Scheme of Instruction and Syllabi

of

BE VII to VIII SEMESTERS

of

FOUR YEAR DEGREE COURSE

in

ELECTRONICS AND COMMUNICATION ENGINEERING

(AICTE Model Curriculum with effect from AY 2020-21)

R-20 Regulation

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY

(Autonomous Institution under UGC, Affiliated to Osmania University)
Department of Electronics & Communication Engineering
Accredited by NBA and NAAC-UGC,
Chaitanya Bharathi (Post), Gandipet, Hyderabad–500075

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

OUR MOTTO: SWAYAM TEJASWIN BHAVA

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 emerge as a vibrant model of excellence in education, research and innovation in Electronics and Communication Engineering.	
Department Mission	M1	To impart strong theoretical and practical knowledge of the state of art technologies to meet growing challenges in the industry
	M2	To carry out the advanced and need based research in consultation with the renowned research and industrial organizations.
	M3	To create entrepreneurship environment including innovation, incubation and encourage to patent the work
PEO 1		Engage successfully in professional career and/or pursue higher education in Electronics and Communication and allied areas.
PEO 2		Pursue research, design and development of state-of-the art systems applying the knowledge of Electronics and Communication engineering
PEO 3		Begin start-ups and involve in entrepreneurship activities by adopting changing professional and societal needs.
PEO 4		Exhibit professional ethics and values with lifelong learning and work effectively as individuals/team members in multidisciplinary projects.
PSO 1		Ability to apply the acquired knowledge of core subjects in design and development of Communications/Signal processing/ VLSI/ Embedded systems.
PSO 2		Analyze and solve the complex Electronics and Communication engineering problems using state-of-art hardware and software tools
PSO 3		Develop innovative technologies for Entrepreneurship based on the research outcomes of Electronics and Communication engineering.

Program Outcomes of B.E (ECE) Program

1. Engineering Knowledge	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization for the solution of complex engineering problems
2. Problem Analysis	Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. Design/Development of Solutions	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations.
4. Conduct Investigations of Complex Problems	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. Modern Tool Usage	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling to complex engineering activities, with an understanding of the limitations.
6. The Engineer and Society	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. Environment and Sustainability	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. Individual and Teamwork	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. Communication	Communicate effectively on complex engineering activities with the engineering community and with the society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. Project Management and Finance	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. Life-long Learning	Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

AICTE Model Curriculum with effect from AY 2023-24

B.E (Electronics and Communication 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	20ECC27	Computer Networks	3	-	-	3	40	60	3
2	20ECC28	Microwave and Radar Engineering	3	-	-	3	40	60	3
3		Professional Elective-VI	3	-	-	3	40	60	3
4		Open Elective-II	3	-	-	3	40	60	3
5	20EGM04	Gender Sensitization	2	-	-	2	-	50	Non-Credit
PRACTICALS									
6	20ECC29	Computer Networks Lab	-	-	2	3	50	50	1
7	20ECC30	IoT and Simulation Lab	-	-	2	3	50	50	1
8	20ECC31	Microwave Engineering Lab	-	-	2	3	50	50	1
9	20ECC32	Project: Part-1	-	-	4	-	50	-	2
10	20ECI03	Industrial Internship	5-6 Weeks/135 Hours				50	-	3
Total			**14**	**-**	**10**	**23**	**410**	**440**	**17+3**
Clock Hours Per Week: 24									

L: Lecture **D: Drawing** **CIE: Continuous Internal Evaluation**

T: Tutorial **P: Practical/Project Seminar/Dissertation** **SEE: Semester End Examination**

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

AICTE Model Curriculum with effect from AY 2023-24

B.E (Electronics and Communication Engineering)

SEMESTER – VII

List of Courses in Professional Elective-VI		List of Courses in Open Elective-II	
Course code	**Title of the Course**	**Course code**	**Title of the Course**
20ECE31	VLSI Technology	20CEO02	Disaster Risk Reduction and Management
20ECE32	Mobile Adhoc and Sensor Networks	20MEO04	Principles of Entrepreneurship
20ECE33	Speech Processing	20CSO01	Fundamentals of Virtual Reality
20ECE34	IoT and its Applications	20ADO01	Introduction to Python Programming
20ECE35	Remote Sensing	20EGO01	Technical Writing Skills
20ECE36	Network Security	20CSO02	Introduction to Web Technology

20EC C27

COMPUTER NETWORKS

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: A course on digital communications is required.

Course Objectives: This course aims to:

1. Understand the general overview of the concepts and fundamentals of computer networks.
2. Familiarize the students with the standard models for the layered approach to communication between machines in a network and the protocols of the various layers.
3. Learn the Routing, congestion control algorithms and application layer protocols.

