature measuring instruments and their industrial applications.
3. Different types of pressure measuring instruments.
4. Methods applied for composition analysis in process industries
5. Different types of flowmeters and level measuring devices.

Course Outcomes: At the end of the course, the students will be able to:

1. Identify and select instruments based on their purpose and function as required in process industry.
2. Select temperature measuring instrument based on the range of operation.
3. Select pressure measuring instrument based on their application.
4. Identify and apply different methods of composition analysis in process industry.
5. Select flow measuring instrument based on type of fluids.
6. Select level measuring instrument based on their need in process industry.

Unit I: Importance of industrial instrumentation

Need, significance, applications and classification. Functional units – elements of instruments and their functions as sensors, transducers, transmitters and receivers. Static and dynamic characteristics of instruments.

Unit II: Temperature measurement

Expansion thermometers – types, mercury in glass, bimetallic, pressure spring type, drawbacks for industrial applications. Industrial thermocouples – types and range of operation, lead wires, need of thermowells.

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Industrial resistance thermometers – types of sensors, Resistive Temperature Detectors [RTD], Thermistors. Infrared thermometry – pyrometers, radiation receiving elements, radiation pyrometer, optical pyrometer.

Unit III: Pressure measurement

Manometers types – U-tube, well type, enlarged leg, inclined leg, ring balance type. Elastic transducer elements – bourdon, bellow and diaphragm.

Electrical pressure transducers – Linear variable differential transformer (LVDT) and strain gauge. Introduction to standard vacuum gauge – McLeod gauge and Pirani gauge.

Unit IV: Flow and Level measurement

Flowmeters – head type, area type, mass flowmeter, electromagnetic flowmeters. Level measurement – hydrostatic head, float type, RF capacitance, Radar type.

Unit V: Analytical Techniques

Spectroscopic analysis, absorption type – infrared, UV, X-ray and NMR. Emission and Mass spectroscopy.

Analysis of moisture in gases (humidity) by psychrometer, hygrometer, dew point methods. Introduction to chromatography – types, uses, Gas Liquid Chromatography, Thin layer Chromatography.

Text Books:

1. Principles of industrial instrumentation, D. Patranabis, 2nd ed., Tata-McGraw Hill Edu. (India) Pvt.Ltd., New Delhi, 2013.
2. Industrial Instrumentation, Donald P. Eckman., CBS pub & distr. Pvt. Ltd., New Delhi, 2004.

Suggested Reading:

1. Instrumentation operation, measurement, scope and application, N. V. S. Raju, B S Pub., Hyd., 2016.
2. Introduction to measurements and Instruments, Arun K. Ghosh, PHI learning Pvt. Ltd., New Delhi, 2013.

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16 CH E 02

SURFACE COATING TECHNOLOGY
(ELECTIVE –II)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To give fundamental concepts in paints (including industrial paints and domestic paints)
2. Basic properties, uses of main ingredients like pigments, extenders, binders, solvents.
3. To know more about paint application systems (both air drying paints and stoving paints of liquid paints and power paints).
4. Study of paint formulation including manufacturing of different types of paints and special paints.
5. Study about quality of paints (including paint tests and paint defects).

Course Outcomes:

1. To identify the suitable paints for domestic and Industries.
2. To study more about specific paint manufactures.
3. To know main ingredients of paints,their manufacturers and properties.
4. To come across the usage of different types of solvents for both industrial paints and domestic paints and also about paint solid structures (Resins).
5. To identify the suitable application methods for powder and liquid paints and also to develop paint testing Lab.
6. The student can differentiate between normal paints and special paints and their applications and uses.

UNIT-I

Introduction: Surface coatings- Scope, properties, applications & uses. Major components of surface coatings. Fundamentals of film formation

Classification of Paints: Air drying paints, stoving paints, their properties and uses. Liquid paints & powder paints, their properties & uses.

Manufacture of Paints: Distempers- Manufacture, properties & uses. Powder Paints- Manufacture, properties & uses. Enamel - Manufacture, properties & uses.

UNIT – II

Pigments: Importance of pigments - their basic properties, uses & their applications. Classification of pigments: Inorganic & organic pigments.

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Special properties of pigments: Criteria for selection of color, tinting strength, fastness to light, bleeding, hiding power, refractive index, particle size & anti-corrosive properties.
Manufacture of Pigments: Titanium di-oxide, red lead, Ultramarine blue.

UNIT – III
Extenders: Importance, properties & significance.
Manufacture of Extenders: Blanc fixe, China clay, Gypsum, Mica & talc.
Solvents: Importance, uses & their properties,
Manufacture of solvents: Turpentine, Alcohols- Methyl Alcohol, Ethyl Alcohol, n-Propyl Alcohol .
Natural Resins: Rosin & shellac. Synthetic Resins: Alkyd resins, phenolic resins, amino resins.

UNIT – IV
Application methods of paints: Air drying paints, industrial liquid stoving paints & industrial stoving powder paints. Brush application, Roller coating, spray application, electrostatic spray application.
Testing of Paints: Wet paint & dry paint testing film like thickness, adhesion, resistance ,gloss, impact & paint coverage. Defects in paints & paintings & their remedies: defects in grinding skinning, sagging, bleeding, flooring, floating, brushing, orange peel, fish eye, brush marks, lifting.

UNIT – V
Special Coatings: Importance, Significance & their applications.
Powder Coatings, Water soluble coatings, aluminum coatings, water proof coatings, heat resistant coatings, automobile coatings, fire retardant coatings, space, air craft coatings, swimming pool coatings and Anti Micro growth Paints (Marine Paints).

Text Books:

1. W.M. Morgans, “Outline of Paint Technology”, Edward Arnold Publishers, London, 1990
2. R. Lambourne& T A Strivens, “Paint & Surface coatings”, Second edition, 1999

Suggested Reading:

1. Patton Temple, “C Pigment Flow & Pigment Dispersion”, Wiley Inter science, 1979
2. Swaraj Paul, “ Surface Coatings science and technology” , 1995

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16CH E 03

TECHNOLOGY OF VEGETABLE OILS AND FATS
(ELECTIVE –II)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To impart knowledge about sources, types and composition of oils and fats
2. To comprehend the physicochemical characteristics
3. To familiarize the students about extraction and processing
4. To study the production of value added products from oils and fats
5. To study the methods of preparation of soaps and detergents

Course Outcomes: At the end of the course the student will be able to:

1. Analyze the various properties of fats and oils to determine their use in food, soap and other industries
2. Identify unit operations involved in extraction of oils
3. Know the methods of purification of oils and fats
4. Know about the degradation occurring during storage of oils and fats and prevention methods
5. Understand the mechanism Hydrogenations of oils
6. Know the techniques involved in the preparation of soaps

UNIT – I

History and general introduction: Oils, fats, waxes,essential oils, their sources and composition. Natural glyceride constituents of oils and fats: Triglycerides, fatty acids, their nomenclature, and structural formulas. Distribution of fatty acids among glyceride molecules : Even and Random Distribution theories .Non-Glyceride Components: Phosphatides, sterols, pigments, tocopherols, tocotrienols, oryzanol, β-carotene

UNIT – II

Classification of Oils and Fats with Examples, Physical and chemical properties, iodine value, saponification value, hydroxyl value of oil and fats. Detailed glyceride composition of the following oils – palm, palm kernel, coconut, cotton seed, peanut, sunflower, safflower, sesame, rice bran and mustard, linseed (flax seed), soya been,

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Tung, castor oil, lard, tallow and fish oils. Industrial applications of Non Traditional oils - Neem, Karanja and Jatropa

UNIT– III

Chemical Reactions of Oils and Fats:

Reactions in the fatty acid chain - Hydrogenation, Oxidation reactions, .Esterification and Interesterification, Saponification, formation of metal soaps, Hydrogenolysis, formation of fatty amines, fatty amides and fatty chlorides, Halogenation, Addition of Maleic anhydride, sulfation, sulfonation Chemical oxidation(hydroxylation), atmospheric oxidation (rancidity), Polymerization, Isomerisation.

Reaction of hydroxyl groups

UNIT – IV

Storage, Pre-treatment of Oil Seeds, Mechanical expression of oils, Solvent extraction of oils, Fat splitting (chemical and enzymatic methods)

UNIT – V

Chemical and Physical Refining: De-gumming, neutralization, refining losses, Miscella refining, Bleaching, dewaxing, and Deodorization.

Partial and Total Hydrogenation: Mechanism, selectivity, continuous process, preparation of Raney Nickel catalysts.

Soap Manufacture: Selection of raw materials, Full boil process, INS factor and Solubility ratio.

Text Books:

1. Ed. D Swern, "Bailey's Industrial Oils and Fats Products" , Wiley Inter Science publication, N.Y. John Wiley and Sons ,6th Edition, 2006

Suggested Reading:

1. M M Chakrabarty , "Chemistry and Technology of Oils and Fats", Allied Publishers Pvt.Ltd., 1st Edition, 2007
2. O P Narula, "Treatise on fats,Fatty acids and Oleochemicals", Vol I and II, Industrial Consultants (India), 1994
3. R J Hamilton , "Recent Advances in Chemistry and Technology of Fats and Oils", Elsevier Applied Science 1987
4. Chemistry and Technology of Oils and Fats, 2003, Edited by M.M. Chakraborty

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16CH E 04

CORROSION ENGINEERING
(ELECTIVE " III)

Instruction	3L Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course helps the students to understand the:

1. Definition and classification of corrosion.
2. Principles of corrosion, common corrosion forms,
3. Different corrosion testing methods.
4. Corrosion control methods and material selection for cost reduction.
5. Modern theories to explain corrosion

Course Outcomes: At the end of the course, student will be able:

1. Identity the type of corrosion.
2. Correlate the damage with the cause of corrosion.
3. Identify the correct method of testing any corrosion.
4. Select the appropriate preventive method to avoid corrosion.
5. Select the significant coating for corrosion prevention.
6. Apply modern method of corrosion measurement.

UNIT–I: Introduction:

Definition, corrosion environments, damage, classification of corrosion. Principles and corrosion rate expressions. Environmental effects such as velocity, temperature, galvanic coupling. Metallurgical and other aspects

UNIT– II: Different forms of corrosion:

Uniform attack, galvanic corrosion, crevice corrosion, fitting corrosion, inter–granular corrosion, selective leaching, erosion corrosion, stress corrosion and hydrogen damage. Pitting: pit shape and growth, velocity, metallurgical variables, evaluation of pitting damage, prevention.

UNIT– III: Corrosion testing methods:

Classification, purpose, surface preparation, measuring and weighing, duration, plant interval test, NACE test methods, slow – strain rate test and paint test.

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Composites testing: Exposure techniques, Huey test, Sea water test, Stress corrosion, Corrosion of palstics, Invivo corrosion.

UNIT–IV: Corrosion prevention methods:

Selection of metals and alloys–Cast iron, steel, Al, Mg, Ti, Composites and Refractory metals. Non-metallics: Thermosetters, laminates and reinforced plastics, Rubbers, Wood, Ceramics, Carbon and Graphite. Alteration of environment such as changing mediums, lowering temperature, design rules, design of cathodic and anodic protection, selected coating techniques to prevent corrosion; Failure analysis. High temperature corrosion.

UNIT – V: Advanced techniques:

Modern theory–principles and applications, electrode kinetics, predicting corrosion behavior, corrosion prevention, Corrosion rate measurements in Petroleum Industry with examples.

Text Books:

1. Pierre R. Roberge, " Handbook of Corrosion Engineering", 2nd edition, MCGraw-Hill, Newyork, 2012
2. Zaki Ahmad, "Principles of Corrosion Engineering and Corrosion Control", Butterworth-Heinemann, 2006.

Suggested Reading:

1. Pierre R Roberge, "Corrosion Engineering – Principles and Practice, MCGraw-Hill, 2008
2. Pierre R. Roberge, Corrosion Basics: An Introduction, NACE International, 2006.

Web resources :

1. www.academia.edu/5491377/corrosion_engineering_mars_g._fontana

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16CH E 05

MINERAL PROCESSING TECHNOLOGY

ELECTIVE - III

Instruction	3 hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	3

Course objectives:

1. Review all unit operations in mineral processing technology and the mineral concentration processes.
2. Introduce students to the importance and principles of materials handling in the mineral processing plant with special emphasis on feeding and conveying of bulk material.
3. Provide students the opportunities to acquire practical skills in concentrates handling, grade.
4. Determination, recovery and loss calculation and participatory laboratory experiments.

Course Outcomes: At the completion of this course, students will be able to

1. Understand the principles governing a range of processes applied in the mineral industry.
2. Describe typical unit processes and flow-sheets for production of a number of metals.
3. Apply basic engineering principles to the design of mineral processes.
4. Produce conceptual designs for simple extraction processes.
5. Understand the operation of beneficiation units for coal and mineral.

UNIT – I: Introduction to Mineral Processing, Scope and importance. Properties and Types of Minerals

Ore handling: removal of harmful materials - sampling of ores: moisture sampling, assay sampling, sampling systems, sample division methods.

UNIT – II:

Mineral Liberation, degree of liberation, concentration, measures of assessing metallurgical performance viz., recovery, ration of concentration, grade, enrichment ratio.

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Laboratory sizing: particle size and shape, sieve analysis, sub sieve techniques, centrifugal methods (warman cyclosizer), microscopic sizing, online particle size analysis.

UNIT – III:
Classification: Principle, types of classifiers – Gravity concentration: principle, concentration in vertical surren (Jigging), Jigs, types of Jigs viz., Harz Jig, circular and radial jigs, coal jigs (Baum and Batac jigs) – Gravity concentration in streaming currents: pinched sluice, cones, spirals, shaking tables.

UNIT –IV:
Heavy medial separation: Principle, liquids and suspension for heavy media separation.
Separation vessels : Gravitational vessels (Wemco Cone separator, Drum separator)
Centrifugal separators: (Vorsyl separator, LARCODEMS, Dyna whirlpool separator) DMS cyclone DMS circuits.

UNIT – V:
Floatation – History and theory: contact angle, work of adhesion; Floatation Reagents: collectors, frothers, regulators; and their action – Floatation practice: ore and pulp preparation, reagents and conditioning- Flotation Machines: pneumatic (Davcra cell, flotation column, Jameson cell, froth separators) and mechanical (Denver cell, Wemco cell) electro flotation, skin flotation, Case studies: i) Coal Beneficiation process. ii) Different methods for fine particles collections(Copper, Iron, Au).

Text Books:

1. B.A.Wills – "Mineral Processing Technology " –7th edition Maxwell International Edition - 1987.
2. S.K.Jain "Ore Processing"Oxford and TBHY Publishing Co. (P) Ltd., India (1986).
3. S. K. Jain, Ore Processing, Oxford- IBH Publishing Company, 2005.

Suggested Reading:

1. Ashoka Gupta & Denis Yen, "Mineral Processing Design and Operations", 1st Edition, Elsevier Publishers.

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16CH C 14

MECHANICAL UNIT OPERATIONS LAB.

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	50 Marks
Sessionals	25 Marks
Credits	2

Course Objectives:

1. To provide student the opportunity to acquire practical skills in mechanical unit operations.
2. To introduce students the importance and principles of material handling.
3. To provide an overall view of size reduction equipments.
4. To know the techniques of separating solids based on size by different methods.
5. To impart the concept and functioning of filtration unit.

Course Outcomes: At the end of the course, the student will be able to:

1. Understand mechanical unit operations and their role in chemical engineering industries.
2. Understand the nature of solids, their characterization, handling and the processes involving solids.
3. Analyze the performance of size reduction equipment and calculate the power and efficiency requirements.
4. Understand the solid-fluid separation process and operation.

LIST OF EXPERIMENTS

(Minimum of 8 Experiments in the list are to be performed)

1. Verification of the laws of size reduction using Jaw crusher.
2. Verification of the laws of crushing using drop weight crusher and determination of work index.
3. Determination of laws of crushing in a pulverizer.
4. Verification of the comminution laws and critical speed of a ball mill
5. Analysis of various sizes of given material by sieve analysis and determination of cumulative and differential analysis.

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6. Determination of the specific cake resistance and medium resistance in a vacuum filter or plate and frame filter press.
7. Calculation of the effectiveness of screen in horizontal and inclined position (vibrating screens)
8. Determination of separation factors of air and hydraulic classifiers.
9. Determine settling rate classification of particles using cyclone separator and to determine the efficiency
10. Determination of the froth flotation characteristics in mineral concentration.

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16CH C 15

PROCESS HEAT TRANSFER LABORATORY

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	50 Marks
Sessionals	25 Marks
Credits	2

Course Objectives:

1. To make students to understand the basic concepts of fundamentals of heat transfer modes.
2. To make students learn the applications of modes of heat transfer.

Course Outcomes:

1. At the end of the semester the students will be in a position to know the principles involved in different modes of heat transfer.
2. They will be in a position to design and analyze heat exchangers such as shell and tube, extended surface exchangers etc.
3. Thermal conductivity of insulating materials can be found by them involving conduction mode. Emissivity of given surfaces will be found based on radiation phenomenon.

LIST OF EXPERIMENTS

(Minimum of 8 Experiments in the list are to be performed)

1. Determination of Thermal conductivity of given insulating powder under steady state conditions.
2. Determination of interface temperatures in composite wall under steady state conditions.
3. Determination of heat transfer coefficient in Natural convection.
4. Determination of overall heat transfer coefficient in unsteady conditions
5. Determination of inside heat transfer coefficient in coil heat exchangers
6. Determination of overall heat transfer coefficient and effectiveness of a Double pipe heat exchanger

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7. Determination of heat transfer area in a 1-2- shell and tube heat exchangers
8. Determination of heat transfer coefficient on a single tube by film wise and drop wisecondensation.
9. Determination of emissivity and Boltzmann's constant of a sample body
10. Determination of heat transfer coefficient in forced convection.
11. Determination of fin efficiency of longitudinal fins of extended surface
12. Determination of peak flux and critical temperature drop in pool boiling of saturated liquid
13. Determination of heat transfer coefficient of a pin fin under free convection.
14. Determination of heat transfer coefficient of a pin fin under forced convection

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16CH E 06

SURFACE COATING TECHNOLOGY LAB
(ELECTIVE – II LAB)

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	50 Marks
Sessionals	25 Marks
Credits	2

Course Objectives : To make the students

1. understand the theoretical concepts of organic surface coating technology (Paints)
2. perform the experimental procedures on paints to determine various properties.
3. practice various application systems of powder paints and liquid paints

Course Outcomes :

1. Students are able to understand the importance of Organic surface coatings.
2. Students are able to perform different paint tests and analyze the quality of paints.
3. Student can differentiate between lacquers , varnishes and paints.

LIST OF EXPERIMENTS

(Minimum of 8 experiments are to be performed)

1. Preparation of panels for painting (power coating or liquid paints)
2. Powder particles size analyser
3. Determination of apparent viscosity of paints (only liquid paints)
4. Determination of resistance to scratching under a specified load of a dried film of paint
5. Measurement of paint film thickness using dry film thickness gauge (finish paint)
6. Determination of flexibility and adhesion of the paints (as per 101 BS 3960 m and size ¼ inch)
7. Determination of impact resistance of the painted panel
8. Measurement of hardness of magnesium phosphate coating or zinc phosphate coating
9. Measurement of gloss of painted film at 45 degree angle

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10. Determination of drying consistency of different paints
11. Determination of coverage or spreading capacity of different paints
12. Salt Spray Test (only for Powders)

Text Books:

1. Industrial Hand Books
   a). Berger Protection Protective Coatings – Product Data Manual
   b). Goodlass Nerolac Paints Product Data Manual
2. ICI Paints Quality Manual Book

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16CH E 07

TECHNOLOGY OF VEGETABLE OILS AND FATS LABORATORY (ELECTIVE -II)

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	50 Marks
Sessionals	25 Marks
Credits	2

Course objectives: - To make students to understand the

1. Theoretical concepts by performing the practicals on some of the important physical and chemical properties of oils and fats.
2. Procedure involved in knowing the characteristics of different oils and fats.

Course Outcomes: - At the end of the semester the students will be in a position

1. to analyze the different oil samples
2. to carry out various techniques used to determine quality oils and fats.

Technology of vegetable oils and fats laboratory (Elective II -Lab)

1. Determination of Acid value of given samples
2. Determination of percentage of free fatty acid present in the given sample and its acid value
3. Determination of Iodine value of given sample
4. Determination of saponification value of given oil samples
5. Determination of the hydroxyl value of given samples
6. Determination of unsaponifiable matter of given oil sample
7. Determination of melting point of fats.
8. Determination of the percentage of moisture and volatile matter under the conditions of test
9. Determination of total fatty matter (TFM) in soaps

Note: - A minimum of 8 experiments should be performed

Reference Books and suggested readings:

1. BIS specifications; IS- 548, part I,II & III
2. A text book of oil and fat analysis By Cocks & Reid
3. Modern Technology in Oils and Fats Industry, Vol-II, OTAI (NZ)

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Choice Based Credit System (with effect from 2018-19)

B.Tech (Chemical Engineering)

SEMESTER -VI

S.NO	Course Code	Title of the Course	Scheme of Instruction		Scheme of Examination			
			Periods per week		Duration in Hours	Maximum Marks		Credits
			L/T	P/D		CIE	SEE	
THEORY								
1.	**16CH C16**	Bio Chemical Engineering	3	--	3	30	70	3
2.	**16CHC 17**	Chemical Engineering Thermodynamics – II	4	--	3	30	70	4
3.	**16CH C18**	Chemical Process Safety	3	--	3	30	70	3
4.	**16CH C19**	Process Dynamics and Control	4	--	3	30	70	4
5.	**16CH C20**	Process Modeling Simulation And Optimization	4	--	3	30	70	4
6.	--	Elective-IV	3	--	3	30	70	3
PRACTICALS								
7.	**16CH C 21**	Chemical Reaction Engineering Laboratory	--	3	3	25	50	2
8.	**16CH C 22**	Process Dynamics And Control Laboratory		3	3	25	50	2
9.	**16CH C23**	Process Modeling Simulation Laboratory	--	3	3	25	50	2
Total			**21**	**9**	**--**	**255**	**570**	**27**

L: Lecture, T: Tutorial, D: Drawing, P: Practical

SNO	ELECTIVE-IV Course Code	Title of Elective –II Course
1	16CH E 08	Energy Engineering.
2	16CH E 09	Fluidization Engineering.
3	16CH E 10	Pharmaceutical Technology

L: Lecture T: Tutorial D: Drawing P: Practical

CIE - Continuous Internal Evaluation SEE - Semester End Examination

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16CH C 16

BIO CHEMICAL ENGINEERING

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To understand the functions of living cells
2. To apply the principles of Chemical Engineering to bioprocesses.
3. Conduct analysis on the biological factors that are important in the design, operation, performance, and/or monitoring of a biological process
4. To understand the significance of microbes
5. To understand the applications of different bio processes

Course Outcomes: On successful completion of this module, students should be able to

1. Describe the basic structure and function of cells & Relate cell function to products and processes useful to man
2. Understand classification, growth concepts and various types of interactions in microbes
3. Significance of enzymes as biocatalysts.
4. Identify and explain the basic features of bioreactors
5. Describe the principles of the various separation procedures involved in the downstream processing of products
6. Understand various other aspects of bioprocess technology viz, fermentation types, media formulation, environmental biotechnology and commercial aspects.

UNIT – I Basic Concepts of Biochemical Engineering, Molecular Biology& Bio Chemistry

Biochemical Engineering Principles, Biophysics and cell doctrine:

Atomic Theory and Cell Theory, Important cell types, structure and functions of a typical cell and their components, Transport across cell membranes: Passive and facilitated diffusion, Active transport.

Structure and functions of Bio Molecules:

Carbohydrates, lipids, Nucleotides to Nucleic Acids – RNA and DNA, Amino acids to Proteins - the building blocks of biochemical life.

Biosynthesis and Metabolic Pathways:

Biosynthesis of Small and Macro Molecules Introduction of metabolic pathways and end products of glucose metabolism

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UNIT – II Introductory Microbiology

Introduction to Microbiology: Classification and Industrial uses of Microorganisms Growth and Reproduction of Microbes: Growth cycle phases for batch cultivation. Monod's growth kinetics – Growth Rate dependant classification of Microorganisms Microbial Genetics: Recombinant DNA technology and mutant populations. Multiple Interacting Microbial populations: Neutralism, Mutualism, Commensalism, Amesanalism, Predatism and Parasitism

UNIT – III Enzyme Technology

Enzymology: Enzymes as Biocatalysts - The enzyme substrate complex and enzyme action and Classification of Enzymes based on Functions.

Kinetics of Enzyme Catalyzed Reactions: Simple enzyme kinetics with one and two substrates. Determination of rate constants, substrate activation and inhibition, modulation and regulation of enzyme activity / effect of PH and temp on enzyme activity

Immobilized Enzyme Technology: Types of Enzyme immobilization, Immobilized enzymes in industrial processes, Cofactors, Apo-enzymes and Coenzymes utilization and regeneration

UNIT – IV Bioreactors and Down Stream Techniques - Introduction

Design and Analysis of Biological Reactors: Batch and Continuous Stirred Tank Reactors, Enzyme reactors Ideal Reactors for kinetic measurements: The ideal batch reactor / The ideal continuous flow stirred tank reactor - Alternate bio-reactor configurations

Separation Processes: Filtration, Centrifugation, Adsorption, Reverse osmosis, Dialysis, Electrophoresis, Sedimentation and Extraction Purification Processes: Precipitation, Crystallization, and Chromatography

UNIT – V Bioprocess Technology

Fermentation Technology: Types of Fermentation ,Medium formulation and Culture Propagation, Environmental biotechnology: Effluent treatment.

Industrial Biotechnology: Commercial enzymes, Antibiotics and single cell protein

Text Books:

1. James, E Bailey and David F Ollis, "Biochemical Engineering fundamentals", 2ndEdition, McGraw-Hill Internal Edition.1986

Suggested Reading:

1. Michael L Shuler and Fikret Kargi, "Bioprocess Engineering: Basic Concepts". Second Edition Prentice Hall, 2002
2. Coulson & Richardson's' Chemical Engineering" Vol 3, Third Edition, Elsevier Publishers, 2006
3. D.G., Rao, "Introduction to BioChemcial Engineering" Second Edition, TMGH Pvt Ltd, 2010

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16CH C 17

CHEMICAL ENGINEERING THERMODYNAMICS – II

Instruction	4 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	4

Course Objectives: This course helps the students to understand about

1. The concepts of Partial and Molar properties, Chemical Potential, Fugacity& Fugacity coefficients.
2. The concepts of fugacity in mixtures and various methods to obtain Fugacity Coefficient in mixtures.
3. Phase Rule and Various models used to determine the activity coefficients.
4. Calculation procedure to generate Vapor- Liquid equilibrium (VLE) in form of T-X-Y or P-X-Y for miscible binary mixtures.
5. Methodology adopted to determine equilibrium constant.

Course Outcomes: The students will be able to

1. Calculate the Partial Properties and Fugacity coefficients using various equations.
2. Calculate Fugacity and Fugacity Coefficients for miscible binary Mixtures.
3. Calculate and determine the activity coefficients by various models.
4. Calculate the Vapor- Liquid equilibrium (VLE) in form of T-X-Y or P-X-Y for miscible binary mixtures using various models.
5. Generate the Vapor- Liquid equilibrium (VLE) in form of T-X-Y or P-X-Y for miscible binary mixtures using various models.
6. Calculate and determine equilibrium constant and composition of product mixture at given temperature and pressure.

UNIT - I

Criterion of Phase Equilibrium: Fundamental property relations, Chemical potential, Gibss -Duhem equation, Partial Properties, Relation between Partial Properties and Molar properties, Chemical potential equation for an ideal gas, Fugacity, Fugacity Coefficients, Determination of Fugacity Coefficient by equations of states (Virial, Vander Waal, R.K. equation.)

UNIT - II

Solution Thermodynamics: Fugacity of pure liquids, Fugacity for Mixtures, Poynting factor, Residual Properties, Excess Properties, Lewis Randall Rule, Activity Coefficients.

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UNIT - III

The Nature of Phase Equilibrium: The Phase Rule, Duhem's Theorem, Models to calculate Activity Coefficients (Margules Equation, Van-laar, Wilson), Introduction to UNIQUAC, UNIFAC. Method to get activity coefficients (Margules and Van laar) by using Excess Gibbs Free Energy models.

UNIT - IV

Application of Phase Equilibrium: To get T-x-y, P-x-y, Using Raoult's law, Modified Raoult's law for miscible binary mixtures, following methods of BUBBL-T, Dew-T, BUBBL-P, DEW-P. Algorithm to find VLE by Peng- Robinson, R-K- Equation.

UNIT - V

Chemical Reaction Equilibrium: Reaction Coordinate, Equilibrium criteria for chemical reactions, equilibrium constant and effect of temperature , temperature and pressure effects on conversion, Calculation of equilibrium conversion for single reactions in homogenous systems, Duhem's Theorem for reacting systems.

Text Books:

1. J M Smith and H C VanNess, "Introduction to Chemical Engineering Thermodynamics", McGraw Hill, International Edition,Fourth edition, 1987.

Suggested Reading:

1. Pradeep Ahuja, "Chemical Engineering Thermodynamics", PHI Publishers, EEE, 2009
2. YVC Rao, "Chemical Engineering Thermodynamics" Universities Press, 2003.

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16CH C 18

CHEMICAL PROCESS SAFETY

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course helps the students to understand the:

1. Importance of safety culture in process industry.
2. Disregard for ethical decision making based on numerous case studies.
3. Interaction and implementation of trade-offs concept in chemical plant operation.
4. Examples of problems that can occur with inadequate process design, improper process modification.
5. Different case studies related to industrial processes

Course Outcomes: At the end of the course, the students will be able to:

1. Evaluate effect of chemical hazards and risks of toxicants.
2. Analyze chemical incidents and possible consequences to plant facilities, workers, and the general public.
3. Apply the technique of safe process design.
4. Analyze fire and explosion hazards.
5. Integrate safety concepts into chemical plant design.
6. Follow the ethics during process plant operation.

UNIT – I

Introduction: Process industrial safety –definition, importance. Safety awareness – Safety aspects of site selection, plant planning and layout, check list, inline arrangement of tower drums, exchangers, pumps and main pipelines.

Case studies of major disasters due to safety violations: Chernobyl disaster, Bhopal disaster, recent oil spills. Chemical hazards and workers safety, industrial process case studies.

UNIT – II

Organized labor interest in safety: Involvement of unions in accident prevention, recommendation of occupational health committees. Work Policy of MCA in accident prevention at process industries. Risk assessment procedures (HAZOP) and typical operational practices. Necessary precautionary measures (OSHA).

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Hazards: Identification and operability studies. Involvement of chemical criminals in process industries and their prevention. DOW Fire and explosion index, calculation of the DOW Fire and EI. Chemical safety data sheets and guides.

UNIT – III

Safety education and training: Training of personnel, on- the- job and job instructed training, meeting and instructional presentations. Effects of toxic Agents, chemicals and smoke on skin, eyes, respiratory tract, digestive tract. Primary protection equipment (PPE) – types, significance and applications. Measuring safety effectiveness: criteria for effective measurement, disabling (Lost-time) injuries, frequency rate, severity rate. Problem related safe-t-score. Involvement of inspector of factories in accident prevention. The technique of safe process design, separation sections, materials handling, storage sections, flowsheet review.

UNIT – IV

Fires and explosions: Definition of fire, fire triangle, Classification of fires as Class - A, B, C and D. Reaction of fires. Fire extinguishers: Portable fire extinguishers applications and their uses, Construction and working of water, Mechanical foam, CO_2, stored powder, ABC powder. Automatic multiple CO_2 extinguishers in chemical process industries.

UNIT – V

Emergency preparation and accident investigation: On-site and off-site emergency plan and infrastructure, learning from accidents, layered investigation, equipments aiding in diagnosis. Safety audit: Introduction, essentials, requirements, programs and procedures.

Text Books:

1. D. A. Crowl and J.F. Louvar, "Chemical Process Safety", Prentice Hall, New Delhi, 2011.
2. Howard H. Fawcett and W. S. Wood, "Safety & Accident prevention in chemical operations", 2nd Ed., John Wiley and Sons Inc, 1982.

Suggested reading

1. Coulson and Richadson, "Chemical Engineering Design", 3rd ed., Vol 6, TMH, 1999.
2. Fulekar M.H, "Industrial Hygiene and Chemical Safety", I.K. International Publisher, 2006.
3. Sanders R.E., "Chemical Process Safety: Learning from case Histories", Butterworth-Heinemann (Elsevier) pub, 2005.

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16CH C 19

PROCESS DYNAMICS AND CONTROL

Instruction	4L Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	4

Course Objectives: To provide a conceptual and methodological framework to

1. Analyze the transient behavior of simple chemical processes (using mathematical modeling from first principles and Laplace transforms)
2. Feedback control of processes - concepts, terminology, methods, and performance
3. Linearise relative to steady state
4. Obtain solution of linear dynamic problems in the laplace domain
5. Understand advanced control strategies with industrial examples

Course Outcomes: At the end of the course the student will be able to:

1. Characterize and analyze the dynamic behavior of linear systems (1^{st} and 2^{nd} order)
2. Understand the importance of various modes of control
3. Construct block diagrams for simple chemical processes
4. Analyze stability of simple feedback control systems
5. Analyze and tune process controllers to achieve desired performance
6. Empirically identify process dynamics

UNIT – I

Introduction: Response of First order system, Transfer Function, Transient response to step, impulse, sinusoidal forcing function, physical examples of first order systems, liquid level, mixing process, concept of time constant, linearization, response of first order systems in series, interacting and non-interacting systems

UNIT – II

Response of Second Order Systems: Transient response of under damped, critically damped, over damped systems to step, impulse and sinusoidal forcing functions. Transportation lag

Control Systems: Negative and Positive feedback control systems, Servo and Regulatory control problems, Development of Block diagram, Controllers and final control elements, Ideal transfer functions of P, PI, PD and PID controllers

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UNIT – III

Control system block diagrams and Stability: Reduction of physical control systems to block diagrams. Closed loop transfer functions for servo & regulator problems. Overall Transfer functions for multi loop control systems. Transient response of simple control systems for servo and regulator problems, measurement lags. Stability of a control system by Routh's Criterion

UNIT – IV

Root Locus: concept of root locus, plotting of the root locus diagram for feedback control systems, Transient response of control system from root locus plot.
Frequency response: Bode diagrams for first order, first order system in series, second order systems and for controllers and transportation lag. Bode stability criterion. Gain margin and phase margin

UNIT – V

Advanced Control Strategies: Cascade Control, Feed Forward Control, Ratio control
Controller Tuning and Process Identification: ISE, ITAE, IAE, Ziegler-Nicholas and Cohen-Coon tuning methods, process identification by step, frequency and pulse testing
Control valves: Construction, sizing, Characteristics and valve positioner (only theoretical aspects)

Text Books:

1. Donald R Coughanowr , Steven E LeBlanc, "Process Systems Analysis and Control", 3rd ed., McGraw Hill Inc, 2009

Suggested Reading:

1. George Stephanopoulos , "Chemical Process Control: An Introduction to Theory and Practice", PHI, 1984
2. Michael L Luyben, William L Luyben, "Essentials of Process Control", McGraw-Hill, 1997
3. Seborg, Edgar, Mellichamp and Doyle, "Process Dynamics and Control", 3rd Edition, Wiley India Pvt. Ltd., 2014

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16CH C 20

PROCESS MODELING SIMULATION AND OPTIMIZATION

Instruction	4 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	4

Course Objectives: This course helps the students to understand the:

1. Fundamental laws of mass and of energy.
2. Uses and types of mathematical models.
3. formulate linear and non-linear process models.
4. formulate ODE process models and curve-fitting.
5. significance of optimization principles.
6. open-loop simulation and design of chemical processes.

Course outcomes: At the end of the course, the students will be able to:

1. formulate a process model by applying fundamental laws of mass and energy balance.
2. formulate linear and non-linear process models for chemical processes and apply numerical methods and MATLAB codes to solve them.
3. formulate ODE process models and solve by numerical methods and MATLAB coding.
4. fit polynomial functions as process models and solve by regression analysis and MATLAB coding.
5. optimize using different elimination methods of non-linear programming.
6. design and simulate chemical processes.

Note: Use of "MATLAB" programming techniques for problem solving.

UNIT – I: Formulation of process models

Definition of mathematical modeling, process models, types and uses, principles of formulation. Fundamental laws of mass and energy. Application of laws and process models to develop – Total continuity equation, component continuity equations, energy equation, momentum equation.

UNIT – III: Numerical solutions of linear and non-linear process models

Formulation of linear simultaneous process models and solutions by direct methods of Gauss-Elimination and Gauss-Jordan methods and indirect Gauss-Seidel method.

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Understanding the concept of ill-conditioning. Formulation of non-linear process models and solutions by Bisection, Regula-falsi and Newton Raphson methods.

UNIT – II: Curve-fitting and numerical solutions of ordinary differential process models

Curve-fitting and engineering problem solving by linear and nonlinear least square analysis. Formulation of ordinary differential process models and solutions by Euler's method and Runge-Kutta fourth order method.

UNIT – IV: Chemical process optimization

Introduction, engineering applications, statement of an optimization problem, design constraints, objective function, classification of optimization problems.
Non-linear programming – elimination methods like unrestricted search, exhaustive search, dichotomous search, Fibonacci method, golden-section method.

UNIT – V: Simulation of chemical processes

Application of mathematical modeling and open loop simulation and design of gravity flow tank, two-heated tanks, three CSTRs in series, batch reactor, binary distillation column.

Textbooks:

1. Applied numerical methods with MATLAB for engineers and scientists, Steven C. Chapra, 3rd ed., Tata-McGraw Hill Edu. (India) Pvt.Ltd., New Delhi, 2012.
2. Process Modeling, Simulation and Control for Chemical Engineers, by William L. Luyben, 2nd ed., McGraw Hill Pub. Co., New Delhi, 1990.
3. Engineering optimization, theory and practice, Singiresu S. Rao, 3rd ed., New-age Intl. Pvt. Ltd., Hyderabad, 1999.

Reference books:

1. Numerical methods for chemical engineering: Applications in MATLAB, Kenneth J. Beers, Cambridge Univ. press., New York, 2007.
2. Numerical methods in engineering and science (with programs in C, C++ and MATLAB), B. S. Grewal, 10th ed., Khanna pub., Nagpur, 2014.
3. Applied mathematical methods for chemical engineers, Mickley H.S., Sheerwood T.K., Reed C.E., McGraw Hill book Co., New York, 1957.

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16CH E 08

ENERGY ENGINEERING (ELECTIVE IV)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To impart knowledge on various energy sources and their applications
2. To introduce emerging technologies viz., fuel cells, bio fuels etc.
3. To know the process of crude fuels
4. To understand the advantages and disadvantages of various energy sources
5. To familiarize the concepts of energy audit and conservation

Course Outcomes: At the end of the course the student will be able to understand:

1. The significance and classification of energy sources.
2. The basic principles and fundamentals of conventional energy sources
3. The basics and applications of various non-conventional energy sources.
4. The production and future perspectives of bio fuels
5. The significance of future energy resources
6. The importance of energy auditing and conservation

UNIT – I

Introduction: Introduction to conventional and non conventional energy sources, alternative energy sources, their significance & availability, consumption patterns in India. Energy survey and policies for India

UNIT – II

Conventional Energy Sources:

Wood and wood Charcoal, products of wood carbonization Coal and Coal derived fuels, characteristics, production methods and uses. Oil and Gases: Fuels derived from oil and gases, Characteristics, production methods and uses. Technology for combustion of fuels derived from oil and gas. Shale oil and gas, oil sands

UNIT – III

Non conventional Energy Sources:

Solar Energy: Basics, Types of Solar Energy Collectors, Applications- Solar Distillation, pumping, production of hydrogen.

Photo Voltaic Cells: Introduction, Types of photo voltaic Cells, Applications, Electrical Storage and Future developments

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Wind-Energy: Introduction, Basic principles of wind energy conversion. Types of wind machines.

UNIT – IV

Bio Fuels: Introduction, Bio mass conversion technologies- Wet processes, dry processes, Bio-gas generation. Factors affecting bio-digestion, Classification of biogas plants Production methods, characteristics, uses of bio-diesel, bio-butanol and bio-ethanol, Second generation bio-fuel feed stocks.

Fuel Cells: Working principle, Types, Advantages, Current and Future Applications.

Nuclear Energy: Nuclear fission and fusion fuels processing, nuclear reactions and nuclear reactors.

UNIT - V

Energy Auditing and Conservation: Short term, medium term, long term schemes, energy conversion, energy index, energy cost, representation of energy consumption, Sankey diagram, energy auditing. Conservation methods in process industries, theoretical analysis, practical limitations.

Text Books:

1. G D Rai, "Non -conventional energy sources," Khanna Publishers, 4th edition, 2000.
2. Samir Sarkar, "Fuels and Combustion", Universities Press, 3rd Edition 2009.

Suggested Reading:

1. Om Prakash Gupta, "Fundamentals of Nuclear Power Reactors", Khanna Publishers S Srinivasan, "Fuel Cells: From Fundamentals to Applications", Springer, 2006.

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16CH E 09

FLUIDIZATION ENGINEERING
(ELECTIVE IV)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course helps the students to understand:

1. Basic fundamentals of fluidization and fluidized bed behavior.
2. Minimum fluidization and pressure drop across the bed.
3. Various models to analyze the behavior and mixing patterns.
4. Heat and mass transfer aspects of fluidized bed.
5. Concepts of fluidized bed combustion chamber.

Course Outcomes: At the end of the course, the students will be able to:

1. Calculate the minimum fluidization velocity and optimum operating fluidization velocity.
2. Design the cooling tube length for required heat transfer area.
3. Design the fluidized bed in terms of pressure drop across the bed.
4. Design the distributors, TDH, height, diameter, power consumption of compressor for air.
5. Distinguish between boiler and furnaces, methods of starting up.
6. Calculate the amount of chemicals required to control the emission like SO2.

UNIT – I
INTRODUCTION:
Processes involving contact between solid particles and a Fluid, Packed Beds, Fluidized Beds advantages and disadvantages of fluidized beds for industrial applications. Fundamental fluidized bed behavior, Fast fluidization, circulating fluidized beds. Particles and Fluidization: Physical properties of solid particles, size and shape, size range, surface area of particles in a bed, Bed voidage, classification of particles according to Fluidization characteristics, pressure drop across packed beds, minimum fluidization velocity and its determination.

UNIT – II
TWO – PHASE THEORY OF FLUIDIZATION:
Bubbles and Fluidization Regimes, Bubble rise velocity, Bed expansion, Bubble growth and slugging, Mixing, Elutriation and Transport of solids, General mechanism

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of mixing of particles, mixing and segregation of particles, Terminal velocity of particles, Elutriation, transport disengaging height, solids transport. Davidson's Model, Diffusion model, Bubbling bed model ideal mixing stage model, two regime models.

UNIT – III

FLUIDIZED BED HEAT TRANSFER:

Heat Transfer in Beds of Particles, Gas -to- particle heat transfer, Bed – to- surface heat transfer, particle convection component, interphase gas connective component, Radioactive component, Estimation of Bed–to surface Heat Transfer coefficient, Heat Transfer between the Bed-Distributor, side walls, immersed tubes or components, Heat Transfer to surfaces located above the Bed, Free surface, Design for physical operation, Batch and continuous operation for Mass & Heat Transfer and Drying of solids.

UNIT IV

DESIGN OF SIMPLE FLUIDIZED BEDS:

Introduction, Estimation of Bed Dimensions and Fluidizing velocity, Transport disengaging Height, Distributors, Heat removal from fluidized beds from cooling tubes in the bed, optimum size of a fluidized bed reactor. Power consumption.

UNIT – V

FLUIDIZED BED COMBUSTION:

Introduction, combustion systems for solid fuels combustors and the first law of thermodynamics, fluidized Bed combustion of solid fuels size of fluidized bed combustion system, size of inert particles in the bed, turndown efficiency of fluidized bed combustion, Equipment, combustion of fuel particles in a fluidized bed, Distinguish between boiler and furnaces, methods of starting up, circulating or fast fluidized bed combustion systems, control of emission of SO_x ,CO and CO_2

Text Books:

1. J.R. Howard Adam Hilger, "Fluidized Bed Technology -Principles & Applications", IOP, Pub Ltd., NY. 1989.

Suggested Reading

1. Diazo Kuni & Octave Levenspiel, " Fluidization Engineering", 2nd Edition, John Wiley and Sons, 2002.
2. John M. Matsen, Grace John R , "Fluidization", Springer-Verlag New York Inc., 1980.

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16CH E 10

PHARMACEUTICAL TECHNOLOGY
(ELECTIVE IV)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The students will able to understand

1. Grade of chemicals, Principles & Various Tests.
2. Preparation & testing of Pharmaceuticals & final chemicals.
3. The Concepts & Principles to draw the flow sheets.
4. Methods & equipment used for Tablets, Capsules Preparation
5. Sterilization methods.

Course Outcomes: At the end of the Course Students will able to

1. Get a know how about the grades, Identify the Impurities & limit tests.
2. Prepare & test the Properties of Pharmaceuticals & fine Chemicals.
3. Draw flow sheets for Manufacturing Pharmaceuticals.
4. Draw flow sheets for Manufacturing Chemicals.
5. Have a theoretical knowledge about tablet & Capsule making.
6. Know various sterilization methods.

UNIT I

Introduction : A brief outline of grades of chemicals, sources of impurities in chemicals, principles (without going into details of individual chemicals) of limit test for arsenic, lead, iron, chloride and sulfate in Pharmaceuticals.

UNIT II

Outlines of Preparation, properties, uses and testing of the following Pharmaceuticals - sulfacetamide, paracetamol, riboflavin, nicotinamide, Outlines of Preparation, properties, uses and testing of the following fine chemicals - Methyl orange, fluorescence, procaine hydrochloride, para amino salicylic acid, isonicatinic acid hydrazide.

UNIT III

Study of Manufacture & Production of Pharmaceuticals – aspirin, penicillin, calcium gluconate with uses Properties flow sheets and testing Methods.

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UNIT IV

Study of Manufacture & Production of Chemicals with flowsheets, properties uses and testing of the following: ferric ammonium citrate, pthallic anhydride and phenol flourobenzene process and benzene sulfate process, other processes in outline only.

UNIT V

Tablet making, coating, granulation and granulation equipments Preparation of capsules, extraction of crude drugs. Sterilization: introduction, risk factor, methods of sterilization, heat (dry and moist), heating with bactericide, filtration, gaseous sterilization and radiation sterilization, suitable example to be discussed.