Course Outcomes: Upon completion of this course, students will be able to:

1. Relate the communication tasks with basic concept of networking, protocols and Service models at different layers and Interpret the Design issues of Data link layer using protocols and services.
2. Apply random accessing Protocols for Medium Access Control.
3. Examine the performance of network and Internetworking with routing algorithms and the congestion control approaches.
4. Understand the transport layer and Application Layer concepts.
5. Demonstrate the Application layer Protocols.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PSO2	PSO3
CO1	3	3	3	2	1	3	1	1	1	1	1	3	3	2	3
CO2	3	3	3	3	1	2	2	2	1	2	2	3	3	2	3
CO3	3	2	3	3	1	2	2	1	2	1	2	3	3	2	3
CO4	2	2	2	3	1	2	2	2	1	2	1	3	3	2	3
CO5	3	2	3	2	1	3	2	1	2	1	1	3	3	2	3

UNIT-I

Introduction: History and development of computer networks, Network topologies, Types of Networks: PAN, LAN, MAN, WAN. Network software, OSI, TCP/IP Reference models, Example Networks: ARPANET, Internet.

Data Link Layer: Design issues, framing, Error detection and correction. Elementary data link protocols: simplex protocol, A simplex stop and wait protocol for an error-free channel, A simplex stop and wait protocol for noisy channel. Sliding Window protocols: A one-bit sliding window protocol, A protocol using Go-Back-N, A protocol using Selective Repeat, Example data link protocols - HDLC, the data link layer in the internet.

UNIT-II

Medium Access sub layer: The channel allocation problem, Multiple access protocols: ALOHA, Carrier sense multiple access protocols, collision free protocols. Concepts of Local Area Networking technologies such as Zigbee, BT, WLAN. Data link layer switching. Ethernet, Data Link Layer switching, Wireless LAN. Broadband Wireless, Bluetooth

UNIT-III

Network Layer: Design issues, Routing algorithms: shortest path routing, Flooding, Hierarchical routing, Broadcast, Multicast, distance vector routing, Congestion Control Algorithms, Quality of Service, Internetworking, the Network layer in the internet (IPv4 and IPv6).

UNIT-IV

Transport Layer: Transport Services, Elements of Transport protocols, Internet transport layer protocols: UDP and TCP. **Application Layer:** Domain Name System, electronic mail, World Wide Web: architectural overview, dynamic web document and HTTP.

UNIT-V

Application Layer Protocols: Simple Network Management Protocol, File Transfer Protocol, Simple Mail Transfer Protocol, Telnet.

Text Books:

1. Andrew Tanenbaum and D. Wetherall, "Computer networks", 5th Edition, Prentice-Hall, 2011.
2. J.F. Kurose and K. W. Ross, "Computer Networking – A top-down approach featuring the Internet", Pearson Education, 3rd Edition, 2005.
3. William Stallings, "Data and computer communications", Prentice Hall, 8th Edition,2007.

Suggested Reading:

1. B. A. Forouzan, "Data Communications and Networking", Tata McGraw Hill, 4th Edition,2007.
2. L. Peterson and B. Davie, "Computer Networks – A Systems Approach", Elsevier Morgan Kaufmann Publisher, 5th Edition, 2011.
3. S. Keshav, "An Engineering Approach to Computer Networking", Pearson Education, 2nd Edition, 2001.

20EC C28

MICROWAVE AND RADAR ENGINEERING

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: Knowledge of Electromagnetics and Antennas

Course Objectives: This course aims to:

1. To understand the importance of microwaves and their applications.
2. To understand the principle and operation of microwave sources.
3. To understand principle and operation of different radar systems.

Course Outcomes: Upon completion of this course, students will be able to:

1. Apply the wave equations and their solutions to analyze the waves in the waveguides.
2. Determine the scattering matrix for various microwave components.
3. Analyze the interaction of electron beam and RF field for various microwave sources.
4. Examine the principles of operation of pulse, CW and MTI radar system.
5. Compare different types of tracking radars.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	2	-	2	2	2	-	2	1	1	3	3	2
CO2	3	3	2	2	1	1	1	1	1	-	1	1	3	2	2
CO3	3	3	3	2	1	2	2	2	1	1	2	2	3	2	2
CO4	3	3	2	2	2	1	1	1	1	1	1	2	3	2	2
CO5	3	2	2	2	1	2	-	-	-	-	-	1	3	2	2

Unit-I

Introduction to Microwaves: Microwave frequency spectrum, Advantages and Applications of Microwaves.