TEXT BOOKS:

1. Remington's Pharmaceutical Science,16th ed, Mac publishing company, 1980.
2. Industrial Chemicals, 3rd ed., Faith, Kayes and Clark, John Wiley & Sons,. 1965.

Suggested Reading:

1. Blently's Text Book of Pharmaceutical Chemistry, 8th ed, H A Rawlins, B Tindell and Box,. Oxford University Press, London, 1977.

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16CH C 21

CHEMICAL REACTION ENGINEERING LABORATORY

Instruction	3Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	2

Course Objectives: Students will be able to understand

1. Reaction kinetics in homogenous systems.
2. Reaction kinetics in heterogeneous systems.
3. Behavior of non Ideal reactors.

Course Outcomes: Students will able to

1. Find rate equations in batch reactor, mixed flow reactor, PFR, packed bed Reactor.
2. understand the concept of reaction and mass transfer in a liquid –liquid and solid-liquid system.
3. Predict conversion in adiabatic reactor.
4. Determine the extent of non –ideality in tubular reactor.

LIST OF EXPERIMENTS

(Any Eight Experiments to be performed)

1. Studies in Batch Reactor: To find the Arrhenius form of temperature dependency of reaction
2. Studies in Mixed Flow Reactor (CSTR) : To find kinetics from reactor performance of CSTR
3. Studies in Tubular Reactor: To determine the rate constant and to verify the order of reaction
4. Mass Transfer with Chemical Reaction: (Liquid – Liquid Reaction System) To find out the mass transfer coefficient in a stirred cell: With chemical reaction and without chemical reaction
5. Mass Transfer with Chemical Reaction: (solid – Liquid Reaction System) To find the mass transfer co-efficient without chemical reaction and with chemical reaction.
6. R.T D Studies in Packed bed reactor: To determine the axial mixing (axial dispersion) in the packed column.

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7. R T D Studies in Tubular Column To determine the variance of residence time distribution and the dispersion number in a tubular column.
8. Studies in Batch Reactor: With Equimolar Feed (M = 1) : To determine the rate constant and to verify the order of reaction by differential & integral methods of analysis.
9. Studies in Batch Adiabatic Reactor: to determine the kinetics of an exothermic reaction from the Temperature of the reaction system.
10. Studies in Mixed Flow Reactors in series: To compare the actual & ideal performances of a Reaction system.
11. Studies in Packed bed: To determine the rate constant and to verify the order of reaction from performance of the reactor.

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16CH C 22

PROCESS DYNAMICS AND CONTROL LABORATORY

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	2

Course Objectives: Students will be able to understand

1. Dynamic response of first and second order processes
2. The difference between interacting and non-interacting systems
3. Characteristics of various controller modes
4. Method and significance of controller tuning
5. Relation between valve stem position and the fluid flow through a control valve

Course Outcomes: Students will able to

1. Evaluate the step response and frequency response of first order systems
2. Identify the difference between closed loop and open loop operations
3. Choose the controller mode for a particular requirement in the system
4. Determine the characteristics of a second order under damped system
5. Determine the controller parameters using tuning rules
6. Analyze the stability of a system using Frequency response (Bode Plots)

LIST OF EXPERIMENTS

(Minimum of EIGHT experiments has to be performed)

1. Determination of order and time constant of a first order system
2. Determination of frequency response of a first order system
3. Determination of Bode plot from dynamic studies of first order system
4. Study the effect of PID controller parameters on closed loop servo response
5. Feedback controller tuning by Zeigler-Nicholas method
6. Feedback controller tuning by Cohen-Coon method
7. Determination of dynamics of interacting liquid level system
8. Determination of dynamics of non-interacting liquid level system
9. Determination of dynamics of a first order system (thermometer)

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10. Determination of second order under damped characteristics from the dynamics of second order system (manometer/thermo well)
11. Determination of pneumatic valve characteristics
12. Study of cascade control system

Note: Experiments (1 to 5) can be designed on any of the following computer controlled systems.

a. Liquid-Level
b. Flow
c. Temperature
d. Pressure

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16CH C 23

PROCESS MODELING SIMULATION LABORATORY

Instruction	3 hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	25 Marks
Credits	2

Course Objectives: This practical course helps the students to understand the:

1. Application of their MATLAB coding skills learnt in previous semesters, as a prerequisite for problem solving.
2. Formulation of a process models leading to ODE.
3. Formulation of a process models leading to linear equations.
4. Formulation of a process models leading to non-linear equations.
5. Open-loop simulation through MATLAB coding for simple chemical processes.

Course outcomes: At the end of the course, the students will be able to:

1. Develop and solve ODE for chemical processes and apply numerical methods to solve them using MATLAB.
2. Develop and solve linear equations and apply numerical methods to solve them using MATLAB.
3. develop and solve non-linear equations and apply numerical methods to solve them using MATLAB.
4. Fit polynomial functions to given data and solve by regression analysis using MATLAB.
5. Solve the process models developed for open-loop simulation of selected unit operations in chemical engineering using MATLAB.

LIST OF EXERCISES

Note: The Programs are to be written in "MATLAB"

PART – A: Chemical engineering problem solving [All exercises are compulsory]

1. Solution of ordinary differential equations by Euler's method, Runge-Kutta fourth order method
2. Solution of set of linear simultaneous equations by Gauss-elimination, Gauss-Jordan and Gauss-Seidel methods

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3. Solution of non-linear equations by bisection, Newton Raphson andRichmond iteration methods
4. Curve fitting by Linear Least square analysis.

PART – B: Application for open loop simulation(Any four process systems)

1. Two-heated Tanks in series
2. Three CSTRs in series at isothermal, constant holdup condition
3. Batch Reactor
4. Vapor Liquid Equilibrium
5. Ideal Binary distillation
6. Gas-Phase Pressurized CSTR

PART – C: Demonstration of process simulators

Application of process simulation software packages. Understanding the basicconcepts and steps involved for developing process flowsheet.

Suggested Reading:

1. Applied numerical methods with MATLAB for engineers and scientists, Steven C. Chapra, 3rd ed., Tata-McGraw Hill Edu. Pvt.Ltd., New Delhi, 2012.
2. Process Modeling, Simulation and Control for Chemical Engineers, by William L. Luyben, 2nd ed., McGraw Hill Pub. Co., New Delhi, 1990.
3. Numerical methods in engineering and science (with programs in C, C++and MATLAB), B. S. Grewal, 10th ed., Khanna pub., Nagpur, 2014.

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)
Choice Based Credit System (with effect from 2019-20)
B.TECH (Chemical Engineering)

SEMESTER – VII

S. No.	Course Code	Title of the Course	Scheme of Instruction		Scheme of Examination			Credits
			Hours per week		Duration of SEE in Hours	Maximum Marks		
			L/T	P/D		CIE	SEE	
THEORY								
1	16CH C 24	Mass Transfer Operations –II	3	-	3	30	70	3
2	16CH C 25	Petrochemical Engineering	3	-	3	30	70	3
3	16CH C 26	Process Equipment Design	3	-	3	30	70	3
4	16CH C 27	Transport Phenomena	3	-	3	30	70	3
5		Core Elective-V	3	-	3	30	70	3
6		Open Elective-I	3	-	3	30	70	3
PRACTICALS								
7	16CH C 28	Equipment Design and Drawing Lab	-	3	3	25	50	2
8	16CH C 29	Mass Transfer Operations Lab	-	3	3	25	50	2
9	16CH C 30	Seminar	-	3	-	50	-	2
TOTAL			**18**	**9**	**-**	**280**	**520**	**24**

L: Lecture T: Tutorial D: Drawing P: Practical
CIE - Continuous Internal Evaluation SEE - Semester End Examination

Core Elective-V	
16CH E 11	Polymer Technology
16CH E 12	Pulp and Paper Technology
16CH E 13	Pollution Control in Process Industries

Open Elective-I	
16CE O 02	Disaster Mitigation and Management
16ME O 01	Entrepreneurship
16ME O 04	Intellectual Property Rights
16EG O 01	Technical Writing Skills

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16CH C 24

MASS TRANSFER OPERATIONS – II

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course helps the students to understand the

1. Distillations methods - batch, semi continuous, continuous distillation for binary miscible systems.
2. Various methods to design distillation columns.
3. Concepts of solvent extraction methods using Triangular diagrams for ternary systems and binary immiscible system along with design.
4. Concepts of various leaching methods and leaching equilibriums with design.
5. Concepts of Absorption, Adsorption equilibrium / Isotherms and design.

Course Outcomes: At the end of the course, the students will be able to

1. Differentiate the application of various types of distillation processes.
2. Design and estimate the number of theoretical stages of distillation column using McCabe- Thiele method and Ponchan-Savarit method.
3. Design and estimate the number of theoretical stages for Liquid-Liquid extraction.
4. Design and estimate the number of theoretical stages for Solid-Liquid extraction.
5. Design and estimate the number of theoretical stages for Adsorber.

UNIT- I: Distillation

VLE Phase diagrams – Tie lines and mixture rule – Flash vaporization and differential distillation for binary mixtures – Steam distillation. Batch distillation with reflux for binary mixtures.

UNIT-II: Continuous fractionation

Continuous fractionation of binary mixtures, Ponchan – Savarit method, McCabe – Thiele method for determination of ideal plates for binary mixtures, Optimum reflux ratio, Use of total and partial condensers. Use of open steam. Packed bed distillation. Principles of Azeotropic and Extractive distillation.

UNIT–III: Liquid – Liquid Extraction

Solubilities of ternary liquid systems. Triangular and solvent free coordinate systems. Choice of solvent. Extraction with insoluble and partially soluble systems – single stage, multistage cross-current and multistage counter-current extraction without reflux and Continuous contact extraction (packed beds). Equipments for liquid – liquid extraction operation.

UNIT–IV: Leaching

Preparation of solid, Unsteady state operation, in-place leaching, heap leaching, percolation leaching, Shanks system, agitated vessels, percolation in closed vessels, Percolation Vs Agitation. Steady state continuous operation–equipment-methods of calculation, stage efficiency and practical equilibrium. Single stage leaching, multistage cross current leaching, multistage counter current leaching.

UNIT-V: Adsorption

Principles of Adsorption and their applications – Types of adsorption – Adsorbents – Adsorption equilibrium – Adsorption Isotherms for vapor and dilute solutions. Single stage and multistage adsorption, Adsorption wave and breakthrough curve and fixed bed adsorption. Equipment for Adsorption operation.

Text Books:

1. R.E.Treybal, “Mass Transfer Operations”, 3rd Edition, McGraw Hill Book Company, 2002.
2. Geankoplis, “Transport Processes and Separation Processes Principles”, 4th Edition, Prentice Hall, 2003.

Suggested Readings:

1. Richardson and Coulson, “Chemical Engineering”, Volume 1, Tata McGraw Hill Publications, 2000
2. Binay.K. Dutta, “Principles of Mass Transfer & Separation Processes”, Eastern Economy Edition, PHI learning Pvt, ltd, 2015.
3. Warren McCabe and Julian Smith and Peter Harriott, “Unit Operations of Chemical Engineering”, 7 th ed., McGraw Hill Book Company, 2005.

16CH C 25

PETRO CHEMICAL ENGINEERING

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course helps the students to understand the

1. Petroleum refinery worldwide.
2. Extraction and production of oil and gas to meet energy needs.
3. Importance of refining crude oil for a wide spectrum of useful products such as petrochemicals, plastics.
4. Manufacturing of Propylene derivatives
5. Manufacturing of higher Hydrocarbons

Course Outcomes: At the end of the course, the students will be able to

1. Grade the crude oil, its composition and applications based on formation theories.
2. Know refining process of crude oil.
3. Apply the techniques of catalytic and non-catalytic cracking methods.
4. Design the manufacture of derivative products.
5. Design the safety and pollution control techniques in petroleum refining industries.

UNIT-I

Origin and formation of petroleum: Organic theories, Inorganic theories and biological methods for explaining the formation of Crude oil. Definition of refining terms - API Gravity, Aniline point, Octane number, Cetane number, Smoke point, Fire point, Flash point, Diesel Index, Naphtha, Types of Naphtha etc. Composition and applications of crude oil. Petroleum Refining - Overall refining of crude petroleum. Production of gasoline, kerosene and lubricating oils.

UNIT-II

Rebuilding of Hydrocarbons and techniques involved: Naphtha cracking: Definition, types, reactions, fluidized bed cracking, description of the reactors. Alkylation - Hydrofluoric acid process and sulphuric acid process Isomerization - Aluminum chloride process and isomerization with platinum catalyst. Polymeriztion - Types of polymerizations, mechanism of polymerization, polymerization in presence of sulphuric acid, polymerizations in presence of phosphoric acid.

UNIT-III

Ethylene Derivatives: various products with ethylene as the starting materials. Manufacturing of the following - Vinyl Chloride Monomer, Perchloroethylene " pyrolysis of carbon tetra chloride, chlorination and pyrolysis method, Ethyl alcohol by direct hydration and liquid phase hydration methods, Vinyl acetate monomer, Ethylene oxide and its applications , Polyethylene, Styrene.

Unit-IV

Propylene derivatives: list of propylene derivatives. Manufacturing of the following - Isopropyl alcohol, Acetone by catalytic dehydrogenation, Propylene oxide, Glycerine by Acrolein, allyl chloride and by isomerization of propylene oxide methods. Derivatives of C_4 Hydrocarbons: List of butadiene derivatives, Manufacturing of butadiene from n-butylene and by oxidative dehydrogenation., Purification of butadiene

UNIT-V

Derivative of Higher Paraffins:-Manufacturing of Isoprene, olefins of C_5 , C_6, long chain and straight chain Olefins.

Derivatives of Aromatics: Sources of aromatic compounds, production of aromatics. Effect of temperature, pressure and catalyst on dehydrogenation process. Separation of aromatics from Non-aromatics and separation of aromatics into individual streams

Text Books:

1. W.L.Nelson, "Petroleum refinery engineering" 4th ed., McGraw Hill company, 2013.
2. B.K.Bhasker Rao, "Modern petroleum refining process", 5th ed., Oxford and IBH, 2008.

Suggested Readings:

1. N.K.Sinha, "Petroleum Refining and Petro Chemicals", 1st edition, Umesh publications, 2003.
2. Kirk-Othmer, "Encyclopedia of Chemical Technology", 3rd Ed..John Wiley and sons.Inc, 2004.

16CH C 26

PROCESS EQUIPMENT DESIGN

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course objectives: This course helps the students to understand the

1. Classification of unfired pressure vessels observed in process industries.
2. Mechanical design of process vessels for shells, domes and other significant component parts.
3. Process design of reactors based on their operation.
4. Sieve-tray hydraulics and downcomer design of distillation columns.
5. Shell and tube heat exchanger design and applications

Course outcomes: At the end of the course, the students will be able to

1. Identify the design needs for process equipment based on operating conditions of chemical plant operation.
2. Design flanges and nozzles and to select the right component parts for any process vessel
3. Design process equipments like storage vessels, reactors.
4. Design continuous distillation for multi component system
5. Design shell and tube heat exchanger (1-2)

UNIT – I: Design of Pressure Vessels

Classification of equipment, types of pressure vessels, General design considerations for process equipment like pressure, temperature, codes and standards, stresses, welding categories, material of construction, corrosion allowance, major and minor constraints.

Design and calculations for thin-walled vessels under internal pressure: cylindrical and spherical shells, domes – flat plates, torispherical, elliptical, hemispherical, conical heads.

Design of thin-walled vessels under external pressure: cylindrical shells, vessel heads, need and types of stiffeners.

UNIT – II: Design of Vessel Components

Significant component parts of process vessels. Flanges and gasket – classification, types, design calculations for loose type non-standard flanges. Equipment supports – types, selection criteria.

Nozzles – design calculations for deciding the compensation requirements for openings and branches. Jackets for process vessels – Types, selection criteria, comparison with immersion coils.

UNIT – III: Design of Reactors

Reactors – classification basis, types, selection criteria, application, comparison. Process design – significance of mass and energy balances, reaction rates. Calculations to estimate volume of reactor.

UNIT – IV: Design of Continuous stage-wise Distillation Column

Design of tall columns under combined loading – source of loads, stress balance – pressure, wind and weight loads.

Prediction of plate efficiency of distillation columns – types and design methodology.

Underwood-Fenskee method for design of continuous distillation with multiple feeds and side streams for multi component system (three component).

UNIT – V: Design of Shell and Tube Heat Exchanger (1-2)

Introduction to Heat Exchangers, Temperature difference, Pressure drop in shell and tube side, overall heat transfer coefficient, LMTD calculation, Flow arrangement for increased heat recovery (1-2 shell tube heat exchanger)

Design of Shell and Tube Heat exchanger, shell side film coefficients, shell side pressure drop.

Text Books:

1. Dr. Shrikanth D. Dawande, "Process Design of Equipments" Vol. 1 & 2, Central Techno Publications, Nagpur, 2000.
2. D Q Kern, "Process Heat Transfer" International Edition 1965, McGraw-Hill Book.

Suggested Readings:

1. M.V. Joshi, "Process Equipment Design", 2nd Ed., McMillan Co. of India Limited, Madras, 1976.
2. J.M.Coulson, J.F.Richardson, R.K. Sinnott, "Chemical Engineering Design", Vo1. 6, Ed 3, Butterworth – Heinemann publishers, New York, 2000.
3. Ernest E. Ludwig, "Applied process design for chemical and petrochemical plants", Vol 3, Elsevier Inc., 2001.
4. Bachurst, J.R. and Harker, J.H, "Process Plant Design", American Elsevier Pub. Co., London, 1973.

16CH C 27

TRANSPORT PHENOMENA

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course objectives: This course helps the students to understand the

1. Fundamentals to solve flow problems involving transport of momentum, energy and mass using a unified approach.
2. Analogy between momentum, mass and energy transport.
3. Turbulent phenomena and the methods of characterizing the turbulent fluxes
4. Equations of change for isothermal and non-isothermal systems and multi-component mixtures.
5. Development of governing equations

Course Outcomes: At the end of the course, student will be able to

1. Apply the first principles to solve various chemical engineering problems.
2. Compare various flow phenomena
3. Develop expressions for steady state velocity, temperature and concentration profiles using shell balance method
4. Apply equations of change to solve flow problems.
5. Develop expressions for unsteady state isothermal and non-isothermal flows

UNIT – I

Introduction – Mechanism of molecular transport of momentum, heat and Mass Transfer. Flux equations – Newton's, Fourier's and Fick's laws - Similarities and differences

Non-Newtonian fluids, transport properties – estimation, temperature and pressure dependence, estimation of transport properties of binary gaseous mixtures

Velocity distributions in laminar flow – shell momentum balances – Flow of falling film – flow of fluids through circular tubes, annulus and Immiscible fluids between parallel plates.

UNIT – II

Temperature distributions in solids and in laminar flow – shell balances - Heat conduction with electrical, Nuclear, viscous and chemical heat source Heat conduction through composite walls, and cooling fin; Forced convection and free convection

UNIT – III

Concentration distributions in solids and in laminar flow - shell mass balances, diffusion through a stagnant gas film, Diffusion with homogenous chemical reaction and heterogeneous chemical reaction. Diffusion into a falling liquid film-chemical reaction inside a porous catalyst

UNIT – IV

Equations of change for isothermal systems – Equation of continuity, Equation of Motion, Equations of change, use of equations of change to set up steady flow problems. Equations of change for non-isothermal systems – Equation of energy – use of equations of change to set up steady state flow problems. Equation of change for a binary mixture – Equation of continuity of a component in curvilinear coordinates

UNIT – V

Unsteady state problems in momentum, energy and mass transfer operations; Turbulence - Time smoothing of equations of change of momentum, energy and Mass Transfer; Eddy properties - Intensity of turbulence Reynolds stresses; Semi empirical expressions for turbulent –Momentum – energy and mass fluxes

Text Books:

1. R.B.Bird, W.E.Stewart, and E.N.Lightfoot , "Transport Phenomena", John Wiley & Sons. Inc. 2002

Suggested Readings:

1. R.S.Broadkay, "Introduction to Transport Phenomena", McGraw Hill Publications, 1980.
2. J. R. Welty, C. E Wicks and R. E. Wilson, Fundamentals of Momentum, Heat and Mass Transfer, 3rd Ed., 1984
3. Geankoplis, "Transport Processes and Separation Processes Principles". 4th Edition, Prentice Hall, 2003

16CH E 11

POLYMER TECHNOLOGY

(CORE ELECTIVE V)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course objectives: This course helps the students to understand the

1. To provide a fundamental knowledge on polymers and their chemical, physical and mechanical behavior.
2. Understand the structure-processing-property relationship of polymers.
3. Emphasis is on the processing techniques, along with the production of polymers.
4. To understand the synthesis, manufacture, processing and characterization of different polymers
5. To understand the basic issues involved in polymer blends, composites and nanocomposites.

Course Outcomes: At the end of the course, student will be able to

1. Familiarize the polymers, polymerization techniques and behavior in polymers
2. Understand the different types of polymerization.
3. Illustrate the different techniques used to determine the molecular weight of polymers
4. Impart knowledge on various testing methods and characterization of polymers
5. Familiarize the various polymer processing techniques for polymers, rubbers and fibers

UNIT-I

Definitions and concepts of terms used in polymer engineering, Classification of polymers; Polymer structures, functionality; polymerization reactions – mechanism of polymerization; stereospecific polymerization, copolymerization. Polymer material structure and Properties: Deformation, flow and melt characteristics. Morphology and order in crystalline polymers. Rheology and the mechanical properties of polymers. Polymer structure and physical properties.

UNIT-II

Polymerization reactors, polymerization processes, characterization of polymers, analysis of polymerization reactions, polymer degradation, Condensation polymerization, Addition polymerization, Ionic and coordination polymerization.

UNIT-III

Molecular weight and molecular weight distribution in polymers, properties of polymers – physical, chemical, mechanical and electrical properties of polymers, elementary idea on polymer rheology, polymer blends. Experimental methods for molecular weight determination: cryoscopy, ebulliometry, membrane osmometry, light scattering method, viscometry, intrinsic viscosity measurement, gel permeation chromatography. Structure and Properties: Thermal transitions, Crystallinity, Molecular weight characterization, Nuclear Magnetic Resonance (NMR) and Fourier Transform Infrared (FTIR) techniques.

UNIT–IV

Polymer processing: modeling – compression & transfer, injection & jet; casting; extrusion, calendaring, lamination, spinning & finishing. Processing methods , effect of additives used, plasticizers, colourants, heat stabilizers, antioxidants, ultraviolet absorbers, antistatic agents, flame retardants, blowing agents, fillers etc. Molding techniques for plastics, injection molding, compression molding, calendaring, blow moulding, extrusion, thermoforming, spinning methods for fibres, compounding methods for elastomers, general study of elastomer processing methods.

UNIT-V

Industrial polymers: Manufacturing processes, properties and uses of Polyethylene, Polypropylene, Polyvinylchloride, Polystyrene, Nylon, Polyethylene terephthalate. Hydrocarbon plastics and elastomers. Other carbon chain polymers. Heterochain thermoplastics. Thermosetting resins. Polymer Blends: Types, Compatibility, Thermal and Mechanical Properties. Polymer Composites: Types, Properties, Preparation, Fibre-reinforced composites, In-situ composites. Polymer Nanocomposites: Basic concepts, Processing, Characterization.

Text Books:

1. Text Book of Polymer Science, F. W. Billmeyer, John Wiley, New York
2. Polymer Science & Technology, P.Ghosh, TMC

Suggested Readings:

1. The elements of Polymer Science & Engineering, Alfred Rudin, Academic Press, 2nd Edition.
2. Introduction to Polymers, R. J. Young, Chapman & Hall, London

16CH E 12

PULPAND PAPER TECHNOLOGY
(COREELECTIVE V)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course will help the students to understand the

1. Basic concepts of Pulp and Paper making processes
2. Details of physical and chemical characteristics of fibrous raw materials and black liquor
3. Various types of cooking and bleaching methodologies
4. Recovery of energy and chemicals used in pulping processes with due techno-economic and environmental considerations
5. Different paper testing methods

Course outcomes: At the completion of this course, students will be able to

1. Design the operation, maintenance and safety aspects for paper making.
2. Identify the factors that drive industry trends.
3. Grade paper and boards based on different testing methods.
4. Select appropriate bleaching technique for required paper quality.
5. Differentiate the important wood and fiber properties that affect paper quality.

UNIT – I: Introduction

Importance of Paper: Definitions of Pulps

Wood Parts & Types: Ultra structure of Cell Wall, Wood cell types, Early & Latewood, Softwoods, Hardwoods & Non-woods. Comparison of different raw materials. Distribution of Wood Constituents – Cellulose, Hemi-cellulose, Lignin, Extractives and Inorganic components.

UNIT – II: Overview of pulping process

Mechanical Pulping: Pressurized ground pulping, Refiner Pulping, Chemo (thermo) mechanical pulping processes.

Kraft Pulping: Description of Kraft Cooking Process, Kraft recovery, Composition & Analysis of white liquor, Chemical reactions & process variables. Pulp yield, End uses of kraft pulps.

UNIT – III: Pulp and black liquor characterization

Pulp testing methods - Kappa number, water retension value, CED viscosity, drainability, beater evaluation, zero span tensile strength.

Black liquor characterization - Chemical properties, viscosity and rheological behavior at different concentrations, thermal properties, calorific value, thermal conductivity, specific heat, black liquor oxidation, desilication and concentration of black liquor.

UNIT-IV: Bleaching operations

Objectives of bleaching – Elemental chlorine free and total chlorine free bleaching; Bleachability and its measurement, bleaching reactions, reaction kinetics and operating variables for different bleaching agents like ClO_2, O_2, O_3, hypochlorite, H_2O_2 .

Stages of bleaching – Oxygen delignification, Chlorination, Extraction, Hypochlorite bleaching, Ozone bleaching, Peroxide bleaching, Operating variables for different bleaching stages; ECF and TCF bleaching systems for chemical pulps; bleaching systems for mechanical and high yield pulps.

UNIT – V: Paper Making and its Properties

Paper Testing Methods – Flowsheet of complete pulp and paper making process, Strength properties, Surface properties, Optical properties & Absorption properties. Different grades of paper, boards & newsprint specifications; BIS and ISO standards of paper. Paper properties dependence on paper making processes, Calibration of instruments. Paper recycling process, Effluent treatment processes with environmental considerations.

Text Books:

1. Kenneth W. Britt , " Handbook of Pulp & Paper Technology", 2nd Edition, Reinhold Publishing Corporation, 2004.
2. G.A Smook ., "Handbook for Pulp & Paper Technologists" , 3rd Edition, Angus Wilde Publications, 2003.

Suggested Readings:

1. Hakan Karlsson, "Fiber Guide-Fiber analysis and process applications in the pulp & paper industry", Ab Lorentzen and Wetre, 1st Ed., 2006.
2. EIRI Board ., "Handbook of Pulp & Paper, Paper board and Paper based Technology", Engineers India Research Institute, 2nd Ed., 2015.

16CH E 13

POLLUTION CONTROL IN PROCESS INDUSTRIES
(CORE ELECTIVE V)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course will help the students to understand the

1. Effects of pollution on environment and ecosystems
2. Types and sources of pollution from process industries,
3. Measurement of air and water pollution in process industries
4. Different methods and equipment used in industrial pollution abatement
5. Pollution control practices in process industries

Course outcomes: At the completion of this course, students will be able to

1. Differentiate the types of wastes generated in an industry, their effects on living and non-living things
2. Understand the effect of climate changes, atmospheric dispersion of air pollutants, and operating principles.
3. Working principles of particulate control devices.
4. Quantify industrial wastewater and its treatment.
5. Analyze the hazardous and nonhazardous solid wastes and select the treatment and disposal methods.

UNIT - I Introduction

Definition and types of pollution from chemical industries. Effects of pollution on environment and ecosystems - global warning - greenhouse effect. Laws and standards for pollution. Sources, types, characteristics and effects of air pollutants, liquid effluents, solid wastes in process industries.

UNIT – II Air Pollution

Meteorological aspects of pollution dispersion, adiabatic and environmental lapse rate, Turbulence and stability of atmosphere. Indoor air pollution - smoke and hydrocarbons. Richardson Number, Plume raise, plume behavior and characteristics, effective stack height.

General Control Methods and Equipment: removal of sulphur dioxide, oxides of nitrogen and carbon, organic vapors from gaseous effluents. Removal of particulate matter - principle and working of settling chambers cyclone separators solid traps, fabric and fiber filters, electro-static precipitators.

UNIT – III: Water pollution

Concepts and estimation of oxygen demands - DO, BOD, COD, TOD. Oxygen sag curve, BOD curves and modeling. Wastewater Treatment – Concept, significance and classification as Primary, Secondary, Tertiary methods. Principle, working mechanism and applications of biological treatment techniques like stabilization ponds, Aerated lagoons, conventional activated sludge process, aerobic and anaerobic methods, suspended and attached growth processes, fluidized bed contractors. Trickling filters.

UNIT - IV Introduction to industrial Solid waste management

Industrial solid wastes “ Types, classification, properties, management and general disposal methods. industrial solid wastes – environmental effects and disposal methods commonly practiced. Methods practiced in paper and textile industries.

UNIT - V Pollution control practices in Process Industries

Principle, working mechanism and application of tertiary treatment methods like carbon adsorption, Ion-exchange, Reverse Osmosis, Ultra Filtration in process industries.

Sludge treatment and disposal methods like Incineration and land filling. Pollution control in petroleum and fertilizer industries

Text Books

1. C.S.Rao, “ Environmental Pollution Control Engineering “, 2nd Ed, New Age International, 2007.
2. S.P.Mahajan, “ Pollution control in process industries”, 27th Ed, McGraw Hill Pub., 2002.

Suggested Readings:

1. Metcalf and Eddy, “ Wastewater Engineering: Treatment and Reuse”, 4th Edition , MGH publishing, 2004.
2. M.N Rao and H.V.N Rao, “Air Pollution”, Tata McGraw- Hill Publishing Company Limited, New Delhi, 2000.
3. Peavy, H.S., Rowe, D.R. and Technobanolous, G., “Environmental Engineering”, McGraw Hill, 1985.

16CE O 02

DISASTER MITIGATION AND MANAGEMENT

(OPEN ELECTIVE I)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course will help the students to understand the

1. Basic knowledge of hazards, disasters, risks and vulnerabilities including natural, climatic and human induced factors and associated impacts
2. Nature, causes, consequences and mitigation measures of the various natural disasters
3. Risks, vulnerabilities and human errors associated with human induced disasters
4. Impacts of any disaster on the affected area depending on its position/ location, environmental conditions, demographic, etc.
5. Chronological phases in a disaster management cycle and to create awareness about the disaster management framework and legislations in the context of national and global conventions

Course outcomes: At the completion of this course, students will be able to

1. Ability to analyze and critically examine existing programs in disaster management regarding vulnerability, risk and capacity at different levels
2. Ability to understand and choose the appropriate activities and tools and set up priorities to build a coherent and adapted disaster management plan
3. Ability to understand various mechanisms and consequences of human induced disasters for the participatory role of engineers in disaster management
4. To understand the impact on various elements affected by the disaster and to suggest and apply appropriate measures for the same
5. Develop an awareness of the chronological phases of disaster preparedness, response and relief operations for formulating effective disaster management plans and ability to understand various participatory approaches/strategies and their application in disaster management

UNIT-I:

Introduction: Basic definitions- Hazard, Disaster, Vulnerability, Risk, Resilience, Mitigation, Management; classification of types of disaster- Natural and man-made; International Decade for natural disaster reduction (IDNDR); International strategy for disaster reduction (ISDR), National disaster management authority (NDMA).

UNIT-II:

Natural Disasters: Hydro meteorological disasters: Causes, Early warning systems- monitoring and management, structural and non-structural measures for floods, drought and Tropical cyclones; Geographical based disasters: Tsunami generation, causes, zoning, Early warning systems- monitoring and management, structural and non-structural mitigation measures for earthquakes, tsunami, landslides, avalanches and forest fires. Case studies related to various hydro meteorological and geographical based disasters.

UNIT-III:

Human induced hazards: Chemical disaster- Causes, impacts and mitigation measures for chemical accidents, Risks and control measures in a chemical industry, chemical disaster management; Case studies related to various chemical industrial hazards eg: Bhopal gas tragedy; Management of chemical terrorism disasters and biological disasters; Radiological Emergencies and case studies; Case studies related to major power break downs, fire accidents, traffic accidents, oil spills and stampedes, disasters due to double cellar construction in multi-storeyed buildings.

UNIT-IV:

Disaster Impacts: Disaster impacts- environmental, physical, social, ecological, economical, political, etc.; health, psycho-social issues; demographic aspects-gender, age, special needs; hazard locations; global and national disaster trends; climate change and urban disasters.

UNIT-V:

Concept of Disaster Management: Disaster management cycle – its phases; prevention, mitigation, preparedness, relief and recovery; risk analysis, vulnerability and capacity assessment; Post-disaster environmental response-water, sanitation, food safety, waste management, disease control; Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR programmes in India and the activities of National Disaster Management Authority.

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Text Books:

1. Pradeep Sahni, *Disaster Risk Reduction in South Asia*, Prentice Hall, 2003.
2. B. K. Singh, *Handbook of Disaster Management*: *techniques & Guideline* , Rajat Publication, 2008.

Suggested Readings:

1. Ministry of Home Affairs". *Government of India, "National disaster management plan, Part I and II",*
2. K. K. Ghosh," *Disaster Management",* APH Publishing Corporation, 2006.
3. http://www.indiaenvironmentportal.org.in/files/file/disaster_management_india1.pdf
4. http://www.ndmindia.nic.in/ (National Disaster management in India, Ministry of Home Affairs)
5. Hazards, Disasters and your community: A booklet for students and the community, Ministry of home affairs.

16ME O 01

ENTREPRENEURSHIP (OPENELECTIVEI)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course will help the students to understand the

1. The environment of industry and related opportunities and challenges
2. Concept and procedure of idea generation
3. Elements of business plan and its procedure
4. Project management and its techniques
5. Behavioral issues and Time management

Course outcomes: At the completion of this course, students will be able to

1. Identify opportunities and deciding nature of industry
2. Brainstorm ideas for new and innovative products or services
3. Analyze the feasibility of a new business plan and preparation of Business plan
4. Use project management techniques like PERT and CPM
5. Analyze behavioural aspects and use time management matrix

UNIT-I

Indian Industrial Environment: Competence, Opportunities and Challenges, Entrepreneurship and Economic growth, Small Scale Industry in India, Objectives, Linkage among small, medium and heavy industries, Types of enterprises, Corporate Social Responsibility.

UNIT-II

Identification and Characteristics of Entrepreneurs: First generation entrepreneurs, environmental influence and women entrepreneurs, Conception and evaluation of ideas and their sources, Selection of Technology, Collaborative interaction for Technology development.

UNIT-III

Business Plan: Introduction, Elements of Business Plan and its salient features, Technical Analysis, Profitability and Financial Analysis, Marketing Analysis, Feasibility studies, Executive Summary.

UNIT-IV

Project Management: During construction phase, project organization, project planning and control using CPM, PERT techniques, Human aspects of project management, Assessment of tax burden

UNIT-V

Behavioral Aspects of Entrepreneurs: Personality, determinants, attributes and models, Leadership concepts and models, Values and attitudes, Motivation aspects, Change behavior

Time Management: Approaches of time management, their strengths and weaknesses. Time management matrix and the urgency addiction

Text Books:

1. Vasant Desai, "Dynamics of Entrepreneurial Development and Management", Himalaya Publishing House, 1997.
2. Prasanna Chandra, "Project-Planning, Analysis, Selection, Implementation and Review", Tata Mcgraw-Hill Publishing Company Ltd. 1995.
3. S.S. Khanka, "Entrepreneurial Development", S. Chand & Co. Pvt. Ltd., New Delhi

Suggested Readings:

1. Robert D. Hisrich, Michael P. Peters, "Entrepreneurship", 5/e, Tata Me Graw Hill Publishing Company Ltd., 2005.
2. Stephen R. Covey and A. Roger Merrill, "First Things First", Simon and Schuster Publication, 1994.
3. Sudha G.S., "Organizational Behavior", National Publishing House, 1996.

16ME O 04

INTELLECTUALPROPERTYRIGHTS
(OPENELECTIVEI)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course will help the students to understand the

1. Fundamental aspects of IP
2. Aspects of IPR acts.
3. Awareness of multi disciplinary audience
4. Awareness for innovation and its importance
5. The changes in IPR culture and techno-business aspects of IPR

Course outcomes: At the completion of this course, students will be able to

1. Will respect intellectual property of others
2. Learn the art of understanding IPR
3. Develop the capability of searching the stage of innovations.
4. Will be capable of filing a patent document independently.
5. Completely understand the techno-legal business angle of IPR and converting creativity into IPR and effectively protect it.

UNIT-I

Overview of Intellectual Property: Introduction and the need for intellectual property right (IPR), IPR in India – Genesis and Development, IPR abroad, Some important examples of IPR. Importance of WTO, TRIPS agreement, International Conventions and PCT

Patents: Macro economic impact of the patent system, Patent and kind of inventions protected by a patent, Patent document, How to protect your inventions. Granting of patent, Rights of a patent, how extensive is patent protection. Why protect inventions by patents. Searching a patent, Drafting of a patent, Filing of a patent, the different layers of the international patent system, (national, regional and international options), compulsory licensing and licensers of right & revocation, Utility models, Differences between a utility model and a patent. Trade secrets and know-how agreements

UNIT-II

Industrial Designs: What is an industrial design. How can industrial designs be protected? What kind of protection is provided by industrial designs? How long does the protection last? Why protect industrial designs?

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UNIT-III

Trademarks: What is a trademark, Rights of trademark? What kind of signs can be used as trademarks. Types of trademark, function does a trademark perform, How is a trademark protected? How is a trademark registered. How long is a registered trademark protected for? How extensive is trademark protection. What are well-known marks and how are they protected? Domain name and how does it relate to trademarks? Trademark infringement and passing off.

UNIT-IV

Copyright: What is copyright. What is covered by copyright. How long does copyright last? Why protect copyright? Related Rights: what are related rights. Distinction between related rights and copyright. Rights covered by copyright? Copy rights in computer programming.

UNIT-V

Enforcement of Intellectual Property Rights: Infringement of intellectual property rights Enforcement Measures Emerging issues in Intellectual property protection. Case studies of patents and IP Protection.

Unfair Competition: What is unfair competition. Relationship between unfair competition and intellectual property laws.

Text Books:

1. Ajit Parulekar and Sarita D' Souza, "Indian Patents Law – Legal & Business Implications", Macmillan India ltd , 2006
2. B. L.Wadehra; "Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications", Universal law Publishing Pvt. Ltd., India 2000
3. P. Narayanan, "Law of Copyright and Industrial Designs", Eastern law House, Delhi 2010

Suggested Readings:

1. W.R1 Cronish, "Intellectual Property; Patents, copyright, Trad and Allied rights", Sweet & Maxwell, 1993.
2. P. Narayanan, "Intellectual Property Law", Eastern Law Edn., 1997.
3. Robin Jacob and Daniel Alexander, "A Guide Book to Intellectual Property Patents, Trademarks, Copy rights and designs", 4/e, Sweet, Maxwell,.

16EG O 01

TECHNICAL WRITING SKILLS
(OPEN ELECTIVE I)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course will help the students to understand the

1. Process of communication and channels of communication in general writing and technical writing in particular.
2. Learn Technical Writing including sentence structure and be able to understand and use technology specific words.
3. Write business letters and technical articles.
4. Write technical reports and technical proposals.
5. Learn to write agenda, record minutes of a meeting, draft memos. Understand how to make technical presentations.

Course outcomes: At the completion of this course, students will be able to

1. Communicate effectively, without barriers and understand aspects of technical communication.
2. Differentiate between general writing and technical writing and write error free sentences using technology specific words
3. Apply techniques of writing in business correspondence and in writing articles.
4. Draft technical reports and technical proposals.
5. Prepare agenda and minutes of a meeting and demonstrate effective technical presentation skills.

Unit I

Communication – Nature and process.

Channels of Communication – Downward, upward and horizontal communication. Barriers to communication.

Technical Communication – Definition, oral and written communication. Importance and need for Technical communication. Nature of Technical Communication. Aspects and forms of Technical communication. Technical communication Skills – Listening, Speaking, Reading & Writing.

Unit II

Technical Writing – Techniques of writing. Selection of words and phrases in technical writing. Differences between technical writing and general writing.

Abstract and specific words. Sentence structure and requisites of sentence construction. Paragraph length and structure.

Unit III

Business correspondence – Sales letters, letters of Quotation, Claim and Adjustment letters.

Technical Articles: Nature and significance, types. Journal articles and Conference papers, elements of technical articles.

Unit IV

Technical Reports: Types, significance, structure, style and writing of reports. Routine reports, Project reports.

Technical Proposals : Definition, types, characteristics, structure and significance.

Unit V

Mechanics of Meetings: Preparation of agenda, participation, chairing and writing minutes of a meeting. Memorandum. Seminars, workshops and conferences.

Technical Presentations : Defining purpose, audience and locale, organizing content, preparing an outline, use of Audio Visual Aids, nuances of delivery, importance of body language and voice dynamics.

Text Book

1. Meenakshi Raman & Sangeeta Sharma, **"Technical Communications- Principles and Practice",** Oxford University Press, Second Edition, 2012.
2. 1.M Ashraf Rizvi, **"Effective Technical Communication",** Tata McGraw Hill Education Pvt Ltd, 2012.

Suggested Readings:

1. Kavita Tyagi & Padma Misra, **"Basic Technical Communication",** PHI Learning Pvt Ltd, 2012.
2. R.C Sharma & Krishna Mohan, **"Business Correspondence and Report Writing",** Tata McGraw Hill, 2003

Web Resources:

1. https://onlinecourses.nptel.ac.in/noc18_mg13/preview
2. https://www.technical-writing-training-and-certification.com/
3. https://academy.whatfix.com/technical-writing-skills

16CH C 28

EQUIPMENT DESIGN AND DRAWING LAB

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	25 Marks
Credits	2

LIST OF EXERCISES

1. Symbols for Piping and Instrumentation.
2. Flow sheet symbols for unit operations.
3. Types of Heat transfer equipment and their representation symbols.
4. Process fluid transport equipment symbols.
5. Development and drawing of few flow sheets.
6. Typical layout, mechanical design and elevation drawings of storage vessels.
7. Design and elevation drawings of Reactor kettles.
8. Layout, design and elevation drawings of heat exchangers.
9. Elevation drawings and design of plate distillation column.

Text Books

1. Vilbrandt, C.T. and Dryden, C.E., "Chemical Engineering plant design", 4th Ed., Kogakusha, 1979.
2. Joshi, M.V. "Process Equipment Design", 2nd Ed., McMillan Co. of India Limited, Madras, 1976.
3. Bachurst, J.R. and Harker, J.A. "Process Plant Design", Heiman Education Books, London, 1973.
4. Evans, F.L., "Equipment Design Hand Book for refineries and Chemical Plants", Vol .I, 1979, Vol. II, 1980, Gulf Publishing Co., Houston, Texas.

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16CH C 29

MASS TRASNFER OPERATION LAB

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	25 Marks
Credits	2

LIST OF EXERCISES

1. Determination of concentration profile for the given system
2. Estimation of diffusivity coefficient for the gaseous system (CCl_4 - Air)
3. Estimation of diffusivity coefficient for the liquid system (H_2SO_4 - water)
4. Determination of vapor - liquid equilibrium data for the given system.
5. Estimation of vaporization efficiency and prediction of steam distillation temperature.
6. Verification of the Rayleigh's equation for the system of methanol and water.
7. Determination of the capacity coefficient of the packed column under total reflux conditions and calculation of height equivalent to theoretical plate.
8. Development of the solubility curve for the given system
9. Prediction of Liquid - Liquid equilibrium data for the given system and determination of the plait point.
10. Calculation for percentage of extraction of solute from solid mixture using a solvent (Solid-Liquid extraction).
11. Estimation of the mass - transfer coefficient k_G for Air- Water system and plotting the variation of k_G with Reynold's number.
12. Developing the drying curve by using tray drier and estimation and composition of time required for drying the given solid.

Text Books

1) Christie John Geankoplis, " Transport Processes and Separation Process Principles" , 4th Ed., Prentice Hall India, 2003.
2) McCabe and Julian Smith and Peter Harriott, " Unit Operations of Chemical Engineering", 7 th Ed., McGraw Hill Book Company, 2005.
3) R.E.Treybal, "Mass Transfer Operations", 3rd Edition, McGraw Hill Book Company 1981.

16CH C 30

SEMINAR

Instruction	3 Hours per week
CIE	50 Marks
Credits	2

The goal of a seminar is to introduce students to critical reading, understanding, summarizing, explaining and preparing report on state of the art topics in a broad area of his/her specialization. Seminar topics may be chosen by the students with advice from the faculty members and the student shall read further relevant articles in the domain.

The seminar must be clearly structured and the power point presentation shall include following aspects:

1. Introduction to the field
2. Literature survey
3. Consolidation of available information
4. Summary and Conclusions
5. References

Each student is required to:

1. Submit a one page synopsis of the seminar talk for display on the notice board.
2. Deliver the seminar for a maximum duration of 30 minutes, where the presentation should be for 20 minutes in PowerPoint, followed by Question and Answers session for 10 minutes.
3. Submit the detailed report of the seminar in spiral bound in a précised format as suggested by the department.

Seminars are to be scheduled from 3rd week to the last week of the semester and any change in schedule shall be discouraged.

For the award of sessional marks students are judged by three (3) faculty members and are based on oral and written presentations as well as their involvement in the discussions during the oral presentation.

Note: Topic of the seminar shall preferably be from any peer reviewed recent journal publications.

Guidelines for awarding marks		
Sl No.	Description	Max Marks
1.	Contents and relevance	10
2.	Presentation skills	10
3.	Preparation of PPT slides	05
4.	Questions and answers	05
5.	Report in a prescribed format	20

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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)
Choice Based Credit System (with effect from 2019-20)
B.TECH (Chemical Engineering)

SEMESTER – VIII

S. No.	Course Code	Title of the Course	Scheme of Instruction		Scheme of Examination			Credits
			Hours per week		Duration of SEE in Hours	Maximum Marks		
			L/T	P/D		CIE	SEE	
THEORY								
1.	16CH C 31	Plant Design Economics	3	-	3	30	70	3
2.	-	Core Elective-VI	3	-	3	30	70	3
3.	-	Open Elective-II	3	-	3	30	70	3
4.	16CH C 32	Project Seminar	-	3	-	50	-	2
5.	16CH C 33	Project	-	6	viva	50	100	6
Total			**9**	**9**	**--**	**190**	**310**	**17**

L: Lecture T: Tutorial D: Drawing P: Practical
CIE – Continuous Internal Evaluation SEE - Semester End Examination

Core Elective-VI	
16CH E 14	Membrane Separation Technology
16CH E 15	Sugar Technology
16CH E 16	Food Technology

Open Elective-II	
16ME O 05	Nano Materials and Technology
16CS O 03	iOT and application
16PY O 01	History of Science and Technology
16EG O 02	Gender Sensitization

16CH C 31

PLANT DESIGN AND ECONOMICS

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course will help the students to understand the
1. Fundamentals of investments and engineering economics.
2. Flow sheet synthesis and integrate with process equipment design.
3. Design concepts with principles of process economics.
4. Methods to quantify concepts such as fixed capital investment, cash-flow analysis, profitability analysis and decision making.
5. Piping and tubing specifications, P and ID diagrams

Course outcomes: At the completion of this course, students will be able to
1. Calculate the time value of money and depreciation.
2. Estimate fixed and working capitals and operating costs for process plants.
3. Evaluate the profitability of process industry projects using measures such as ROI, NPV and DCF
4. Identity and apply the selection criteria for design of flow sheets, equipment and material.
5. Design the piping specifications as per standards.

UNIT – I
Economic equations. Present and future worth. Equivalence and value for money. Nominal and effective interest rates.
Capitalized cost, sinking fund, definition of bond and problems. Types of depreciation and problems.

UNIT - II
Capital requirements by Chilton and Lang, Schweyer, Cost indices methods. Total investment schedule. Sources of capital. Balance sheet and problems. Economic charts. Problems on break even, variable cost, fixed cost. Estimation of profit and capital ratios.

UNIT-III
Selection of alternative equipment or plants by annual cost. Present cost and Capitalized cost methods. Replacement of existing equipment. Rate of return and payout time methods and problems.

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UNIT – IV

Process evolution. Stages of process design. Types of flowsheets. Selection criteria of process equipment - material handling (solids, liquids & gases) - separation equipment (solid - solid sold - liquid, liquid - solid etc), Size reduction equipment, agitators, drying equipment filtration equipment, reactors. Procedure for material selection. Introduction to Design and Automation of process plants. Examples.

UNIT – V

Piping and tube specifications, pipe fabrication methods, piping material, principles of piping layout, piping stresses, stress design and supports. Pressure drop in pipe lines, piping friction factor, design of pipe lines for natural gas, selection of valves. Introduction to P & ID Diagrams.

Text Books

1. Max. Peters, K Timmerhaus and Ronal West, "Plant Design and Economics for Chemical Engineers", 5th Ed., McGraw Hill Publications, 2003.
2. C.Vilbrandt and Dryden C.E, "Chemical Engineering Plant Design", 4th Ed, MGH Book Co., Reprints 2015.

Suggested Readings:

1. Seider W.D., Seader J.D. & Lewin D.R., "Product and Process Design principles: Synthesis, Analysis and Evaluation", John Wiley & Sons, Inc., 2nd ed., 2010
2. J.M. Coulson and J.F Richardson, "Chemical Engineering", Vol.6, 5th ed. Pergamon and ELES, 2003.
3. H.E.Schweyer., "Process Engineering Economics", MGH Book Co, NewYork, 2001.

16CH E 14

MEMBRANE SEPARATION TECHNOLOGY
(COREELECTIVEVI)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course will help the students to understand the

1. The fundamental principles and applications of different membrane processes
2. Types of membranes and preparation
3. Selection criteria for membrane processes
4. Various installations for Membrane Processes and simple design considerations
5. Design of membrane systems

Course outcomes: At the completion of this course, students will be able to

1. Understand different types of membrane processes
2. Identify a membrane process for a specific application
3. Understand the types and preparation of membranes
4. Calculate performance factors for various membrane processes
5. Write design equations for simple membrane modules

UNIT – I Introduction to Membrane Separation Processes: Classification of separation processes - Separating agents - principles of gas permeation, reverse osmosis, ultra-filtration, pervaporation, dialysis, Electro-dialysis.
Applications of membranes - for the separation of gases, waste water treatment, pulp and paper, electroplating and Electro-coating industries, food industry - denaturing of liquid foods, cheese making and whey processing

UNIT – II Preparation of Membranes: Basic introduction to different types of membrane materials. Basics of preparation of synthetic membranes - Sintering, Stretching, Track-Etching, Template Leaching, Phase-inversion, Coating, Sol-gel process

UNIT – III Ideal Separation on Capabilities of Membrane Processes: Separation factor, rejection factor, expressions for ideal separation factors in various membrane processes.

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Secondary Phenomena in Membrane processes: Secondary physical and transport phenomena in membrane processes, concentration polarization in membrane processes.

UNIT – IV **Equipment for Membrane Processes:** Flat sheet, tubular, spiral wound and hollow fiber membrane modular designs for various membrane processes, single entry and double entry separating elements, separation stage. Flow configuration in membrane systems.

UNIT – V **Design of Membrane Systems:** Design equations for perfect mixing and cross flow configuration, separation stages for gas permeation, reverse osmosis and ultra filtration. Design equations for perfect mixing and parallel flow dialyze. Simple design equations for Electro-dialytic stacks

Text Books

1. Kaushik Nath, "Membrane Separation Processes", PHI Learning, 2008
2. Marcel Mulder, "Basic Principles of Membrane Technology", Kluwer Academic Publishers, 2nd Ed., 1996.

Suggested Readings:

1. Membrane Technology Lecture series of Winter School conducted at College of Tech, O.U., December, 1987
2. W L McCabe, J C Smith and P Harriot, "Unit Operations of Chemical Engineering", 7th Ed., Mc-Graw Hill, 2005
3. Christie John Geonkoplis "Transport Processes and Separation Process Principals", Pearson New Intl. Ed., 2013

16CH E 15

SUGAR TECHNOLOGY
(COREELECTIVEVI)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course helps the students to understand the

1. Performance measures of different types of unit operations in sugar processing
2. Applications, advantages and limitations of the processing procedure
3. Competence and optimization of advanced technology in sugar processing.
4. Crystallization methodology and their applications
5. Possible byproducts of any sugar industry and production of salable derivatives.

Course outcomes: At the completion of this course, students will be able to

1. Principles and skills of work in sugar cane milling, processing and refining in practical settings.
2. Analyze the composition of different types of sugars by volumetric and gravimetric determination.
3. Different unit operations for effective processing of cane juice.
4. Batch and continuous methods for an efficient operation of sugar industry.
5. Concepts of quality assurance and control in industry as per Indian regulations and practices.

UNIT-I

Importance of sugar industry. Different raw materials for sugar manufacturing, composition of raw materials, history, origin and distribution of sugarcane, production and productivity of sugarcane in India. Indian sugar industry on global screen. Manufacturing processes of raw sugar and crystalline white sugar. Reducing sugars - composition, volumetric and gravimetric determination methods.

UNIT-II

Conveying of raw materials - cane carrier and feeding table working principles. Cane preparation – objective, sieving, preparation index, cane knives, crushing

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and shredding applications. Extraction of cane juice by milling operation - basic concept of roller mills, working principles, conditions for good milling operation, milling efficiency, maceration and imbibitions – importance, effect, method, objective and efficiency. Cane juice clarification – simple, compound and neutral defaction procedures. Sulphitation and carbonation - batch and continuous methods. Single and double carbonation process, De-Hans process, comparison of different clarification modern techniques.

UNIT-III

Juice heaters - construction and working principles. Juice filtration - plate and frame filter presses, RVDF, types of filter cake washing. Evaporation- multiple effect evaporators - construction and operation. Steam economy and capacity. Vacuum pan boiling - construction, types of pans, speed of circulation, heating surface to volume ratio, pan boiling techniques, different boiling schemes.

UNIT-IV

Crystallization – nucleation, graining methods, advantages and disadvantages of graining. Theory of crystallization, crystallization zone, crystal growth. centrifuge –construction & working, factors influences on time of curing. Advantages and disadvantages of batch / continuous centrifugal machine. Separation of molasses-different molasses conditioning methods, precautions during molasses conditioning.

Sugar drying -various aspects regarding drying and cooling, rotary dryer. Packing of sugar -types of sugar grader, dilution indicator, quality and safety factors, location and stalking of sugar bags.

UNIT-V

Sugar byproducts: bagasse, pressmud and molasses- their composition and applications. Production of bio-gas, fibre board, furfurol filter mud, extraction of cane wax, manure, industrial alcohol and rectified spirit. Sugar scales and normal weight.

Text Books

1. Meade and Chen, " Hand of book of cane sugar", 11^{th} Ed , Wiley Interscience, New York, 2001.
2. James C.P Chen, "Cane Sugar Hand book", 12^{th} Ed, Elsevier Pub. Co., New York, 1993.

Suggested Readings:

1. R B L Mathur, Hand Book of Cane Sugar Technology", 2^{nd} Ed, Oxford & IBH, 1978.
2. John H. Payne, "Unit operation in cane sugar production", Sugar series book 4, Elsevier Pub. Co., New York, 1982.

16CH E 16

FOOD TECHNOLOGY
(COREELECTIVEVI)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course objectives: This course helps the students to understand the

1. Basic food preparation techniques. Food quality.
2. Physical, chemical, and/or microbiological changes in food and mechanical manipulation.
3. Learn fundamentals of modifying food to meet current nutrition recommendations
4. Learn to find credible sources of information re. food science and nutrition.
5. Food processing Applications and Packaging

Course Outcomes: At the end of the course, student will be able to

1. Explain techniques in food processing
2. Design process equipment to achieve the desired quality of food.
3. Develop novel food processes that have a minimal effect on food quality
4. Select control strategies to maintain food quality
5. Apply the scientific method to food science problems

UNIT–I

Introduction: General aspects of food industry, World food demand and Indian scenario, Constituents of food, Quality and nutritive aspects, Product and Process development, engineering challenges in the Food Processing Industry.

UNIT–II

Basic principles: Properties of foods and processing theory, Heat transfer, Effect of heat on micro-organisms, Basic Food Biochemistry and Microbiology: Food Constituents; Food fortification, Water activity, Effects of processing on sensory characteristics of foods, Effects of processing on nutritional properties, Food safety, good manufacturing practice and quality Process Control in Food Processing.

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UNIT–III

Ambient Temperature Processing: Raw material preparation, Size reduction, Mixing and forming, Separation and concentration of food components, Centrifugation, Membrane concentration, Fermentation and enzyme technology, Irradiation, Effect on micro-organisms, Processing using electric fields, high hydrostatic pressure, light or ultrasound.

UNIT–IV

Heat processing using steam, water and air: Blanching, Pasteurization, Heat sterilization, Evaporation and distillation, Extrusion, Dehydration, Baking and roasting, Heat processing by direct and radiated energy: Dielectric heating, Ohmic heating, Infrared heating, Gamma irradiation.

UNIT–V

Post Processing Applications Packaging: Coating or enrobing, Theory and Types of packaging materials, Printing, Interactions between packaging and foods, Environmental considerations.

Text Books:

1. Fellows P., Food Processing Technology: Principles and Practice, Wood head Publishing, 4th Edition, 2016.
2. Toledo R, Fundamentals of Food Process Engineering, Springer, 3rd Edition, 2010.

Suggested Reading:

1. Singh R.P. & Heldman D.R., Introduction to Food Engineering, Academic Press, 3rd Edition, 2001.

16ME O 05

NANO MATERIALS AND TECHNOLOGY
(OPEN ELECTIVE II)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course helps the students to understand the

1. Nanotechnology approach and challenges
2. Materials and characterization procedures
3. Zero and One dimensional Nano structures
4. Various Fabrication Techniques
5. Special nano materials and Nano biomaterials

Course outcomes: At the completion of this course, students will be able to

1. Understand the developments and challenges in nano technology
2. Understand magnetic and electronic properties and its microstructure
3. Learn synthesis and characterization techniques of Zero and One dimensional Nano structures and their applications
4. Study various Nano Material Fabrication Techniques
5. Understand the applications of special nano materials and nano bio materials

UNIT-I

Introduction: Nanoscale, Properties at Nanoscale, advantages and disadvantages, importance of Nanotechnology, Bottom-up and Top-down approaches, challenges in nanotechnology

UNIT-II

Materials of Nanotechnology: Introduction, Si-based materials, Ge-based materials, Ferroelectric materials, Polymer materials, GaAs& InP (HI-V) group materials, Nanotribology and materials, characterization using Scanning Probe Microscope, AFM

UNIT-III

Nano Structures: Zero dimensional Nanostructure, synthesis procedure by heterogeneous method, characterization techniques, properties and applications of Nano particles

One dimensional Nanostructures: Synthesis procedure, characterization procedure and principles involved, properties and applications of Nano Wires

UNIT-IV

Nano Fabrication: Introduction, Basic fabrication techniques by Lithography and doping, MEMS fabrication techniques, Nano fabrication techniques by E-beam, Nano-imprint fabrication, Epitaxy and strain engineering

UNIT-V

Special Nano Materials: Introduction, Synthesis procedure by metal-polymer, Characterization procedures, applications

Nano Biomaterials: Introduction, Biocompatibility, anti-bacterial activity, applications

Text Books:

1. Dieter Vollath, "Nanomaterials: An introduction to Synthesis, properties and applications", Wiley, 2013
2. Guozhong Cao, "Nanostructures and Nano Materials, Synthesis properties and applications", Imperial College Press
3. Carl C Koch, "Nano materials Synthesis , Properties and applications", Jaico Publishing House

Suggested Reading:

1. Willia Tllsey Atkinson, "Nano Technology", Jaico Publishing House
2. George W. Hanson, "Fundamentals of Nanoelectronics", Pearson Education, 2009
3. T. Pradeep, "Nano: Essentials-understanding Nano Science and Technology", TMH, 2007

16CS O 03

Iot AND APPLICATIONS
(OPEN ELECTIVE II)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The main objectives of this course are:

1. Impart necessary and practical knowledge of components in Internet of Things.
2. Understand working of IOT Systems.
3. Develop skills required to build IOT based systems.

Course Outcomes: On Successful completion of this course, student will be able to

1. Understand Internet of Things and its hardware and software components.
2. Interface I/O devices, sensors & communication module.
3. Remotely monitor data and control devices.
4. Develop real time IOT based projects.
5. Advance towards research based IOT.

UNIT – I

Introduction to IoT: Sensors, Types of sensors and Transducers, Actuators and Types of Actuators.

UNIT – II

Basics of Networking: Functional Components of IoT, IoT interdependencies, IoT Service oriented architecture, IoT categories, IoT gateways, IoT and associated technologies, Key technologies for IoT, IoT challenges.

UNIT – III

IoT Hardware Components: Computing (Arduino/Raspberry Pi), Communication, Sensors, Actuators, I/0 interfaces, Programming API's (for Arduino/ Raspberry Pi).

UNIT – IV

IoT Application Development: Solution framework for IoT applications-Implementation of Device integration, Data acquisition and integration, Device data storage- Unstructured data storage on cloud/local server, Authentication, Authorization of devices

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UNIT – V

IoT Systems and Applications: Smart Lighting, Weather Monitoring System, Weather Reporting Bot, Forest Fire Detection, Alcohol Detection System, Smart Parking Environment., Drip-irrigation, Biological water treatment system, Work flow Automation in Industries, Smart Intrusion Detection System, monitoring space risks and hazardous conditions in industrial regions like underground tanks , trap door margins.

Text Books:

1. Raj and Anupama C. Raman,"The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press, 2017.
2. Jeeva Jose, "Internet of Things", Khanna Publishing House, Delhi, 2018.
3. Arshdeep Bahga and Vijay Madisetti, "Internet of Things: A Hands-on Approach", Universities Press, 2014.

Suggested Reading:

1. Dr. SRN Reddy, Rachit Tirnkral and Manasi Mishra, "Introduction to Internet of Things: A practical Approach", ETI Labs, 2018.
2. Adrian McEwen, "Designing the Internet of Things", Wiley, 2013.
3. Raj Kamal, "Internet of Things:Architecture and Design", McGraw Hill, 2017.
4. Cuno Pfister, "Getting Started with the Internet of Things", 0 Reilly Media, 2011.
5. O. Vermesan, P. Friess, "Internet of Things – Converging Technologies for Smart Environments and Integrated Ecosystems", River Publishers, Series in Communications, 2013.

Online Resources:

1. Li Da Xu, Wu He, and Shancang Li, "Internet of Things in Industries: A Survey ", IEEE Transactions on Industrial Informatics, Vol. 10, No. 4, Nov. 2014.
2. Gotovtsev, Pavel M., and Andrey V. Dyakov. "Biotechnology and Internet of Things for green smart city application." 2016 IEEE 3rd World Forum on Internet of Things (WF-IoT). IEEE, 2016.
3. Yanjing, Sun, et al. "Research and design of agriculture informatization system based on IOT." Journal of Computer Research and Development 48 (2011): 316-331.
4. Somov, Andrey, et al. "Bacteria to power the smart sensor applications: Biofuel cell for low-power IoT devices." 2018 IEEE 4th World Forum on Internet of Things (WF-IoT). IEEE, 2018.
5. Han, Shuqing, et al. "Analysis of the frontier technology of agricultural IoT and its predication research." IOP Conference Series: Materials Science and Engineering. Vol. 231. No. 1. IOP Publishing, 2017.

16PY O 01

HISTORY OF SCIENCE AND TECHNOLOGY
(OPEN ELECTIVE II)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course helps the students to understand the

1. To enablestudents to understand science as a socio-cultural product in specific socio-historical contexts.
2. To expose students to philosophical, historical and sociological perspectives to look atscience as a practice deeply embedded in culture and society.
3. To inculcate the scientific culture and ethics in the development of technologies.

Course outcomes: At the completion of this course, students will be able to

1. Demonstrate knowledge of broad concepts in the history of science, technology ranging over time, space and cultures.
2. Recognize the values of a wide range of methodologies, conceptual approaches and the impact of competing narratives within the history of science, technology.
3. Identify, locate and analyze relevant primary and secondary sources in order to construct evidence-based arguments.
4. Think independently and critically, using appropriate methodologies and technologies to engage with problems in the history of science, technology.
5. Demonstrate academic rigor and sensitivity to cultural and other diversity, and understanding of the ethical implications of historical and scientific enquiry within a global context.

Unit-I

Science - The Beginning (through 599 BC): The Stone Ages, Knowledge among hunter gatherers,Agricultural Revolution and other revolutions,Civilization,Major advances.

Science in Antiquity (600 BC - 529 AD): Philosophy, a precursor to science, Hellenistic world and the Roman Empire, Other cultures of the period, major advances.

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Unit-II

Medieval Science (530 AD - 1452 AD): The decline of science in Europe , Science in China, Science and mathematics in India, Arab science, revival of science in Europe, technology revolution of the Middle ages, Major advances.

The Renaissance and the Scientific Revolution (1453 AD – 1659 AD): Renaissance, Scientific Revolution, Technology, Major advances.

Unit-III

Scientific Method: Measurement and Communication (1660 AD – 1734): European domination, The scientific method, Major advances.

The Industrial Revolution (1735 AD – 1819 AD): Industrial Revolution, Rise of the engineer, Major Advances.

Unit-IV

Science and Technology in the 19th Century (1820 AD – 1894 AD): philosophical basis of 19th-century science,Science and the public, Science and technology, Major advances.

Rise of Modern Science and Technology (1895 AD – 1945 AD): The growth of 20^{th}century science, Newphilosophies, Quantum reality, Energy sources, Electricity: a revolution intechnology, Majoradvances.

Unit-V

Big Science and the Post-Industrial Society (1946 AD – 1972 AD): Big science, Specialization and changing categories, Technology changes society, Major advances.

The Information Age (1973 AD – 2015 AD): Information and society, Globalization, The post-industrial society,Problems of the Information age, Major Advances

Text Books:

1. Bryan Bunch and Alexander Hellemans, "The History of Science and Technology", Houghton Mifflin Company (New York), 2004
2. JD Bernal, "Science in History", 4 Volumes, Eklavya Publishers, 2012

Suggested Readings:

1. "The 100 Most Influential Scientists of All Time", Edited by Kara Rogers, Britannica Educational Publishing, 2010
2. Alberto Hernandez, "A Visual History of Science and Technology", The Rosen Publishing Group, 2016

16EG O 02

GENDER SENSITIZATION
(OPEN ELECTIVE II)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course helps the students to understand the

1. To develop students' sensibility with regard to issues of gender in contemporary India.
2. To provide a critical perspective on the socialization of men and women.
3. To expose the students to debates on the politics and economics of work. To help students reflect critically on gender violence.

Course outcomes: At the completion of this course, students will be able to

1. Develop a better understanding of important issues related to what gender is in contemporary India.
2. Be sensitized to basic dimensions of the biological, sociological, psychological and legal aspects of gender. This will be achieved through discussion of materials derived from research, facts, everyday life, literature, and film.
3. Attain a finer grasp of how gender discrimination works in our society and how to counter it. Students will acquire insight into the gendered division of labour and its relation to politics and economics.
4. Understand what constitutes sexual harassment and domestic violence and be made aware of New forums of Justice.
5. Draw solutions as to how men and women, students and professionals can be better equipped to work and live together as equals.

UNIT – I

Understanding Gender:

Gender: Why Should We Study It? (Towards a World of Equals: Unit -1)

Socialization: Making Women, Making Men (Towards a World of Equals: Unit -2)

Introduction. Preparing for Womanhood. Growing up Male. First lessons in Caste. Different Masculinities.

UNIT – II

Gender And Biology:

Missing Women: Sex Selection and Its Consequences (Towards a World of Equals: Unit -4)

Declining Sex Ratio. Demographic Consequences.
Gender Spectrum: Beyond the Binary (Towards a World of Equals: Unit -10)
Two or Many? Struggles with Discrimination.

UNIT–III

Gender and Labour:
Housework: the Invisible Labour (Towards a World of Equals: Unit -3)
"My Mother doesn't Work." "Share the Load."
Women's Work: Its Politics and Economics (Towards a World of Equals: Unit -7) Fact and Fiction. Unrecognized and Unaccounted work. Additional Reading: Wages and Conditions of Work.

UNIT-IV

Issues Of Violence
Sexual Harassment: Say No! (Towards a World of Equals: Unit -6)
Sexual Harassment, not Eve-teasing- Coping with Everyday Harassment- Further Reading:
"Chupulu".
Domestic Violence: Speaking Out (Towards a World of Equals: Unit -8)
Is Home a Safe Place? -When Women Unite [Film]. Rebuilding Lives. Additional Reading:
New Forums for Justice.
Thinking about Sexual Violence (Towards a World of Equals: Unit -11)
Blaming the Victim-"I Fought for my Life…." - Additional Reading: The Caste Face of
Violence.

UNIT – V

Gender: Co - Existence
Just Relationships: Being Together as Equals (Towards a World of Equals: Unit -12)
Mary Kom and Onler. Love and Acid just do not Mix. Love Letters. Mothers and Fathers.
Additional Reading: Rosa Parks-The Brave Heart.

Text Books:

1. A. Suneetha, Uma Bhrugubanda, DuggiralaVasanta, Rama Melkote,VasudhaNagaraj, AsmaRasheed, GoguShyamala, DeepaSreenivas and Susie Tharu "Towards a World of Equals: A Bilingual Textbook on Gender" published by Telugu Akademi, Hyderabad, Telangana State, 2015.

Suggested Readings:

1. Menon, Nivedita. Seeing like a Feminist. New Delhi: Zubaan-Penguin Books, 2012
2. Abdulali Sohaila. "I Fought For My Life…and Won."Available online at:
3. http://www.thealternative.in/lifestyle/i-fought-for-my-lifeand-won-sohaila-abdulal/

Web Resources:

1. https://aifs.gov.au/publications/gender-equality-and-violence-against-women/introduction
2. https://theconversation.com/achieving-gender-equality-in-india

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16CH C 32

PROJECT SEMINAR

Instruction	3 Hours per week
CIE	50 Marks
Credits	2

The objective of 'Project Seminar' is to enable the student take up investigative study in the broad field of Engineering / Technology, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on an individual basis or two/three students in a group, under the guidance of a supervisor. This is expected to provide a good initiation for the student(s) towards R&D. The work shall include:

1. Survey and study of published literature on the assigned topic;
2. Working out a preliminary Approach to the Problem relating to the assigned topic;
3. Conducting preliminary Analysis/Modelling/Simulation/Experiment/ Design/Feasibility;
4. Preparing a Written Report on the Study conducted for Presentation to the Department;
5. Final Seminar, as oral Presentation before a departmental Committee.

Guidelines for the award of Marks:Max. Marks: 50

Evaluation by	Max .Marks	Evaluation Criteria / Parameter
Supervisor	20	Project Status / Review
	5	Report
Department Committee	5	Relevance of the Topic
	5	PPT Preparation
	5	Presentation
	5	Question and Answers
	5	Report Preparation

16CH C 33

PROJECT

Instruction	6 Hours per week
CIE	50 Marks
SEE	100 Marks
Credits	6

The object of Project is to enable the student extend further the investigative study, either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry. This is expected to provide a good training for the student(s) in R&D work and technical leadership. The assignment to normally include:

1. In depth study of the topic assigned;
2. Review and finalization of the Approach to the Problem relating to the assigned topic;
3. Preparing an Action Plan for conducting the investigation, including team work;
4. Detailed Analysis/Modelling/Simulation/Design/Problem Solving/ Experiment as needed;
5. Final development of product/process, testing, results, conclusions and future directions;
6. Preparing a paper for Conference presentation/ Publication in Journals, if possible;
7. Preparing a Dissertation in the standard format for being evaluated by the Department.
8. Final Seminar presentation before Departmental Committee.

Guidelines for the award of marks in CIE: (Max. Marks: 50)

Evaluation by	Max .Marks	Evaluation Criteria / Parameter
Department Review Committee	05	Review 1
	08	Review 2
	12	Submission
Supervisor	05	Regularity and Punctuality
	05	Work Progress
	05	Quality of the work which may lead to publications
	05	Report Preparation
	05	Analytical / Programming / Experimental Skills

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Guidelines for awarding marks in SEE: (Max. Marks: 100)Max. Marks: 100

Evaluation by	**Max .Marks**	**Evaluation Criteria / Parameter**
External and Internal Examiners together	20	Power Point Presentation
	40	Thesis Evaluation
	20	Quality of the project ● Innovations ● Applications ● Live Research Projects ● Scope for future study ● Application to society
	20	Viva-Voce

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19CE C106

STRUCTURAL DYNAMICS

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: To enable the student

1. To make the student understand the importance of structural dynamics and appreciate its practical applications.
2. To make the student learn the process of formulation of equations of motion and generate their solutions.
3. To make the student well versed with modal analysis and make him to develop the response by mode superposition.
4. To make him learn the methods of practical vibration analysis and also generate response considering the system as continuous systems.
5. To make him conversant with the numerical solutions to find the response of dynamic systems.

Course Outcomes: At the end of the course, student is able to

1. The student gains expertise and confidence to tackle field dynamic problems, especially in the field of earthquake and wind engineering.
2. Gets the ability to model any dynamic system and get its response.
3. Can carry out modal analysis and can easily handle any software and can correctly interpret the results.
4. Can effectively use practical vibration analysis methods and obtain the dynamic parameters.
5. Gets the ability to apply numerical methods to get the dynamic response of the systems.

UNIT-I:

Introduction to structural Dynamics – Source of dynamic forces – Rotating machinery, wind and seismic forces, blast loads. **Methods of discretization**: Lumped mass Procedure and Consistent mass procedure.

Single Degree Freedom Systems – **Formulation of Equation of Motion**: D'Alemberts's Principle, Method of Virtual Work, Hamilton's Principle. Generalized SDOF systems and Rigid Body assemblage. Influence of Gravity Forces and Ground Motion on equation of motion.

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UNIT-II:

Single Degree of Freedom System: Response to Free Vibration with and without Damping, Logarithmic decrement. Response to Harmonic loading and impulsive loading. Dynamic magnification factor, phase angle and band width. Response to General Dynamic loading using Duhamel's Integral - Fourier analysis for Periodic Loading.

UNIT-III:

Multiple Degree of Freedom System: Evaluation of structural property matrices – Formulation of MDOF equations of motion – Undamped free vibration – Solution of Eigen value problem for natural frequencies and mode shapes- Analysis of dynamic response- Normal coordinates – Orthogonal properties of normal modes -Uncoupled equations of motion –- Mode super position procedure.

UNIT-IV:

Practical Vibration Analysis: Stodola Method – Fundamental mode analysis, Analysis for second and higher modes. Holtzer Method – basic procedure.

Continuous Systems: Flexural vibrations of beams- Elementary case - Derivation of governing differential equation of motion - Analysis of undamped free vibration of beams in flexure – Natural frequencies and mode shapes of simple beams with different end conditions.

UNIT-V:

Numerical Evaluation of Dynamic Response of linear (SDOF/MDOF) systems: Time stepping methods, Central difference method, Newmarks method and Wilson method.

References:

1. Anil. K. Chopra," *Dynamics of Structures",* Pearson Education India, 2007.
2. Ray W. Clough, Joseph Penzin," *Dynamics of Structures*", CBS Publishing, 2015.
3. Mario Paz,"*Structural Dynamics: Theory And Computation*", CBS Publishing, 2004.
4. Pankaj Agarwal and Manish Shrikhande*," Earthquake Resistant Design of Structures"*, PHI, 2006.
5. Biggs," *Introduction to Structural Dynamics*", Mc Graw Hill Education, 2013.

19CE E106

ADVANCED STEEL DESIGN
(ELECTIVE-III)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Note:

1. IS Codes required: IS 800, IS 802, IS 805
2. For all units design philosophy is working stress method

Course Objectives: To enable the student

1. Structural steel is used extensively in the construction of Industrial buildings, bridges, roof trusses, water tanks & transmission line towers.
2. The aim of introducing this course is to provide a student to have ability to perform analysis and design of steel structures with reference to relevant IS codes.

Course Out comes:

1. Students will understand behaviour of structural steel, pressed steel and design philosophies of steel structures.
2. Students will be able to analyze and design of grillage foundation.
3. Students will able to analyze and design of overhead steel and pressed steel water tanks.
4. Students will be able to analyze and design of tubular trusses.
5. Students will be able to analyze and design of bunkers and silos.
6. Students will be able to analyze and design of foundations of Transmission line towers overall arrangements and design of members of Transmission line towers.
7. Students will be able to analyze and design of Beam –Columns subjected to uni-axial and bi-axial bending.

UNIT-I:

Design of Bolted Connections: Rigid & Semi Rigid Connections.
Steel Columns: Effective Length; PM Interaction; Joint Panel Zones

UNIT–II:

Beam Columns: Introduction, Design for Uni-axial and Bi-axial bending as per IS 800: 2007

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Grillage Foundations: Introduction, necessity of grillage foundations, various types, Design of Grillage foundations for axial loads under single and double columns by Limit State Method

UNIT-III:

Steel Tanks: Introduction, Types, loads, permissible stresses - detailed design of elevated rectangular mild steel and pressed steel tanks including staging by working stress method

UNIT-IV:

Bunkers and Silos: introduction - general design principles- design theories - Janssen's Theory and Airy's Theory - Detailed design of bunkers and silos.

UNIT-V:

Transmission Line Towers: Classification, economical spacing and design loads - IS code provisions - Calculation of wind loads and permissible stresses - Overall arrangement and design procedure - Detailed design including foundations.

References:

1. B.C. Punmia by "*Design of Steel Structures*" Laxmi Pub. – 2015.
2. P. Dayaratnam by "*Design of Steel Structures*" S Chand Publications, 2012.
3. I.C. Syal and S. Singh, by "*Design of Steel Structures*", Standard Pub. -2009.
4. Ram Chandra, by "*Design of Steel Structures"*, Scientific Publishers, 2010.

19CE E110

DESIGN OF ADVANCED CONCRETE STRUCTURES (ELECTIVE-IV)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course objectives: To enable the student

1. To make the students effectively analyse and design Curved and Deep Beams.
2. To enable the students understand the nuances of internal stresses and design of Domes, and thoroughly learn the analysis and design procedures for bunkers and silos.
3. To make the student attain the detailed knowledge to understand the performance of flat slabs and design them by both DDM and EFM.
4. To make the students understand the structural behaviour Raft, Pile and Machine foundations and be able to design them.
5. To make them understand and appreciate the importance of ductile detailing. The student should also be able to design solid shear walls.

Course out Comes: Upon the completion of this course, the student should be able to

1. Analyse and Design curved and deep beam as per the field requirements.
2. be able to find the stresses in domes for various loads and design them.
3. With the thorough knowledge acquired during the course, the student is able to analyzeand design Bunkers and Silos with ease.
4. be able to assess the structural behaviour of Raft, Pile and Machine foundations and design them.
5. Gets reasonable expertise to implement ductile detailing and also design solid shear walls.

UNIT–I:

Beams curved in plan: Introduction – Design Principles – Structural Design of beams circular and semi-circular in plan, continuously and symmetrically supported, rectangular in cross-section.

Deep Beams: Introduction – flexural and shear stresses in deep beams. – I.S. Code provisions – design of simply supported and continuous I

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UNIT-II:

Domes: Introduction - Stresses and forces in domes - design of spherical and conical domes.

Bunkers and Silos: Introduction - Design principles and theories - IS Code provision - design of rectangular bunkers - design of cylindrical soils.

UNIT–III:

Flat Slabs: Introduction, components, IS code provisions, Design Methods, design for flexure and shear

UNIT–IV:

Pile foundations: Structural design of piles and pile caps.

Raft Foundations: Definitions, Types – Design of Raft foundation, flat plate type and beam-slab type for buildings with column grids up to five by five.

UNIT-V:

Ductile Detailing: Ductile detailing of RCC beams and columns using IS: 13920 -1993 code

Design of Shear Walls: Design and Detailing of Shear Walls considering shear wall-frame interaction in a tall RC structure subjected to seismic loading.

References:

1. N.KrishnaRaju," *Advanced Reinforced Concrete Design*", CBS Publishers, 2005.
2. H.J. Shah, "*Reinforced Concrete*", Charotar Publishers, 2014.
3. P.C.Varghese, "*Advanced Reinforced Concrete Design*", PHI, 2005
4. B.C.Punmia, Ashok Kumar Jain," *Comprehensive R.C.C. Designs*", Laxmi Pub. 2005.

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19CE E111

ADVANCED FOUNDATION ENGINEERING
(ELECTIVE-IV)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Outcomes: To enable the student to

1. Deal with field problems.
2. Understand the principle and evaluate bearing capacity and settlements of shallow foundations.
3. Understand the principles and design of pile foundations.
4. Understand the analysis of well foundations and design of well foundations.
5. Understand the concept of coffer dams and sheet piles.

Course Outcomes: At the end of the course, students will be able to

1. Decide the sustainability of soil strata for different projects.
2. Design shallow foundations by deciding the bearing capacity of Soil.
3. Analyze and design the pile foundation.
4. Understand analysis methods and design for well foundation.
5. Interpret and implement the concepts of coffer dams and sheet piles.

UNIT-I:

Soil exploration: Planning of Soil Exploration for different Projects, Methods of Subsurface exploration, Methods of boring along with various penetration tests.

UNIT-II:

Shallow Foundation: Requirements for satisfactory performance of foundations, Methods of Estimating bearing capacity by Terzaghi's, Meyerhof, Hansen's, IS code theories and plate load test, settlements of footings, proportioning of footings using field test data.

UNIT-III:

Pile Foundations: Estimation of load carrying capacity of single and pile group under various loading conditions by Static, Dynamic methods and pile load test, settlement of pile foundation, code provisions, design of single pile and pile groups, Negative skin friction.

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UNIT-IV:

Well Foundations: Types, components, construction methods, design methods (IS and IRC) approaches, check for stability, base pressure, side pressure and deflection, Elastic theory and ultimate Resistance methods.

UNIT-V:

Coffer Dams, various types, construction methods of various types of coffer dams, analysis and design of flexible sheet piles for cohesive and cohesion less soils, Open cuts, sheeting and bracing systems in shallow and deep open cuts in different soil types.

References:

1. N. P.Kurian," *Design of Foundation System"*, Narosa Publishing House, 2006.
2. J. E. Bowles," *Foundation Analysis and Design*, Tata McGraw Hill Newyork, 2017.
3. Swami Saran, "*Analysis and Design of Substructures*", Oxford and IBH Publishing Co. Pvt. Ltd, New Delhi, 2008.
4. Braja M Das," *Principles of foundation engineering*", **Cengage** India Private Ltd., 2017.

19CE C107

MODEL TESTING LAB

Instruction (Practical)	4 Hours per week
Duration of Semester End Examination	0 Hours
Semester End Examination	0 Marks
CIE	50 Marks
Credits	2

Course Objectives: To enable the student to

1. Learn to estimate natural frequencies and mode shapes of a beam.
2. Understand the evaluation process of dynamic response of a building model using shake table / mini shake table
3. Learn to compute the response of building models to wind loads, using wind tunnel set up.
4. Know the pattern of deflection and cracking in RC slab elements and portal frames under gravity loading.
5. Understands the use of Piezo electric sensors in the determination of vibration characteristics of a beam

Course Outcomes: At the end of the course, student is able to

1. Estimate the natural frequencies and mode shapes of a beam.
2. Evaluate the dynamic response of a building model using shake table / mini shake table set up.
3. Evaluate the response of building models under wind loads, using wind tunnel setup.
4. Determine the pattern of deflection and cracks in RC slab elements and portal frames, under static loading.
5. Use Piezoelectric sensor for the determination of vibration characteristics of a beam.

List of Experiments:

1. Estimation of natural frequencies and mode shapes of a beam.
2. Evaluation of dynamic response of building model using shake table set up.
3. Evaluation of response of building models subjected to wind loads using wind tunnel set up.
4. Deflections and crack pattern study of RC slab elements subjected to static loading.
5. Deflections and crack patterns in portal frame subjected to gravity loading.
6. Demonstration of use of Piezoelectric Sensors for the of Vibration Characteristics of a beam

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19CE C108

NUMERICAL ANALYSIS LAB

Instruction (Practical)	4 Hours per week
Duration of Semester End Examination	0 Hours
Semester End Examination	0 Marks
CIE	50 Marks
Credits	2

Course Objectives: To enable the student

1. Find Roots of non-linear equations by Bisection method and Newton's method.
2. Do curve fitting by least square approximations
3. Solve the system of Linear Equations using Gauss - Elimination/ Gauss - Seidal Iteration/ Gauss - Jordan Method
4. To Integrate Numerically Using Trapezoidal and Simpson's Rules
5. To Find Numerical Solution of Ordinary Differential Equations by Euler's Method, Runge- Kutta Method.
6. Apply computational methods in engineering using MAT Lab program

Course Outcomes: At the end of the course, student is able to

1. To find roots of non linear equations by using numerical methods
2. To know how to fit the given data in different curves
3. To know how to solve system of linear equations by using direct and indirect methods
4. To know how to integrate by using numerical methods
5. To find solution of first order ODE by numerical methods
6. To know how to apply computational methods in engineering by using MAT Lab program

List of Programmes

1. Find the Roots of Non-Linear Equation Using Bisection Method.
2. Find the Roots of Non-Linear Equation Using Newton's Method.
3. Curve Fitting by Least Square Approximations.
4. Solve the System of Linear Equations Using Gauss - Elimination Method.
5. Solve the System of Linear Equations Using Gauss - Seidal Iteration Method.
6. Solve the System of Linear Equations Using Gauss - Jordan Method.
7. Integrate numerically using Trapezoidal Rule.

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8. Integrate numerically using Simpson's Rules.
9. Numerical Solution of Ordinary Differential Equations by Euler's Method.
10. Numerical Solution of Ordinary Differential Equations by Runge-Kutta Method.

References:

1. RudraPratap," *Getting started with MATLAB: A quick Introduction for Scientists and Engineers*", Oxford University press, 2010.
2. Grewal B. S," *Numerical Methods in Engineering and Science with Programs in C, C++ & MATLAB*", Khanna Publishers 2014.
3. Dukkipati Rao V, "*Applied Numerical Methods using MATLAB*", New Age International Pvt. Ltd. Publishers, 2011.

19CE C109

MINI PROJECT with SEMINAR

Instruction	4 Hours per week
CIE	50 Marks
Credits	2

Outcomes: Students are able to

1. Formulate a specific problem and give solution.
2. Develop model/models either theoretical/practical/numerical form.
3. Solve, interpret/correlate the results and discussions.
4. Conclude the results obtained.
5. Write the documentation in standard format.

Guidelines:

- As part of the curriculum in the II- semester of the programme each students shall do a mini project, generally comprising about three to four weeks of prior reading, twelve weeks of active research, and finally a presentation of their work for assessment.
- Each student will be allotted to a faculty supervisor for mentoring.
- Mini projects should present students with an accessible challenge on which to demonstrate competence in research techniques, plus the opportunity to contribute something more original.
- Mini projects shall have inter disciplinary/ industry relevance.
- The students can select a mathematical modeling based/Experimental investigations or Numerical modeling.
- All the investigations are clearly stated and documented with the reasons/explanations.
- The mini-project shall contain a clear statement of the research objectives, background of work, literature review, techniques used, prospective deliverables, and detailed discussion on results, conclusions and references.

Department committee: Supervisor and two faculty coordinators

Guidelines for awarding marks (CIE): Max. Marks: 50

Evaluation by	Max .Marks	Evaluation Criteria / Parameter
Supervisor	20	Progress and Review
	05	Report
Department Committee	05	Relevance of the Topic
	05	PPT Preparation
	05	Presentation
	05	Question and Answers
	05	Report Preparation

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19CE C101

ADVANCED STRUCTURAL ANALYSIS

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: To enable the student

1. Gain knowledge of using matrix methods of structural analysis stiffness and flexibility methods to analyse beams and trusses
2. Learns the basic concepts of analyse of frames and grids using flexibility methods.
3. Learns the basic concepts of analysis frames and slides using stiffness method
4. Understand the concepts of beams on elastic foundations with semi infinite and infinite lengths
5. Grasps the fundamentals of solving boundary value problems using approximate methods

Course Outcomes: At the end of the course, student will be able to

1. Analyse continuous beams and redundant trusses using force and displacement approaches (flexibility & stiffness approaches) of matrix methods
2. Analyse rigid jointed plane frames and grids by flexibility methods.
3. analyse rigid jointed plane frames and grids by stiffness methods.
4. Applies the concepts of (beams of semi-infinite and infinite lengths) an elastic foundation to field problems and analytical models.
5. Solve the boundary value problems using approximate methods.

UNIT-I:

Introduction to matrix methods of structural analysis: Static and kinematic indeterminacies, Matrix formulations by force and displacement methods, Analysis of continuous beams and redundant trusses by force and displacement methods with degree redundancy and freedom not exceeding three.

UNIT-II:

Analysis of rigid jointed plane frames and grids: by Flexibility approach with degree of redundancy not exceeding three.

UNIT-III:

Analysis of rigid jointed plane frames and grids: by Stiffness degree of freedom not exceeding three.

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UNIT-IV:

Beams on elastic foundation: Introduction - Modulus of foundation and basic equation - Beams of infinite length under concentrated and uniformly distributed loads - Analysis of semi-infinite beams making use of functions for infinite beams.

UNIT-V:

Boundary Value Problems (BVP): Approximate Solution of Boundary Value Problems, Modified Galerkin Method for One-Dimensional BVP, Matrix Formulation of the Modified Galerkin Method.

References:

1. William Weaver and James M. Gere, "*Matrix Analysis Framed Structures* ", CBS, 2004.
2. Devadas Menon," *Advanced Structural Analysis*", Narosa, 2009.
3. A. K. Jain, "*Advanced Structural Analysis*", Nem Chand & Bros. 2015.
4. R. C. Hibbler," *Structural Analysis*", Pearson, 2015.
5. P. Seshu," *Text Book of Finite Element Analysis*", PHI, 2003.

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19CE C102

ADVANCED SOLID MECHANICS

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course objectives: To enable the student

1. To make the students understand the concepts of elasticity and equip them with the knowledge to independently handle the problems of elasticity.
2. To enhance the competency level and develop the self-confidence through quality assignments in theory of Elasticity and plasticity.
3. To inculcate the habit of researching and practicing in the field of elasticity and plasticity.

Course Out Comes: The students

1. Will be able to solve the problems of 3-D elasticity with confidence.
2. Can independently work with the problems of 2-D elasticity in Cartesian/Polar Coordinates.
3. Are familiarized with the use of Airy's stress function in 2-D problems of elasticity in Cartesian/Polar Coordinates.
4. Are equipped with the knowledge of various theories of torsion of prismatic bars of various cross sections and can solve the problems of torsion.
5. Will be able to solve plasticity problems in Structural engineering

UNIT-I:

Definition of stress and strain: Notation of stresses in three dimensions – Generalized Hooks law.

General Theorems: Differential equations of equilibrium in 3-D - Equations of Equilibrium in terms of displacements – Boundary Conditions - conditions of compatibility - Transformation of stress components under change of co-ordinate system.

UNIT-II:

Plane stress and plane strain: differential equations of equilibrium - boundary conditions - compatibility equations

Stresses on an oblique plane – Stress Invariants - principal stresses - stress ellipsoid - max shear stresses - Octahedral shear stress – Strain
volume - Strain of a line element - principal strains.

UNIT-III:

Two dimensional problems in rectangular coordinates: Stress function - Applications - solution by polynomials - Saint- Venant's principle - determination of displacements - bending of simple beams - gravity loading.

Two dimensional problems in polar coordinates: Airy's stress function - general solution of two- dimensional problem in polar coordinates - stress distribution symmetrical about an axis – Effect of hole on stress distribution in a plate in tension, Stresses in a circular disc under diametrical loading - strain components in polar coordinates

UNIT-IV:

Torsion of Prismatic Bars: torsion of prismatic bars - bars with elliptical cross sections – other elementary solution - membrane analogy - torsion of rectangular bars - solution of torsion problems by energy method - use of soap films in solving torsion problems

UNIT-V:

Theory of Plasticity: Introduction – Idealized Stress-Strain curve, concepts and assumptions - yield criterions – Von Mises Yield Criterion, Tresca Yield Criterion, Plastic Stress-strain relations- Principle of Normality and plastic potential.

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References:

1. Timoshenko S. and Goodier, "*Theory of Elasticity*", Mc Graw hill Publications, 2015.
2. J.Chakraborty,"*Theory of Plasticity*", Mc Graw hill Publications, 2007.
3. S. Singh, "*Theory of Elasticity*", Khanna Publishers, 2003.

19CE E102

THEORY AND APPLICATIONS OF CEMENT COMPOSITES (ELECTIVE-I)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: To enable the student

1. Understand the classification of cement composite materials as per orthotropic and anisotropic behavior.
2. Acquire knowledge of formulating the constitutive relationship and comparing the mechanical behavior of cement composites.
3. Understand the Preparation, analysis and design structural elements made of cement composites. Gain the knowledge of determining the mechanical properties and durability characteristics of cement composites.
4. Understand the constitutive relationships in respect of Ferro cement and Fiber reinforced concretes and their applications in miscellaneous structures.

Course Outcomes: At the end of the course, student is able to

1. Classify the composite materials as per orthotropic and anisotropic behavior.
2. Formulate the constitutive relationship and compare the mechanical behavior of cement composites.
3. Prepare, Analyze and design structural elements made of cement composites.
4. Determine the mechanical properties and durability characteristics of cement composites.
5. Utilize Ferro cement and Fiber reinforced concretes in housing, water storage and boats by understanding the constitutive relationship of materials.

UNIT-I:

Introduction: Classification and characteristics of composite materials - Basic Terminology, Advantages. Stress - Strain Relations - Orthotropic and Anisotropic Materials, Engineering constants for orthotropic Materials, Restrictions on Elastic constants, Plane stress problem, Biaxial Strength, Theories for an Orthotropic Lamina.

UNIT-II:

Mechanical Behavior: Mechanics of Materials Approach to Stiffness - Determination of Relations between Elastic Constants, Elasticity Approach to Stiffness - Bounding Techniques of Elasticity, Exact Solutions - Elasticity Solutions with Continuity, Halpin, Tsai Equations, Comparison of approaches to Stiffness.

UNIT-III:

Cement Composites: Types of cement Composites, Terminology, Constituent Materials and their properties, Construction Techniques for fiber Reinforced concrete - Ferro cement, SIFCON, Polymer concretes, Preparation of Reinforcement, casting and curing. Analysis and design of cement composite structural elements - Ferrocement, SIFCON and fiber reinforced concrete.

UNIT-IV:

Mechanical properties of Cement Composites: Behavior of ferrocement, Fiber reinforced concrete in tension, compression, flexure, shear, fatigue and impact, durability and corrosion.

UNIT-V:

FRC and Ferro cement: Housing, water storage, boats and miscellaneous structures. Composite Materials - Orthotropic and Anisotropic behavior, constitutive relationship, elastic constants.

References:

1. Robert M Jones, "*Mechanics of Composite Materials*", Taylor and Francis, 2017.
2. R. P. Pama, "*Ferrocement - Theory and Applications*, IFIC, 1980.
3. R. N. Swamy, "*New Concrete Materials*", 1st Ed., Blackie, Academic and Professional, Chapman & Hall, 1983.

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19CE E104

STRUCTURAL HEALTH MONITORING
(ELECTIVE-II)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: To enable the student to understand the fundamental concepts of

1. Distress in the structure.
2. Assess the health of structure. Audit for structural health monitoring
3. Static and dynamic field tests.
4. Repairs, strategies for repairs and rehabilitation methods of the structure
5. Piezo–electric materials and other smart materials,

Course Outcomes: At the end of the course, students will be able to

1. Appraise importance of Diagnosis the distress in the structure, develop an understanding the root causes and factors.
2. Assess the health of structure using static field methods.
3. Assess the health of structure using dynamic field tests.
4. Identify the locations for repairs and various repair methods, can able to suggest rehabilitation methods for structure
5. Adapt and implement EMI technique

UNIT-I:

Structural Health: Factors affecting Health of Structures, Causes of Distress, Regular Maintenance.

Structural Health Monitoring**:** Concepts, Various Measures, Structural Safety in Alteration.

UNIT-II:

Structural Audit: Assessment of Health of Structure, Collapse and Investigation, Investigation Management, SHM Procedures.

UNIT-III:

Static Field Testing: Types of Static Tests, Simulation and Loa
sensor systems and hardware requirements, Static Response M

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UNIT-IV:

Dynamic Field Testing: Types of Dynamic Field Test, Stress History Data, Dynamic Response Methods, Hardware for Remote Data Acquisition Systems, Remote Structural Health Monitoring.

UNIT–V:

Introduction to Repairs and Rehabilitations of Structures: Case Studies (Site Visits), piezo–electric materials and other smart materials, electro–mechanical impedance (EMI) technique, adaptations of EMI technique.

References:

1. Daniel Balageas, Claus Peter Fritzen, Alfredo Güemes," *Structural Health Monitoring*", John Wiley and Sons, 2006.
2. Douglas E Adams,"*Health Monitoring of Structural Materials and Component Methods with Applications*", John Wiley and Sons, 2007.
3. J. P. Ou, H. Li and Z. D. Duan,"*Structural Health Monitoring and Intelligent Infrastructure, Vol1"*, Taylor and Francis Group, London, UK, 2006.
4. Victor Giurglutiu," *Structural Health Monitoring with Wafer Active Sensors*", Academic Press Inc, 2007.

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19ME C103

RESEARCH METHODOLOGY AND IPR

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
SEE	50 Marks
CIE	25 Marks
Credits	2

Objectives: To make the students to

1. Motivate to choose research as career
2. Formulate the research problem, prepare the research design
3. Identify various sources for literature review and data collection report writing
4. Equip with good methods to analyze the collected data
5. Know about IPR copyrights

Outcomes: At the end of the course, student will be able to

1. Define research problem, review and asses the quality of literature from various sources
2. Improve the style and format of writing a report for technical paper/ Journal report, understand and develop various research designs
3. Collect the data by various methods: observation, interview, questionnaires
4. Analyze problem by statistical techniques: ANOVA, F-test, Chi-square
5. Understand apply for patent and copyrights

UNIT–I:

Research Methodology: Research Methodology: Objectives and Motivation of Research, Types of Research, research approaches, Significance of Research, Research Methods verses Methodology, Research Process, Criteria of Good Research, Problems Encountered by Researchers in India, Benefits to the society in general. Defining the Research Problem: Selection of Research Problem, Necessity of Defining the Problem

UNIT–II:

Literature Survey Report writing: Literature Survey: Importance and purpose of Literature Survey, Sources of Information, Assessment of Quality of Journals and Articles, Information through Internet. Report writing: Meaning of interpretation, layout of research report, Types of reports, Mechanics of writing a report. Research Proposal Preparation: Writing a Research Proposal and Research Report, Writing Research Grant Proposal

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UNIT–III:

Research Design: Research Design: Meaning of Research Design, Need of Research Design, Feature of a Good Design, Important Concepts Related to Research Design, Different Research Designs, Basic Principles of Experimental Design, Developing a Research Plan, Steps in sample design, types of sample designs.

UNIT–IV:

Data Collection and Analysis: Data Collection: Methods of data collection, importance of Parametric, non parametric test, testing of variance of two normal population, use of Chi-square, ANOVA, Ftest, z-test

UNIT–V:

Patents and Copyright: Patent: Macro economic impact of the patent system, Patent document, How to protect your inventions. Granting of patent, Rights of a patent, how extensive is patent protection. Copyright: What is copyright. What is covered by copyright. How long does copyright last? Why protect copyright? Related Rights: what are related rights? Enforcement of Intellectual Property Rights: Infringement of intellectual property rights, Case studies of patents and IP Protection

References:

1. C.R Kothari, "*Research Methodology, Methods & Technique*"; New Age International Publishers, 2004
2. R. Ganesan, "*Research Methodology for Engineers*", MJP Publishers, 2011
3. Y.P. Agarwal, "*Statistical Methods: Concepts, Application and Computation*", Sterling Publs., Pvt., Ltd., New Delhi, 2004.
4. AjitParulekar and Sarita D' Souza, "*Indian Patents Law – Legal & Business Implications*"; Macmillan India ltd , 2006
5. B. L.Wadehra; "*Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications*"; Universal law Publishing Pvt. Ltd., India 2000.
6. P. Narayanan; *"Law of Copyright and Industrial Designs*"; Eastern law House, Delhi 2010

19CE C103

STRUCTURAL DESIGN LAB

Instruction (Practical)	4 Hours per week
Duration of Semester End Examination	0 Hours
Semester End Examination	0 Marks
CIE	50 Marks
Credits	2

Course Objectives: **Course Objectives: To enable the student**

1. Learn the principles of idealization of beam grids and frames for the given plan of a building
2. Know the methods of calculating loads on the building elements
3. Grasp the concepts of Analysis of building frames manually & also using software elements
4. Understand the concepts of design of building elements with a practical approach, and also concepts of grouping the designs.
5. Learn the professional practices of preparing structural drawings with good detailing.

Course Outcomes: At the end of the course, student is able to

1. Idealize beam grids and frames for the given plan of a building
2. Calculate loads on building elements for a given plan
3. Analyse building frames using a manual method and software
4. Design all structural elements of a given building with a practical approach and grouping the design.
5. Prepare structural drawings with good detailing, in a professional way.

Design Project:

Design and Detailed drawing of complete G+ 3 structures: Idealization of beam grid and frames for a given plan – Load calculations and preliminary design – Analysis of frames using software, manual check for atleast one frame – Design of building elements using software – grouping of members – design of typical elements (manually) - detailing of reinforcement for various groups of elements – preparation of structural drawings – introduction to processional practices in drawing.

References:

1. V. L. Shah and V. R. Karve, "*Illustrated Design of Reinforced Concrete Buildings (Design of G+3 Storeyed Buildings + Earthquake Analysis & Design)* ", Assorted Editorial; 8th edition (2017).
2. **SP: 34 (1987),"***Handbook on Concrete Reinforcement and Detailing*", Bureau of Indian Standards.
3. **IS: 456 (2000),"***Plain and Reinforced Concrete - Code of Practice*", Bureau of Indian Standards.
4. **SP: 16** (1978),"Design Aids for Reinforced C 456:1978",*Bureau of Indian Standards*.

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19CE C104

ADVANCED CONCRETE LAB

Instruction (Practical)	4 Hours per week
Duration of Semester End Examination	0 Hours
Semester End Examination	0 Marks
CIE	50 Marks
Credits	2

Course Objectives: To enable the student

1. Understand the stress- strain behavior of high strength concretes
2. Assesses the correlation between cube strength cylindrical strengths, split tensile strength and modulus of rupture of concrete
3. Knows the effect of cyclic loading on steel
4. Grasps the various procedures of conducting non-destructive tests on existing concrete members.
5. Understand the behavior of concrete beams under flexural and shear.
6. Understands the behavior of concrete beams under torsion.

Course Outcomes: At the end of the course, student is able to

1. Deduce the stress - strain values for a given high strength concrete and checks its suitability for a purpose.
2. Interpret the correlation between the cube strength, cylindrical strength split tensile strength And modulus of rupture and determines any missing value among these, others being known.
3. Suggest suitable grade and quantity of steel for resisting cyclic loads.
4. Conduct suitable non-destructive test for the condition assessment of existing concrete members
5. Take proper precaution to avoid flexural and shear failures in concrete beams
6. Strengthen the concrete members to resist torsion.

List of Experiments / Assignments:

1. Study of stress - strain curve of high strength concrete
2. Correlation between cube strength, cylinder strength, split tensile strength and modulus of rupture.
3. Effect of cyclic loading on steel.
4. Non-Destructive testing of existing concrete members.
5. Behavior of Beams under flexure, Shear
6. Torsion

References:

1. A. M. Neville," *Properties of concrete*", 5th Edition, Prentice
2. M. S. Shetty, "Concrete *technology*", S. Chand and Co., 200

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18MT CO1

MATHEMATICS– I

(Common to all branches and except for Bio-Tech)

Instruction	3 L+1T Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation:	30 Marks
Credits	4

Course Objectives:

1. To solve linear system of equations using Matrix Methods.
2. To know the convergence of the Series.
3. To represent the function in series form.
4. To know the Partial Derivatives and use them to interpret the way a function of two variables behaves.
5. To learn Vector Differential Operator and its Physical interpretations on Scalars and vector functions.
6. To solve improper integrals.

Course Outcomes: On the successful completion of this course student shall be able to

1. Solve system of linear equations and identify the Eigen values and Eigen vectors in engineering problems.
2. Check the series convergence.
3. Find the evolutes of the given curves.
4. Expand and find extreme values of functions of two variables.
5. Understanding the significance of gradient, divergence and curl.
6. An ability to solve the problems and interpret in geometrical approach.

UNIT-I: Matrices:

Rank of the matrix, Echelon form, System of linear equations, Linearly dependence and independence of vectors, Eigenvalues, Eigenvectors, Properties of eigenvalues, Cayley-Hamilton theorem, Quadratic forms, Diagonalization of Matrices, Reduction of quadratic form to canonical form by linear transformation, Nature of quadratic forms.

UNIT-II: Sequences and Series:

Definition of Convergence of sequence and series. Tests for convergence of series: comparison test, limit comparison test, D'Alembert ratio test, Raabes test, Cauchy's n^{th} root test, logarithmic test, alternative series, absolute and conditional convergence.

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UNIT-III: Calculus:
Rolle's Theorem, Lagranges Mean value theorem, Cauchy's mean value theorem (without proofs). Curvature, radius of curvature, Evolutes and involutes ,
Fourier series, half range sine and cosine series.

UNIT-IV: Multivariable Calculus (Differentiation):
Functions of two variables, Partial derivatives, Total differential and differentiability, Derivatives of composite and implicit functions (Chain rule), Change of variables, Jacobian, Higher order partial derivatives, Taylor's series of functions of two variables, Maximum and minimum values of functions two variables, Lagrange's multipliers method.

UNIT-V: Vector Calculus (Differentiation):
Scalar and vector fields, Gradient of a scalar field, Directional derivative, Divergence and Curl of a vector field, vector identities. Improper integrals: Beta and Gamma functions and their properties.

Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.

Suggested Reading:

1. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
2. R.K. Jain, S.R.K. Iyengar, Advanced engineering mathematics Narosa Publications, 5th edition, 2016. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.

18PY C03

INTRODUCTION TO MECHANICS AND ELECTROMAGNETIC THEORY
(for Civil, Mech & Prod)

Instruction:	3L+1T Hours per Week
Duration of Semester End Examination:	3 Hours
Semester End Examination:	70 Marks
Continuous Internal Evaluation:	30 Marks
Credits:	4

Course Objectives:

The objectives of the course is to make the student

1. Understands the fundamentals of oscillations and ultrasonics.
2. Gains knowledge of rigid body dynamics.
3. Learns the basics of electrostatics.
4. Understands the fundamentals of magnetostatics.
5. Familiar with electromagnetic waves.

Course Outcomes:

At the end of the course, the student will be able to

1. Describe the types of oscillations and analyze them.
2. Develop the concepts of dynamics and apply them to solve the related problems.
3. Analyze the role of different laws in electrostatics.
4. Discuss the significance of magnetostatics.
5. Develop the concepts related to electromagnetic behavior.

UNIT- I :Oscillations:

Simple harmonic motion, Harmonic oscillator; Damped harmonic motion – over-damped, critically damped and lightly- damped oscillators; Forced oscillations and resonance.

Ultrasonics: Production of ultrasonics by piezoelectric and magnetostriction methods – Detection of ultrasonics -– Determination of ultrasonic velocity in liquids – Applications.

UNIT-II: Rigid body Dynamics:

Definition and motion of a rigid body in the plane; Rotation in the plane; Kinematics in a coordinate system rotating and translating in the plane; Angular momentum about a point of a rigid body in planar motion; Euler's laws c independence from Newton's laws, and their necessity in descri motion; Examples. two-dimensional motion in terms of (a) Angular and its rate of change and (b) Moment of inertia tensor.

UNIT- III :Electrostatics in Vaccum:

Calculation of electric field and electrostatic potential for a charge distribution; Divergence and curl of electrostatic field; Laplace's and Poisson's equations for electrostatic potential and uniqueness of their solution and connection with steady state diffusion and thermal conduction, Boundary conditions of electric field and electrostatic potential.

UNIT - IV : Magnetostatics:

Bio-Savart law, Divergence and curl of static magnetic field; vector potential and calculating it for a given magnetic field using Stokes' theorem; the equation for the vector potential and its solution for given current densities: ferromagnetic, paramagnetic and diamagnetic materials, B-H curve.

UNIT- V : Electromagnetic Waves:

The wave equation; Plane electromagnetic waves in vacuum, their transverse nature and polarization; relation between electric and magnetic fields of an electromagnetic wave; energy carried by electromagnetic waves, Maxwell's equation in vacuum and non-conducting medium; Energy in an electromagnetic field; Flow of energy and Poynting vector with examples.

TEXT BOOKS:

1. B.K. Pandey and S. Chaturvedi, *Engineering Physics*, Cengage Publications, 2012.
2. M.N. Avadhanulu and P.G. Kshirsagar, *A Text BookEngineering Physics*, S. Chand Publications, 2014.
3. M. Arumugam, *Materials Science*, Anuradha Publications, 2015.
4. S.L. Gupta and Sanjeev Gupta, *Modern Engineering Physics*, Dhanpat Rai Publications, 2011.

SUGGESTD READING:

1. R. Murugeshan and Kiruthiga Sivaprasath, *Modern Physics*, S. Chand Publications S. Chand Publications, 2014.
2. V. Rajendran, *Engineering Physics*, McGahill Education Publications, 2013.
3. P.K. Palanisamy, *Engineering Physics*, Scitech Publications, 2012.
4. V. Raghavan, *Materials Science and Engineering*, Prentice Hall India Learning Private Limited; 6th Revised edition, 2015.

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18CS C01

Programming for Problem Solving
(Common to All Programs)

Instruction	3 Periods per week
Duration of Semester-End Examination	3 Hours
Semester-End Examination	70 Marks
Sessional	30 Marks
Credits	3

Course Objectives

1. Identification of computer components, Operating environments, IDEs
2. Understanding the steps in problem solving and formulation of algorithms to problems.
3. Develop programming skills as an means of implementing an algorithmic solution with appropriate control anddata structures.
4. Develop intuition to enable students to come up with creative approaches to problems.
5. Manipulation of text data using files.

Course Outcomes: At the end of the course, students will be able to:

1. Identify the computing environments.
2. Formulate solutions to problems and represent them using algorithms/ Flowcharts.
3. Choose proper control statements and data structures to implement the algorithms.
4. Trace the programs with test the program solution.
5. Decompose a problem into modules and use functions to implement the modules.
6. Develop applications using file I/O.

UNIT -I

Introduction to computers and Problem Solving: Components of a computer, Operating system, compilers, Program Development Environments, steps to solve problems, Algorithm, Flowchart / Pseudocode with examples.

Introduction to programming: Programming languages and generations, categorization of high level languages.

Introduction to C: Introduction, structure of C program, keywords, identifiers, Variables, constants, I/O statements, operators, precedence and associativity.

UNIT – II

Introduction to decision control statements: Selective, loop statements.

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Functions: Introduction, uses of functions, Function definition, declaration, passing parameters to functions, recursion, scope of variables and storage classes.

Case study:

UNIT – III

Arrays: Introduction, declaration of arrays, accessing and storage of array elements, 1-dimensional array, Searching (linear and binary search algorithms) and sorting(selection and Buble) algorithms, 2-D arrays, matrix operations.

Strings: Introduction, stringsrepresentation, string operations with examples.

Case study:

UNIT – IV

Pointers: Understanding computer's memory, introduction to pointers, declaration pointer variables, pointer arithmetic, pointers and strings, array of pointers, function pointers, array of function pointers, dynamic memory allocation, advantages and drawbacks of pointers.

Structures: Structure definition, initialization and accessing the members of a structure, nested structures, structures and functions, self- referential structures, unions and enumerated data types.

UNIT-V

Files: Introduction to files, file operations, reading data from files, writing data to files, error handing during file operations.

Preprocessor Directives: Types of preprocessor directives, examples.

Suggested Reading:

1. A K Sharma "**Computer Fundamentals and Programming**", 2nd Edition, University Press, 2018.
2. PradeepDey and Manas Ghosh, "**Programming in C**", Oxford Press, 2nd Edition, 2017.

References:

1. Byron Gottfried, Schaum's"**Outline of Programming with C**", McGraw-Hill.
2. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India.
3. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill.
4. ReemaTharaja "**Introduction to C Programming**", Second Edition, OXFORD Press,2015.
5. https://www.tutorialspoint.com/cprogramming/index.htm
6. https://onlinecourses.nptel.ac.in/noc18-cs10/preview.

18EG C01

ENGLISH

(Common to all branches)

Instruction	2Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation:	20 Marks
Credits	2

Course Objectives:

1. To enable the students to understand the role and importance of communication and to develop their basic communication skills in English.
2. To equip the students with basics of writing correct sentences to coherent paragraphs.
3. To equip the students with techniques of writing a précis and an essay by using accurate grammar and appropriate vocabulary.
4. To train the students to describe, define and classify processes and to draft formal reports by adhering to the proper structure.
5. To develop the reading skills and reading comprehension techniques of the students.
6. To develop the students reading, writing, grammatical, lexical and communicative competence.

Course Outcomes:

1. The students will understand the nature, process and types of communication and will communicate effectively without barriers.
2. The students will write correct sentences and coherent paragraphs.
3. The students will know how to condense passages by writing précis and write essays by using accurate grammar and appropriate vocabulary.
4. The students will demonstrate advanced writing skills by drafting formal reports.
5. The students will apply their reading techniques and analyze reading comprehension passages.
6. The students will become effective communicators and will display their advanced skills of reading and writing and use correct grammar and appropriate vocabulary in all contexts.

UNIT-IUnderstanding Communication in English:

Introduction, nature and importance of communication.Process of communication.Basic types of communication - verbal and non-verbal.Barriers to communication.Intrapersonal and interpersonal communication.Johari Window.

Vocabulary &Grammar: The concept of Word Formation. Impo punctuation.Articles.

UNIT- II Developing Writing Skills I:
Types of sentences.Use of phrases and clauses in sentences.Cohesion and coherence.Paragraph writing.Organizing principles of paragraphs in documents.Vocabulary & Grammar: Cohesive devices. Root words from foreign languages and their use in English. Prepositions.

UNIT- III Developing Writing Skills II:
Techniques for writing precisely. Précis Writing. Essay Writing.
Vocabulary and Grammar: Subject-verb agreement, Noun-pronoun agreement Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives, Redundancies, Clichés.

UNIT- IV Developing Writing Skills III:
Describing, Defining, Classifying, Providing examples or evidence.Writing introduction and conclusion.
Report writing – Importance, structure and elements of style of formal reports.
Vocabulary and Grammar: Misplaced modifiers. Synonyms, antonyms.

UNIT-VDeveloping Reading Skills:
The reading process, purpose, different kinds of texts. Reading comprehension.Techniques of comprehension – skimming, scanning, drawing inferences and conclusions.
Vocabulary and Grammar : Words often Confused. Standard abbreviations.

Text Books:

1. Language and Life: A Skills Approach, Board of Editors, Orient Black Swan, 2017.
2. Swan Michael,Practical English Usage.OUP. 1995.

Suggested Readings:

1. Wood F.T,Remedial English Grammar, Macmillan,2007
2. Zinsser William,On Writing Well, Harper Resource Book, 2001
3. Sanjay Kumar and PushpLata,Communication Skills.Oxford University Press, 2011.

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18PY C06

MECHANICS AND ELECTROMAGNETIC LABORATORY
(for Civil, Mech & Prod)

Instruction:	3 Hours per Week
Duration of Semester End Examination:	3 Hours
Semester End Examination:	50 Marks
Continuous Internal Evaluation:	25 Marks
Credits:	1.5

Course Objectives:

The objectives of the course is to make the student

1. Apply theoretical physics knowledge in doing experiments.
2. Understand the various kinds of oscillators.
3. Analyze the behavior of magnetic and dielectric materials.

Course Outcomes:

At the end of the course, the student will be able to

1. Understand the concept of errors and find the ways to minimize the errors
2. Demonstrate the various kinds of oscillations.
3. Determine the loss of energy of a ferromagnetic material and its uses in electrical engineering .
4. Understand the suitability of dielectric materials in engineering applications.
5. Use LCR circuits in different applications.

Experiments

1. *e/m* of Electron by Thomson's Method.
2. B-H curve – Determination of Hall coefficient, carrier concentration & mobility of charge carriers of given semiconductor specimen.
3. Stewart & Gee's.
4. Mutual induction.
5. Dielectric constant – Determination of dielectric constant of given PZT sample.
6. Error analysis – Estimation of errors in the determination of time period of a torsional pendulum.
7. Helmholtz's resonator.
8. Compound pendulum.
9. Flywheel.
10. Coupled oscillator.
11. LCR circuit.
12. Melde's experiment.
13. Young's modulus.
14. Viscosity by oscillating disc (Lamp scale method).

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15. Ultrasonic interferometer – Determination of velocity of ultrasonics in a given liquid.

SUGGESTED READING:

1. *Engineering Physics Manual* by Department of Physics, CBIT, 2016.
2. S.K. Gupta*, Engineering Physics Practical*, Krishna's Educational Publishers, 2014.
3. O.P. Singh, V. Kumar and R.P. Singh, *Engineering Physics Practical Manual*, Ram Prasad & Sons Publications, 2009.
4. Indu Prakash, Ram Krishna and A.K. Jha, *A Text Book of Practical Physics*, Kitab Mahal Publications, 2012.

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18CS C02

Programming for Problem Solving
(Programming Lab – I)
(Common to All Programs)

Instruction	4 Periods per week
Duration of Semester-End Examination	3 Hours
Semester-End Examination	50 Marks
Sessional	25 Marks
Credits	2

Course Objectives

1. Setting up programming environment.
2. Develop Programming skills to solve problems.
3. Use of appropriate C programming constructs to implement algorithms.
4. Identification and rectification of coding errors in program.
5. Develop applications in a modular fashion.
6. Manage data using files.

Course Outcomes:

At the end of the course students will be able to:

1. Identify and setup program development environment.
2. Implement the algorithms using C programming language constructs.
3. Identify and rectify the syntax errors and debug program for semantic errors.
4. Analyze the results to evaluate the solutionsof the problems.
5. Solve problems in amodular approach using functions.
6. Implement file operations with simple text data.

Lab experiments

1. Familiarization with programming environment.
2. Simple computational problems using arithmetic expressions.
3. Problems involving if-then-else structures.
4. Iterative problems e.g., sum of series.
5. 1D Array manipulation.
6. 2D arrays and strings.
7. Matrix problems, String operations.
8. Simple functions.
9. Recursive functions.
10. Pointers and structures.
11. Dynamic memory allocation and error handling.
12. File handling.

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Design the experiments in such a way that the students will be able to end up the solution for a real world problem that uses most of the concepts of C programming language. For example: A banking application where it uses the concepts of operators, control structures, switch case for menu, structures, functions, error handling, files etc.

Suggested Reading:

1. Pradeep Dey and Manas Ghosh, "**Programming in C"**, Oxford Press, 2nd Edition, 2017.
2. ReemaTharaja "**Introduction to C Programming**", Second Edition, OXFORD Press,2015.

References:

1. https://www.tutorialspoint.com/cprogramming/index.htm
2. https://www.w3resource.com/c-programming/programming-in-c.php
3. https://www.w3schools.in/c-tutorial/

18ME C02

WORKSHOP/ MANUFACTURING PRACTICE

Instruction	1T+4P Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation:	25 Marks
Credits	3

Course Objectives:

1. Give a feel of Engineering Practices & develop holistic understanding of various Engineering materials and Manufacturing processes.
2. Develop skills of manufacturing, safety, precision, quality, intelligent effort, optimization, positive & team work attitude to get things right the first time.
3. To provide basic knowledge of Steel, Plastic, Composite and other materials for suitable applications.
4. Study of Principle and hands on practice on techniques of fabrication, welding, casting, manufacturing, metrology, and allied skills.
5. To advance important hard & pertinent soft skills, productivity, create skilled manpower which is cognizant of industrial workshop components and processes and can communicate their work in a technical, clear and effective way.
6. Engineering Skill development with regard to making components, system integration and assembly to form a useful device.

Course Outcomes – (Laboratory): Student will be able to

1. Fabricate components with their own hands.
2. Get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.
3. Assembling different components, student will be able to produce small mechanisms/devices of their interest.
4. Gain practical skills of carpentry, tinsmithy, fitting, house wiring.
5. Gain knowledge of different Engineering Materials and Manufacturing Methods.
6. Understand trades and techniques used in Workshop and chooses the best material/ manufacturing process for the application.

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18EG C02

ENGLISH LAB

(Common to all branches)

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	35 Marks
Continuous Internal Evaluation:	15 Marks
Credits	1

Course Objectives:

1. To introduce students to phonetics and the different sounds in English.
2. To familiarize the students with the software and give them sufficient practice in correct pronunciation.
3. To enable students to speak English correctly with focus on stress and intonation.
4. The students will enhance their listening skills by practicing IELTS and TOEFL material.
5. To help students overcome their inhibitions while speaking in English and to build their confidence. The focus shall be on fluency rather than accuracy.
6. To help students to understand team work, role behavior and to develop their ability to discuss in groups and make oral presentations.

Course Outcomes:

1. The students will differentiate the speech sounds in English.
2. The students will interact with the software and understand the nuances of pronunciation in English.
3. The students will speak with the proper tone, intonation and rhythm and apply stress correctly.
4. The students will demonstrate their listening skills by analyzing the IELTS and TOEFL listening comprehension texts.
5. The students will speak with clarity and confidence.
6. The students will work in teams and discuss various topics and demonstrate their presentation skills through posters.

Exercises

1. **Introduction to English Phonetics**: Introduction to auditory, acoustic and articulatory phonetics, organs of speech: the respiratory, articulatory and phonatory systems.
2. **Sound system of English**: Phonetic sounds and phonemic sounds, introduction to international phonetic alphabet, classification and description of English phonemic sounds, minimal pairs . The syllable: types of syllables, consonant clusters.
3. **Word stress**: Primary stress, secondary stress, functional word stress.

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4. **Rhythm &Intonation** : Introduction to Rhythm and Intonation. Major patterns, intonation of English with the semantic implications.
5. **Listening skills** – practice with IELTS and TOEFL material.
6. **Situational dialogues and role play –** Dialogue writing, **–** Role behavior and role enactment.
7. **Group Discussions -** Dynamics of a group discussion, group discussion techniques, body language.
8. **Public speaking –** Speaking with confidence and clarity in different contexts on various issues.
9. **Poster presentation –** Theme, poster preparation, team work and presentation.

Suggested Reading

1. T Balasubramanian. A Textbook of English Phonetics for Indian Students, Macmillan, 2008.
2. J Sethi et al. A Practical Course in English Pronunciation (with CD), Prentice Hall India, 2005.
3. PriyadarshiPatnaik. Group Discussions and Interviews, Cambridge University Press Pvt Ltd 201.
4. ArunaKoneru, Professional Speaking Skills, Oxford University Press, 2016.

18MT CO3

MATHEMATICS– II

(Common to all branches and except for Bio-Tech)

Instruction	3 L+1T Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation:	30 Marks
Credits	4

Course Objectives

1. To evaluate double and triple integrals of various functions and their significance.
2. To evaluate vector line, surface and volume integrals.
3. To know the relevant method to solve higher order differential equations.
4. To evaluate complex integration.
5. To evaluate real and definite integrals.
6. To know the methods to solve real life problems.

Course Outcomes: On the successful completion of this course student shall be able to

1. Find the areas, volumes and surface of solids revolution.
2. Use Greens, Gauss and Stoke's theorems to find the surface and volume integrals.
3. Able to solve solutions of differential equations with initial and boundary value problems.
4. Solve the problems on analytic functions, Cauchy's theorem and Cauchy's integral formula.
5. Real and complex integrals by using Cauchy's theorems.
6. Solve physical and engineering problems.

UNIT-I: Multivariable Calculus (Integration):

Applications of definite integrals to evaluate surface areas and volumes of revolutions. Double integrals, Change of order of integration, Triple integrals, Change of variables in integrals, Applications: areas and volumes, Centre of mass and Gravity (constant and variable densities).

UNIT-II: Vector Integral Calculus:

Line, Surface and Volume integrals, Green's theorem in a plane, Gau theorem and Stroke's theorem (without proof).

First Order Ordinary Differential Equations: Exact first order differential equations , Integrating factors, Linear first order equations , Bernoulli's, Riccati's and Clairaut's differential equations ,Orthogonal trajectories of a given family of curves.

UNIT-III: Ordinarydifferential equations of higher orders:
Solutions of higher order linear equations with constants coefficients, Method of variation of parameters, solution of Euler-Cauchy equation. Ordinary point, singular point and regular singular point, Power Series solution. Legendre Polynomial of first kind (without proof), Rodrigues formula, Generating function, recurrence relations, orthogonality of Legendre polynomials, Bessel's function of first kind (without proof), recurrence relations and problems.

UNIT- IV: Complex Variables –I :
Differentiation, analytic functions, Cauchy-Riemann equations, harmonic functions, finding harmonic conjugate, elementary analytic functions (exponential, trigonometric, logarithm) and their properties; Conformal mappings, Mobius transformations and their properties. Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof).

UNIT- V: Complex Variables – II:
Liouville's theorem and Maximum-Modulus theorem (without proof); Taylor's series, Laurent's series, zeros of analytic functions, singularities, Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine. Improper real integrals with singular points on the upper half plane.

Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

Suggested Reading:

1. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
2. R.K. Jain, S.R.K. Iyengar, Advanced engineering mathematics Narosa Publications,5th edition,2016.
3. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.

18CY C01

CHEMISTRY

(Common to all branches)

Instruction:	3L+1T Hours per Week
Duration of Semester End Examination:	3 Hours
Semester End Examination:	70 Marks
Continuous Internal Evaluation:	30 Marks
Credits:	4

Course Objectives

1. The aim of framing the syllabus is to impart intensive and extensive knowledge of the subject so that students can understand the role of chemistry in the field of engineering.
2. This syllabus helps at providing the necessary introduction of the inorganic chemistry principles and concepts of chemical bonding involved in a comprehensive manner understandable to the students aspiring to become practicing engineers.
3. Thermodynamic and Electrochemistry units give conceptual knowledge about spontaneous processes and how can they be harnessed for producing electrical energy and efficiency of systems.
4. To teach students the value of chemistry and to improve the research opportunities knowledge of stereochemistry and organic reactions is essential.
5. New materials lead to discovering of technologies in strategic areas like defense and space research for which an insight into nano and composite materials of modern chemistry is essential.

Course Outcomes

The concepts developed in this course will aid in quantification of several concepts in chemistry that have been introduced at the 10+2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications. Quantum theory is more than 100 years old and to understand phenomena at nanometer levels; one has to base the description of all chemical processes at molecular levels. The course will enable the student to:

1. Analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
2. Rationalize bulk properties and processes using thermodynamic considerations & Ionic Equilibria.
3. List major chemical reactions that are used in the synthesis of molecules.
4. Apply the various methods used in treatment of water for industrial use.

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5. Discuss the various Engineering materials & Drug synthesis & their applications.

UNIT-I Atomic and molecular structure:

Molecular Orbital theory - atomic and molecular orbitals.Linear combination of atomic orbitals (LCAO) method. Molecular orbitals of diatomic molecules. Energy level diagrams of diatomics (H_2, He_2^+, N_2, O_2, O_2^- , CO, NO). Pi- molecular orbitals of butadiene , benzene and their aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties.

UNIT-II Use of free energy in chemical equilibria and Ionic Equilibria:

Use of free energy in chemical equilibria : Thermodynamic functions: Internal energy, entropy and free energy. Significance of entropy and free energy(criteria of spontaneity).Free energy and emf (Gibbs Helmholtz equations and its applications). Cell potentials –electrochemical series.Nernst equation and its applications.Potentiometric Acid base & Redox Titrations.Numericals.

Ionic Equilibria: Solubility product, Determination of solubility product, Applications of solubility product- Determination of solubilities of sparingly soluble salts; Predicting precipitation reactions; Precipitation of an insoluble salt; Precipitation of soluble salts ; Inorganic analysis .Numericals.

UNIT- III Stereochemistry and Organic reactions

Stereochemistry: Representations of 3 dimensional structures , Symmetry and chirality, Stereoisomers - Configurational isomers (Geometrical&Optical isomers), Conformational isomers - Newman and sawhorse representations of n-butane ,enantiomers (lactic acid), diastereomers (Tartaric acid) , optical activity, absolute configurations , Sequence rules for R&S notation.

Organic reactions

Types of Organic reactions:

Substitution Reactions- Electrophilic substitution (Nitration of Benzene) ;Nucleophilic Substitution(S_N1& S_N2) ; Free Radical Substitution(Halogenation of Alkanes)

Additions Reactions:

Electrophilic Addition – Markonikoff’s rule

Nucleophilic Addition – (Addition of HCN to carbonyl compounds)

Free radical Addition - Anti Markonikoff’s rule (Peroxide effect)

Eliminations-E_1 and E_2 (dehydrohalogenation of alkyl halides)

Oxidation with $KMno_4$, $K_2 Cr_2O_7$; **Reduction** with $LiAlH_4$,NaB

Cyclization (Diels - Alder reaction)

UNIT–IV Water Chemistry:

Hardness of water – Types, units of hardness, Disadvantages of hard water , Boiler troubles - scales & sludge formation , causes and effects , Softening of water by ion exchange method and Reverse Osmosis. Specifications of potable water & industrial water. Disinfection of water by Chlorination , Ozonisation & UV radiation.

UNIT-V Engineering Materials and Drugs:

Nano materials-Introduction to nano materials and general applications, basic chemical methods of preparation- Sol gel method. Carbon nanotubes and their applications.

Composite materials- Definition, types of composites, fibre reinforced, glass fibre reinforced and carbon fibre reinforced composites and applications.

Conducting polymers- Definition, classification and applications.

Drugs-Introduction,Synthesis and uses of Aspirin (analgesic), Paracetamol (Antipyretic), Atenolol (antihypertensive).

TEXT BOOKS

1. P.C. Jain and M. Jain, "Engineering Chemistry", Dhanpat Rai Publishing Company Ltd., New Delhi,16th edition (2015).
2. W.U. Mali, G.D.Tuli and R.D.Madan, "Selected topics in Inorganic Chemistry", S Chand & Company Ltd, New Delhi, reprint (2009).
3. R.T. Morrison, R.N. Boyd and S.K. Bhattacharjee, "Organic Chemistry", Pearson, Delhi, 7th edition(2011).
4. G.L. David Krupadanam, D. Vijaya Prasad, K. Varaprasad Rao, K.L.N. Reddy and C. Sudhakar, "Drugs", Universities Press (India) Limited, Hyderabad (2007).

SUGGESTED READINGS

1. B. H. Mahan, "University Chemistry", Narosa Publishing house, New Delhi, 3rd edition (2013).
2. B.R. Puri, L.R. Sharma and M.S. Pathania, "Principles of Physical Chemistry", S. Nagin Chand & CompanyLtd.,46th edition(2013).
3. T.W. Graham Solomons, C.B. Fryhle and S.A. Snyder, "Organic Chemistry", Wiley,12th edition (2017).
4. P.W. Atkins, J.D. Paula, "Physical Chemistry", Oxford, 8thedition (2006).

18CE C01

ENGINEERING MECHANICS

Instruction:	3L+1T Hours per Week
Duration of Semester End Examination:	3 Hours
Semester End Examination:	70 Marks
Continuous Internal Evaluation:	30 Marks
Credits:	4

Course Objectives:

1. The objective of this course is to understand the resolution of forces and to obtain resultant of all force systems, to understand moment of a force and equilibrium conditions of static loads for smooth and frictional surface
2. To obtain centroid, centre of gravity and moment of inertia for various regular and composite areas and bodies.
3. To understand the basic structural analysis, principles of virtual work and energy methods.
4. To know the basic concepts of dynamics and analysis as a particle and rigid bodies.
5. To understand the work energy principles, impulse momentum and their applications and to know the concept of simple harmonic motion and free vibration.

Course Outcomes: The students will be able to

1. Solve problems dealing with forces in plane and space force systems, draw free body diagrams to analyze various problems in equilibrium, for smooth and frictional surface.
2. Determine centroid and moment of inertia for elementary, composite areas and bodies.
3. Analyze simple trusses for forces in various members of a truss.
4. Solve problem in kinematics and kinetics of particles and rigid bodies.
5. Analyze body motion using work energy principles, impulse and momentum approach and able to apply the concepts of simple harmonic motion and free vibrations in dynamics.

Unit–I: Resolution, Resultant and Equilibrium of force system and Friction: Concepts of force, System of forces, components of forces in a plane and in space systems.Resultant of force systems.Moment of forces and its applications.Couples and its applications.Equilibrium of Force systems. Free body diagrams, equation of equilibrium of coplanar and spatial force systems. Static indeterminacy. Types of friction, Laws of friction, application of friction to a single bod systems, wedge friction.

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Unit–II: Centroid, centre of gravity and moment of Inertia:
Centroid of simple figures from first principle, centroid of composite sections. Centre of gravity and its implications, Definition of Area moment of Inertia, Moment of inertia of plane section from first principles, Theorems of moment of inertia, moment of inertia of standard sections and composite sections, Mass moment of inertia of rectangular and circular plates, cylinder, cone & sphere.

Unit–III: Analysis of simple trusses, Virtual work and Energy methods:
Analysis of simple trusses using method of joints, methods of sections. Determine if a member is in tension or compression, zero force members. Virtual displacements, Principle of virtual work for particle and ideal system of rigid bodies, degrees of freedom.Conservative forces and potential energy, energy equation for equilibrium.

Unit–IV: Particle Dynamics:
Rectilinear and curvilinear translation using rectangular, normal and tangential components.Relative and constrained motion. Newton's 2nd Law, rectangular and path coordinates. Basic terms, general principles in dynamics, D'Alembert's principle and its application in plane motion and connected bodies.Instantaneous centre of rotation in plane motion and simple problems.

Unit–V: Work- Energy, Impulse-momentum and Mechanical Vibrations:
Equation of work energy for translation and fixed axis rotation, work energy principles applied to particle motion, connected systems. Introduction to linear impulse momentum, principle of conservation of linear momentum, Impact, direct and oblique. Introduction to vibration, free and forced vibrations, simple harmonic motion, simple pendulum and compound pendulum.

Text Books:

1. Reddy Vijaykumar K. and J. Suresh Kumar," Singer's Engineering Mechanics Statics and Dynamics", B. S. Publications 2011.
2. A. Nelson, "Engineering Mechanics", Tata McGraw Hill, New Delhi, 2010.

Suggested Reading:

1. Irving H. Shames, "Engineering Mechanics", 4th Edition, Prentice Hall, 2006.
2. F. P. Beer and E. R .Johnson, "Vector Mechanics for engineers, Vol. I - Statics, Vol. II - Dynamics",
   9th edition, Tata McGraw Hill, 2011.
3. R. C. Hibbeler, "Engineering Mechanics: Principles of Statics and Dynamics", Pearson Press, 2006.

18ME C01

ENGINEERING GRAPHICS AND DESIGN

Instruction	1T+4D Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation:	30 Marks
Credits	3

Course Objectives:

1. to prepare to design a system, component, or process to meet desired needs within realistic constraints.
2. to prepare the student to communicate effectively.
3. to prepare the student to use the techniques, skills, and modern. engineering tools necessary for engineering practice.
4. to get exposure to a CAD package.

Course Outcomes:

1. Introduction to engineering design and its place in society.
2. Exposure to the visual aspects of engineering design.
3. To become familiar with engineering graphics standards.
4. Exposure to solid modelling.
5. Exposure to computer-aided geometric design.
6. Exposure to creating working drawings.
7. Exposure to engineering communication.

Detailed contents

Traditional Engineering Graphics:

Principles of Engineering Graphics; Orthographic Projection; Descriptive Geometry; Drawing Principles; Isometric Projection; Surface Development; Perspective; Reading a Drawing; Sectional Views;
Dimensioning & Tolerances; True Length, Angle; intersection, Shortest Distance.

Computer Graphics:

Engineering Graphics Software; -Spatial Transformations; Orthographic Projections; Model Viewing; Coordinate Systems; Multi-view Projection; Exploded Assembly; Model Viewing; Animation; Spatial Manipulation; Surface Modeling; Solid Modeling; Introduction to Building Information Modeling (BIM).

(Except the basic essential concepts, most of the teaching part can happen concurrently in the laboratory).

UNIT-1 Introduction to Engineering Drawing:

Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections including the Rectangular Hyp
method only); Cycloid, Epicycloid, Hypocycloid and Involute;

UNIT-2 Orthographic Projections:
Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes (without traces) ; Projections of planes inclined Planes;
Introduction to CAD package:
Listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids.

UNIT-3 Projections of Regular Solids:
Projection of Prism, Cylinder, Pyramid and Cone : Simple position, axis inclined to one of the reference plane only. Customization & CAD Drawing: consisting of set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerancing; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles;

UNIT-4 Sections and Sectional Views of Right Angular Solids:
Sections of solids in simple position Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids.
Annotations, layering & other functions:
applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); rinting documents to paper using the print command; orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation, Computer-aided design (CAD) software modeling of parts and assemblies. Parametric and non-parametric solid, surface, and wireframe models. Part editing and twodimensional documentation of models. Planar projection theory, including sketching of perspective, isometric, multi view, auxiliary, and section views. Spatial visualization exercises. Dimensioning guidelines, tolerancing techniques; dimensioning and scale multi views of dwelling;

UNIT-5 Isometric Projections:
Principles of Isometric projection – Isometric Scale, Isometric View[illegible]
Isometric Views of lines, Planes, Simple and compound Solids;
Isometric Views to Orthographic Views and Viceversa, Conventio[illegible]

Demonstration of a simple team design project:

Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; geometric dimensioning and tolerancing;

Use of solid-modeling software for creating associative models at the component and assembly levels; (Examples of specific components to the branch of study may be included).

Text Books:

1. N.D.Bhatt, Elementary Engineering Drawing, Charotar Publishers,2012.
2. K.L.Narayana and P.K.Kannaiah, –Text Book of Engineering Drawing Scitech Publications, 2011.
3. Basanth Agrawal and C M Agrawal –Engineering Drawing 2e –, McGraw-Hill Education(India) Pvt.Ltd.

Suggested Reading:

1. Shaw M.B and Rana B.C., –Engineering drawing Pearson, 2ndedition, 2009.
2. K.Veenugopal, –Engineering Drawing and Graphics + Autocad New Age International Pvt.Ltd,2011.
3. Bhattacharya. B, –Engineering Graphics I. K. International Pvt.Ltd, 2009.

18EE C01

BASIC ELECTRICAL ENGINEERING

Instruction:	3L+1T Hours per Week
Duration of Semester End Examination:	3 Hours
Semester End Examination:	70 Marks
Continuous Internal Evaluation:	30 Marks
Credits:	4

Course Objectives:

1. To understand the behavior of different circuit elements R,L & C, and the basic concepts of electrical circuit analysis.
2. To know the concepts of AC circuits, RMS value, Average value, Phasor analysis etc., 3. To understand the basic principle of operation of Transformer and DC machines.
4. To understand the basic principle of operation of DC machines and AC machines.
5. To know about different types of electrical wires and cables, domestic and industrial wiring.
6. To understand safety rules and methods of earthing.

Course Outcomes: At the end of the course, the student will be able to

1. Acquire the concepts of Kirchhoff's laws and network theorems and able to get the solution of simple dc circuits.
2. Obtain the steady state response of RLC circuits and also determine the different powers in AC circuits.
3. Acquire the concepts of principle of operation of Transformers and DC machines.
4. Acquire the concepts of principle of operation of DC machines and AC machines.
5. Acquire the knowledge of electrical wiring and cables and electrical safety precautions.
6. Recognize importance of earthing and methods of earthing and electrical installations.

UNIT-I: DC Circuits

Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation, Superposition, Thevenin and Norton Theorems, Time-domain analysis of first o[r]
circuits.

UNIT-II: AC Circuits

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor, Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel). Three phase balanced circuits, voltage and current relations in star and delta connections.

UNIT-III: Transformers

Construction, Working principle, EMF Equation, Ideal and Practical transformer, Equivalent circuit of Transformer, OC and SC tests on a transformer, Efficiency and Regulation, Auto transformer

UNIT-IV: DC and AC Machines

DC Generators: Construction, Principle of operation, EMF equation, Classification, Characteristics of shunt, series and compound generators. DC Motors: Classification, Torque equation, Characteristics, Efficiency, Speed Control of Series and Shunt Motors. Three - Phase Induction Motors: Construction, Principle of operation, Torque equation, torque-slip characteristics, Power stages, speed control of induction motors.

UNIT-V: Electrical Installations

Electrical Wiring: Types of wires and cables, Electrical Safety precautions in handling electrical appliances, electric shock, first aid for electric shock, safety rules.
Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Earthing, Elementary calculations for energy consumption.

Text books:

1. L. S. Bobrow, Fundamentals of Electrical Engineering, Oxford University Press, 2011.
2. E. Hughes, Electrical and Electronics Technology, Pearson, 2010.

Suggested Reading:

1. D. P. Kothari & I. J. Nagrath, –Basic Electrical Engineering .Tata McGraw Hill, 2010.
2. V. D. Toro, –Electrical Engineering Fundamentals Prentice Hall India, 1989.
3. D.C. Kulshreshtha, –Basic Electrical Engineering McGraw Hill,2009
4. P.V.Prasad, S.sivanagaraju, R.Prasad, "Basic Electrical Engineering" Cengage Learning, 1st Edition, 2013.

18EE C02

BASIC ELECTRICAL ENGINEERING LAB

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	35 Marks
Continuous Internal Evaluation:	15 Marks
Credits	1

Course Objectives:

1. To acquire the knowledge of different types of electrical elements.
2. To verify the basic electrical circuit laws and theorems.
3. To determine the parameters and power factor of a coil.
4. To calculate the time and frequency responses of RLC circuits
5. To determine the characteristics of Transformers.
6. To determine the characteristics of dc and ac machines.

Course Outcomes: At the end of the course, the students are expected to

1. Get an exposure to common electrical components and their ratings.
2. Make electrical connections by wires of appropriate ratings.
3. Understand the circuit analysis techniques.
4. Determine the parameters of the given coil.
5. Understand the basic characteristics of transformer.
6. Understand the basic characteristics of dc and ac machines.

List of Laboratory Experiments/Demonstrations:

1. Demonstration of Measuring Instruments and Electrical Lab components
2. Verification of KCL and KVL.
3. Time response of RL and RC circuits.
4. Calculation of permittivity of a choke or coil by Wattmeter Method.
5. Verification of Thevenin's and Norton's theorems.
6. Turns ratio /voltage ratio verification of 1-Ph Transformers.
7. OC and SC tests on a given 1-Ph Transformer.
8. Observation of Excitation Phenomenon in Transformer.
9. Measurement of 3-Ph power in a balanced system (By 2- Wattmeter method).
10. Measurement of 3-Ph Energy by an Energy Meter (Demonstration of Principle).
11. Load test of DC Shunt motor.
12. Speed control of DC Shunt motor.
13. Load test of 3-Ph Induction motor.
14. Demonstration of LT Switchgear Equipment/Components.
15. Demonstration of cut - out section of Machines like DC Machine. Induction Machine, etc.

Note: at least **TEN** experiments should be conducted in the se

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18CY C02

CHEMISTRY LAB

(Common to all branches)

Instruction:	3 Hours per Week
Duration of Semester End Examination:	3 Hours
Semester End Examination:	50 Marks
Continuous Internal Evaluation:	25 Marks
Credits:	1.5

Course Objectives

1. To impart fundamental knowledge in handling the equipment / glassware and chemicals in chemistry laboratory
2. The student should be conversant with the principles of volumetric analysis and identification of organic functional groups.
3. To apply various instrumental methods to analyze the chemical compounds and to improve understanding of theoretical concepts.

Course Outcomes

The chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and engineering.

The students will learn to:

1. Estimate rate constants of reactions from concentration of reactants/ products as a function of time.
2. Measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water, etc
3. Synthesize a small drug molecule and Identify the organic compounds.
4. understand importance of analytical instrumentation for different chemical analysis.
5. Perform interdisciplinary research such that the findings benefit the common man.

Chemistry Lab

1. Estimation of temporary and permanent hardness of water using EDTA solution.
2. Estimation of amount of chloride in water.
3. Determination of rate constant for the reaction of hydrolysis of methyl acetate (first order).
4. Estimation of amount of HCl Conductometerically using NaOH solution.

5. Estimation of (a) amount of CH_3 COOH Conductometerically using NaOH solution. (b) amount of HCl and CH_3 COOH present in the given mixture of acids Conductometerically using NaOH solution.
6. Estimation of amount of HCl Potentiometrically using NaOH solution.
7. Estimation of amount of Fe^{+2} Potentiometrically using $KMnO_4$ solution.
8. Distribution of acetic acid between n-butanol and water.
9. Synthesis of drug - Aspirin.
10. Organic Chemistry- Identification of Functional groups - neutral group (carbonyl groups-acetaldehyde and acetone); acidic group(benzoic acid) ; basic group (aniline).
11. Determination of surface tension of organic solvents (ethanol, ethyl acetate).
12. Determination of Viscosity.

TEXT BOOKS

1. J. Mendham and Thomas ,"Vogel' s text book of quantitative chemical analysis", Pearson education Pvt.Ltd., New Delhi , 6th ed. 2002.

SUGGESTED READINGS

1. Dr. Subdharani , "Laboratory Manual on Engineering Chemistry", Dhanpat Rai Publishing, 2012.
2. S.S. Dara , "A Textbook on experiment and calculation in engineering chemistry", S.Chand and Company, 9th revised edition, 2015.

18CE C02

BUILDING CONSTRUCTION PRACTICE

Instruction	3L Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: To enable the student

1. To study about the basic building materials, properties and their applications.
2. To study about smart and Eco-friendly building materials.
3. To understand different types of masonries and their applications
4. To acquire concepts in building planning and to draw, plan, section, elevation of buildings with a flat /sloped roof.
5. To understand the concepts of framed RCC Structures, Roof trusses and formwork.

Course outcomes: At the end of the course the student is able

1. To identify various building materials and select suitable type for given situation.
2. To know different types of masonry, types of bonds used in construction of walls of buildings.
3. To know the different types of roofs, stair used in building works.
4. To plan suitable types of building and to prepare plan, section and elevation of building with flat / sloped roof.
5. To know the various components of RCC framed structure, RCC Structures, Roof trusses and formwork.

UNIT- I:

Traditional Building Materials: Properties, Types, Applications and testing of traditional building materials - Stone, Timber, Brick, Cement, Fly Ash, Sand, Coarse Aggregates, Mortar, Concrete and Steel.

Emerging Building Materials: Smart and Eco-Friendly materials - Sustainable materials - Recycled materials.

UNIT- II:

Concepts of Building Planning: Types of Buildings, Functional needs and differences in their planning requirements - Introduction to building byelaws - Provisions of National Building code - Conventional Representation of building materials and elements in plans and sections - Representations of electrical and plumbing services.

Drawing of plans, sections and elevations and sections of a single storey 1, 2 and 3- bed room residential buildings in AUTOCAD.

UNIT- III:

Sub-structure Construction: Introduction, Site clearance-Marking, Earthwork, and Foundations - Function of Foundations, Essential requirements of good foundations, Types of foundations- Open Foundations or Shallow Foundations, Raft Foundations, Deep Foundations, Well Foundations, Coffer Dams. General procedure in foundation design.

UNIT- IV:

Masonry Construction: Introduction, **Stone Masonry**: Elevation, sectional plans and cross sections of walls of Ashlar, CRS I and II sort and RR stone masonry

Brick Masonry: Plan and isometric view of external main wall junctions, Stretcher Bond, Header Bond; English Bond& Flemish Bond – for half brick, one & one and a half brick wall.

Composite Masonry: Stone Composite Masonry, Brick Stone Composite Masonry, Cement Concrete Masonry, Hollow Clay tile Masonry, Reinforced Brick Masonry.

UNIT- V:

Super-structure Construction: Reinforced Concrete Framed structure – Introductory concepts, Types of roofs, beams, columns, and stairs.

Different types of roof trusses. Formwork –Shuttering for Beams, Columns, slabs and stairs.

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Text Books:

1. S.P. Arora & S. P. Bindra, "*A text book of Building Construction*", Dhanpat Rai Publications, 2010.
2. B.C Punmia, Ashok Kumar Jain &Arun Kumar Jain “*Building Construction*”, Laxmi Publications (P) LTD, 2016.

Suggested Reading:

1. P.C. Varghese, “*Building construction*” PHI, 2016.
2. CBRI Roorkee, "*Advances in Building Materials and construction*".
3. Sushil Kumar, "*Building Construction*", Standard Publishers, 1992.
4. National Building Code of India, 2006.

18CE C03

SOLID MECHANICS

Instruction	4(3L+1T) Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: To enable the student

1. Understand the stress - strain behaviour of different materials and temperature stresses, statically indeterminate problems in compression and tension.
2. Analyze the statically determinate beams and sketch shear force and bending moment diagrams,
3. Comprehend compound stresses, direct and bending stresses in beams.
4. Analyze thin and thick cylinders for fluid pressure and /or shrink fit pressures.

Course Outcomes: At the end of the course the students are able to

1. Evaluate the strength of various Civil Engineering materials, against structural actions such as compression, tension, shear and bending.
2. To analyze statically determinate beams and sketch SFD and BMD.
3. To suggest suitable material and sections from among the available, for use in Civil Engineering context.
4. To evaluate the behaviour and strength of Civil Engineering materials under the action of compound stresses and thus understand failure concepts.
5. To design thin and thick cylinders for resisting internal and external pressures.

UNIT- I:

Simple Stresses and Strains: Various types of stresses and strains. Hooke's law, Modulus of Elasticity, Stress-Strain curve for ductile & brittle materials, Working stress and factor of safety. Deformation of bars of uniform, varying and tapering sections under axial loads, Elongation of bars due to self weight, Bars of uniform strength, Compound bars and temperature stresses. Statically indeterminate problems in tension and compression.

Elastic Constants: Poisson's ratio, volumetric strain and derivation of relationship between elastic constants.

UNIT- II:

Shear force and Bending moment: Different types of beams and loads, Shear force and bending moment diagrams for cantilever, and simply supported beams with and without over hangs subjected to different kinds of loads viz, point loads, uniformly distributed loads, uniformly varying loads and couples- Relation between loading, shear force and bending moments.

UNIT- III:

Bending stresses in Beams: Assumptions in theory of simple bending- Derivation of bending equation, Moment of resistance -Calculation of stresses in statically determinate beams for different loads and different types of structural sections.

Shear stresses in Beams: Equation of shear stress, shear stress distribution across rectangular, circular, triangular, I, T, and diamond sections.

UNIT- IV:

Direct and bending stresses: Basic concept, Eccentric loading, limit of eccentricity - core of sections-rectangular, circular, solid and hollow sections.

Compound Stresses and Strains: Stresses on oblique planes, principal plane and principal stresses. Ellipse of stress and Mohr’s circle of stress.

UNIT- V:

Thin cylinders: Thin cylinders subjected to internal fluid pressure, volumetric change, Wire winding of thin cylinders.

Thick cylinders: Lame's equations, stresses under internal and external fluid pressures. Compound cylinders-shrink fit pressure.

Text Books:

1. B. C. Punmia," *Mechanics of Materials*", Laxmi publishers, Delhi, 2017.
2. S. Ramamrutham, "*Strength of Materials*", Dhanpat Rai & Sons, Delhi, 2014.

Suggested Reading:

1. S.B. Junnarkar, "*Mechanics of structures (Vol-I &Vol-II)",* Charotar Publishing house, 2016.
2. D.S. Prakash Rao, "*Strength of Materials-A Practical Approach*", Universities Press, 1999.
3. E.P. Popov, "*Engineering Mechanics of solids*", Pearson, 2015.
4. G.H. Ryder, "*Strength of Materials*", 3rd Edition in SI units, Macmillan India Ltd, 1969.
5. A. Pytel and F.L. Singer, "*Strength of Materials*", Harper & Row, 4 Edition, New York, 1999.

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18CE C04

SURVEYING AND GEOMATICS

Instruction	(3L+1T) Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: To enable the student to

1. Understand the basics of Surveying
2. Know and read the topo sheets.
3. Use the topo sheets for taking appropriate decisions.
4. Expose to various Surveying instruments.
5. Develop the maps required for various applications accurately.

Course Outcomes: At the end of the course the student is able to

1. Know the estimation of various parameters required for execution of a project.
2. Be in a position to choose appropriate instruments for carrying Surveying.
3. Can identify the data required for preparation of topo sheets.
4. Acquiring the data accurately and quickly with proper checks.
5. Knows the way of transferring data from topo sheets to ground and vice versa.

UNIT- I:

Introduction to Surveying :Principles and objectives of surveying, Linear, angular and graphical methods, concept of Survey stations, Survey lines- ranging, brief introduction to offsets-types and uses; Bearing of survey lines using prismatic compass, concepts of whole circle bearing system and quadrantal bearing system.

Levelling: principles, terms used in levelling, bench marks and types, booking and reduction of levels, types of levelling; contouring: Contours- definition, contour interval, characteristics, methods of contouring and interpolation and uses of contours, estimation of areas and volumes using Trapezoidal and Simpson's method.

Plane table surveying: concepts, methods of plane table surveying.

Triangulation and Trilateration: Theodolite survey: Instruments, Measurement of horizontal and vertical angle; Trigonometric levelling - Axis signal correction.

UNIT - II:

Curves: Elements of simple and compound curves – Method of setting out, Elements of Reverse curve, Transition curve – length of curve – Elements of transition curve, Vertical curves-types, setting out of vertical curves-tangent correction method and chord gradient method.

UNIT - III:

Modern Field Survey Systems: Principle of Electronic Distance Measurement, Modulation, Types of EDM instruments, Diatomite, Total station-Parts of a Total Station – Accessories, Advantages and Applications, Field Procedure for total station survey, Errors in Total Station Survey-concepts of consecutive coordinates- Total coordinates-balancing of traverse-Plotting of traverse.

Global Positioning: Systems- Segments, GPS measurements, errors and biases, surveying with GPS, Co-ordinate transformation, accuracy considerations.

UNIT - IV:

Photogrammetric Surveying: Introduction, Basic concepts, perspective geometry of aerial photograph, relief and tilt displacements, terrestrial Photogrammetric, flight planning; Stereoscopy, ground control extension for photographic mapping- aerial triangulation, radial triangulation, methods; photographic mapping- mapping using paper prints, mapping using stereo plotting instruments, mosaics, map substitutes.

UNIT - V:

Remote Sensing: Introduction –Electromagnetic Spectrum, interaction of electromagnetic radiation with the atmosphere and earth surface, remote sensing data acquisition: platforms and sensors.

Visual image interpretation: introduction, fundamentals of visual image elements, image interpretation strategies and keys, wavelength of sensing, temporal aspects of image interpretation. Introduction to types of digital image processing.

Text Books:

1. Subramanian,"
2. *Surveying and Levelling*", Oxford Higher Education, 2012.
3. K. R. Arora, "*Surveying, Vol-I, II and III*", Standard Book House, 2015.
4. GopiSatheesh and R.Sathikumar, "*Advanced Surveying: Total Station, GIS and Remote Sensing*", Pearson India, 2006.

Suggested Reading:

1. K. Manoj K. Arora and R. C. Badjatia*," Geomatics Engineering*", Nem Chand & Bros, 2011
2. A. M. Chandra, "*Higher Surveying",* Third Edition, New Age International (P) Limited, 2002.
3. M. Anji Reddy, "*Remote sensing and Geographical information system*", B.S. Publications, 2001.

18CE C05

FLUID MECHANICS

Instruction	3L Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The objective of this course is

1. To introduce the concepts of fluid mechanics and fluid properties useful in Civil Engineering applications.
2. To understand fluid pressure and forces, pressure measuring devices and stability of floating bodies.
3. To understand the fluid motion, energy equation, analyze the forces on various objects.
4. To know various measuring instruments in finding the fluid velocity, and discharge in pipe and channel flow. To understand dimensional analysis, model and prototype and models applied to practical applications.
5. To understand and analyze different flow characteristics of laminar and turbulent flow.

Course Outcomes: At the end of the course, the student will be able to

1. Apply fluid flow concepts and evaluate the various properties of fluid.
2. Use of pressure gauges, design hydraulic gates.
3. Apply the continuity, momentum and energy principles in hydraulic applications.
4. Measure velocity and Discharge of fluid flow in pipes, channels, and tanks. Apply model studies to practical applications.
5. Quantify losses and design pipes

UNIT – I:

Basic Concepts and Fluid properties: Distinction between a fluid and a solid, conservation principles applied in fluid mechanics, ideal fluid, real fluid, fluid continuum, density, specific weight, specific gravity, dynamic viscosity, kinematic viscosity, variation of viscosity with temperature, Newton law of viscosity; vapour pressure, surface tension, cohesion, adhesion, capillarity, bulk modulus of elasticity and introduction to compressible fluids.

UNIT – II:

Fluid Statics: Fluid pressure-pressure at a point, Pascal's law, pressure variation, absolute and gauge pressure, piezometer, u-tube manometer, single column manometer, u-tube differential manometer, inverted u-tube differential manometer, pressure gauges-bourdon's pressure gauge, hydrostatic pressure and force-horizontal, vertical, inclined and curved surfaces. Buoyancy, metacentre, metacentric height and stability of floating bodies.

UNIT – III:

Fluid Kinematics: Classification of fluid flow-steady and unsteady flow; uniform and non-uniform flow, laminar and turbulent flow, rotational and irrotational flow, compressible and incompressible flow, one, two and three dimensional flows, stream line, path line, streak line and stream tube, stream function, velocity potential function, flow net, three -dimensional continuity equations in Cartesian coordinates.

Fluid Dynamics: Forces causing motion, equations of motion - Euler's equation, Bernoulli's equation-derivation, momentum principle, forces exerted by fluid flow on pipe bend, impact of jets-force exerted by a liquid jet on a stationary, moving flat plate and curved vanes.

UNIT – IV:

Measurement of Velocity and Discharge: Pitot tube, and current meter, measurement of discharge in pipes and tanks: venturimeter, orifice meter, flow through mouthpiece and orifice. Measure discharge in free surface flows: notches and weirs.

Dimensional Analysis and Hydraulic Similitude: Dimensional homogeneity, Rayleigh method, Buckingham's π-Theorem method, dimensionless groups, dimensionless numbers, similitude, model studies, types of models, scale effect in models, application of Reynold's and Froude's model laws.

UNIT – V:

Flow through Pipes: Loss of head through pipes, major loss-Darcy's Weisbach equation, minor losses, total energy equation, hydraulic gradient line, pipes in series, equivalent pipes, pipes in parallel, power transmission through pipes, water hammer in pipes and control measures.

Text Book:

1. P. N. Modi and S. M. Seth, "*Hydraulic and Fluid Mechanics*", Standard Book House, Delhi, 2013.
2. Victor Streeter and E. Benjamin Wylie, "*Fluid Mechanics*", Mc-Graw Hill, Newyork, 2017

Suggested Reading:

1. K.L. Kumar, "*Engineering Fluid Mechanics",* S. Chand, , Delhi, 2010.
2. Frank M. White, "*Fluid Mechanics*", Mc-Graw Hill, Newyork, 2011.
3. Yunus A. Cengel& John M. Cimbla, "*Fluid Mechanics Fundamentals and Applications*", Tata Mc Graw Hill Education private Ltd, 2012.

18EG M01

INDIAN CONSTITUTION

Instruction	2L Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	50 Marks
CIE	0 Marks
Credits	0

Course Objectives: The course will introduce the students to

1. The history of Indian Constitution and how it reflects the social, political and economic perspectives of the Indian society.
2. Address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. Have knowledge of the various Organs of Governance and Local Administration.

Course Outcomes: After successful completion of the course the students will be able to

1. Understand the making of the Indian Constitution and its features.
2. Have an insight into various Organs of Governance - composition and functions.
3. Understand powers and functions of Municipalities, Panchayats and Co-operative Societies.
4. Be aware of the Emergency Provisions in India.
5. Understand the Right To equality, the Right To freedom and the Right To Liberty.

Unit-I:

Constitution of India: Introduction and salient features .Constitutional history.
Directive Principles of State Policy - Its importance and implementation.

Unit -II:

Union Government and its Administration: Structure of the Indian Union: Federalism, distribution of legislative and financial powers between the Union and the States.
Parliamentary form of government in India. President: role, power and position.

Unit- III:

Emergency Provisions in India: National emergency, President rule, Financial emergency

Unit- IV:

Local Self Government: District's Administration Head: Role and Importance.
Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation.
Panchayati Raj: Introduction, ZillaPanchayat, Elected officials and their roles, CEO ZillaPanchayat: Position and role. Block level: Organizational Hierarchy (Different departments). Village level: Role of Elected and officials.

Unit- V:

Scheme Of The Fundamental Rights and Duties: Fundamental Duties - the legal status.
Scheme of the Fundamental Rights - To Equality, to certain Freedom under Article 19, to Life and Personal Liberty under Article 21.

Suggested Reading:

1. **"***The Constitution of India***"**, 1950 (Bare Act), Government Publication.
2. S. N. Busi S. N., Ambedkar B. R, "*Framing of Indian Constitution***"**, 1st Edition,2015.
3. Jain M. P., "*Indian Constitution Law"*, 7th Edn., Lexis Nexis,2014.
4. Basu D. D**, "***Introduction to the Constitution of India",* Lexis Nexis,2015.

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18EE A01

INDIAN TRADITONAL KNOWLEDGE

Instruction	2L Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	50 Marks
CIE	0 Marks
Credits	0

Course Objectives: To enable the student
1. To get a knowledge in Indian Culture
2. To Know Indian Languages and Literature and the fine arts in India
3. To explore the Science and Scientists of Medieval and Modern India

Course Outcomes: After completion of this course, students will be able to:
1. Understand philosophy of Indian culture
2. Distinguish the Indian languages and literature
3. Learn the philosophy of ancient, medieval and modern India
4. Acquire the information about the fine arts in India
5. Know the contribution of scientists of different eras.

UNIT-I:
Introduction to Culture: Culture, civilization, culture and heritage, general characteristics of culture, importance of culture in human literature, Indian Culture, Ancient India, Medieval India, Modern India

UNIT-II:
Indian Languages, Culture and Literature:
Indian Languages and Literature-I: the role of Sanskrit, significance of scriptures to current society, Indian philosophies, other Sanskrit literature, literature of south India.
Indian Languages and Literature-II: Northern Indian languages & literature

UNIT-III:
Religion and Philosophy: Religion and Philosophy in ancient India, Religion and Philosophy in Medieval India, Religious Reform Movements in Modern India (selected movements only)

UNIT-IV:
Fine arts in India (Art, Technology& Engineering): Indian Painting, Indian handicrafts, Music, divisions of Indian classic music, modern Indian music, Dance and Drama, Indian Architecture (ancient, medieval and modern), Science and Technology in India, development of science in ancient, medieval and modern India

UNIT-V:
Education system in India: Education in ancient, medieval and modern India, aims of education, subjects, languages, Science and Scientists of Ancient India, Science and Scientists of Medieval India, Scientists of Modern India

Text Books:

1. KapilKapoor, "*Text and Interpretation: The India Tradition*", ISBN: 81246033375, 2005
2. "*Science in Samskrit*", Samskrita Bharti Publisher, ISBN-13: 978-8187276333, 2007
3. Narain S., "*Examinations in ancient India*", Arya Book Depot, 1993
4. Satya Prakash, "*Founders of Sciences in Ancient India*", Vijay Kumar Publisher, 1989
5. M. Hiriyanna, "*Essentials of Indian Philosophy*", MotilalBanarsidass Publishers, ISBN-13: 978-8120810990, 2014

Suggested Reading:

1. KapilKapoor,"*Language, Linguistics and Literature: The Indian Perspective*", ISBN-10: 8171880649, 1994.
2. Karan Singh, "A Treasury of Indian Wisdom: An Anthology of Spiritual Learn", ISBN: 978-0143426158, 2016.

18CE C06

SURVEYING AND GEOMATICS LAB

Instruction	3P Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	35 Marks
CIE	15Marks
Credits	1

Course Objectives: To enable the student

1. To know the use of simple survey instruments in the field.
2. To develop topo maps from the field data.
3. To get exposure to modern surveying instruments for solving the problems
4. To understand the concepts of automation in surveying.
5. To be in a position to set the curves by using various methods and identifying the data required to be computed for the same.

Course Outcomes: At the end of the course the student should have learnt

1. To use simple as well as modern surveying instruments.
2. To develop L.S and C.S for road works, Canal works, using Auto levels and to develop contour map of the given area.
3. To use Total Station for locating ground details and plotting.
4. To set simple curves using Total Station.
5. To locate ground features using GPS.

LIST OF EXPERIMENTS:

1. Ranging, running perpendicular lines and types of offsets by using chain, tape, cross staff.
2. Use of prismatic compass for measuring the area of a given land by using compass traverse.
3. Introduction to plane table work. - Radiation and intersection methods.
4. Introduction to levelling - Fly levelling using Auto level.
5. Development of L.S. and C.S after obtaining levels by using Auto levels.
6. Developing contour maps.
7. Measurement of horizontal angles using theodolite.
8. Study of Total station operations.
9. Traversing by Total station.
10. Setting of simple curve with the help of Total Station.
11. Study of GPS operations.
12. Establishing control points using GPS.
13. Demonstration of Remote Sensing Data processing software

Suggested Reading:

1. B. C. Punmia and A. K. Jain," *Surveying and Levelling", Vol. I and II*, Laxmi Publications, 2016.
3. Subramanian, *"Surveying and Levelling*", Oxford Higher Education, 2012.

18CE C07

FLUID MECHANICS LAB

Instruction	3P Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	35 Marks
CIE	15Marks
Credits	1

Course Objectives: To enable the student

1. To enable the student to understand the governing parameters for the discharge measurement for flow through pipes, channels and tanks.
2. To enable the student to understand viscosity.
3. To understand flow visualization, Energy and Momentum principles by conducting experiments.
4. To understand stability of floating bodies by conducting experiments.
5. To understand Hydrostatic forces on flat and curved surfaces by conducting experiments.

Course Outcomes: At the end of the course, the student should have learnt

1. Ability to find the coefficient of discharge for flow through pipes, channels and tanks.
2. To differentiate between viscous and non-viscous flows and identify the governing parameters for both.
3. Applies the concept of energy and momentum principles.
4. Ability to find the stability and metacentre of floating body.
5. Applies the concept of hydrostatic forces on flat and curved surfaces.

List of experiments (Max 10 to be conducted):

1. Measurement of viscosity
2. Stability of Floating Body
3. Hydrostatics Force on Flat Surfaces/Curved Surfaces
4. Verification of Bernoulli's Theorem
5. Venturimeter
6. Orifice meter
7. Impacts of jets
8. Flow Visualization
9. Determination of C_d for mouthpiece (constant Head method).
10. Determination of C_d for V notch.
11. Determination of C_d of a mouth piece for unsteady flow in a hemi – spherical tank.

Suggested Reading:

1. N. Kumara Swamy, "*Fluid Mechanics and Machinery Laboratory Manual*", Charotar Publishing House Pvt. Ltd., Anand, Gujarat, 2008.
2. Sarbjit Singh, "*Experiments in Fluid Mechanics*", PHI Learning Private Limited, New Delhi, 2012.

18CS C05

BASICS OF DATA STRUCTURES
(Common for other Programmes except CSE& IT)

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	50 Marks
CIE	20 Marks
Credits	2

Pre-requisites: Basic knowledge of programming language such as C or C++ is preferred (but not mandatory) and some mathematical maturity also will be expected.

Course Objectives: To introduce
1. Basic linear and non-linear data structures.
2. Analyzing the performance of operations on data structures.
3. Different sorting and searching techniques and their complexities.

Course Outcomes: The Student will be able to
1. Understand the basic concepts of data structures.
2. Understand the notations used to analyze the performance of algorithms.
3. Choose and apply an appropriate data structure for a specified application.
4. Understand the concepts of recursion and its applications in problem solving.
5. Demonstrate a thorough understanding of searching and sorting algorithms.

UNIT – I:

Introduction: Data Types, Data structures, Types of Data Structures, Operations, ADTs, Algorithms, Comparison of Algorithms, Complexity, Time- space tradeoff.

Recursion: Introduction, format of recursive functions, recursion Vs. Iteration, examples.

UNIT – II:
Linked Lists: Introduction, Linked lists and types, Representation of linked list, operations on linked list, Comparison of Linked Lists with Arrays and Dynamic Arrays.

UNIT – III:
Stacks and Queues: Introduction to stacks, applications of stacks, implementation and comparison of stack implementations. Introduction to queues, applications of queues and implementations, Priority Queues and applications.

UNIT – IV:
Trees: Definitions and Concepts, Operations on Binary Trees, Representation of binary tree, Conversion of General Trees to Binary Trees, Representations of Trees, Tree Traversals, Binary search Tree.

UNIT – V:
Graphs: Introduction, Applications of graphs, Graph representations, graph traversals, Minimal Spanning Trees.
Searching and Sorting: Linear searching, binary Searching, sorting algorithms- bubble sort, selection sort, quick sort, heap sort.

Text Books:

1. Narasimha Karumanchi, "*Data Structures and Algorithms Made Easy*", Career Monk Publications, 2017
2. Horowitz E, Sahni S., and Susan Anderson-Freed," *Fundamentals of Data structures in C*", Silicon Pr; 2 edition (1 August 2007)
3. ReemaThareja, "*Data Structures using C*", Oxford, 2014.

Suggested Reading:

1. Kushwaha D. S. and Misra A. K, "*Data structures A Programming Approach with C"*, PHI.
2. Seymour Lipschutz," *Data Structures with C*", McGraw Hill Education, 2017.

Online Resources:

1. https://www.tutorialspoint.com/data_structures_algorithms/index.htm
2. https://www.edx.org/course/foundations-of-data-structures
3. https://sites.google.com/site/merasemester/data-structures/data-structures-1#DS

18CE C08

HYDRAULIC ENGINEERING

Instruction	4(3L+1T) Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The objective of this course is

1. To understand and analyze the laminar and turbulent flow.
2. Exposure to the basic principles of Aerodynamic forces, boundary layer.
3. Understand and analyze the open channel flows, steady uniform flow and computation.
4. Understand and analyze the non-uniform flows and flow profile, energy dissipation.
5. Familiarize with hydraulic machinery and its design, understand performance of hydraulic machinery.

Course Outcomes: At the end of the course, the student will be able to

1. Analyze the fluid effect related to laminar and turbulent flow in pipes.
2. Interprets the basics of computation of drag and lifts forces in the field of aerodynamics, boundary layer effect.
3. Apply the concepts of open channel flow and design the efficient channel.
4. Apply the concepts of non-uniform open channel flow to the field problems.
5. Design the turbines and pumps, should be able to run the turbines and pumps for efficient conditions.

UNIT – I:

Laminar Flow and Turbulent Flow: Laminar Flow: Laminar flow through circular pipes, annulus and parallel plates, measurement of viscosity. Turbulent Flow-Reynolds experiment, transition from laminar to turbulent flow, definition of turbulence, scale and intensity, causes of turbulence, instability, mechanism of turbulence and effect of turbulent flow in pipes.

UNIT – II:

Boundary Layer Analysis, **Drag and Lift**: Boundary Layer Analysis-Assumption and concept of boundary layer theory. Boundary-layer thickness, displacement, momentum and energy thickness, laminar and turbulent boundary layers on a flat plate, laminar sub-layer, smooth and rough boundaries, local and average friction coefficients, separation and control.

Drag and Lift: Fundamental concepts of drag and lift forces, Magnus effect, drag on sphere, cylinder, flat plate and aerofoil.

UNIT – III:

Introduction to Open Channel Flow and Uniform Flow: Introduction to Open Channel Flow: Comparison between open channel flow and pipe flow, geometrical parameters of a channel, classification of open channel flow, velocity and pressure distribution of channel section.

Uniform Flow: Continuity equation, energy equation and momentum equation, characteristics of uniform flow, Chezy's formula, Manning's formula, factors affecting Manning's roughness coefficient, most economical section of channel, computation of uniform flow, normal depth.

UNIT- IV:

Non-Uniform Flow and Hydraulic Jump: Non-Uniform Flow-Specific energy, specific energy curve, critical flow, discharge curve, critical depth. channel transitions, measurement of discharge and velocity –venture flume, standing wave flume, gradually varied flow-dynamic equation of gradually varied flow, classification of channel bottom slopes, classification of surface profile, characteristics of surface profile, computation of water surface profile-direct step method.

Hydraulic Jump: Theory of hydraulic jump, elements and characteristics of hydraulic jump in a rectangular channel, length and height of jump, location of jump, types and energy dissipation.

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UNIT- V:

Hydraulic turbines and Centrifugal Pumps: Hydraulic turbines-Classification, specific speed, unit quantities velocity triangles, power developed and efficiencies, principles of design of reaction and impulse turbines, characteristics curves, selection of turbines. Centrifugal Pumps- Components, work done and efficiency, minimum starting speed, Euler head equation, specific speed and characteristic curves of centrifugal pumps.

Text Books:

1. P. N. Modi and S. M. Seth, "*Hydraulic and Fluid Mechanics*", Standard Book House, Delhi, 2013.
2. K. Subramanya, "*Flow in Open Channels*", Tata McGraw-Hill Education, 2009.

Suggested Reading:

1. K. Subramanya, "*1000 Solved Problems in Fluid Mechanics*", Tata Mc-Graw Hill Publications 2005.
2. Ven Te Chow, "*Open-Channel Hydraulics",* McGraw-Hill, New York, 1959.

18CE C09

REINFORCED CONCRETE DESIGN – I

Instruction	4(3L+1T) Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The student is able to

1. Understand general mechanical behavior of reinforced concrete, design philosophies, design requirements get introduced to IS: 456 code and working stress method of design applied to RC rectangular beams.
2. Understand the basic principles of Limit state design, assumptions made in theory of flexure and flexural design procedures for singly reinforced and doubly reinforced rectangular beam.
3. Grasp the fundamentals of analysis and design of rectangular beams for shear and torsion, checking for bond and applying serviceability check for beams.
4. Know the procedures for analysis and design of one-way simply supported and cantilever slabs and two-way simply supported and continuous slabs.
5. Learn the design and detailing of columns and footings of rectangular and circular sections.

Course Outcomes: At the end of the course, student is able to

1. Use and suggest Reinforced concrete for various practical applications, interpret the clauses of IS:456 and apply the working stress method of design for rectangular beams.
2. Design RC beams of rectangular and flanged sections/ for flexure using limit state method.
3. Design RC beams for shear and torsion and check for bond and serviceability.
4. Analyze and design solid rectangular RC slabs of one way (cantilever, simply supported and continuous) and two way (simply supported and continuous).
5. Design RC columns (short and long) and axially loaded footings of circular and rectangular sections.

UNIT - I:

Introduction to Reinforced Cement concrete: Concept of reinforced concrete - basic requirement of RC structures- Stresses, loads & combinations- Design Philosophies: Development of design philosophies - working stress method - Ultimate load method - Limit state method - Merit and demerits. Introduction to IS: 456- General design requirements and specifications. Working Stress method: Assumptions made in design of flexural members – Theory of bending in RC beams - Balanced, under and over reinforced sections. Analysis and design for flexure of singly and doubly reinforced rectangular beams-Analysis and design T-beams using WSM.

UNIT- II:

Limit state method of design: Introduction to limit state method - classification of limit states – characteristic loads - partial safety factors – Factors for material and load - design stress – stress and strain diagram of concrete and steel - Assumptions made in design of flexural members - Stress block parameter - Analysis and flexural design of singly reinforced, doubly reinforced rectangular beams and flanged beams.

UNIT - III:

Limit state of collapse in shear and torsion: Types of shear reinforcement – analysis and design for shear and torsion in beams - Bond - development length and curtailment of reinforcement in beams and detailing of bars: IS a code provision. Limit state of serviceability: Short term, long term, total deflection - check for deflection - cracking - IS code provisions.

UNIT - IV:

Analysis and design of slabs: Solid rectangular slabs - cantilever slab – simply supported and cantilever one way and two way slabs subjected to uniformly distributed loads - IS code method of design of these slabs - Detailing of reinforcement and check for serviceability in slabs. Design of stair: Design and detailing of dog legged slab type staircase.

UNIT - V:

Analysis and design of columns: Short and long columns - End conditions- effective length of columns assumptions made in design - analysis - design and detailing of axially loaded square, rectangular and circular columns with lateral ties and helical bar - Design of axially loaded short columns subjected to uni-axial and bi-axial moments , using interaction diagrams – design principles for long columns. Footings: Types of Foundations and IS Specifications, Design and detailing of isolated rectangular and circular footings for axial loads.

Text Books:

1. N. Subramanian, "*Design of Reinforced Concrete Structures*" Oxford University Press. First Published in 2013, Second impression 2014.
2. S. Unni Krishnan Pillai and Devadas Menon, "*Reinforced Concrete Design*", Tata McGraw-Hill Publishing Co Ltd, (Third Edition), 2009.

Suggested Reading:

1. V. L. Shah and S. R. Karve, "*Limit State Theory and Design of Reinforced Concrete*", Structures Publications, 7th Edition,2014.
2. A.K. Jain, "*Reinforced Concrete: Limit State Design*", Nem Chand & Brothers-Roorkee; Seventh edition, paperback – 2012.
3. Sushil Kumar, "*Treasure of RCC Designs",* Standard Book House; Edition: 19th, Year-2014 edition (1 December 2009).
4. N. Krishna Raju, "*Design of Reinforced Concrete Structures*", CBS Publishers and Distributors, New Delhi, 4th edition, 2016.

18CE C10

STRUCTURAL ANALYSIS-I

Instruction	3L Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: To enable the students

1. Comprehend the concept of determination of flexural deflections statically determinate beams using various methods.
2. Analyze the indeterminate beams.
3. Understand the behavior of circular shafts subjected to torsion and also to the combined effect of bending & torsion and compute the strain energy in bars subjected to the action of various types of loads.
4. Understand the failure behavior of compression members and the significance & analysis of types of springs.
5. Gain the knowledge on unsymmetrical bending and shear center determination in different types of sections.

Course Outcomes: At the end of the course, the student will be able to

1. Compute deflections in determinate beams, under various types of static loads, using a suitable method.
2. Analyze the indeterminate beams subjected to various types of loads.
3. Analyze & design circular shafts subjected a given torque and also to determine the strain energy in members under various loading situations.
4. Analyze various types of springs and also the columns.
5. Analyze the members subjected to unsymmetrical bending and locate shear center for different sections.

UNIT - I:

Slopes and Deflections: Determination of Slope and deflections by double integration method and Macaulay's Method for cantilever, simple supported beams and overhanging beams carrying point loads, uniformly distributed loads, uniformly varying loads and couples. Application of Moment area method and Conjugate beam method for determination of Slope and deflections in simple cases.

UNIT - II:

Propped Cantilevers: Analysis of propped cantilever beams with elastic and rigid props for point loads and uniformly distributed loads, and determination of slope and deflections.

Fixed beams: Analysis of fixed beams subjected to point loads, uniformly distributed loads, uniformly varying loads. Slope and deflections in fixed beams with and without sinking of supports.

Continuous beams: Theorem of three moments and its derivation. Analysis of continuous beams with and without sinking of supports using theorem of three moments.

UNIT - III:

Torsion: Theory of pure torsion, solid and hollow circular shafts, strength and stiffness of shafts, Transmission of power. Combined torsion and bending with and without end thrust. Determination of principal stresses and maximum shear stresses. Equivalent Bending and Torsional Moments.

Strain energy: Strain energy, proof resilience and modulus of resilience. Strain energy in bars subjected to gradually applied loads, suddenly applied and impact loads. Strain energy due to shear, bending and torsion.

UNIT - IV:

Springs: Types of springs & significance, analysis of Closed and open coiled helical springs under axial load and twist and leaf springs.

Columns and Struts: Columns and classification, Empirical formulae Column & Struts, Failure of short, medium & slender column, Different end conditions of columns, Euler's theory for long columns. Rankine - Gordon's formula. Eccentrically loaded columns, Secant and Prof. Perry's formulae.

UNIT- V:

Unsymmetrical bending of beams: Unsymmetrical bending - Location of neutral axis, maximum stresses for rectangular section, Symmetric channel section.

Shear Centre: Shear stress, shear flow, locating of shear center for angle section, channel section and T-section, with one axis of symmetry.

Text Books:

1. B .C. Punmia, "*Strength of Materials*", Laxmi publishers, Delhi, 2011.
2. S. Ramamrutham, "*Strength of* Materials", Dhanpat Rai & Sons, Delhi, 2012.

Suggested Reading:

1. S.B. Junnarkar*," Mechanics of structures (Vol-I &Vol-II)",* Charotar Publishing house, Anand, 2002.
2. D.S. Prakash Rao, "*Strength of Materials-A Practical Approach"*, Universities Press, 1999.
3. E.P. Popov, "*Engineering Mechanics of solids*", 1993.
4. G.H. Ryder, "*Strength of Materials",* 3 Edition in SI units, Macmillan India Ltd, Delhi, 2012.
5. A. Pytel and F. L. Singer, "*Strength of Materials",* Harper & Row, 4 Editions, New York.1999.

18ME C09

PRINCIPLES OF MANAGEMENT

Instruction	3L Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Objectives: To make the students to

1. Understand basic fundamentals and insights of management
2. Understand the nature and purpose of planning
3. Gain the knowledge about the frame work of organizing
4. Understand the essence and significance of directing
5. Recognize the importance of controlling and its outcomes

Outcomes: At the end of the course, student will be able to understand

1. Identify and evaluate the principles of management
2. Demonstrate the ability to have an effective and realistic planning
3. Identify the nature and the type of organization
4. Apply the tools and techniques of directing
5. Explain and evaluate the necessity for controlling and further refinement of an organization.

UNIT – I:

Management: Definition of management, science or art, manager vs entrepreneur; managerial roles and skills;. Evolution of management, Basic management theories by FW Taylor, Henry Fayol, Types of Business Organizations, sole proprietorship, partnership, company, public and private enterprises; Organization culture and environment; Current trends and issues in management

UNIT – II:

Planning: Nature and purpose of Planning, types of Planning, objectives, setting objectives, policies, Strategic Management, Planning Tools and Techniques, Planning plant location and layout, Decision making steps & processes.

UNIT – III:

Organizing: Nature and purpose of Organizing, formal and informal organization, organization structure, types, line and staff authority, departmentalization, delegation of authority, centralization and decentralization, job design, human resource management, HR planning, Recruitment selection, Training & Development, Performance Management, Career planning and Management

UNIT – IV:

Directing: Individual and group behavior, motivation, motivation theories, motivational techniques, job satisfaction, job enrichment, leadership, types & theories of leadership, effective communication.

UNIT – V:

Controlling: system and process of controlling, budgetary and non-budgetary control techniques, use of computers and IT in management control, productivity problems and management, control and performance, direct and preventive control, reporting.

Text Books:

1. S.P. Robins and M. Couiter, "*Management*", 10/e, Prentice Hall India, 2009.

2. JAF Stoner, RE Freeman and DR Gilbert, "*Management*", 6/e., Pearson Education, 2004.

Suggested Reading:

1. P.C. Tripathy and P.N. Reddy, "*Principles of Management*", Tata McGraw Hill, 1999
2. Harold Koontz and Cyril O'Donnell "*Principles of Management''*, Tata McGraw Hill, 2017

18CE M01

ENVIRONMENTAL SCIENCE

Instruction	2L Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	50 Marks
CIE	0 Marks
Credits	0

Course Objectives: To enable the student
1. Identify environmental problems arising due to engineering and technological activities and the science behind those problems.
2. Become aware about the importance of eco system and biodiversity for maintaining ecological balance
3. To identify the importance of interlinking of food chain
4. Learn about various attributes of pollution management and waste management practices.
5. To make the students contribute for capacity building of nation for arresting and/or managing environmental disasters.

Course Outcomes: At the end of the course, the student should have learnt
1. To define environment, identify the natural resources and ecosystems and contribute for the conservation of bio-diversity.
2. To suggest suitable remedial measure for the problems of environmental pollution and contribute for the framing of legislation for protection of environment.
3. To relate the social issues and the environment and contribute for the sustainable development.
4. To follow the environmental ethics.
5. To contribute for the mitigation and management of environmental disasters.

UNIT – I:
Environmental Studies: Definition, Scope and importance, need for public awareness.
Natural resources: Use and over utilization of Natural Resources - Water resources, Food resources, Forest resources, Mineral resources, Energy resources, Land resources.

UNIT – II:
Ecosystems: Concept of an ecosystem, structure and function of an ecosystem, role of producers, consumers and decomposers, energy flow in an ecosystem, food chains, food webs, ecological pyramids, Nutrient cycling, Bio-geo chemical cycles, Terrestrial and Aquatic ecosystems.

UNIT – III:
Biodiversity: Genetic, species and ecosystem biodiversity, Bio-geographical classification of India, India as a Mega diversity nation. Values of biodiversity, hot-spots of biodiversity, threats to biodiversity, endangered and endemic species of India, methods of conservation of biodiversity.

UNIT – IV:
Environmental Pollution: Cause, effects and control measures of air pollution, water pollution, marine pollution, soil pollution, noise pollution and Solid waste management, nuclear hazards
Environmental Legislations: Environment protection Act, Air, Water, Forest & Wild life Acts, issues involved in enforcement of environmental legislation, responsibilities of state and central pollution control boards

UNIT – V:
Social issues and the environment: Water conservation methods: Rain water harvesting and watershed management, Environmental ethics, Sustainable development and Climate change: Global warming, Ozone layer depletion, forest fires, and Contemporary issues.

Text Books:

1. Y. Anjaneyulu," *Introduction to Environmental Science"*, B S Publications, **2004**.
2. Suresh K. Dhameja, "*Environmental Studies"*, S. K. Kataria& Sons, **2009**.

Suggested Reading:

1. C. S. Rao," *Environmental Pollution Control Engineering"*, Wiley, **1991**.
2. S. S. Dara, "*A Text Book of Environmental Chemistry & Pollution Control"*, S. Chand Limited, 2006.

18CS C06

BASICS OF DATA STRUCTURES LAB
(Common for other Programmes except CSE & IT)

Instruction	2 Hours per week
Duration of End Examination	2 Hours
Semester End Examination	35 Marks
Continuous Internal Evaluation	15 Marks
Credits	1

Pre-requisites: Any Programming Language(C)

Course Objectives: To enable the student

1. Design and construct simple programs by using the concepts of Data structures as abstract data type.
2. To have a broad idea about how efficiently pointers can be used in the implement of data structures.
3. To enhance programming skills while improving their practical knowledge in data structures.
4. To strengthen the practical ability to apply suitable data structure for real time applications.

Course Outcomes: The Student will be able to

1. Implement the abstract data type.
2. Implement linear data structures such as stacks, queues using array and linked list.
3. Understand and implement non-linear data structures such as trees, graphs and its traversal techniques.
4. Implement various kinds of searching, sorting techniques.
5. Develop the suitable data structure for real world problem.

List of Experiments

1. Implementation of operations on arrays.
2. Implementation of Stack.
3. Implementation of Queue.
4. Implementation of basic operations on Single Linked List.
5. Implementation of Searching techniques.
6. Implementation of sorting techniques.
7. Case study like Banking System, Students Marks Management, Canteen Management etc.

Text Books:

1. Brian W Kernighan, Dennis Ritchie, "*The C Programming Language*", PH PTR, 2nd Edition.
2. Richard M Reese, "*Understanding and Using C Pointers*", O`Reilly, 2013.

Web links:

https://nptel.ac.in/courses/106102064/

18CE C11

SOLID MECHANICS LAB

Instruction	3P Hours per week
Duration of Semester End Examination	3Hours
Semester End Examination	35 Marks
CIE	15 Marks
Credits	1

Course Objectives: To know and understand the mechanical characteristics of various engineering materials by conducting different tests.

1. Mechanical properties of engineering materials under different structural actions like direct tension, compression, flexure and torsion.
2. Measurement of deflections and hence there by finding elastic behaviours.
3. To assess the behaviour of steel rods under impact loads and shear.
4. To conduct and understand bendable property of steel bar.
5. To understand the working principle of equipment to determine shear force and bending moment in statically determinate beams.

Course Outcomes: At the end of the course, the students will be able

1. To determine the strength of various materials under structural actions like direct tension, compression, flexure and torsion.
2. To compute the elastic property of the materials of the determinate beams by measurement of deflections.
3. To determine the impact/ shear strength of steel specimen.
4. Conduct bend test of steel bars.
5. Determine the shear force and bending moment in determinate beams.

List of Experiments:

1. Tension Test
2. Deflection test on Simply Supported beam
3. Deflection test on Cantilever beam
4. Compression test on Concrete
5. Impact test
6. Shear Test
7. Torsion Test
8. Bend test of steel bar
9. Determination of Shear forces in beams
10. Determination of Bending moments in beams.

Suggested Reading:

1. William Kendrick Ha, "*Laboratory Manual of Testing Materials*", Bibliolife, 2009.

18CE C12

HYDRAULIC ENGINEERING LAB

Instruction	3P Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	35 Marks
CIE	15 Marks
Credits	1

Course Objectives: To enable the student

1. To understand uniform and non-uniform flows in open channel flows.
2. To understand drag and lift of a flow around an Aerofoil and circular cylinder.
3. To enable the student to understand major and minor losses through pipes.
4. To understand the performance and efficiencies of turbine and centrifugal pump.
5. To understand the significance of viscosity and its role in laminar flow through pipes.

Course Outcomes: At the end of the course, the student should have learnt

1. Ability to compute the velocity, discharge, channel roughness coefficient, and energy loss in uniform flows and non- uniform flows.
2. Ability to find drag and lift forces and coefficients.
3. To differentiate between major loss and minor loss and find the losses.
4. Ability to construct characteristic curves and find performance, efficiency of turbine and pumps.
5. Ability to find viscosity, shear stress, velocity changes and loss in a laminar flow.

List of experiments (Max 10 to be conducted):

1. Uniform Flow
2. Venture flume
3. Hydraulic Jump
4. Laminar flow through pipes
5. Major losses
6. Minor losses in pipe
7. Pelton Wheel turbine-find efficiency and construct performance characteristics of a Pelton wheel turbine.
8. Francis Turbine-find efficiency and construct performance characteristics of a Francis turbine.
9. Kaplan Turbine-find efficiency and construct performance characteristics of a Kaplan turbine.
10. Centrifugal Pump-find efficiency and construct operating characteristic curves of a constant speed pump.
11. Studies in Wind Tunnel
12. Flow around an Aerofoil / circular cylinder

Suggested Reading:

1. N. Kumara Swamy, "*Fluid Mechanics and Machinery Laboratory Manual",* Charotar Publishing House Pvt. Ltd., Anand, Gujarat, 2008.
2. Sarbjit Singh, "*Experiments in Fluid Mechanics*", PHI Learning Private Limited, New Delhi, 2012.

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18EG C03

SOFT SKILLS LAB

Instruction	2P Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	35 Marks
CIE	15 Marks
Credits	1

Course Objectives: The course will introduce the students to

1. Imbibe an impressive personality, etiquette, professional ethics & values, effective time management & goal setting.
2. Understand the elements of professional update & upgrade through industry exposure in a mini-live project. Understand confidence building strategies and thereby to make effective presentations through PPTs.
3. Learn what constitutes proper grooming and etiquette in a professional environment. Acquire the necessary skills to make a smooth transition from campus to corporate.

Course Outcomes: After successful completion of the course the students will be able to

1. Be assertive and set short term and long term goals. Also learn to manage time effectively and deal with stress.
2. Win in professional communication situations and participate in group discussions with confidence. Write abstracts.
3. Write effective resumes. Plan, prepare and face interviews confidently.
4. Adapt to corporate culture by being sensitive - personally and sensible - professionally. Draft an SOP.
5. Apply the soft skills learnt in the mini-live project, by collecting and analyzing data and making oral and written presentations on the same.

Exercise 1:
Main Topics: Thinking Skills, Personality Development – Effective Time Management, setting realistic goals, self confidence and assertiveness, stress management, moral values.
Flipped Sessions: Personal Sensitivity & Professional Sensibility (Reading & Discussion)
Writing Input: Writing to Express - Drafting & Delivering a Speech (Free Writing Exercise)

Exercise 2:
Main Topics: Advanced Group Discussion with Case studies: Dynamics of group discussion, intervention, summarizing, and modulation of voice, body language, relevance, fluency and coherence.
Flipped Sessions: Importance of Professional Updating & Upgrading (Reading & Discussions)
Writing Input: Writing with Precision - Writing Abstracts

Exercise 3:
Main Topics: Interview Skills – concept and process, pre-interview planning, opening strategies, answering strategies, mock interviews. Resume' writing – structure and presentation, planning, defining the career objective, projecting ones strengths and skills.
Flipped Sessions: Mock Interviews (Video Sessions & Practice)
Writing Input: Writing to Reflect - Resume Writing

Exercise 4:
Main Topic: Corporate Culture – Grooming and etiquette, communication media, academic ethics and integrity
Flipped Sessions: Corporate Culture, Etiquette & Grooming (Video Sessions & Practice through Role-play)
Writing Input: Writing to Define - Writing an effective SOP.

Exercise 5:
Main Topic: Mini Project – General/Technical. Research, developing a questionnaire, data collection, analysis, written report and project seminar. Elements & Structure of effective presentation. Presentation tools – Body language, Eye-contact, Props & PPT.
Flipped Sessions: Effective Presentations (Video & Writing Sessions, Practice through Emulation)
Writing Input: Writing to Record - Writing minutes of

Suggested Reading:

1. Madhavi Apte , “**A Course in English communication**”, Prentice-Hall of India, 2007
2. Dr. Shalini Verma, **“Body Language- Your Success Mantra**”, S Chand, 2006
3. Ramesh, Gopalswamy, and Mahadevan Ramesh, “**The ACE of Soft Skills”,** New Delhi: Pearson, 2010
4. Van Emden, Joan, and Lucinda Becker, “**Presentation Skills for Students**”, New York: Palgrave Macmillan, 2004

* Flipped Class-room: Students explore the concept first and then trainer explains it, students work on their own.

Web Resources:

1. https://www.goskills.com/Soft-Skills
2. https://www.trainerbubble.com
3. https://www.skillsconverged.com

16CE C18

REINFORCED CONCRETE DESIGN - I

Instruction	4(3L+1T) Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	4

Course Objectives: To enable the student

1. Understand general mechanical behavior of reinforced concrete, design philosophies, design requirements get introduced to IS: 456 code and working stress method of design applied to RC rectangular beams.
2. Understand the basic principles of Limit state design, assumptions made in theory of flexure and flexural design procedures for singly reinforced and doubly reinforced rectangular beam.
3. Grasp the fundamentals of analysis and design of rectangular beams for shear and torsion, checking for bond and applying serviceability check for beams.
4. Know the procedures for analysis and design of one-way simply supported and cantilever slabs and two-way simply supported and continuous slabs.
5. Learn the design and detailing of columns and footings of rectangular and circular sections.

Course Outcomes: At the end of the course, student is able to

1. Use and suggest Reinforced concrete for various practical applications, interpret the clauses of IS:456 and apply the working stress method of design for rectangular beams.
2. Design RC beams of rectangular and flanged sections/ for flexure using limit state method.
3. Design RC beams for shear and torsion and check for bond and serviceability.
4. Analyze and design solid rectangular RC slabs of one way (cantilever, simply supported and continuous) and two way (simply supported and continuous).
5. Design RC columns (short and long) and axially loaded footings of circular and rectangular sections.

Note: All relevant IS codes necessary for teaching their course may be introduced and referred in detail by the concerned faculty.

UNIT - I:

Introduction to Reinforced Cement concrete: Concrete - characteristics strength - Grade of Concrete - Workability, durability of concrete - Rein

(RC) - Types of reinforcing steel - Yield stress - Advantages of reinforced concrete - basic requirement of RC structures.

Design Philosophies: Development of design philosophies - working stress method - Ultimate load method - Limit state method - Merit and demerits.

Introduction to IS:456:General design requirements and specifications.

Working Stress method: Assumptions made in design of flexural members - Cover to reinforcing steel - Theory of bending in RC beams - Balanced, under and over reinforced sections. Analysis and design for flexure of singly and doubly reinforced rectangular beams.

UNIT- II:

Limit state method of design:

Introduction to limit state method - classification of limit states - characteristic loads - partial safety factors – Factors for material and load - design stress - stress and strain diagram of concrete and steel - Assumptions made in design of flexural members - Stress block parameter - Analysis and flexural design of singly reinforced, doubly reinforced rectangular beams and flanged beams.

UNIT - III:

Limit state of collapse in shear and torsion: Types of shear reinforcement - analysis and design for shear and torsion in beams - Bond - development length and curtailment of reinforcement in beams and detailing of bars: IS code provisions.

Limit state of serviceability: Short term, long term, total deflection - check for deflection - cracking - IS code provisions.

UNIT - IV:

Analysis and design of slabs: Solid rectangular slabs - cantilever slab - simply supported and cantilever one way and two way slabs subjected to uniformly distributed loads - IS code method of design of these slabs - Detailing of reinforcement and check for serviceability in slabs.

Design of stair: Design and detailing of dog legged stair.

UNIT - V:

Analysis and design of columns: Short and long columns - End conditions- effective length of columns assumptions made in design - analysis - design and detailing of axially loaded square, rectangular and circular columns with lateral ties and helical bar - Design of axially loaded short columns subjected to uni-axial and bi-axial moments , using interaction diagrams – design principles for long columns.

Footings: Types of Foundations and IS Specifications, Design and detailing of isolated rectangular and circular footings for axial loads.

Text Books:

1. N. Subramanian, "Design of Reinforced Concrete Stru
University Press. First Published in 2013,Second impress

2. S Unni Krishnan Pillai and Devadas Menon, “Reinforced Concrete Design”, Tata McGraw-Hill Publishing Co Ltd, (Third Edition), 2009.

Suggested Reading:

1. V.L.Shah and S.R.Karve, “Limit State Theory and Design of Reinforced Concrete”, Structures Publications, 7th Edition,2014.
2. A.K. Jain, “Reinforced Concrete: Limit State Design”, Nem Chand & Brothers-Roorkee; Seventh edition, paperback – 2012.
3. Sushil Kumar, “Treasure of RCC Designs”, Standard Book House; Edition: 19th, Year-2014 edition (1 December 2009).
4. N. Krishna Raju, “Design of Reinforced Concrete Structures”, CBS Publishers and Distributors, New Delhi,4th edition, 2016.

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16CE C19

SOIL MECHANICS

Instructions	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: To enable the students

1. Understand the basic principles of soil mechanics and basic properties of soils and basic knowledge of identifying soil.
2. Understand the flow through soils and its behavior and gain a practical outlook of utilizing soil as construction materials.
3. To know the knowledge about the highly compressible soil settlements.
4. Capable of estimating the strength of soil to different loading conditions.
5. Deal with problem of earth pressures and slope stability and to utilize the knowledge with respect to practical orientation and R&D perspective.

Course Outcomes: At the end of the course, the student should

1. Be able to identify various types of soils, their properties and to apply the basic principles of soil mechanics to simple field problems.
2. Be able to prepare models for the behavior of soils, flow through soils and use / suggest soil as a construction material.
3. Be able to compute the settlements of the compressible soils.
4. Be able to estimate the strength of soil under different loading conditions.
5. Be able to deal with field problems of earth pressures and slope stabilities.

UNIT-I:

Physical and Index properties of soils: Introduction about origin and formation of soils, basic definitions from soil three phase diagram (weight ratios & volume ratio), Inter relationships of preliminary properties. Determination of laboratory tests for water content, field density, specific gravity by various methods, Index properties, sieve analysis, consistency of soils (Liquid limit, Plastic limit & shrinkage limit), Indian soil classification IS-1498-1970.

UNIT-II:

Permeability of soils: Darcy's. law of seepage water through soils- validity of determination of co-efficient of permeability (constant head, variable head permeability tests) – Field tests (Pumping in and pumping out tests) – Equivalent permeability of stratified soils.

Seepage in Soil: Seepage flow, seepage pressure – Flow nets – L[illegible] line in a homogeneous earthen dam using Kogeny's parabola – seepage quantity.

Stress in Soils: Total effective and neutral stress.
Quick Sand Phenomena**:** Critical Hydraulic gradient.

UNIT-III:

Compaction: Compaction Mechanism, factors affecting compaction. Laboratory determination of compaction characteristics- standard and modified Proctor tests – IS Light and Heavy compaction tests; Field surface compaction: compaction equipment, procedure, quality control.

Consolidation: Spring Analogy, Laboratory consolidation test, calculation of void ratio, compression characters (a-$_v$, m—$_v$& C_c) and settlement equation, differential equation for one dimensional consolidation, co-efficient of consolidation - square root & logarithm time fitting method and problems in consolidation settlements.

UNIT-IV:

Shear strength: Significance of Shear strength in soils – Mohr-Coulomb equation – shear parameters – Laboratory tests for determination of shear strength – Direct shear test, Tri-axial compression tests. (UU, CU and CD), Un-confined compression test, Vane shear test. Factors affecting shear strength of cohesion-less and cohesive soils. Determination of elastic Moduli.

UNIT-V:

Earth pressure: States of earth pressure – Active, Passive at rest condition; Rankin's theory; computation of active and passive earth pressure in cohesion-less & Cohesive Soils and c-ø soils; Coulomb's Wedge theory; Rehbhan's graphical solution.

Slope stability: Definition and classification of slopes – types of slope failures- Factors of safety with respect to cohesion, angle of shearing resistance, Height – Analysis of stability of slope using Swedish slip circle method and Taylor's stability number.

Text Books:

1. K. R. Arora, "*Soil Mechanics and Foundation Engineering*", Standard Publisher Dist.; 7th Edition, 2009.
2. B. C. Punmia, A. K Jain, and A. K. Jain "*Soil Mechanics and Foundations*", Laxmi Publications; Sixteenth edition, 2017.

Suggested Reading:

1. Relevant IS Codes
2. Gopal Ranjan, "*Basic and Applied Soil Mechanics*", New Age International Pvt Ltd; Third edition 2016.
3. C.Venkatramaiah, "*Geotechnical Engineering*", New Age Publications, revised Fifth edition, 2017.
4. B. M. Das and K. Sobhan, "*Principles of Geotechnica*[illegible]" NPTEL study material.

16CE C20

THEORY OF STRUCTURES – I

Instruction	4(3L+1T) Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	4

Course Objectives: To enable the student to

1. Understand the concept of influence line diagrams for determinate beams for various types of loads and to find maximum SF and BM in the beams.
2. Grasp the procedure to construct influence line diagrams for different truss girders for various types of loads and to find maximum forces in the members of trusses.
3. Study the behavior of arches (two and three hinged) and their analysis for point loads and uniformly distributed loads.
4. Know the concept and analysis of cables and suspension bridges with three hinged stiffening girder.
5. Understand the methods to find the deflections of determinate trusses and frames by different methods and to analyze the redundant frames by different methods.

Course Outcomes: At the end of the course, the student will be able to

1. Draw the ILD's and able to find the maximum SF and BM for various positions of the moving loads.
2. Draw the ILD's for forces in the members of trusses and to find the maximum forces for various positions of the moving loads.
3. Analyze three and two hinged arches for various loads.
4. Find maximum forces in the cables and able to analyze suspension bridges with stiffened girders.
5. Find deflections of joints plane frames and trusses and analyze redundant trusses.

UNIT– I:

Moving loads: Influence line diagrams for support reactions, bending moment and shear force for a simply supported beam/girder. Determination of maximum values of support reactions, bending moment and shear force at any section for various moving load systems on simply supported beam / girder.

Curves of maximum bending moment and shear force for simply supported girders traversed by (i) single point load, (ii) two point loads (iii) uniformly distributed load longer than the span, and (iv) uniformly distributed load short
Focal length, enveloping parabola and EUDL.

UNIT– II:

Moving loads on truss girders: Influence lines for forces in the members of statically determinate trusses like Warren truss, Pratt truss, and Curved flange trusses. Determination of maximum forces in truss members due to moving point loads and uniformly distributed loads. Counter bracing.

UNIT– III:

Three hinged arches: Three hinged parabolic and segmental arches, determination of horizontal thrust, bending moment, normal thrust and radial shear for static loading. Influence lines for horizontal thrust, bending moment, normal thrust and radial shear.

Two hinged arches: Parabolic and segmental arches, determination of horizontal thrust, bending moment, normal thrust and radial shear for static loading and temperature effects.

UNIT– IV:

Cables and Suspension bridges: Stresses in suspended cables due to point loads and uniformly distributed loads, equation of the cable, length of cable and general cable theorem. Suspension bridge with 3-hinged stiffening girders for static loading, determination of maximum tension in the cable, bending moment and shear force.

UNIT– V:

Deflections of Determinate structures: Deflection of pin-jointed plane frames and rigid jointed plane frames using Castigliano's theorem –I and Unit Load method. **Redundant pin-jointed plane frames:** Analysis of pin-jointed plane frames using Castiglione's theorem –II and Unit load method, with one degree of redundancy (internal / external), Assembly and temperature effects.

Text Books:

1. B.C Punmia, and A. K. Jain, "*SMTS - II Theory of Structures*", Laxmi Publications, New Delhi, 2017.
2. S. Ramamrutham, "*Theory of Structures*", Khanna Publishers, New Delhi, 2018.

Suggested Reading:

1. H. J. Shah, S. B. Junnarkar, "*Mechanics of Structures Vol. II [Theory and analysis of structures]*", 24th Edition, Charotar Publishing House Pvt. Ltd., 2015.
2. T. S. Thandava Moorthy, "*Structural Analysis*", 2nd edition. Oxford University Press, 2012.
3. C. S. Reddy, "*Basic Structural Analysis*", 3rd Ed., Tata McGraw Hill, New Delhi, 2017.
4. D.S. Prakash Rao, "*Structural Analysis*" - *A Unified Appr* Press, 2012.

16CE C21

CONCRETE TECHNOLOGY

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course objectives: To enable the students

1. Learn the properties of various ingredients of concrete.
2. Understand the behaviour of concrete in fresh and hardened states.
3. Understand concrete mix design and compare the quantities using various design methods.
4. To acquire knowledge on the properties and effective usage of various admixtures.
5. Gain knowledge of various special concretes and their applications.

Course outcomes: At the end of the course, the students will be able to

1. Determine the properties of the ingredients of concrete and adjudge their suitability.
2. Determine the properties of fresh and hardened concretes.
3. Carryout concrete mix design and apply statistical quality control techniques for quality assurance.
4. Use admixtures in suitable doses for improvement in various properties of concrete and for use in ready-mix concrete preparation.
5. Employ a special type of concrete depending on the purpose.

UNIT-I:

Constituents of concrete- review: Manufacture of Cement, Types of cements, tests on cements and aggregates.

Properties of Fresh concrete: Batching and Mixing, Workability, factors affecting workability, Measurement of workability using slump cone, compaction factor and V-B time tests, Segregation and bleeding, Compaction of concrete and Types of vibrators.

UNIT-II:

Hardened concrete: Strength of concrete and influencing factors, water- cement ratio, Gel, space ratio, Role of water in the mix, Short term and long term properties of concrete - shrinkage & creep, Types of Shrinkage, Factors affecting shrinkage & creep, Relationship between various mechanical strengths of c of concrete, Methods of curing, Maturity concept, Stress-Strai concrete, Durability of concrete.

UNIT-III:

Mix design of concrete: Basic considerations, Factors to be considered in the choice of mix proportions, Quality control, various methods of mix design- I.S. code method, British and ACI methods.

UNIT-IV:

Admixtures: Classification of admixtures, Mineral and Chemical admixtures, Influence of various admixtures on properties of concrete, Applications, Ready mix concrete (RMC), Fly ash concrete – properties and applications.

UNIT-V:

Special Concretes: High strength concrete, High density concrete, Light weight concrete, Ferro cement, Recycled aggregate concrete, Self compacting concrete (SCC).

Fiber Reinforced Concrete: Need, Mechanism and properties of Fiber reinforced concrete (FRC), Types of Fibers and applications of FRC.

Text Books:

1. A.M Neville., "Properties of Concrete", English Language Book Society / Longman Publications, 1996.
2. M.S. Shetty, "Concrete Technology", S. Chand Publishers, 2005.
3. A. R. Santhakumar, "Concrete Technology", Oxford University, Press 2006.

Suggested Reading:

1. A.M. Neville and J.J. Brooks, "*Concrete Technology*", Dorling and Kindersley Publications, 2006.
2. P. K. Mehta, and J. M. M. Paulo, "*Concrete- Microstructure – properties and Material*", Mc. Graw Hill Publishers, 1997.
3. N. Krishnaraju, "*Design of Concrete Mixes*", CBS Publishers, 2010.

16CE C22

FLUID MECHANICS - II

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: To enable the student

1. Understand and analyze the open channel flows, steady uniform flow and computation, friction and energy losses.
2. Understand and analyze the non-uniform flows and flow profile, energy dissipation.
3. Exposure to the basic principles of Aerodynamic forces, boundary layer formation and effects, pressure wave and compressibility effect in pipes.
4. Understand dimensional analysis, study of models, models applied to practical applications.
5. Familiarize with various types of hydraulic machinery (turbines and pumps), design and performance studies.

Course Outcomes: At the end of the course, the student will be

1. Able to apply the concepts of open channel flow and pipe flow to the field problems.
2. Able to apply the concepts of non-uniform open channel flow to the field problems.
3. Interprets the basics of computation of drag and lifts forces in the field of aerodynamics, boundary layer effect, effect of pressure wave in pipes.
4. Able to apply model studies to practical applications, should be able design and study models in labs.
5. Design the turbines and pumps, should be able to run the turbines and pumps for efficient conditions.

UNIT–I

Steady uniform flow through open channels: Definitions, difference between pipe flow and channel flow, velocity and pressure distributions in channel cross section, energy and momentum correction coefficients, uniform flow, Manning and Chezy formulae, most efficient channel cross-section, specific energy and specific force, concept of critical depth and its applications.

UNIT-II

Non-uniform flow through open channels: Critical flow, Signifi
Number, dynamic equation of gradually varied flow, classification of
flow profiles and computation of flow profiles. Hydraulic Jump- Mon

for a jump in horizontal rectangular channel, energy dissipation in hydraulic jump. Introduction to surges.

UNIT-III

Boundary layer-Definition, laminar and turbulent boundary layers, boundary layer thickness, displacement thickness, momentum thickness and energy thickness, hydro dynamically smooth and rough boundaries, boundary layer separation.
Drag and lift: Fundamental concepts of drag and lift forces. Drag on sphere, cylinder, flat plate and aerofoil. Principles of streamlining, Magnus effect.

UNIT-IV

Unsteady flow in pipes: Water hammer phenomenon, pressure rise due to gradual and sudden valve closure, critical period of the pipeline.
Dimensional analysis and models studies: Dimensional analysis as a tool in experimental hydraulics, Rayleigh Method, Buckingham method; geometric, kinematic and dynamic similarity, similarity laws; significance of Reynolds, Froude and Mach numbers, different types of models and their scale ratios, distorted and undistorted models, scale effect in models.

UNIT-V

Hydraulic turbines: Classification, specific speed, unit quantities velocity triangles, power developed and efficiencies. Principles of design of reaction and impulse turbines, characteristics curves, selection of turbines.
Centrifugal Pumps: Components, work done and efficiency, minimum starting speed, Euler head equation, specific speed and characteristic curves of centrifugal pumps, Pumps in series and parallel.

Text Books:

1. P. N. Modi & S. M. Seth, "*Hydraulic and Fluid Mechanics*", Standard Book House, Delhi, 20th Edition, 2013.
2. K. Subramanya, "*Flow in Open Channels*", Tata McGraw-Hill Education, 2009.

Suggested Reading:

1. K. Subramanya, "*1000 Solved Problems in Fluid Mechanics*", Tata Mc-Graw Hill Publications 2005.
2. Ven Te Chow, "*Open-Channel Hydraulics*", The Blackburn Press; 57th edition, 2009.
3. A. K. Jain, "*Fluid Mechanics: Including Hydraulic Machines*", Khanna Publisher, 12th edition, 2016.
4. R. L. Streeter, G. Z. Watters, and J. K. Vennerd, "*Elementary Fluid Mechanics*", John Wiley International Publications, 7th E[illegible]

16CE E01

ROCK MECHANICS
(Elective-I)

Instructions	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:
1. The objective of the course is to provide basic knowledge of Rock Mechanics and its application.
2. To understand the properties of the rocks.
3. To know the strength of the rock.
4. To study the application of rocks in engineering.
5. To know and apply the preventive techniques in rocks.

Course Outcomes:
1. Able to know the basic knowledge about rocks.
2. Able to determine the rock properties.
3. Able to determine the strength and quality of the rocks.
4. Able to know the failure criteria of the rock.
5. Able to apply the preventive techniques for the rock.

UNIT- I:
Introduction, Importance and application of rock mechanics to engineering problems, Rock Mechanics and its relationship with soil mechanics and engineering geology. Definition of Rock masses. Rock masses as construction material, Main features constituting rock mass. Effect of alteration and weathering.

UNIT- II:
Engineering properties of rocks, Porosity, Density, Moisture content, Degree of saturation, Coefficient of permeability, Durability, Compressive strength, Tensile strength, Shear strength, Elasticity, Plasticity deformability. Sampling and samples preparations - IS codes, Uni-axial compressive strength, Tensile strength - Brazilian test, Shear strength test. Plate load test for deformability, shear test, Test for internal stresses - flat jack.

UNIT– III:
Classification - Litho logical classification of rocks, Rock mass classification, Rock Quality Designation, Rock Structure rating, RMR classification, [illegible] Inter relation between Q and RMR. Classification of fissures, Join[illegible]

UNIT– IV:

Geophysical Methods - Seismic Refraction & Electrical Resistivity methods, GPR, rock blasting.

UNIT– V:

Earthquake: Magnitude and intensity of earthquake. Seismic waves. Seismic zones in India. Geological Hazards - Rock Instability and slope movement: Concept of sliding blocks. Different controlling factors - Prevention by rock bolting and rock anchoring, retaining wall, slope treatment, grouting. Case studies.

Text Books:

1. B. P. Verma, "*Engineering Geology and Rock Mechanics*", Khanna Publishers, 1998.
2. T. Ramamurthy, "*Engineering in Rocks for Slopes, Foundations and Tunnels*", Prentice Hall India Learning Private Limited; Third edition, 2014.

Suggested Reading:

1. J.C. Jaeger and N.G.W. Cook, "*Fundamentals of Rock Mechanics*", Wiley India Pvt Ltd, 4th edition, 2012.
2. D. Deb and A. K. Verma, "*Fundamentals and Applications of Rock Mechanics*", PHI, 2016.
3. R. E. Goodman, "*Introduction to Rock Mechanics*", Wiley India Pvt Ltd; Second edition, 2010.

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16CEE02

ADVANCED SURVEYING

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours Semester
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To enable the student understand the basic principles of Aerial surveying and its role in civil engineering.
2. To expose the student to image interpretation and equipment used for the same.
3. To enable the student to get acquainted with digital image processing system.
4. To expose the student to understand about how microwave sensing can be used in surveying.
5. To understand about the errors in surveying and application various statistical procedures for adjusting the errors in different

Course out comes:

1. To be in a position to understand the Photogrammetric surveying techniques.
2. To know the techniques involved in image processing.
3. To get exposure to digital image processing.
4. To be able to understand microwave sensing and its application.
5. To be able to adjust the errors that are cropping while carrying surveying.

UNIT– I:

Aerial surveying : Aerial Photogrammetry -introduction, activities of Photogrammetry, Basic Geometric Characteristics of Aerial Photographs-element s of a vertical photograph-photo coordinate measurement-Photographic scale-problems, ground coverage of aerial photographs, area measurement, Relief displacement of vertical features-correction for relief displacement, image parallax, ground control aerial photography, mapping with aerial photographs, Flight planning.

UNIT– II:

Visual Image interpretation: Introduction, fundamentals, elements, strategies, interpretation keys, wavelengths of sensing, temporal aspects, process, preparation of images and viewing- basic visual interpretation equipment, concepts of land use land cover mapping- classification With remotes Sensor data.

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UNIT– III:

Digital image Processing: Introduction, various types of image manipulations, image rectification and restoration-geometric correction— Radiometric correction-Noise removal, image enhancement, spatial feature manipulation -spatial filtering-low pass filters and high pass filters-convolution-edge enhancement, Multi image manipulation.

UNIT– IV:

Microwave sensing - introduction, Radar development- side looking radar system , operation, Range resolution ,synthetic aperture radar - geometric characteristics-transmission characteristics-other characteristics. Radar image interpretation, Lidar-introduction and applications.

UNIT– V:

Theory of errors and survey adjustments introduction, types of errors, laws of weights, Principles of Least squares, Most probable value, method of displacements, Method of correlates, probable errors , distribution error, Triangulation adjustment-station adjustment, figure adjustment- adjustment of a triangle, chain of triangles, quadrilaterals, polygon with central station -methods of equal shifts, adjustment of levels and adjustment of a closed traverse.

Text Books:

1. T. Lillesand, R. W. Kiefer, "*Remote Sensing and Image Interpretation*", Jhon Willey & Sons, 2015.
2. A. M. Chandra, "*Higher Surveying*", New Age international (P) Limited, 2015.

Suggested Reading :

1. A. M. Chandra, "Geo-informatics", New age international Publishers, 2016.
2. R. Subramanian, "*Surveying and Levelling*", Oxford University Press, 2nd edition, 2012.
3. C. Venkatramaiah, "*Textbook of Surveying*", Orient Blackswan Private Limited, 2nd edition, 2011.
4. K. R. Arora, "*Surveying Volume - II*", Standard Book House; 13th edition, 2015.

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16CE E03

ADVANCED STRENGTH OF MATERIALS
(Elective-I)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To understand the flexural behaviour of curved bars and determining the stresses in various X-sections.
2. To understand the behaviour of beams curved in plan, subjected to different types of loads.
3. To learn the determination of stresses in rotating discs, rings & cylinders.
4. To realize the significance of experimental techniques in stress analysis & understand the brittle coating & strain gauge methods for stress analysis
5. To know the failure criteria of materials and various theories of elastic failure.

Course Outcomes: At the end of the course, the student is expected to be

1. Capable of designing curved bars of different X-sections.
2. Able to determine stresses in beams curved in plan.
3. Expert to determine stresses in discs, rings & cylinders.
4. Competent to employee methods of brittle coating and strain gauges for stress analysis.
5. Proficient in using an appropriate elastic theory of failure for the materials and determine principal stresses.

UNIT – I:

Bending of curved bars: Introduction, Bending of curved bars, stresses in curved bars with large curvature (Winkler-Bach Theory), calculation of stresses in curved bars of different sections-rectangular, circular and trapezoidal in crane hooks, rings and chain links.

UNIT-II:

Beams curved in plan: Introduction, circular beam loaded uniformly and symmetrically supported on columns, Semi-Circular beam simply supported on 3 equally spaced supports, fixed cantilever quarter circular beam with a point load at free end, A fixed ended segmented curved beam.

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UNIT-III:

Rotating Rings, Discs & Cylinder: Introduction, thin rotating ring or cylinder, rotating solid thin disc, rotating disc with a central hole, rotating disc of uniform strength, rotating long cylinder, temperature stresses in a thin disc.

UNIT-IV:

Experimental stress analysis Techniques:- Introduction, Brittle Lacquers - Brittle coating techniques, Coating stresses, Theory of failure for Brittle coatings, crack patterns in brittle coating, crack detection, types of Brittle coating, Resin based brittle coating, equipment for Stress analysis by brittle coating method, specimen preparation, Testing & calibration of brittle coating.

Strain gauge: Introduction, strain sensitivity, metal foil gauge, temperature compensator, parameter influencing the behaviour of strain gauge.

UNIT-V:

Elastic theories of failure: Introduction - Failure by Yielding-Failure by Fracture - Yield and Fracture Criteria-Maximum Shearing Stress Theory-Maximum Distortion Energy Theory-Octahedral Shearing Stress Theory-Comparison of Yielding Theories-Maximum Principal Stress Theory- Mohr's Theory-Coulomb-Mohr Theory.

Text Books:

1. V. N. Vazirani and M. M Ratwani, "*Analysis of Structures Vol. 1: Analysis, Design And Details Of Structures*", Khan Publications, 2003.
2. U.C. Jindal, "*Advanced Topics of Strength of Materials (PART-II)*", Galgotia Publications Pvt.Ltd. 2001.

Suggested Reading:

1. Heinemann, "*Mechanics of Materials*" Butterworth, 3rd edition, 1997.
2. J. O. Seely and F. B. Smith, "*Advanced Mechanics of Ma*terials", 1967.
3. R. Subramanian, "*Strength of Materials*", Oxford University press, 2016.
4. U. C. Jindal, "*Strength of Materials*", Pearson Education; 2nd edition, 2017.

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16CE C23

FLUID MECHANICS LAB

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	2

Course Objectives:

1. To enable the student understand the governing parameters for the discharge measurement for flows through various measuring devices.
2. To verify the flow and velocity measurements by conducting different tests.
3. To understand Bernoulli's principle by conducting experiments.

Course Outcomes: At the end of the course, the student should have learnt

1. Ability to find the co-efficient of discharge for flows through various flow measuring devices.
2. To differentiate between laminar and turbulent flows and identify the governing parameters for both.
3. Applies the concept of Bernoulli's energy principle.

LIST OF EXPERIMENTS

1. Determination of C_d, C_v, and C_c for circular Orifice (constant Head method).
2. Determination of C_d for mouthpiece (constant Head method).
3. Determination of C_d for V notch.
4. Determination of minor losses in pipes.
5. Determination of C_d broad crested weir.
6. Determination of C_d for venturimeter.
7. Determination of C_d of a mouth piece for unsteady flow in a hemi – spherical tank.
8. Determination of types of flows using Reynolds apparatus.
9. Determination of Darcy's friction factor.
10. Verification of Bernoulli's principle.

Text Books:

1. M.N. Shesha Prakash, "*Experiments in Hydraulics and Hydraulic Machines – Theory and Procedures*", PHI Learning Private Limited, 2011.

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16CE C24

ENVIRONMENTAL ENGINEERING LAB

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	2

Course Objectives: To enable the students

Conduct physical and chemical analysis of water sample

1. Interpret laboratory results and report the values in comparison with environmental quality standards.
2. Find the optimum coagulant dosage for effective sedimentation.
3. Determine dissolved oxygen of water sample.
4. Determine the dosage for chlorination for disinfection of water supplies.

Course Outcomes: At the end of the course, the students should have learnt

1. To characterize the quality of water for suspended matter by physical tests.
2. To evaluate the quality of water for hardness, chlorides using chemical analysis.
3. To assess the alum dosage for effective sedimentation.
4. To measure Dissolved Oxygen concentration to assess the quality of water.
5. To measure the concentration of degradable organic matter.

List of Experiments:

1. Determination of alkalinity.
2. Determination of hardness.
3. Determination of chlorides.
4. Determination of pH.
5. Determination of electrical conductivity.
6. Determination of D.O.
7. Determination of B.O.D.
8. Determination of Iron.
9. Determination of Turbidity.
10. Determination of total solids, total inorganic solids.
11. Determination of residual chlorine.
12. Determination of optimum coagulant dosage by jar test.
13. Determination of C.O.D.

References:

1. Relevant IS codes and Specifications.

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16CE C25

CONCRETE LABORATORY

Instruction	3 Hours per week
Duration of semester End Examination	3 Hours
Semester Examination	50 Marks
CIE	25 Marks
Credits	2

Course objectives:

1. To understand properties of constituent materials of concrete
2. To comprehend the behaviour of fresh concrete
3. To understand mechanical behaviour hardened concrete
4. To acquire knowledge of conducting Non-Destructive testing on concrete structures

Course outcomes: At the end of this course, students will be able to:

1. Test different concrete mixing materials and issue test reports
2. Assess the workability of field concrete and guide the site supervisor in preparing a good concrete
3. Perform tests on mechanical characteristics of concrete and issue test reports.
4. Handle NDT equipment's and evaluate concrete by NDT methods

List of Experiments:

1. Determination of specific gravity and bulk density of cement.
2. Determination of normal consistency and initial setting time of cement.
3. Determination of compressive strength of cement.
4. Determination of fineness of cement by sieving and by air permeability methods.
5. Determination of specific gravity, bulk density, voids ratio and porosity of fine aggregate.
6. Determination of Bulking of sand by field and laboratory methods of coarse aggregate.
7. Determination of fineness moduli of fine & coarse aggregates.
8. Measurement of workability of design concrete mixes by slump & compaction factor tests.
9. Determination of Compressive, split tensile and flexural strengths of design concrete mixes.
10. Non-Destructive testing of concrete using Rebound hammer & UPV tests.

References:

1. Relevant IS codes and Specifications

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16CE C26

THEORY OF STRUCTURES-II

Instruction	4 (3L+1T) Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	4

Course Objectives: To enable the student to

1. Understand the concept of indeterminate beams and frames and to analyze by slope deflection method due to point loads and udl load system.
2. Grasp the procedure for indeterminate beams and frames by moment distributed method due to point loads and udl load system.
3. Understand the concepts of Kani's Method for indeterminate beams and frames due to point loads and udl load system.
4. Grasp the procedure for indeterminate beams and frames by flexibility matrix method due to point loads and udl load system.
5. Analyze the indeterminate beams and frames by stiffness matrix method due to point loads and udl load system.

Course Outcomes: At the end of the course, the student will be able to

1. Analyze the indeterminate beams and frames by slope deflection method due to point loads and UDL load system.
2. Analyze the indeterminate beams and frames by moment distribution method due to point loads and UDL load system.
3. Analyze the indeterminate beams and frames by Kani's method due to point loads and UDL load system.
4. Analyze the indeterminate beams and frames by flexibility matrix method due to point loads and UDL load system.
5. Analyze the indeterminate beams and frames by stiffness matrix method due to point loads and UDL load system.

UNIT – I:

Slope deflection method: Introduction, Analysis of Continuous beams with and without sinking of supports. Single bay - single storied portal frames with and without side sway. Loading on each span may be point load(s) and uniformly distributed load on whole span.

UNIT-II:

Moment distribution method: Introduction, Analysis of Continuous beams with and without sinking of supports. Single bay - single storied portal
without side sway. Loading on each span may be point load(s)
distributed load on whole span.

UNIT– III:

Kani's method: Introduction, Analysis of Continuous beams with and without sinking of supports. Single bay - single storied portal frames with and without side sway. Loading on each span may be point load(s) and uniformly distributed load on whole span.

UNIT– IV:

Flexibility method of Analysis: Introduction, Analysis of continuous beams, and rigid jointed plane frames with static indeterminacy not exceeding three. Analysis pin jointed plane frames with static indeterminacy not exceeding two.

UNIT– V:

Stiffness method of Analysis: Introduction, Analysis of continuous beams, pin jointed plane frames and rigid jointed plane frames with kinematic indeterminacy not exceeding three.

Text Books:

1. T. S. Thandava Moorthy, "*Structural Analysis*", Oxford University Press, 2nd Edition, 2012.
2. C. S. Reddy, "*Basic Structural Analysis*", Tata McGraw Hill, 3rd Edition 2017.

Suggested Reading:

1. B.C. Punmia, and A. K. Jain, "*SMTS - II Theory of Structures*", Laxmi Publications, 2017.
2. S. Ramamrutham, "*Theory of Structures*", Khanna Publishers, 2018.
3. D. S. Prakash Rao, "*Structural Analysis*" - *A Unified Approach*, University Press, 2012.
4. W. Weaver, JR. and J. M. Gere., "*Matrix Analysis of Framed Structures*", CBS Publishers, 2nd edition, 2004.

16CE C27

REINFORCED CONCRETE DESIGN-II

Instruction	4 (3L+1T) Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	4

Course Objectives: To enable the student

1. Understand the design and detailing of rectangular and trapezoidal combined footings.
2. Learn the concepts of design and detailing of cantilever and counter fort retaining walls.
3. grasp the design and detailing of circular and rectangular water tanks
4. Comprehend the concepts of design and detailing of Solid slab bridges
5. Know the procedures for design and detailing of T-bean bridges

Course Outcomes: At the end of the course the student will be able to

1. Design and detail the rectangular and trapezoidal combined footing .
2. Design and detail the cantilever and counter fort retaining wall .
3. Design and detail circular and rectangular water tanks
4. Design and detail solid slab, bridges under given condition.
5. Design and detail the various components of T-Beam bridges.

(Note: All relevant IS and IRC codes necessary for teaching this course may be introduced and referred in detail by the Faculty concerned)

UNIT – I

Combined Footings: Limit state design & detailing of combined rectangular and trapezoidal footings.

UNIT – II

Retaining walls: Limit state design and detailing of cantilever and counter fort type of retaining walls.

UNIT – III

Water tanks: Elastic Design & Detailing of circular and rectangular ground level and over-head tanks, design of staging for wind loads.

UNIT – IV

Bridges: Basic components- Types of bridges -Loads on bridges- IRC standards; Elastic design and detailing of two lane, simply supported RC Sc[illegible] including Kerb.

UNIT- V

T-beam bridges: Components of a T-beam bridge- Elastic design and detailing of two lane, Simply Supported, Three girder T-beam bridge- Use of effective width method- Pigeaud's curves and Courbon's method.

Text Books:

1. N. Krishna Raju, "*Advanced Reinforced Concrete Design (IS: 456-2000)* ",CBS Publications 2nd Edition,2010.
2. Vazirani and Ratwani," *Design Of Concrete Bridges*", Khanna Publishers, 1998.

Suggested Reading:

1. D.S. Prakash Rao, "*Design Principles and Detailing of Concrete Structures*", Tata McGraw-Hill Publishing Co. Ltd., 1998.
2. D. Johnson Victor, "*Essentials of Bridge Engineering*", paperback, Oxford & IBH, Publishing Co., New Delhi, 6th Edition, 2015.
3. S. Ponnuswamy, "*Bridge Engineering*", Tata McGraw Hill, Third Edition, 2017.
4. N. Krishna Raju, "*Design of Bridges*", Oxford &IBH-Pubs Company-New Delhi, Fourth Edition, 2008.

16CE C28

WATER RESOURCES ENGINEERING - I

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. Understand surface & sub surface hydrology, peak flow estimation, computation of yield from an open well.
2. Learn flow irrigation, lift irrigation, Design of Canal sections, and efficient use of Irrigation water.
3. Acquaint with locating site of a reservoir, design of a reservoir capacity.
4. Grasp the Design procedure for a diversion head works.
5. Technical acquaintance of water regulation.

Course Outcomes:

1. Ability to design a Rain Gauge network, flood estimation, estimate yield from an open well.
2. Capability to design canals, Capacity to operate irrigation system efficiently.
3. Select an ideal site for a reservoir, estimate its optimum capacity and regulate a reservoir efficiently.
4. Design, Construct and operate a barrage.
5. Regulate Canal flows efficiently as an irrigation engineer.

UNIT- I :

Water Resources: India's water wealth-Regional, National -Inequity in distribution-Role of Water resources in National Development.

Hydrology: Scope of hydrology in civil engineering, Hydrologic cycle, Rainfall, measurement of rainfall and estimation of mean rainfall over a catchment, optimum number of rain gauges for a catchment- infiltration, evaporation, runoff, factors affecting runoff- peak flow estimation, unit hydrograph method, flood frequency and return period.

UNIT-II:

Irrigation: Duty, delta and base period of crops, crop water requirements, methods of irrigation, micro-irrigation, irrigation efficiencies, depth of irrigation, wilting point, consumptive use, irrigation interval-types of canals, alignment of canals, canal sections, balancing depth of cutting, Kennedy's and Lacey's theories, design of lined and unlined canals.

Lift Irrigation: Necessity, layout and component parts of Lift irri

UNIT-III:

Reservoirs: Investigations and site selection criteria, Storage capacity design, sedimentation, Flood routing.

Ground water: Types of aquifers, Aquifer parameters, steady radial flow into a confined and unconfined aquifers, Darcy's law, yield of an open well, Safe yield, Water harvesting structures and augmentation of ground water, Sustainable Ground Water management.

UNIT-IV:

Diversion head works: Components, causes of failures, Design criteria, Difference between weir and barrage, Bligh's Creep theory, Khosla's theory and method of independent variables, design principles of barrage.

UNIT-V:

Regulation works: Canal falls, types, design principles of trapezoidal notch fall, types of regulators, Functions of cross regulator and head regulator, cross drainage works, types, Criteria for selection of CD work, and design principles of an aqueduct, types of outlets, flexibility, sensitivity and proportionality of outlets.

Text Books:

1. P. N. Modi, "*Irrigation Water Resources & Water Power Engineering",* Standard Publishers, 9th edition 2014.
2. S. K. Garg, "*Irrigation Engineering and Hydraulic Structures: Water Resources Engineering - Vol. II",* Khanna Publishers, 2017.

Suggested Reading:

1. M. M. Dandekar and K. N. Sharma, "*Water Power Engineering*", Vikas Publishers, New Delhi, 2013.
2. Ch. S. N. Murthy, "*Water Resources Engineering: Principles and Practice*", New Age International Publishers; 2nd edition, 2002.
3. B.C. Punmia and Ashok Kumar Jain, "*Irrigation and Water Power Engineering*, Laxmi Publishers, 2016.
4. K. C. Patra," Hydrology and Water Resources Engineering", Alpha Science, 2008.

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16CE C29

FOUNDATION ENGINEERING

Instructions	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course objectives: To enable the students

1. Understand the stress distribution in the soils for different loading conditions.
2. Understand the principle of bearing capacity and settlement analysis.
3. Understand the principles of deep foundations.
4. Deal with the field problems.
5. Learn about coffer dams, caissons, and timbering of excavations.

Course outcomes: At the End of the course the students should be able to

1. Compute the stress distribution in the ground under different loading conditions.
2. Estimate the bearing capacity of different soils for shallow foundation.
3. Design the deep foundation by piles or wells.
4. Deal with the field problems in laying cofferdams and different dewatering techniques and sampling methods.
5. Interpret and implement the Concepts of Coffer dams , Caissons and Timbering of Excavations

UNIT-I:

Stress distribution in Soils: Boussinesq's and Westegaurd's equations for point load. Application of point load formulae for uniformly distributed load on circular area, Line load, Strip Load, rectangular area. Use of Newmark's chart for different areas using Boussinesq's equation, Contact pressure distribution.

UNIT-II:

Bearing capacity of soils: Terzaghi's equation for bearing capacity in soils –It's modification for continuous, square, rectangular and circular footings, general and local shear failure conditions. Plate load test as per IS specification. Allowable bearing capacity. Standard penetration test and use of N values for estimating soil conditions and bearing capacity.

Settlement Analysis: Computation of pressures before loading and after loading. Estimation of settlement – ultimate and after any given period.

UNIT-III:

Pile Foundations: Types of piles–Timber, steel, concrete, cast-in si
bearing piles, friction piles, compaction piles, large diameter piles
Static formulae, dynamic formulae, pile load test, determination of

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and skin friction as per IS code. Bearing capacity of pile groups, negative skin friction.

UNIT-IV:

Coffer dams: Earth embankments, cantilever sheet piles, braced coffer dams. Double wall cofferdams, cellular coffer dams – circular, diaphragm type, general description and construction methods.

Caissons: types of caissons–Open caissons, pneumatic caissons, box caissons(floating caissons). General description and construction methods. Dewatering techniques: sumps, ditches. Well points, deep walls. Geo-textile methods: Types and uses.

UNIT-V:

Site investigation: Principles of exploration, sampling methods, transportation and storage of samples, boring and drilling methods, log of bore holes, sampling tubes and samplers. Sampling records.

Timbering of excavation: Bracing for shallow and deep excavations. Computation of lateral earth pressure. Reaction of struts.

Text Books:

1. K. R. Arora, "*Soil Mechanics and Foundation Engineering*", 7th Edition, Standard Publishers, 2009.
2. Gopal Ranjan, "*Basic and Applied Soil Mechanics*", 3rd Edition, New Age International, 2016.

Suggested Reading:

1. B.C Punmia and Ashok Kumar Jain and Arun Kumar Jain, "*Soil Mechanics and Foundations*", Laxmi Publications, 16th Edition, 2017.
2. E. J. Bowles, "*Foundation Analysis and Design*", Tata Mc Graw Hill, 2017.

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16CE E04

FINITE ELEMENT METHODS
(Elective-II)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: To enable the student

1. Learn the fundamentals of Finite element method (FEM) and derive elasticity matrices fro 2-D and 3-D elasticity problems.
2. Understand basic principles of minimum potential energy methods and variational formulation of FEM know the stiffness matrix formulations using bar element and analyze simple problems.
3. Understand the FEM formulation using truss, beam, and plane frame elements and analyze simple problems with kinematic indeterminacy not greater than 3.
4. Get familiarized with displacement models, Isoparametric elements and quadrilateral elements and know the formulation of global stiffness matrices.
5. Know the formulation of stiffness matrices for Axi-Symmetric elements, Tetrahedron elements.

Course outcomes: At the end of the course, the student should have learnt

1. The fundamentals of FEM, elements of theory of elasticity.
2. Principle of minimum potential energy and variation formulation of FEM and analyze simple problems using bar elements.
3. The analysis of trusses, beams and rigid jointed plane frames.
4. The formulation of Global stiffness matrix, load matrix and analysis structures using 1st order triangular elements, isoparametric elements, and quadrilateral elements.
5. Application of Axi-Symmetric and Tetra-Hedron elements.

UNIT-I:

Introduction to FEM: General description of the method, brief history of the method, applications of the method, advantages of the finite element method, steps in the finite element method. Types of elements; Types of forces: body forces, surface tractions and point loads, Boundary conditions.

Strain displacement, and stress- strain relations for 2-D and 3-D problems. Equations of equilibrium and compatibility conditions for 2-D and 3-D problems. Plane stress and plane strain situations and derivation of elasticity matrices (D`

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UNIT-II:

Finite Element Formulation: Principle of minimum potential energy, Principle of virtual displacement, Global coordinate system, local coordinate system, Raleigh Ritz method, Weighted Residual method- Galerkin's method, Boundary value problems- with one element and two elements.

Bar Elements: Shape functions, stiffness matrix for a 2- noded bar element, axial bar subjected to point loads-constant cross section and varying cross section bar.

UNIT-III:

Truss Elements: Transformation matrix, Stiffness matrix of truss member in local and global axis, analysis of trusses with kinematic indeterminacy not exceeding three.

Beam Elements: Shape functions, beam element stiffness matrix, element load vector, and analysis of continuous beams with kinematic indeterminacy not exceeding three.

Plane Frame elements: Element stiffness matrix in local coordinates, Transformation or Rotation matrix, and stiffness matrix and load vector in global coordinates.

UNIT-IV:

Displacement models: Selection of displacement models, geometric invariance, conforming and non-conforming elements.

2-D Triangular Elements (CST):Determination of strain-displacement matrix, area coordinates, shape functions, determination of element stiffness and load matrices, assembling global stiffness and load matrices. Problems with kinematic indeterminacy not exceeding three.

Iso-parametric elements: Iso-parametric concept, Iso-parametric, Sub parametric and Super parametric elements. Gauss Quadrature of numerical integration.

Quadrilateral elements: Construction of shape functions for 4 noded and 8 noded elements, determination of stiffness matrix, and nodal load matrices for 4-noded quadrilateral element.

UNIT-V:

Axi-symmetric elements: Strain-displacement relationship, stress-strain relationship, determination of stiffness matrix for 3-noded ring element and load matrices for body force and surface traction.

Tetrahedron elements: Volume coordinates, Strain-displacement matrix, and stiffness matrix.

Text Books:

1. David V. Hutton, "*Fundamentals of Finite Element Analysis*", McGraw Hill Education (India) Private Limited, 2017.
2. P. N. Godbole, "*Introduction to Finite Element Method*", I. Publishing House Pvt. Ltd. New Delhi, 2013.

Suggested Reading:

1. T. R. Chandrupatla, and A.D. Belegundu, "*Introduction to Finite Elements in Engineering"*, Pearson Education India; 4 edition, 2015.
2. D. L. Logan, "*A First Course in the Finite Element Method"*, Cengage Learning India Private Limited; 5 edition, 2012.
3. O. C. Zienkiewicz, and R. L. Taylor, "*The Finite Element Method: Its Basis and Fundamentals*", Butterworth-Heinemann; 7 edition, 2013.
4. P. Seshu. "Textbook of *Finite Element Analysis*", PHI, 1st edition, 2010.

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16CE E05

GEOGRAPHICAL INFORMATION SYSTEM AND REMOTE SENSING
(Elective - II)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course objectives: To enable the student

1. Understand the basics and applications of GIS, and to take decisions using GIS under uncertain Conditions.
2. Understands the basic difference between vector GIS and raster GIS.
3. Understand the various types of data, realize the importance of spatial data and also in a position to apply methods of data compression techniques.
4. Perform data analysis and modeling using GIS.
5. Understand the basics of remote sensing and apply the principles to watershed modeling, environmental modeling and watershed management.

Course Outcomes: At the end of the course, the student

1. Is able to apply the principles of GIS to various field problems and take decisions under uncertain conditions.
2. Is able to understand advantages and disadvantages of using vector GIS and raster GIS.
3. Is able to apply the methods of data Compression using GIS.
4. Can perform the data modeling and analysis using GIS.
5. Is able to apply the basic principles of Remote Sensing for Watershed modeling, Environmental Modeling and for Watershed Management.

UNIT– I:

Introduction: Map, definitions, representations–Point line, polygon, common coordinate systems, map projects – transformations – Coordinate systems- – map analysis. History of development of GIS – Applications of GIS: Soil and water resources, agriculture, land use planning, geology and municipal applications, using GIS for decision making under uncertainty.

UNIT-II:

Data entry, storage and maintenance: Data types–spatial non spatial (attribute data)–data-structure, data format – point line vector – Raster – Polygon – Object structural model – filters and files data in computer – keyboard entry, manual digitizing, scanner, remotely sensed data. Concepts of Geo refere digital data – cartographic database. Digital elevation data – data

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UNIT-III:

Data analysis and modeling: Spatial analysis, data retrieval, query (SQL)–Simple analysis, recode overlay, vector analysis, raster data analysis – modeling in GIS – Digital elevation model– cost and path analysis – knowledge based systems.

GIS Analysis Functions: Organizing data for analysis, classification of GIS analysis function, maintenance and analysis of spatial data – transformation, conflation, edge matching and editing, Maintenance and analysis for non-spatial attribute data editing and query functions.

UNIT-IV:

GIS analysis function for integrated analysis of spatial and attribute data: Retrieval and classification function: Overlay operations, neighborhood operations, connectivity function, output formatting – Map annotations text pattern and line styles, graphic symbols, cartographic modeling by GIS analysis procedure with an example.

Presentation of Geo-data Analysis: Types of output data–types of errors elimination and accuracies – sampling - components of data quality.

UNIT-V:

Introduction of Remote Sensing: Electromagnetic radiation, characteristics, interaction with earth surface, sensors types, satellite characteristics IRS series, data products interpretation of data.

Software scenario – Functions: Watershed modeling, Watershed Management, Environmental modeling – Visibility analysis. Vehicle tracking.

Text Books:

1. K. T. Chang, "*Introduction to Geographic Information Systems*", McGraw-Hill Education, 1st edition, 2015.
2. P.A. Burrough, "*Principles of Geographical Information Systems for Land Resources Assessment (Monographs on Soil and Resources Survey)",* Oxford University Press, 1986.
3. Lillesand and Kiefer, "*Remote Sensing and Image Interpretation*", Wiley; Sixth edition, 2011.

Suggested Reading:

1. I. Heywood, S. Cornelius and Steve Carver, "*An Introduction to Geographical Information Systems*", Pearson, 4th Edition, 2012.
2. B. Bhatta, "*Remote Sensing and GIS*", Oxford, Second edition, 2011.
3. S. Kumar, "*Basics of Remote Sensing and GIS*", Laxmi Publications, First edition, 2016.
4. S. Aronoff, "*Geographic Information Systems: A Management Perspective*", WDL Publications Ottawa, 1991.

16CE E06

ARTIFICIAL NEURAL NETWORKS, FUZZY LOGIC & EXPERT SYSTEMS
(ELECTIVE - II)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To understand the importance of Artificial Intelligence and get introduced to Fuzzy Logic (FL), Artificial neural networks (ANN)& Expert systems (ES).
2. To get acquaintance with various components & types of Neural Networks.
3. To learn the fundamentals & applications of fuzzy sets to civil engineering problems.
4. To learn the concepts & various types of expert systems tools.
5. To get exposure of different software packages by solving a case study using FL, ANN & ES.

Course Outcomes: At the end of the course, the student is expected to

1. Have the overall idea &knowledge to employ FL, ANN & ES for specific applications.
2. Have fundamental knowledge of ANN.
3. Have rudimentary knowledge of Fuzzy sets & their applications.
4. Have the grasp of Expert System & its applications.
5. Apply FL, ANN & ES to the real cases of civil engineering and get the solutions to the problems, with the help of standard software packages.

UNIT– I:

Introduction: Brief introduction to the study of artificial intelligence:" An insight to the concept of natural intelligence followed by the development of artificial neural networks, fuzzy logic systems and expert systems tools. Demonstration of the importance of artificial neural networks, fuzzy logic, and expert systems with the help of at least two practical examples of Civil Engineering for each study. Importance of nuerofuzzy systems.

UNIT– II:

Neural Networks: Components of artificial neural networks neurons, inputs, outputs, error, error propagation, hidden layers threshold logic, wei[illegible] momentum, rate of learning, training and testingHebb's rule, Delta [illegible] learning – Generalized delta rule unsupervised learning.

Types of Neural Networks Perceptions feed forward back propagation networks Hop field networks.

UNIT– III:

Fuzzy sets: Crispness vagueness, uncertainty, and fuzzy sets. Basic Definitions and operations of Fuzzy sets, approximate reasoning, and membership function.
Fuzzy Relations: Fuzzy relation and fuzzy composition, fuzzy aggregation procedures, Dominance Matrix, Weight ages, applications of Fuzzy sets to civil engineering problems, and pattern recognition.

UNIT- IV:

Expert systems: Structure of expert systems, Knowledge of acquisition, Knowledge organization, methods of representing knowledge, types of inference engines, reasoning under uncertainty, various types of expert system tools, heuristics, search mechanism, expert system Development and hybrid expert systems.

UNIT- V:

Exposure to Software Packages: Neural networks (Mat lab tool kit)–fuzzy logic expert systems (L5 object)Applications of Artificial Neural Networks, Fuzzy logic and expert systems in Civil Engineering Case studies with at least one problem on each aspect of ANN, FL and Expert systems.

Text Books:

1. H. J. Zimmerman, "Fuzzy Sets, Decision Making, and Expert Systems", Kluwer Academic Publications, Boston, 1987.
2. H. Adeli, "Expert Systems in Construction and Structural Engineering", Chapman & Hall, Ltd. London, UK, 1988.

Suggested Reading:

1. K. Knight, E. Rich, S. B. Nair "*Artificial Intelligence*", McGraw Hill Education; 3rd edition, 2017.
2. J. A. Freeman and D. M. Skapura, "*Neural Networks: Algorithms, Applications and Programming Techniques (Computation and Neural Systems Series)*", Addison Wesley, 1991.

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16CE C30

SOIL MECHANICS LABORATORY

Instruction	3Hours per week
Duration of semester End Examination	3 Hours
Semester Examination	50 Marks
CIE	25 Marks
Credits	2

Course Objectives:

1. To prepare the students with good skills in the laboratory procedures in soil mechanics.
2. To empower the students to deal with the field and laboratory, procedures in soil Explorations and sampling procedures.

Course Outcomes: At the end of the course the student should have learnt

1. The basic skills of conducting experiments on Soils for knowing their properties, identifying its type and interpret the results.
2. To apply the experimentation skills to the field problems such as site investigations and Soil Exploration techniques.

Determination of Basic and Index properties (Any Five Tests)

1. Determination of specific gravity of soil solids using "Density bottle" method.
2. Determination of specific gravity of soil solids using "Pycnometer" method.
3. Determination of water content using "Pycnometer" method.
4. Determination of liquid limit using Casgrandes standard LL device.
5. Determination of liquid limit using cone penetration apparatus.
6. Determination of plastic limit.
7. Sieve Analysis for plotting Particle size distribution curve.
8. Determination of Field Density using Sand Replacement Method.
9. Determination of Relative Density of Sand.

Determination of Engineering properties (Any Five Tests)

10. Determination of Compaction Characteristics.
11. Determination of Co-efficient of Permeability by "Constant Head Permeameter test".
12. Determination of Co-efficient of Permeability by "Variable Head Permeameter test".
13. Determination of shear strength parameters by "Direct Shear Test".
14. Determination of shear strength of cohesive soils by "Unconfined compression Test".
15. Determination of shear strength of conducting "Vane she

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Test Procedures:

16. Consolidometer test.
17. Tri-axial Shear test.

Suggested Reading:

1. Relevant IS Codes of Practice.
2. T.W. Lambe, "*Soil Testing for Engineers (Wiley Series in Geotechnical Engineering)*, 1966.
3. Relevant ASTM Codes of Practice.

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16CE C31

HYDRAULICS AND HYDRAULIC MACHINERY LAB

Instruction	3Hours per week
Duration of semester End Examination	3 Hours
Semester Examination	50 Marks
CIE	25 Marks
Credits	2

Course Objectives: To enable the student

1. Understand uniform and non-uniform flows and the importance of Froude number in open channel flows.
2. Determine super elevation in a curved channel.
3. Determine the force exerted by fluid jet on vane, determine efficiency and performance of turbines and centrifugal pumps.
4. Study streamline patterns in a fluid flow system and air pressure distribution around an Airfoil.

Course Outcomes: At the end of the course, the student should have learnt

1. To compute the open channel rugosity coefficient in uniform flows and Froude number, energy losses in non- uniform flows.
2. To differentiate between uniform, non-uniform flows and flow in curved channel.
3. To determine work done by fluid jet on vane, compute work done and draw performance characteristic curves for turbines and centrifugal pumps.
4. To find the discharge between stream lines and pressure variations around an airfoil.

List of experiments

1. Uniform flow in channels - Determination of Manning's Rugosity coefficient, Chezy's constant.
2. Curved Channel flow - Determination of super elevation
3. Hydraulic Jump - Determination of Froude number, loss of energy, type of jump.
4. Impact of Jets - Determination of force on flat vane and curved vane.
5. Centrifugal Pump-Determination of efficiency and performance characteristics of a constant speed pump.
6. Pelton Wheel turbine-Determination of efficiency and performance characteristics of a Pelton wheel turbine.
7. Franics Turbine-Determination of efficiency and performance characteristics of a Francis turbine.
8. Kaplan Turbine-Determination of efficiency and performance characteristics of a Kaplan turbine.
9. Hele Shaw's Apparatus - Study of stream line pattern.

Text Books:

1. M.N. Shesha Prakash, "*Experiments in Hydraulics Machines – Theory and Procedures*", PHI Learning Privat

16CE C32

TRANSPORTATION ENGINEERING LAB

Instruction	3Hours per week
Duration of semester End Examination	3 Hours
Semester Examination	50 Marks
CIE	25 Marks
Credits	2

Course Objectives: To enable the student

1. Assess the quality of the material used in pavement construction and compare with IRC specifications.
2. Identify the field data required for assessing the traffic parameters.

Course Outcomes:

1. To apply methods for assessing various types of material to be used in the pavement construction.
2. To plan for the collection of field data and to present the same data for the analysis and take decisions for smooth movement of the traffic.

A) Tests on bitumen

1. Penetration Test.
2. Ductility test.
3. Softening point test.
4. Specific gravity test.
5. Viscosity test.
6. Flash and fire point test.

B) Tests on road aggregates

7. Aggregate crushing value test.
8. Los Angeles abrasion test.
9. Aggregate impact value test.
10. Aggregate shape test(flakiness & elongation).
11. Water Absorption.
12. Soundness.

C) Traffic Studies (demonstration only)

13. Traffic volume study.
14. Spot Speed Study.
15. O & D Study concepts.
16. Speed and delay studies.

D) Miscellaneous Tests

17. Determination of C.B.R.
18. Preparation of representative sample by coning and quartering.
19. Bitumen extraction test.
20. Marshal stability concepts and Tests.

Suggested Reading:

1. IRC codes and specifications.

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16CE C33

INDUSTRIAL VISIT

Sessional Examination
*Grade

Students are expected to visit at least two works of Civil Engineering importance in and around Hyderabad and submit a detail report on the same to the department. The Department should evaluate the reports and presentation through a Committee consisting of Head of the Department and two more members of the senior faculty.

*** Satisfactory / Unsatisfactory.**

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16CE C34

WATER RESOURCES ENGINEERING - II

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course objectives: To enable the students to understand

1. Storage head works, selection, and stability analysis. Finalize profile of a gravity dam.
2. Types of dams, seepage analysis, design criteria of an earth dam.
3. Types of spillways, selection, energy dissipaters and spillway gates.
4. Understand water power engineering, hydel plant layout and components.
5. Comprehend minor irrigation, river engineering, and water resources management.

Course outcomes: At the End of the course, the student will be able to

1. Analyze and design a non-overflow gravity dam
2. Design a typical earth dam as per criteria.
3. Formulate a spillway proposal with appurtenant energy dissipaters.
4. Prepare a preliminary proposal of hydel plant for a given site.
5. Know about minor irrigation and formulate it. Plan for the river training work, water resources management.

UNIT – I:
Storage Head Works : Types of dams, advantages and disadvantages, selection criteria, Economical height of the dam, Gravity dams, Forces acting on dam, stability analysis, Principal stresses, Elementary Profile and Practical Profile, Low and High Gravity dams, joints, galleries, foundation grouting.

UNIT – II:
Earth Dams: Types, methods of construction, Seepage analysis for homogeneous and zoned embankment dams, Drainage in embankment dams, failure of Earth dams & Design Criteria.
Various types of filters, filter criteria and design. Stability of slopes during steady seepage, sudden drawdown condition, failure due to pore pressure during construction of dam.

UNIT – III:
Spill Ways and Energy Dissipation: Types of Spill Ways, Ogee Spill ways, Design of Ogee Profile, Fixation of levels, Syphon Spill Way & Chute Spill Way. Energy Dissipaters, Hydraulic Jump & Bucket type dissipaters, Tail water rating curve & Jump Height Curve, Spillway gates.

UNIT- IV:
Water Power Engineering: History, demand and generation, comparison hydel and thermal power, types of Hydel Plants, Water Conveyance, Penstocks & Surge tanks, powerhouse layout and components – their functions, flow and power duration curves. Load factor, utilization factor, capacity factor.
Power House: Substructure and super structure of a power house, merits and demerits of an underground power house, fixation of dimensions of a power house.

UNIT- V:
Minor Irrigation: Role and importance of minor Irrigation, delineation of catchment area, free and intercepted catchment, components of minor Irrigation
River engineering: Classification of rivers, meandering process, river training, types of training works.
Water resources management: Integrated river basin planning and management, warabandi, farmer's participation in water management, strategies and problems in water resources management, Interlinking of rivers.

Text Books:

1. P. N. Modi, "*Irrigation Water Resources and Water Power Engineering*", Standard Publishers, New Delhi, 2014.
2. S. K. Garg, "*Irrigation Engineering & Hydraulic Structures*", Khanna Publishers, New Delhi, 2017.

Suggested Reading:

1. Ralph A.Wurbs and Wesley.P.James, "*Water Resources Engineering*", Pearson, New Delhi, 2015
2. M. M. Dandekar&K. N. Sharma, "*Water Power Engineering*", Vikas Publishers, New Delhi, 2016.
3. Challa, Satya N Murthy., "*Water Resources Engineering*", New Age International, New Delhi ,2002.

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16CE C35

DESIGN OF STEEL STRUCTURES -I

Instruction	4(3L+1T) Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	4

Course Objectives: To enable the students

1. Learn and apply the design philosophies(working stress method and limit state method) for various steel structural components and their connections, as per the relevant standards
2. To understand the behaviour of compression members and design column bases
3. To understand the modes of failure of tension members.
4. To understand the behaviour of flexural members in the industry.
5. Learn the Behaviour of trusses and design of purlins.

Course Outcomes: At the end of the course, the student

1. Attains fundamental knowledge of the design of various Steel Structures, connections and is able to interpret the specifications of relevant codes.
2. Able to design compression members & column bases.
3. Able to understand the behaviour of tension members and its design.
4. Able to understand the classification of beam section, local failure of section and design of flexural members.
5. Able to estimate the loading roof trusses and design of purlins.

UNIT – I:

Materials and Specifications: Chemical composition of steel, types of Structural Steel - classification of Rolled Steel Sections.

Design Philosophies: Working Stress Method, Limit State Method,

Loads and Load Combinations: Design Loads & load Combinations; Characteristic Loads, Partial safety factors for materials and loads.

Bolted Connections (Limit State Method): Lap & Butt joints and the behaviour of Bolted Joints -Modes of failure - Design of Bolted joints using ordinary Black Bolts - Concentric Connections and Eccentric Connections – Connections using High Strength Friction Grip Bolts.

Welded Connections (Limit State Method): Lap and Butt Joints- strength of welded joints -design of welded joints - Concentric Connections and Eccentric Connections.

UNIT – II:

Design of Compression Members (Limit State Method): Introduction, Buckling &yielding phenomena, Sections used for compression Members. Effective Length of Compression Members, Design of Compression Members with single section and Built-up Sections (Symmetric in both directions), Lacing and Battening, Column Splices.

Design of Column Bases: Design of Slab and Gusset Bases.

UNIT – III:

Design of tension members (Limit State Method): Introduction to tension members - Applications of tension members, Modes of Failure, Design of Tension Members – Design of Lug Angles - Staggered bolting.

Working Stress Method (as per IS 800-2007): Permissible Stresses, Slenderness Ratio, Design of tension members, Design of Simple Compression Members.

UNIT – IV:

Design of Beams (Limit State Method) : Introduction to Plastic Analysis – Plastic Hinge, Plastic moment, Shape factor; Classification of Cross Sections, Phenomenon of Lateral Torsional Buckling; Design of Laterally Supported beams and laterally Unsupported Beams, Secondary considerations - Check for Web crippling, web buckling and deflection .

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UNIT – V:

Design of Roof trusses (Limit State Method): Types of trusses, Estimation of loads- dead load, live load and wind load, Design of purlins, Analysis and design of roof trusses with angle sections.

Text Books:

1. N. Subramanian, "*Design of Steel Structures",* Oxford University Press, 2008.
2. S. K. Duggal, "*Design of Steel Structures*", 2nd Edition, Tata McGraw Hill Publishing, 2014.

Suggested Reading:

1. S. S. Bhavikatti, "*Design of steel Structures*", 3rd Edition, I.K. International Publishing House Pvt. Ltd. 2012.
2. IS 800:2007,"*Indian Standard General Construction in Steel- Code of Practice*". (Third revision).

16CE C36

ESTIMATION AND SPECIFICATIONS

Instruction	4(3L+1T) Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	4

Course objectives: To enable the students understand

1. The working of detailed estimates for different structures.
2. The working of steel quantities of R.C.C Framed works and preparation of BBS
3. The rate Analysis for different items of works.
4. About TSDSS and Departmental procedures.
5. About Specifications and standard procedure for construction works.

Course outcomes: At the End of the course the students should be able to

1. Prepare detailed estimates for different structures.
2. Prepare the detailed estimate steel qualities of RCC framed works and to prepare BBS.
3. Do the rate analysis for different items of works of buildings, concrete and bituminous road works.
4. Apply TSDSS and departmental procedures.
5. Work out standard procedure and specifications of construction works.

UNIT – I:
Introduction of estimation, object of estimation, factors influencing estimation, types of estimates, Detailed estimated for Flat roof building (load bearing and RCC framed) - long and short wall method - centre line method.

UNIT – II:
Estimation of steel quantities and preparation of bar bending schedule (BBS) - RCC framed works - Slabs (one way and two way), Beams and columns, footings, stair case Retaining wall.

UNIT – III:
Detailed estimate of road works for Bituminous, WBM roads and CC road (including earth work), single cell rectangular box culvert, Septic tank and earth work of irrigation canals.

UNIT – IV:
Preparation of analysis of rates and theoretical requirements of materials as per the Telangana State Standard Data and Schedule of Rates, for major items of works of a building, all items of work of Bituminous and concrete road works.

UNIT – V:
General and detailed specifications of works as per Telangana State Standard Data and Schedule of Rates, Departmental procedure for construction work, Measurement Book and Muster Roll.

Text Books:

1. B. N. Dutta, "*Estimating and Costing in Civil Engineering – Theory and Practice*", UBS, publishers' distributors (p) ltd.-New Delhi 2012.
2. M. Chakraborti, "*Estimating, Costing, Specifications and Valuation in Civil Engineering"*, Chakraborti 2006.

Suggested Reading:

1. Jagjit Singh, "*Estimating and Costing in Civil Engineering*", Galgotia Publications, New Delhi, 1996.
2. B. S. Patil," *Civil Engineering Contracts and Estimation*", Orient Black swan Private Ltd; Fourth edition 2015.
3. Standard Scheduled Rates and Relevant BIS Codes

16CE E07

ADVANCED REINFORCED CONCRETE DESIGN
(ELECTIVE – III)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: To enable the student
1. To understand the concepts of beams curved in plan along with analysis and design.
2. To understand the Analysis and Design and Detailing of Deep Beams.
3. To understand the behaviour of portal frames, Bunkers, silos and their design.
4. To understand the design principles of Flat Slabs and grid slabs.
5. To understand the structural behaviour and design principles of Raft and Pile.

Course Outcomes: Upon the completion of this course, the student should be able to
1. Analyse and Design beams curved in plan as per the field requirements.
2. Design simply supported and continuous deep beams.
3. Analyse, design and detail the Bunkers, silos and portal frames.
4. Analyse and design flat slabs and grid slabs using the codal provisions.
5. Predict structural behaviour of Raft, and Pile foundations and design them.

UNIT – I:
Beams curved in plan: Introduction–Design Principles–Structural Design of rectangular beams circular in plan and rectangular in cross-section, continuously supported on 'n' number of symmetrically spaced columns.

UNIT – II:
Deep Beams: Introduction–flexural and shear stresses in deep beams.–I.S. Code provisions – Design of simply supported and continuous Deep beams.
Building Frames: Analysis of Multistorey building frames subjected to gravity loads using Substitute frame method and Design.

UNIT – III:
Bunkers and Silos: Introduction, design principles and theories, IS code provisions, design of Rectangular bunkers and cylindrical silos.

UNIT – IV:
Flat slabs: Introduction, Components- I.S. Codal Provisions–Design principles and methods – Direct design method, Equivalent frame method and Design for flexure and shear.

UNIT – V:
Raft Foundations: Definitions, types, design of Raft foundation -flat plate type and beam slab type for buildings with column grids up to three by three.
Pile Foundations: Structural design of Pile and Pile caps.

Text Books:
1. N. Krishna Raju, "*Advanced Reinforced Concrete Design*", CBS Publishers, 2016.
2. H.J. Shah," *Reinforced Concrete Vol-I and Vol-II"*, Charotar Publishers, 2016 and 2014.

Suggested Reading:
1. P. C. Varghese, "*Advanced Reinforced Concrete Design*", PHI, 2005.
2. B. C. Punmia and Ashok Kumar Jain, "*Comprehensive R.C.C. Designs*", Laxmi Publishers 2005.

16CE E08

ADVANCED ENVIRONMENTAL ENGINEERING
(ELECTIVE - III)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: To enable the student

1. Understand the characteristics and effects of industrial effluents & legislation regarding effluent disposal
2. Understand manufacturing process and effluent treatment of various industries
3. Comprehend and monitor ambient air quality in order to assess the pollutants.
4. Understand the methods of air pollution control and selection of equipment for the control.
5. Understand the need and objectives of Environmental Impact Assessment (EIA), impacts of road projects, industries and dams.

Course Outcomes: At the end of the course, the student will be able to

1. Characterize the effluents, analyze the effects of industrial effluents on the human health & thoroughly practice environmental legislation
2. Apply the methods of Industrial waste water management and treatment.
3. Evaluate, monitor and analyze ambient air quality.
4. Apply the methods of air pollution control to field situations.
5. Evaluate the impact of road project, industry and a dam on the surrounding environment.

UNIT – I:
Industrial waste Management: Types of industries, characteristics of Industrial wastes, effects of industrial effluents on streams, land and human health. Environmental legislation related to Industrial effluents and hazardous wastes. Self-purification of water bodies, Streeter Phelps Equation.

UNIT – II:
Industrial Waste Water treatment: Manufacturing process, waste water characteristics and effluent treatment of the following industries- leather tanning, dairy, pulp and paper, pharmaceutical, textiles, steel plants, thermal power plants, fertilizer, cement, sugar and distilleries.

UNIT – III:
Air pollution: Sources, classification and effects of air pollutants, Meteorology of air pollution, wind rose diagrams, lapse rates, atmospheric stability an dispersion of air pollutants, stack height calculation, ambient air quality monitoring, stack sampling, analysis of air pollutants.

UNIT- IV:
Air Pollution Control: Air quality standards, methods of air pollution control – zoning, source correction, control of suspended particulate meter by equipment (gravitation, centrifugation, flirtation, scrubbing, electrostatic precipitation), selection of proper equipment, gaseous pollutant control by adsorption, condensation, combustion.
Noise Pollution: Sources, measurement and various control methods.

UNIT – V:
Environmental Impact Assessment: Need for environmental impact assessment (EIA), objectives of EIA, EIA capabilities and limitations. Legal provisions of EIA, Base line at a collection required for EIA, Evaluation of impacts, Prediction of impacts, Preparation of Environmental Management Plan, Preparation of EIAs of road project, Industry, and dam. Issues related to rehabilitation of affected people, Preparation of Environment, Impact statement and Environment Management Plan.

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Text Books:

1. M. N. Rao and Dutta, "*Waste Water Treatment",* Oxford and IBM Publications Ltd., 2017.
2. W. W. Eckenfelder, "*Industrial Water Pollution C*ontrol", Mc Graw Hill India, 2005.
3. M.N. Rao, H.V.N. Rao, "*Air Pollution Control*", Tata Mc Graw Hill, 2017

Suggested Reading:

1. C. S. Rao, "*Environmental Pollution Control Engg"*, New Age International Publishers, 2018.
2. Peavy and Rowe, "*Environmental Engg",* McGraw Hill Publications, 2017.
3. Keiley, "*Environmental Engg*", Mc Graw Hill Publishers, 2003.

16CE E09

GROUND IMPROVEMENT TECHNIQUES
(ELECTIVE - III)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: To make the students understand

1. The importance of ground improvement and learn about various types of ground improvement techniques available to date, and selecting and designing suitable ground improvement technique for given soil conditions.
2. The concepts behind a range of ground improvement and soil remediation techniques.
3. The different concepts of dewatering procedures, soil stabilization, grouting in soils, consolidation and shear strength of the soil.
4. The Types, functions and applications of Geo-textiles, geo-grid, tests on geo-textiles and Reinforced earth.
5. The advantages, disadvantages, and limitations for each ground improvement techniques.

Course Outcomes: At the end of the course, the student would

1. Know the importance of ground improvement techniques and types of techniques for different soils.
2. Apply the various ground improvement techniques to address the field problems.
3. Understand the degree to which soil properties may be improved; and the benefits involved
4. Identify suitable ground improvement technique for specific project and its implications.
5. Design ground improvement techniques as well as be able to advice regarding value engineering to save cost and obtain maximum benefits for the specific project

UNIT- I:
Introduction: Need for ground improvement, applications, and factors affecting–different mechanical, chemical, static and dynamic techniques – mechanical stabilization – blending of aggregate – RothfutchTesting. Concept of Soil confinement, Gabion Walls, Crib Walls and Sand Bags.

UNIT – II:
Chemical stabilization: Lime, Cement, Bitumen, Emulsions, Chemicals, factors influencing–Design approach, construction procedure, laboratory testing, additives. Suspension and solution grouts, Principles, method, equipment, applications, compaction grouting, jet grouting, field compaction control.

UNIT – III:
Stabilization of Cohesion less soils: In Situ densification, Vibro techniques–Mechanisms. Factors affecting, suitability number, compacting piles. Vibro replacement process, Vibro flotation process, Terra Probe Method, Dynamic Compaction.

UNIT- IV:
Stabilization of Cohesive soils: In Situ densification, Pre-loading–Dewatering–sand drains. Sand wicks, geo-drains, rope-drains, band-drains, stone columns, and lime piles, thermal and vacuum methods.
Treatment of Expansive Soils: Expansive Soils- parameters of expansive soils and their classification- moisture changes in expansive soils - Design of foundations in expansive soils - CNS technique.

UNIT – V:
Ground treatment for Slopes: Different types of in-situ soil stabilization like soil nailing, anchoring, pre-stressed anchoring - design methods and construction techniques.
Geo-textiles: Woven and non-woven fabrics. Types, functions and applications–Geo-textiles, geo-grids test on geo-textiles, Reinforced earth – Principles and factors governing design.

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Text Books:

1. P.Purushothama Raju, "*Ground Improvement Techniques*", Laxmi publications 2016.
2. K.R Arora, *"Soil Mechanics and Foundation Engineering",* 5th Edition, Standard Publishers, 2005.

Suggested Reading:

1. Nihar Ranjan Patra, "*Ground Improvement Techniques*", Vikas publishing house Pvt. Ltd, 2012.
2. R. Hausmann*., "Engineering Principles of Ground Modification"*, McGraw Hill Publishing Co.,2013.
3. H. Fang*," Foundation Engineering Hand Book*", 2nd Edition, CBS Publication, New Delhi, 2004.
4. G. V. Rao and G. V. S. S. Raju, "*Engineering with Geosynthetics",* McGraw Hill Education, 1998
5. IRC-SP 58 (2001): "*Guidelines for use of fly ash in road embankments*".

16CE E10

ELEMENTS OF EARTH QUAKE ENGINEERING
(ELECTIVE-IV)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course objectives: To enable the student

1. Understand the causes of earthquakes , their Magnitude & effects and various types of earthquake waves
2. Understand the concepts of damped and un damped vibrations and the response of single , two and multi-degree systems to these vibrations , and concepts of Response spectrum
3. Review various case studies of past earthquakes , and performance of buildings during those earthquakes, understand the concepts of Seismic Design Philosophy and Earthquake Resistant Design of Masonry , RC and Steel structure
4. Gain knowledge of Seismic Performance of Engineered and Non-Engineered Urban and Rural buildings
5. Understand the basic concepts of Seismic resistant construction , Base isolation techniques and other energy dissipation devices and Concepts of Seismic retrofitting

Course outcomes: At the end of the course, the student is able to

1. Assess the cause of an earthquake , it's magnitude and its effects on structures
2. Apply the concepts of Damped and Un-damped Vibrations to single , two and multi-degree systems and deduce a response spectrum
3. Apply the concepts of Seismic Design Philosophy and Earthquake Resistant Design to Masonry , RC and Steel structures
4. Evaluate the Seismic Performance of Engineered and Non-Engineered Urban and Rural buildings
5. Apply the concepts of Seismic Resistant Construction , Base isolation techniques and other energy dissipating devices and also the concepts of Seismic Retro fitting, use and interpret the knowledge gained from the case studies of performance of buildings during past earthquakes

UNIT – I:

Engineering Seismology: Causes of earthquakes–Seismic waves-Magnitude, Intensity and Energy release – characteristics of strong earthquake ground motions – Soil effects and Liquefaction. Seismic Zonation of India, Seismic Instruments.

UNIT – II:

Theory of Vibrations: Introduction to theory of vibrations, Equations of motion – single degree of freedom (SDOF) systems, free and forced vibrations. Concepts of damped and undamped vibrations.

UNIT – III:

Multi degree of freedom (MDOF) system: Equation of Motion, Modal analysis - generation of modal frequencies and mode shapes, construction of response spectrum.

UNIT – IV:

Seismic Design Philosophy: Concept of Seismic resistant design, reduction factors– Over strength, Ductility and Redundancy –Determination of earthquake forces on buildings – Equivalent static method and Response spectrum method.

UNIT – V:

Seismic Performance of Buildings: Case Studies* of a few severe earthquakes in the country - Damages to buildings – Damage Patterns – Performance of Non-Engineered Buildings, Rural houses during the Earthquakes.
Concepts of earthquake resistant constructions in rural area. Base isolation and energy dissipation devices. Principles of Seismic Repair, rehabilitation and retrofitting.

- Students are made to discuss case studies in grou

Text Books:

1. Pankaj Agarwal and Manish Shrikhande, "*Earthquake Resistant Design of Structures*", Prentice Hall of India Pvt. Ltd, 2006
2. S. K. Duggal, "Earthquake *Resistant Design of Structures*", Oxford publishers, 2013.

Suggested Reading:

1. A.K. Chopra, "*Dynamics of Structures*", Pearson Education, 2012.
2. A.R Chandrasekaran, J. Krishna, B. Chandra, "*Elements of Earthquake Engineering*", South Asian Publishers Pvt. Ltd, 2000.
3. Steven L Kramer, "Geo-*Technical Earthquake Engineering",* Pearson Education Ltd, 2013.
4. NPTEL notes.

16CE E11

ADVANCED TRANSPORTATION ENGINEERING
(ELECTIVE – IV)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course objectives: To enable the student

1. Understand the various materials and methods used for soil stabilization for roads.
2. Learn and apply the basic design principles for rigid and flexible pavements.
3. Evaluate the distress in highways, capacity of highways, transport cost and economy of a Highway..
4. Know the travel demand and management concepts and use computer applications for traffic and transport planning.

Course Outcomes: At the end of the course, the student should be

1. Able to apply various materials and methods for soil stabilization of roads.
2. Able to design a Rigid and flexible pavement.
3. Able to evaluate a highway for its distress, skid resistance, structural strength and drainage.
4. Able to assess the capacity and economic viability of a highway and also conduct transport cost-benefit analysis.
5. Able to apply the travel demand management concepts and use computer applications for traffic and transport planning.

UNIT- I:
Soil – Stabilized Road: Preliminary investigation, materials, Techniques of stabilizations, Methods of stabilization, Mechanical, Soil Cement, Soil Bitumen, Soil-fly ash -Lime Stabilization.

UNIT- II:
Pavement design: Factors affecting pavement design, Concepts of ESWL, flexible pavements-GI method-CBR method-IRC 37 2018, Rigid pavement design-IRC 58 2015.

UNIT- III:
Pavement Evaluation: Pavement distress**,** Skid resistance, structural evaluation, Benkelman beam method, Overlays, Highway drainage – importance, requirements surface drainage system, sub-surface drainage system.

UNIT- IV:
Highway capacity and Economic evaluation: Passenger car units (IRC), Level of service–concept, factors, multilane capacities for rural, urban, and express ways.

Concept of – Transport cost & benefits: Benefit cost ratio, net present value, rate of return, and their relative comparison for evaluation. Accidents – causes, methodologies for accident costing precautions to minimize the accidents.

UNIT- V:
Travel demand management: Traffic Management Systems (TMS)–Restrictions on turning movements, One way streets, tidal flow – Operations, Exclusive bus lanes. Traffic Relief at junctions, at plane, parking studies, parking inventories, types of parking service, parking analysis, bottle necks.
Nature of traffic problems in cities Effect on environment due to traffic noise and air pollution. Introduction of Computer applications in traffic and transport planning.

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Text Books:

1. L. R. Kadiyali, "*Traffic Engineering and Transportation Planning*", Khanna Publications, 2011.
2. S. K. Sharma, "*Principles, Practice and Design of Highway Engineering",* S. Chand & Company, 2014

Suggested Reading:

1. G. V. Rao," *Principles of transportation and Highway Engineering*", McGraw Hill Education India Pvt. Ltd, 2000.
2. S.K. Khanna and C.E. Justo, "*Highway Engineering*", Nem Chand & Sons, 2017.
3. S.C. Saxena,"*Text book Highway and Traffic Engineering*", CBS 2005.

16CE E12

DESIGN AND DETAILING OF IRRIGATION STRUCTURES
(ELECTIVE - IV)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The student should be able to understand the

1. Principles of a surplus weir
2. Design of direct sluice
3. Basic principles of glacis type canal drop
4. Basic principles of Design of Cross regulator
5. Design of super passage.

Course Outcomes: The Student will be able to design procedures and detail a

1. Surplus weir
2. Direct sluice
3. Glacis type canal drop
4. Cross regulator
5. Super passage.

UNIT – I:
Surplus Weir: - Components of surplus weir - computation of flood discharge - Design of surplus weir & detailing

UNIT- II:
Direct Sluice:-Hydraulic particulars - General arrangements of various components - Design of vent way, Sluice barrel, Head walls, Wing Walls and return walls - Detailing

UNIT- III:
Glacis type Canal Drop:- Components, General arrangements, Fluming ratio, fixing the crest level, length of weir, U/S and D/S glacis, Transitions - Protection works - Curtain wall, Energy dissipation arrangements - Design & Detailing

UNIT- IV:
Cross Regulator: General design principles - General arrangements of various components - design of vent way by drowning ratio - arrangements of energy dissipation - U/S & D/S protection works - Design & Detailing.

UNIT-V:
Super Passage:- Hydraulic particulars of drain & Canal - U/S & D/S transitions -TEL's - fixing vent way - design of trough - Afflux in the canal - Proposal sketch of the super passage including transitions. Concepts of Syphon design.

Text Books:

1. B.C. Punmia, "*Irrigation & Water Power Engineering*", Lakshmi Publications, Delhi, 2016.
2. Ch. S. N. Murthy, "*Water Resources Engineering*: Principles and Practice", New Age International Publishers, Delhi, 2002.

Suggested Reading:

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1. R.S. Varshney, S.C. Gupta, R.L. Gupta, "*Theory & Design Of Irrigation Structures Vol. 1*", Nem Chand & Brothers, 1992
2. S. K. Garg, "*Irrigation Engineering and Hydraulic Structures*", Khanna Publishers, New Delhi, 2017.

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16CS O06

FUNDAMENTALS OF DBMS
(ELECTIVE – V)(OPEN ELECTIVE)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: File Structures.

Course Objectives: The main objectives of this course are:

1. To learn data models, conceptualize and depict a database system using E-R diagram.
2. To understand the internal storage structures in a physical DB design.
3. To know the fundamental concepts of transaction processing techniques.

Course Outcomes: On Successful completion of this course, student will be able to:

1. Understand the find fundamental components of the DBMS.
2. Design the database schema and develop E-R model.
3. Devise queries using relational algebra and SQL.
4. Apply normalization techniques and solve problems using various Indexing techniques.
5. Understand transaction processing, Concurrency control and recovery techniques.

UNIT – I:

Introduction: Database System Applications, Purpose of Database Systems, View of Data, Database Languages, Database Users and Administrators Database System Architecture, Application Architectures. **Database Design and E-R Model:** Basic concepts, Constraints, E-R Diagrams, E-R Design Issues, Extended E-R Features, Specialization and Generalization.

UNIT – II:

Relational Model: Structure of Relational Databases, Database Schema, Keys, Relational Algebra, Fundamental Operations.
Structured Query Language: Overviews, SQL Data Types, SQL Queries, Data Manipulation Language Set Operations, Aggregate Functions, Data Definition Language, Integrity Constraints, Null Values, Views, Join Expression. Index Definition in SQL.

UNIT – III:

Relational Database Design: Undesirable Properties in Relational Database Design, Functional Dependencies, Trivial and Nontrivial Dependencies, Closure of Set of Functional Dependencies, Closure of Set of Attributes, Irreducible Set of Functional Dependencies, Normalization – 1NF, 2NF, and 3NF, Dependency Preservation, BCNF, Comparison of BCNF and 3NF.

UNIT – IV:

Indexing: Basic concepts, Dense and Sparse Indices, Secondary Indices, Tree-Structured Indexing, Indexed Sequential Access Method (ISAM), B+ Tree Index Files.
Transaction Management: Transaction Concept – ACID Properties, States of Transaction, Implementation of Atomicity and Durability, Serializability, Recoverability.

UNIT – V:

Concurrency Control: Lock-Based Protocols, Timestamp-Based Protocols, Validation-Based Protocols, Deadlocks Handling: Deadlock Prevention, Deadlock Detection and Recovery.
Recovery System: Failure Classification, Storage Structure, Recovery and Atomicity, Log-Based Recovery, Recovery with Concurrent Transactions.

Text Books:

1. Abraham Silberschatz, Henry F Korth, S Sudarshan, "*Database System Concepts*", Sixth Edition, McGraw-Hill International Edition, 2011.
2. Date CJ, Kannan A, Swamynathan S, "*An Introduction to Database Systems*", Eight Edition, Pearson Education, 2006.

Suggested Reading:

1. Raghu Ramakrishnan, Johnnes Gehrke, "*Database Management Systems*", Third Edition, McGraw Hill, 2003.
2. Ramez Elmasri, Durvasul VLN Somayazulu, Shamkant B Navathe, Shyam K Gupta, "*Fundamentals of Database Systems*", Fourth Edition, Pearson Education,2006.

16ME O01

ENTREPRENEURSHIP
(ELECTIVE – V)(OPEN ELECTIVE)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Objectives: Student will understand
1. The environment of industry and related opportunities and challenges
2. Concept and procedure of idea generation
3. Elements of business plan and its procedure
4. Project management and its techniques
5. Behavioral issues and Time management

Outcomes: After completing this course, students will be able to:
1. Identify opportunities and deciding nature of industry
2. Brainstorm ideas for new and innovative products or services
3. Analyze the feasibility of a new business plan and preparation of Business plan
4. Use project management techniques like PERT and CPM
5. Analyze behavioural aspects and use time management matrix

UNIT-I:
Indian Industrial Environment: Competence, Opportunities and Challenges, Entrepreneurship and Economic growth, Small Scale Industry in India, Objectives, Linkage among small, medium and heavy industries, Types of enterprises, Corporate Social Responsibility.

UNIT-II:
Identification and Characteristics of Entrepreneurs: First generation entrepreneurs, environmental influence and women entrepreneurs, Conception and evaluation of ideas and their sources, Selection of Technology, Collaborative interaction for Technology development.

UNIT-III:
Business Plan: Introduction, Elements of Business Plan and its salient features, Technical Analysis, Profitability and Financial Analysis, Marketing Analysis, Feasibility studies, Executive Summary.

UNIT-IV:
Project Management: During construction phase, project organization, project planning and control using CPM, PERT techniques, Human aspects of project management, Assessment of tax burden

UNIT-V:
Behavioral Aspects of Entrepreneurs: Personality, determinants, attributes and models, Leadership concepts and models, Values and attitudes, Motivation aspects, Change behavior
Time Management: Approaches of time management, their strengths and weaknesses. Time management matrix and the urgency addiction

Text Books:

1. Vasant Desai, "*Dynamics of Entrepreneurial Development and Management*", Himalaya Publishing House, 1997.
2. Prasanna Chandra, "*Project-Planning, Analysis, Selection, Implementation and Review*", Tata Mcgraw-Hill Publishing Company Ltd. 1995.
3. S.S. Khanka, "*Entrepreneurial Development*", S. Chand & Co. Pvt. Ltd., New Delhi

Suggested Reading:

1. Robert D. Hisrich, Michael P. Peters, "*Entrepreneurship"*, 5/e, Tata Me Graw Hill Publishing Company Ltd., 2005.
2. Stephen R. Covey and A. Roger Merrill, "*First Things First*", Simon and Schuster Publication, 1994.
3. Sudha G.S., "*Organizational Behavior"*, National Publishing House, 1996.

16EG O01

TECHNICAL WRITINGS SKILLS
(ELECTIVE – V)(OPEN ELECTIVE)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The course will introduce the students to
1. Process of communication and channels of communication in general writing and technical writing in particular.
2. Learn Technical Writing including sentence structure and be able to understand and use technology specific words.
3. Write business letters and technical articles.
4. Write technical reports and technical proposals.
5. Learn to write agenda, record minutes of a meeting, draft memos. Understand how to make technical presentations.

Course Outcomes: After successful completion of the course students will be able to
1. Communicate effectively, without barriers and understand aspects of technical communication.
2. Differentiate between general writing and technical writing and write error free sentences using technology specific words
3. Apply techniques of writing in business correspondence and in writing articles.
4. Draft technical reports and technical proposals.
5. Prepare agenda and minutes of a meeting and demonstrate effective technical presentation skills.

UNIT- I:
Communication – Nature and process.
Channels of Communicational: Downward, upward and horizontal communication. Barriers to communication.
Technical Communication: Definition, oral and written communication. Importance and need for Technical communication. Nature of Technical Communication. Aspects and forms of Technical communication.
Technical communication Skills – Listening, Speaking, Reading & Writing.

UNIT –II:
Technical Writing: Techniques of writing. Selection of words and phrases in technical writing. Differences between technical writing and general writing abstract and specific words. Sentence structure and requisites of sentence construction. Paragraph length and structure.

UNIT- III:
Business correspondence: Sales letters, letters of Quotation, Claim and Adjustment letters.
Technical Articles : Nature and significance, types. Journal articles and Conference papers, elements of technical articles.

UNIT- IV:
Technical Reports: Types, significance, structure, style and writing of reports. Routine reports, Project reports.
Technical Proposals:: Definition, types, characteristics, structure and significance.

UNIT- V:
Mechanics of Meetings: Preparation of agenda, participation, chairing and writing minutes of a meeting. Memorandum. Seminars, workshops and conferences.
Technical Presentations: Defining purpose, audience and locale, organizing content, preparing an outline, use of Audio Visual Aids, nuances of delivery, importance of body language and voice dynamics.

Text Book :

1. Meenakshi Raman andSangeeta Sharma, **“***Technical Communications-Principles and Practice***”,** Oxford University Press, Second Edition, 2012.
2. I..M Ashraf Rizvi, **“***Effective Technical Communication***”,** Tata McGraw Hill Education Pvt. Ltd, 2012.

16EE O02

ENERGY MANAGEMENT SYSTEMS
(ELECTIVE – V)(OPEN ELECTIVE)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course objectives: The course will introduce the students to
1. To know the concept of Energy management
2. To understand the formulation of efficiency for various engineering systems
3. To explore the different ways to design various technologies for efficient engineering systems.

Course Outcomes: After completion of this course, students will able to:
1. Know the current energy scenario and importance of energy conservation.
2. Understand the concepts of energy management.
3. Evaluate the performance of existing engineering systems
4. Explore the methods of improving energy efficiency in different engineering systems
5. Design different energy efficient devices.

UNIT-I:

BASICS OF ENERGY AND ITS VARIOUS FORMS: Overview of engineering, elements Solar energy, electricity generation methods using solar energy, PV cell, elements of wind energy, electricity generation using wind energy, elements of bio energy, bio mass energy conservation, elements of geothermal energy, sources of geothermal energy, sources of chemical energy, fuel cells, Energy Scenario in India

UNIT-II:

Energy Management - I: Defining Energy management, need for energy management, energy management techniques, importance of energy management, managing the energy consumption, energy crisis, environmental aspects

UNIT-III:

Energy Management-II: Energy management approach, understanding energy costs, bench marking, energy performance, matching energy use to requirement, optimizing the input, energy requirements, energy audit instruments, material and energy balance diagrams, energy needs of growing economy, long term energy scenario, energy pricing, energy sector reforms, energy and environment, energy security, restructuring of the energy supply sector, energy strategy for the future

UNIT-IV:

Energy Efficient Technologies-I: Importance of energy efficiency for engineers, Energy efficient technology in mechanical engineering: Heating, ventilation and air-conditioning, boiler and steam distribution systems
Energy efficient technology in civil engineering: future of roads, harnessing road and transport infrastructure;

UNIT-V:

Energy Efficient Technologies-II: Energy efficient technology in electrical engineering: Electricity billing, electrical load management and maximum demand control, power factor improvement and its benefit, selection and location of capacitors; Energy efficient technology in chemical engineering: green chemistry, low carbon cements, recycling paper

Text Books:

1. UmeshRathore, *'Energy Management'*, Kataria publications, 2nd edition, 2014.
2. "*Guide books for National Certification Examination for Energy Manager / Energy Auditors Book-1, General Aspects*".

3. Hargroves, K., Gockowiak, K., Wilson, K., Lawry, N., and Desha, C. (2014), "*An Overview of Energy Efficiency Opportunities in Mechanical/civil/electrical/chemical Engineering*", The University of Adelaide and Queensland University of Technology.

Suggested Reading:

1. "*Success stories of Energy Conservation",* BEE, New Delhi (www.bee-india.org)
2. K V Shama, P Venkataseshaiah, "*Energy Management and Conservation*", I. K. International Publishing agency pvt. ltd., 2011, ISBN: 978-93-81141-29-8

16 CE C37

COMPUTER APPLICATIONS LAB

Instruction	3 Periods per week
Duration of Semester End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	2

Course Objectives: To enable the students:

1. Gain exposure to a few software packages used in various areas of Civil Engineering (Structural Analysis & Design, Surveying, Water Supply & Sanitary Engineering, Water resources Engineering and Soil Mechanics) and the applications of these software packages.
2. Attain the fundamental knowledge of navigation of these software packages.
3. Acquire adequate conceptual knowledge and skills to use these software packages in the field in order to provide solutions to civil engineering problems
4. Provide accelerated/time bound solutions with help of these software packages without effecting the accuracy of computations
5. Understand the aspects of debugging, if errors occur while using these software packages

Course Outcomes: At the end of the course the students will be able to:

1. Model and analyse a framed structure and design all its components including isolated footings, using software.
2. Analyse pipe networks and sewer networks using software.
3. Estimate ground water flow head and velocity and also the pollutant concentration in ground water flow, using software.
4. Digitize topo sheets using GIS and also prepare Map overlays using GIS.
5. Analyse a natural slope using slope stability methods and design a cantilever retaining wall using software.

List of Exercises:

1. Modelling & analysis of framed structure.
2. Design of framed structure.
3. Design of isolated footing
4. Steady state analysis of pipe networks (open/looped) using EPANET.
5. Analysis of sewer networks.
6. Estimation of ground water flow head and velocity.
7. Estimation of pollutant concentration in groundwater flow - flow through porous media by using visual.
8. Digitization of topo sheets using GIS.
9. Map overlay using GIS.
10. Analysis of natural slope using Slope stability.
11. Design of cantilever retaining wall.

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16CE C38

PROJECT SEMINAR

Instruction		3 Hours per week
CIE	50 Marks	
Credits	2	

The objective of 'Project Seminar' is to enable the student take up investigative study in the broad field of Engineering / Technology, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on an individual basis or two/three students in a group, under the guidance of a supervisor. This is expected to provide a good initiation for the student(s) towards R&D. The work shall include:

1. Survey and study of published literature on the assigned topic;
2. Working out a preliminary Approach to the Problem relating to the assigned topic;
3. Conducting preliminary Analysis/Modelling/Simulation/Experiment/Design/Feasibility;
4. Preparing a Written Report on the Study conducted for Presentation to the Department;
5. Final Seminar, as oral Presentation before a departmental Committee.

Guidelines for the award of Marks:

Max. Marks: 50

Evaluation by	Max .Marks	Evaluation Criteria / Parameter
Supervisor	20	Project Status / Review
	5	Report
Department Committee	5	Relevance of the Topic
	5	PPT Preparation
	5	Presentation
	5	Question and Answers
	5	Report Preparation

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16CE E13

DESIGN OF STEEL STRUCTURES -II
(ELECTIVE – VI)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Codes required: IS 800 – 2007, steel tables, Bridge rules, Bridge Code (Railways)

Course Objectives: To enable the students to
1. Gain exposure to a few basic types of steel structures (Plate Girders, Gantry girders, Trussed girders etc.) and their components, used in Highway bridges , Industrial workshops and Railway bridges .
2. Attain fundamental knowledge of design of plate girder, gantry girder, steel railway bridges (plate girder & truss girder type), rocker & roller bearings and is able to interpret the specifications of relevant codes.
3. Acquire adequate conceptual knowledge and skills to extend the same to investigate into critical issues , compare various options & choose best solution for the problems in the areas of highway , industrial and railway steel structures
4. Consider economy in the design of these structures without suffering the safety, in a given situation.
5. Understand the intricacies of detailing aspects of these structures and their connections

Course Outcomes: At the end of the course the students are able to
1. Design a welded plate girder for industrial and infrastructural purpose, as per the specifications of relevant codes
2. Design a gantry girder for industrial workshops as per the specifications of relevant codes
3. Design Roller & Rocker bearings for railway bridges
4. Design and detail a deck type riveted plate girder bridge using railway code and bridge rules
5. Design and detail a through type riveted truss girder bridge using railway code and bridge rules

UNIT- I:
Design of Plate girders: Design of welded plate girder for static loads–Economical Depth, Design of Cross Section, Flange curtailment, intermediate and bearing stiffeners, connections- As per IS 800-2007

UNIT- II:
Design of Gantry girders: Basic principles, Loads, Codal provisions, Detailed Design- Cross section and connections, Drawing- general layout and cross section;

UNIT- III:
Introduction to Railway Bridges and Design of bearings: Bridges: Deck and through type bridges – Economical span – Indian standard railway broad gauge train loadings – permissible stresses. Bearings: Types and general description of various bearings, detailed Design of Rocker and roller bearings for railway bridges.

UNIT- IV:
Design of Deck type riveted plate girder railway bridges: Economical depth, detailed design of Cross section, connections, intermediate and bearing stiffeners, Wind effects-Design of Cross frames Drawing-General layout, generation of longitudinal and cross sections

UNIT- V:
Design of Through type riveted truss girder railway bridges: Truss configurations, Detailed design of stringer beams, Cross girders and Truss girders; Wind effects- Design of top lateral and bottom Lateral bracing, Portal and sway bracings; Drawing-General layout , generation of longitudinal and cross sections.

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Text Books:

1. S .K. Duggal, "*Design of Steel Structures, Limit State Method*", 2nd Edition, Tata McGraw Hill Publishing, 2014.
2. A.S Arya and J.L Ajmani, "*Design of Steel Structures*", Nem Chand & Bros, 2011.

Suggested Reading:

1. N. Subramanian, "*Design of Steel Structures, Limit State Method*", Oxford University Press, 2008.
2. Ramachandra and Virendra Gehlot, "*Design of Steel Structures*", Volume – 2, Scientific Publishers, 2008.
3. B.C. Punmia and Dr. Ashok Kumar Jain, "*Comprehensive Design of Steel Structures*", Laxmi Publications, 2015.

16CE E14

ADVANCED STEEL DESIGN
(ELECTIVE – VI)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Note: 1. IS Codes required: IS 800, Is 802, IS 805, IS 806, IS 1161.
2. For all units design philosophy is working stress method

Course Objectives: To enable the students to

1. Gain exposure to the concepts of a beam-column and grillage foundation with their applications
2. Attain fundamental knowledge on steel water tanks, understanding the codal provisions
3. Understand the significance and advantages of using tubular structures along with respective codal provisions
4. Acquire adequate conceptual knowledge on bunkers and silos and design them
5. Gain knowledge on transmission line towers, understand terminology and analyse them.

Course out comes: At the end of the course the students are able to

1. Analyse and design a beam-column and grillage foundation with detailing
2. Learn and apply the design concepts for the design of water tanks
3. To understand the nature of tubular section and their design.
4. To understand the behavior of Bunker's and Silo's and their design.
5. Learn apply basic principles of analysis of transmission towers, arrangement of member and design.

UNIT– I:
Beam Columns: Introduction, Design for Uni-axial and Bi-axial bending.
Grillage Foundations: Introduction, necessity of grillage foundations, various types, Design of Grillage foundations for axial loads under single and double columns.

UNIT- II:
Steel Tanks: Introduction, Types, loads, permissible stresses - detailed design of elevated rectangular mild steel and pressed steel tanks including staging.

UNIT- III:
Tubular Structures: Introduction – Advantages - Permissible Stresses - Design of tubular trusses - Design of tension members, compression members and flexural members including welded joints.

UNIT- IV:
Bunkers and Silos: introduction - general design principles- design theories - Janssen's Theory and Airy's Theory - Detailed design of rectangular bunkers and cylindrical silos.

UNIT- V:
Transmission Line Towers: Classification, economical spacing and design loads - IS code provisions - Calculation of wind loads and permissible stresses - Overall arrangement and design procedure - Detailed design including foundations

Text Books:

1. B.C. Punmia and Dr. Ashok Kumar Jain, "*Comprehensive Design of Steel Structures*", Laxmi Publications,2015.
2. S. Ramachandra and Virendra Gehlot, "*Design of Steel Structures Volume – 2"*, Scientific Publishers, 2008.

Suggested Reading:

1. A.S Arya and J.L Ajmani, "*Design of Steel Structures*", Nem Chand & Bros.2011.
2. S. K. Duggal, "*Design of Steel Structures*", 3rd Edition, Tata McGraw Hill Publishing, 2017.
3. P. Dayaratnam by "*Design of Steel Structures*" Orient Longman, Pub.- 2012.
4. I.C. Sayal and S. Singh, by "*Design of Steel Structures",* Standard Pub. -2009.

16CE E15

INDUSTRIAL STRUCTURES
(ELECTIVE – VI)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: To impart knowledge about the fundamentals of load calculation, mechanical behavior, design and detailing aspects of

1. Steel Gantry Girders.
2. Steel Portal and Gable Frames.
3. Bunker and silo.
4. Steel Chimney.
5. Pre-engineered buildings

Course Outcomes: At the end of the course, the student will be able to

1. Develop an understanding in basic concepts in the Design of Steel Gantry Girders. Design in accordance with Relevant Indian Standard provisions to ensure safety and serviceability
2. Analyze and design with detailing for Steel Portal and Gable Frames according to specific codal criteria.
3. Differentiate between Bunker and silo, and design the Steel Bunkers and Silos on engineering concepts which are applied in field of Structural Engineering.
4. Understand the theoretical and practical aspects of Design of Steel Chimney along with the design aspects.
5. Analyse and design a pre-engineered industrial building.

UNIT- I:
Steel Gantry Girders: Introduction, Basic principles, loads acting on gantry girder, Codal provisions, , permissible stress, types of gantry girders and crane rails, crane data, maximum moments and shears, Detailed Design of gantry girder - Cross section and connections, Drawing- general layout and cross section;

UNIT- II:
Portal Frames: Design of portal frame with hinge base, design of portal frame with fixed base - Gable Structures – Lightweight Structures

UNIT- III:
Steel Bunkers and Silos: Design of square bunker – Jansen's and Airy's theories – IS Code provisions – Design of side plates – Stiffeners – Hopper Bottom – Longitudinal beams. Design of cylindrical silo – Side plates – Ring girder – stiffeners.

UNIT- IV:
Steel Chimneys: Introduction, dimensions of steel stacks, chimney lining, breech openings and access ladder, loading and load combinations, design considerations, stability consideration, design of base plate, design of foundation bolts, design of foundation.

UNIT- V:
Pre-engineered buildings: Concepts of Pre-engineering and Pre-engineered buildings – Analysis and design of an industrial building using pre-engineered elements.

Text Books:

1. B.C. Punmia, K. K. Jain, and A. K. Jain, "*Design of Steel Structures*",., 2nd Ed., Laxmi Publishers,2015.
2. Ram Chandra, "*Design of Steel Structures*", Standard Publishers,2016.
3. Vivek K. S., Vyshnavi P, "Pre-Engineered Steel Building", Lap Lambert publishing, 2017.

Suggested Reading:

1. Subramanian, "*Design of Steel Structures*", Oxford University Press, 2106.
2. Alexander Newman, "Metal Building systems", McGraw Hill Education, 2014.

16ME O04

INTELLCTUAL PROPERTY RIGHTS
(ELECTIVE – VII)(OPEN ELECTIVE)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Objectives: Student will learn
1. Fundamental aspects of IP
2. Aspects of IPR acts.
3. Awareness of multi disciplinary audience
4. Awareness for innovation and its importance
5. The changes in IPR culture and techno-business aspects of IPR

Outcomes: At the end of the course, a student
1. Will respect intellectual property of others
2. Learn the art of understanding IPR
3. Develop the capability of searching the stage of innovations.
4. Will be capable of filing a patent document independently.
5. Completely understand the techno-legal business angle of IPR and converting creativity into IPR and effectively protect it.

UNIT-I:
Overview of Intellectual Property: Introduction and the need for intellectual property right (IPR), IPR in India – Genesis and Development, IPR abroad, Some important examples of IPR. Importance of WTO, TRIPS agreement, International Conventions and PCT
Patents: Macro economic impact of the patent system, Patent and kind of inventions protected by a patent, Patent document, How to protect your inventions. Granting of patent, Rights of a patent, how extensive is patent protection. Why protect inventions by patents. Searching a patent, Drafting of a patent, Filing of a patent, the different layers of the international patent system, (national, regional and international options), compulsory licensing and licensers of right & revocation, Utility models, Differences between a utility model and a patent. Trade secrets and know-how agreements

UNIT-II:
Industrial Designs: What is an industrial design. How can industrial designs be protected? What kind of protection is provided by industrial designs? How long does the protection last? Why protect industrial designs?

UNIT-III:
Trademarks: What is a trademark, Rights of trademark? What kind of signs can be used as trademarks. Types of trademark, function does a trademark perform, How is a trademark protected? How is a trademark registered. How long is a registered trademark protected for? How extensive is trademark protection. What are well-known marks and how are they protected? Domain name and how does it relate to trademarks? Trademark infringement and passing off.

UNIT-IV:
Copyright: What is copyright. What is covered by copyright. How long does copyright last? Why protect copyright? Related Rights: what are related rights? Distinction between related rights and copyright. Rights covered by copyright? Copy rights in computer programming.

UNIT-V:
Enforcement of Intellectual Property Rights: Infringement of intellectual property rights Enforcement Measures Emerging issues in Intellectual property protection. Case studies of patents and IP Protection.
Unfair Competition: What is unfair competition? Relationship between unfair competition and intellectual property laws.

Text Books:

1. Ajit Parulekar and Sarita D' Souza, "*Indian Patents Law – Legal & Business Implications*", Macmillan India ltd , 2006
2. B. L.Wadehra; "*Law Relating to Patents, Trade Mar[illegible] esigns & Geographical Indications*", Universal law Publishing Pvt. Ltd., India 2000
3. P. Narayanan, *"Law of Copyright and Industrial De[illegible]* aw House, Delhi 2010

Suggested Reading:

1. W.R1 Cronish, "*Intellectual Property; Patents, copyright, Trad and Allied rights*", Sweet & Maxwell, 1993.
2. P. Narayanan, "*Intellectual Property Law*", Eastern Law Edn., 1997.
3. Robin Jacob and Daniel Alexander, "*A Guide Book to Intellectual Property Patents, Trademarks*, Copy rights and designs", 4/e, Sweet, Maxwell,.

16EG O02

GENDER SENSITIZATION

(ELECTIVE – VII)(OPEN ELECTIVE)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course will introduce the students to

1. To develop students' sensibility with regard to issues of gender in contemporary India.
2. To provide a critical perspective on the socialization of men and women.
3. To expose the students to debates on the politics and economics of work. To help students reflect critically on gender violence.

Course Outcomes: After successful completion of the course the students will be able to

1. Develop a better understanding of important issues related to what gender is in contemporary India.
2. Be sensitized to basic dimensions of the biological, sociological, psychological and legal aspects of gender. This will be achieved through discussion of materials derived from research, facts, everyday life, literature, and film.
3. Attain a finer grasp of how gender discrimination works in our society and how to counter it. Students will acquire insight into the gendered division of labour and its relation to politics and economics.
4. Understand what constitutes sexual harassment and domestic violence and be made aware of New forums of Justice.
5. Draw solutions as to how men and women, students and professionals can be better equipped to work and live together as equals.

UNIT – I:
Understanding Gender:
Gender: Why Should We Study It? (*Towards a World of Equals*: Unit -1)
Socialization: Making Women, Making Men (*Towards a World of Equals*: Unit -2)
Introduction.Preparing for Womanhood.Growing up Male.First lessons in Caste.DifferentMasculinities.

UNIT – II:
Gender And Biology:
Missing Women: Sex Selection and Its Consequences (*Towards a World of Equals*: Unit -4)
Declining Sex Ratio.Demographic Consequences.
Gender Spectrum: Beyond the Binary (*Towards a World of Equals*: Unit -10)
Two or Many?Struggles with Discrimination.

UNIT – III:
Gender andLabour:
Housework: the Invisible Labour (*Towards a World of Equals*: Unit -3)
"My Mother doesn't Work." "Share the Load."
Women's Work: Its Politics and Economics (*Towards a World of Equals*: Unit -7)
Fact and Fiction.Unrecognized and Unaccounted work. Additional Reading: Wages and Conditions of Work.

UNIT-IV:
Issues Of Violence
Sexual Harassment: Say No! (*Towards a World of Equals*: Unit -6)
Sexual Harassment, not Eve-teasing- Coping with Everyday Harassment- Further Reading:"*Chupulu*".
Domestic Violence: Speaking Out (*Towards a World of Equals*: Unit -8)
Is Home a Safe Place? -When Women Unite [Film]. Rebuilding Lives. Additional Reading: New Forums for Justice.
Thinking about Sexual Violence (*Towards a World of Equals* [illegible])
Blaming the Victim-"I Fought for my Life…." - Additional R[illegible]ste Face of Violence.

UNIT – V:

Gender: Co - Existence
Just Relationships: Being Together as Equals (*Towards a World of Equals*: Unit -12)
Mary Kom and Onler. Love and Acid just do not Mix. Love Letters. Mothers and Fathers.
Additional Reading: Rosa Parks-The Brave Heart.

Textbook:

1. A. Suneetha, Uma Bhrugubanda, DuggiralaVasanta, Rama Melkote,VasudhaNagaraj, AsmaRasheed, GoguShyamala, DeepaSreenivas and Susie Tharu **"***Towards a World of Equals: A Bilingual Textbook on Gende***r"** published by Telugu Akademi, Hyderabad, Telangana State, **2015**.

Suggested Reading:

1. Menon, Nivedita. Seeing like a Feminist. New Delhi: Zubaan-Penguin Books, 2012
2. AbdulaliSohaila. **"***I Fought For My Life…and Won***."**Available online at: http://www.thealternative.in/lifestyle/i-fought-for-my-lifeand-won-sohaila-abdulal/

Web Resources:
1. https://aifs.gov.au/publications/gender-equality-and-violence-against-women/introduction
2. https://theconversation.com/achieving-gender-equality-in-india
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Note: Since it is an Interdisciplinary Course, Resource Persons can be drawn from the fields of English Literature or Sociology or Political Science or any other qualified faculty who has expertise in this field from engineering departments.

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16CS O09

BASICSOF ARTIFICIAL INTELLIGENCE
(ELECTIVE – VII)(OPEN ELECTIVE)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Basic Mathematics.

Course Objectives: The main objectives of this course are:

1. Provide a strong foundation of fundamental concepts in Artificial Intelligence.
2. Discuss the various paradigms involved in solving an AI problems which involve perception, reasoning and learning
3. Apply the AI concepts to build an expert system to solve the real-world problems.

Course Outcomes: On Successful completion of this course, student will be able to

1. Differentiate between a rudimentary Problem and an AI problem, it's Characteristics and problem-solving Techniques.
2. Compare and contrast the various knowledge representation schemes of AI.
3. Understand and analyze the various reasoning and planning techniques involved in solving AI problems.
4. Understand the different learning techniques.
5. Apply the AI techniques to solve the real-world problems.

UNIT – I:

Introduction: Definition, history, applications. **Problem Solving:** AI problems, AI Technique, Defining problem as a State-Space Search, Problem Characteristics. Heuristic Search Techniques: Generate–and–test, Hill Climbing, Constraint Satisfaction.

UNIT – II:

Knowledge Representation (Logic): Representing facts in logic, proposition logic, predicate logic, resolution and unification. **Knowledge Representation (Structured):** Declarative representation, Semantic nets, procedural representation, frames.

UNIT – III:

Reasoning: Probability and Bayes theorem, Certainty factors and Rule based systems, Bayesian Networks, Dempster-Shafer Theory. **Planning:**Components, goal stack planning, nonlinear planning, hierarchical planning.

UNIT – IV:

Learning: Introduction, Rote learning, learning by taking advice, learning in problem solving and learning from examples: Decision tree. **Intelligent Agents:** Classification, Working of an agent, single agent and multi agent systems, multi agent application.

UNIT - V

Expert System: Representing and Using Domain Knowledge, Expert systems shells, Explanation, Knowledge Acquisition. **Perception and Action:** Real Time Search, Vision, Speech Recognition, ACTION: Navigation, Manipulation, Robot architectures.

Text Books:

1. Elaine Rich, Kevin Night, Shivashankar B Nair, "*Artificial Intelligence*", 3rd Edition, 2008
2. Russell Norvig, "*Artificial Intelligence-Modern Approach*", 3rd edition, 2010.

Suggested Reading:

1. Saroj Kaushik, "*Artificial Intelligence*", Cengage Learning India, 2012.
2. Nelson M. Mattos, " *An Approach to Knowledge Base Management*", Springer Berlin Heidelberg, 1991.

Online Resources:

1. http://nptel.ac.in/courses/106106126/
2. http://nptel.ac.in/courses/106105077/

16EE O05

WASTE MANAGEMENT
(ELECTIVE – VII)(OPEN ELECTIVE)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:
1. To Imbibe the concept of effective utilization of any scrap
2. To Become familiar with the processes of all disciplines of engineering.
3. To Learn the technique of connectivity from waste to utility.

Course outcomes: After completion of this course, students will be able to:
1. Understand the various processes involved in allied disciplines of engineering
2. Infer the regulations of governance in managing the waste
3. Distinguish the nature of waste materials concerned to the particular branch of engineering
4. Explore the ways and means of disposal of waste material
5. Identify the remedies for the disposal of a selected hazardous waste material

UNIT-I:
Introduction to waste management: Relevant Regulations Municipal solid waste (management and handling) rules; hazardous waste (management and handling) rules; biomedical waste handling rules; fly ash rules; recycled plastics usage rules; batteries (management and handling) rules. Municipal Solid Waste Management – Fundamentals Sources; composition; generation rates; collection of waste; separation, transfer and transport of waste; treatment and disposal options.

UNIT-II:
Hazardous Waste Management : Fundamentals Characterization of waste; compatibility and flammability of chemicals; fate and transport of chemicals; health effects, Radioactive Waste Management – Fundamentals Sources, measures and health effects; nuclear power plants and fuel production; waste generation from nuclear power plants; disposal options.

UNIT-III:
Environmental Risk Assessment: Defining risk and environmental risk; methods of risk assessment; case studies, Physicochemical Treatment of Solid and Hazardous Waste Chemical treatment processes for MSW (combustion, stabilization and solidification of hazardous wastes); physicochemical processes for hazardous wastes (soil vapor extraction, air stripping, chemical oxidation); ground water contamination and remediation

UNIT-IV:
Biological Treatment: Solid and Hazardous Waste Composting; bioreactors; anaerobic decomposition of solid waste; principles of biodegradation of toxic waste; inhibition; co-metabolism; oxidative and reductive processes; slurry phase bioreactor; in-situ remediation.

UNIT-V:
Landfill design aspects: Landfill design for solid and hazardous wastes; leachate collection and removal; landfill covers; incineration

Text Books:
1. John Pichtel," *Waste Management Practices*", CRC Press, Taylor and Francis Group 2005.
2. LaGrega, M.D.Buckingham,P.L. and Evans, J.C. "*Hazardous Waste Management*", McGraw Hill International Editions, New York, 1994
3. Richard J. Watts, "*Hazardous Wastes - Sources, Pathways*", Receptors John Wiley and Sons, New York, 1997

Suggested Reading:
1."*Basics of Solid and Hazardous Waste Mgmt* Tech", KantiL.Shah 1999, Prentice Hall.
2. "*Solid and Hazardous Waste Management* ", 2007 by S.C.Bhatia Atlantic Publishers & Dist.

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16CE E16

HEALTH MONITORING AND RETROFITTING OF STRUCTURES
(ELECTIVE – VIII)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course objectives: To enable the students to
1. Understand SHM as a way of monitoring health of a structure using smart materials
2. Learn and apply the various vibration based techniques for monitoring the health of the structure
3. Learn and apply the various capacitive sensing techniques for structures
4. Comprehend the methods of condition assessment of damages in buildings and to learn the different non-destructive evaluation and testing methods
5. Learn about implementation of health monitoring in different types of structures

Course Outcomes: At the end of the course the graduate should be able to
1. Interpret SHM as a way of monitoring the health of a structure using smart materials
2. Select and implement an appropriate vibration based technique for health monitoring of a structure
3. Select and implement an appropriate capacitive sensing technique
4. Perform condition assessment survey of damaged/ existing buildings and to identify possible defects in a concrete structure and suggest necessary repairs
5. Implement various health monitoring techniques for different types of structures for different situations

UNIT – I:
Introduction of Structural Health Monitoring (SHM) : Introduction, definition of structural health monitoring (SHM), basic components of SHM, Passive and Active SHM, Relationship between SHM – NDE(Non- Destructive Evaluation) and NDECS (Non- Destructive Evaluation of Co-operative Structures), materials for sensor design.

UNIT – II:
Vibration based techniques used for structural health monitoring: SHM using vibration based technique – Introduction – Local and global methods – Applications, SHM using fiber optic sensors – Applications, SHM using Low Frequency Electromagnetic Techniques – Introduction – Applications to the NDE /NDT domain & SHM domain.

UNIT – III:
Capacitive Method: Introduction of capacitive methods, the principle, types of capacitive sensing, capacitive probe for cover concrete – Capacitive sensing in bridges (case studies), Applications for external post – tensioned cables.

UNIT – IV:
Conditions Survey, NDE and NDT of Concrete Structures: Definition and objective of condition survey, stages of conditions survey – planning, inspections and testing stages, possible defects in concrete structures, quality control of concrete structures, NDT techniques- rebound hammer, infra-red thermography, ground penetration technique, ultra-sonic pulse velocity test and Windsor probe test, calibration of NDT equipment and safety audit, semi destructive testing – core cutting.

UNIT – V:
Case studies on structures: Historical buildings, Special structures – bridges, dams, tunnels, high rise buildings.

Text Books:
1. Daniel Balageas and Claus–Peter Fritzen, "*Structural Health Monitoring*", published by ISTE Ltd., U.K .2006.
2. V.M. Malhotra, "*In Situ/Non-destructive Testing of Concrete (Publication, Sp-82)"*, published by Amer Concrete Inst 1984.

Suggested Reading:
1. Hua- Peng Chen, "*Structural Health monitoring of large engineering structures*", published by Wiley-Blackwell, 2018.
2. "*Guide book on Non-destructive testing of concrete* ning course, series no.17, International Atomic Agency, Vienna 2002.
3. Jean-Paul Balayssac and Vincent Garnier, "*Non Des ion and evaluation of civil engineering structures"*, published by ISTE Press – Elsevier, 2017.

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16CE E17

GROUND WATER HYDROLOGY
(ELECTIVE - VIII)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course objectives: The student should able to understand
1. Basics of groundwater hydrology, familiar with aquifer parameters.
2. Unsteady flow and its flow computation.
3. Exploring groundwater through surface and subsurface methods.
4. Artificial recharge and causes, methods of recharge.
5. Various models in groundwater, quality of groundwater, pollutant transport.

Course outcomes: The student should able to
1. Assess groundwater potential and head.
2. Estimate hydraulic conductivity and storage coefficient for time variant flow.
3. Investigate groundwater availability for a given area.
4. Plan and design artificial recharge.
5. Construct model and analyze groundwater flow.

UNIT- I:
Introduction : Occurrence of groundwater, rock properties effecting groundwater, groundwater basin, ground water in hydraulic cycle, vertical distribution of ground water, Hydrologic balance equation, types of aquifers, unconfined, confined and leaky aquifers. Darcy's law and limitations, compressibility of aquifer, aquifer parameters, specific yield, safe yield, general equation of ground water flow, steady unidirectional flow. Steady radial flow to a well in unconfined and confined aquifers. Steady flow with uniform recharge.

UNIT- II:
Unsteady radial flow to a well: Non equilibrium equation for pumping tests. This method of solution, Cooper Jacob method, Chow's methods of solution.Law of times, well flow near aquifer boundaries, Image well theory, multiple well systems, well losses, pumping and recuperation tests.

UNIT- III:
Geophysical Exploration: Surface investigations, of ground water – electrical resistivity method, seismic refraction method, gravity and magnetic methods, geologic methods, dowsing. Subsurface Investigations – test drilling, resistivity logging, potential logging, Temperature logging, caliper logging, Interpretation of logs and selection of site as a well.

UNIT- IV:
Artificial Recharge of groundwater: Methods of recharge, water spreading, sewage discharge, recharge through pits and shafts, recharge through well, induced recharge.
Sea water intrusion in coastal aquifers, occurrence, Ghyben – Herzberg relation, shape of fresh – salt water interface, Length of the intruded sea water wedge. Prevention and control of sea water intrusion.

UNIT –V:
Modelling techniques: Introduction, porous media, analog, viscous, membrane, thermal, blotting paper models. Numerical modelling and solutions. Finite difference method.
Quality of groundwater: Sources and Pollution of groundwater, groundwater quality criteria, distribution and evaluation of groundwater pollution, pollutant transport and modelling of pollutant transport.

Text Books:

1. D.K. Todd, "*Ground Water Hydrology",* John Wiley & Sons, Inc., USA, 2015
2. H.M. Raghunath, "*Ground Water*", Wiley Eastern Limited, New Delhi, 2007.

Suggested Reading:

1. Bouwer, "*Ground Water Hydrology*", Mc. Graw Hill, Newyork, 2013
2. A. K. Rastogi, "*Numerical Groundwater Hydrology*", Penram International Publishing, Mumbai, 2007.
3. Bear J, "*Hydraulics of Ground Water*", Mc-Graw Hill, Newyork, 2013.

16CE E18

PRE-STRESSED CONCRETE
(ELECTIVE - VIII)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: To enable the student to

1. The aim of this course is to introduce students to the basic principles about structural behaviour, of pre stressed concrete structures, with reference to IS 1343 code
2. The objective is to equip the students with a thorough understanding of the behaviour and analysis, design of prestressed concrete beam, slab and column.
3. Various time dependent factors, such as cracking, creep and shrinkage of concrete, and prestress losses, are discussed thoroughly.
4. Background to design equations and relevant modern research will also be discussed to provide the students with solid understanding of the topics covered.
5. To provide students with an opportunity to enhance their skills in pre stressed concrete design and applications. The specific implication, to the serviceability and ultimate limit states are covered.

Course outcomes: On successful completion of this course

1. Students will understand the general mechanism of pre stressed concrete members, types of pre stressing, losses in pre stressing, short and long term deflections in P.S.C members.
2. Students will be able to evaluate the behaviour of pre stressed concrete structures,
3. Students will be able to analyze and design of pre stressed concrete structures using serviceability limit states.
4. Student will be able to analyze and design for shear in P.S.C members.
5. Student will be able to analyze the stresses in anchorage zones and design the end anchorages

UNIT- I:
General Principles of Pre Stressed Concrete:
Introduction: Basic concepts – Materials - permissible stresses – Advantages – pre-tensing and post tensing – Pre Stressing by straight Concentric, Eccentric bent and Parabolic Tendons – Different methods of Pre stressing – Hoyer System – Freyssinet system – Magnel – Blaton system – Lee Mecal system – Use of IS 1343 code, concepts of precast and post tensioned elements.
Losses of Pre stress: Losses in P.S.C. members due to elastic shortening – Shrinkage – Creep in Concrete – Relaxation of Steel – Slip in anchorage – Frictional Loss – Computation of losses.

UNIT – II:
Analysis: Analysis of sections for pre stress and flexure. Deflections of P.S.C members: Importance of deflections - factors influencing deflections, short term and long term deflections – IS code requirements for Maximum deflections – Computation of deflection due to pre stressing force – Dead and live loads – Different cases of loading.

UNIT – III:
Design of Section for Flexure: Allowable stresses – Elastic Design and Limit state method of Design of Rectangular – I Section beams for Flexure – Kern of section – Pressure Line – Cable Profile – IS 1343 Codal Provisions – Check for ultimate flexural strength.
Design of Section for Shear and Torsion: Shear and principal stresses – Cracked and uncracked sections – Codal provisions – Ultimate shear resistance – Design of shear reinforcement in beams – Design of torsional reinforcement in beams.

UNIT – IV:
Anchorage Zone stress in post tensioned members: Stress distribution in End block – A analysis by Magnel and Guyon's methods – IS 1343 code provisions – Bursting Tensile force – Design of anchorage zone reinforcement.

UNIT – V:
Continuous beams: Advantage and Disadvantages – Primary and Secondary moment – P and C lines– Liner transformation concordant and Non concordant cable profile - Analysis and Design of Continuous beams.
Floor slabs: Analysis and design of one way slab and two way slab

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Text Books:

1. N. Krishna Raju ,"*Prestressed Concrete*" , Tata Mc Graw Hill,2018
2. G.S. Pandit and S.P. Gupta, "*Prestressed Concrete*", CBS Pub., 2009.

Suggested Reading:

1. Arthur H. Nilson, "*Design of Prestressed Concrete*", John Wiley 1987.
2. T.Y Lin and Burn," *Design of prestressed Concrete*",Wiley India Private Limited, 2010.

16CE C39

SEMINAR

Instruction 3Hours per week
CIE 50 Marks
Credits 2

The goal of a seminar is to introduce students to critical reading, understanding, summarizing, explaining and preparing report on state of the art topics in a broad area of his/her specialization. Seminar topics may be chosen by the students with advice from the faculty members and the student shall read further relevant articles in the domain.

The seminar must be clearly structured and the power point presentation shall include following aspects:

1. Introduction to the field
2. Literature survey
3. Consolidation of available information
4. Summary and Conclusions
5. References

Each student is required to:

1. Submit a one page synopsis of the seminar talk for display on the notice board.
2. Deliver the seminar for a maximum duration of 30 minutes, where the presentation should be for 20 minutes in PowerPoint, followed by Question and Answers session for 10 minutes.
3. Submit the detailed report of the seminar in spiral bound in a précised format as suggested by the department.

Seminars are to be scheduled from 3rd week to the last week of the semester and any change in schedule shall be discouraged.

For the award of Sessional marks students are judged by three (3) faculty members and are based on oral and written presentations as well as their involvement in the discussions during the oral presentation.

Note: Topic of the seminar shall preferably be from any peer reviewed recent journal publications.

Guidelines for awarding marks		
Sl No.	Description	Max Marks
1.	Contents and relevance	10
2.	Presentation skills	10
3.	Preparation of PPT slides	05
4.	Questions and answers	05
5.	Report in a prescribed format	20

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16CE C40

PROJECT

Instruction		6 Hours per week
CIE	50 Marks	
Semester End Examination	100 Marks	
Credits	6	

The object of Project is to enable the student extend further the investigative study, either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry. This is expected to provide a good training for the student(s) in R&D work and technical leadership. The assignment to normally include:

1. In depth study of the topic assigned;
2. Review and finalization of the Approach to the Problem relating to the assigned topic;
3. Preparing an Action Plan for conducting the investigation, including team work;
4. Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed;
5. Final development of product/process, testing, results, conclusions and future directions;
6. Preparing a paper for Conference presentation/ Publication in Journals, if possible;
7. Preparing a Dissertation in the standard format for being evaluated by the Department.
8. Final Seminar presentation before Departmental Committee.

Guidelines for the award of marks in CIE: (Max. Marks: 50)

Evaluation by	Max .Marks	Evaluation Criteria / Parameter
Department Review Committee	05	Review 1
	08	Review 2
	12	Submission
Supervisor	05	Regularity and Punctuality
	05	Work Progress
	05	Quality of the work which may lead to publications
	05	Report Preparation
	05	Analytical / Programming / Experimental Skills

Guidelines for awarding marks in SEE: (Max. Marks: 100)

Evaluation by	Max .Marks	Evaluation Criteria / Parameter
External and Internal Examiners together	20	Power Point Presentation
	40	Thesis Evaluation
	20	Quality of the project • Innovations • Applications • Live Research Projects • Scope for future study • Application to society
	20	Viva-Voce

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