Rectangular Waveguides: Rectangular waveguides, TM and TE waves, Impossibility of TEM wave in waveguides. Wave Impedance. Circular Wave guides Concepts.

Microwave Cavities: Rectangular and Circular Cavity Resonators, Quality factor and applications of cavity resonators.

Unit-II

Microwave Circuits and Components: Concept of microwave hybrid circuit, Introduction to scattering parameters. Properties and S-parameters of reciprocal components – E and H Plane Tees, Magic Tee, Directional Coupler.

Non Reciprocal Components: Ferrites – Composition and Faraday Rotation; Ferrite Components – Isolators, Gyrators and Circulators. S- Parameters of Isolator and Circulator.

Unit-III

Microwave Tubes: Limitations of Conventional Tubes at Microwave Frequencies. Principles of Gunn Diode.

O-type tubes: Two cavity klystron, velocity modulation process, bunching process. Output power and efficiency. Reflex Klystron-Velocity Modulation, Power out and efficiency, Electronic admittance.

Helix TWT: Slow Wave Structures, Principles of Operation and Applications of TWT (qualitative treatment only). Concepts of Magnetron.

Unit- IV

Radar Systems: Introduction to radar, radar block diagram, and operation, radar frequencies, Applications of radar, Radar range Equation, 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-V

Radar Types: Doppler effect, CW radar, FM CW radar, multiple frequencies CW radar. MTI radar, delay line canceller, range-gated MTI radar, blind speeds, staggered PRF. Principles of Tracking radar. Concepts of SAR and its applications Fundamentals of EMI and EMC, Surveillance Radar, Applications and Advantages. Introduction to Electronic warfare: ECM and ECCM.

Text Book:

1. Samuel Y. Liao, "Microwave Devices and Circuits", 3/e, Pearson Education, 2003.
2. Merril. I. Skolnik, "Introduction to Radar Systems", 2/e, MGH, 2001.
3. V. Prasad Kodali, Engineering Electromagnetic Compatibility: Principles, Measurements, and Technologies, Wiley-IEEE Press, IEEE, 2001

Suggested Readings:

1. Rizzi P, "Microwave Devices and Circuits", 3/e, Pearson Education, 2003.

20EC E31

VLSI TECHNOLOGY

(Professional Elective-VI)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 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. Describe the various processing steps (including base materials, layers, clean room) involved in the IC fabrication.
2. Illustrate the crystal growth, wafer processing and cleaning methods.
3. Analyze the oxidation and lithography processes with its parameters
4. Explain the doping and etching methods used in IC fabrication
5. Outline the deposition, packaging and testing concepts applied for VLSI circuits

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	-	-	-	-	-	-	-	-	1	1	-	1
CO2	3	2	2	1	1	-	-	-	-	-	-	1	2	1	1
CO3	3	3	2	2	1	-	-	-	-	-	-	1	3	2	2
CO4	3	3	2	1	1	-	-	-	-	-	-	1	3	1	2
CO5	3	1	2	1	1	-	-	-	-	-	-	1	2	1	2

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 SiO2, 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 Annealing Ion 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 and Bonding and Packaging,

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", McGraw hill 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.

20EC E32

MOBILE ADHOC AND SENSOR NETWORKS

(Professional Elective-VI)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: A course on Computer Networks is required.

Course Objectives: This course aims to:

1. Learn Adhoc network and Sensor Network fundamentals.
2. Familiarize the protocols developed for Adhoc and sensor networks
3. Learn the security issues possible in Adhoc and Sensor networks.

Course Outcomes: Upon completion of this course, students will be able to:

1. Understand the concepts of Ad Hoc Networks and Wireless Sensor Networks.
2. Analyse different routing algorithm for Ad Hoc Networks and Wireless Sensor Networks.
3. Acquire the knowledge of various protocols of Mobile Ad Hoc and Sensor Networks
4. Discuss various security practices in Ad Hoc and sensor networks.
5. Comprehend various sensor network platforms, tools and applications.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	1	1	1	1	2	3	1	2	2	2	2
CO2	3	3	2	2	2	1	1	1	2	2	1	2	2	1	2
CO3	3	3	3	3	3	1	1	1	3	3	1	2	3	3	3
CO4	3	3	3	3	2	1	1	1	2	2	1	2	3	3	2
CO5	2	2	1	2	2	1	1	1	2	1	1	2	3	3	3

UNIT I

AD HOC NETWORKS – INTRODUCTION AND ROUTING PROTOCOLS

Elements of Ad hoc Wireless Networks, Issues in Ad hoc wireless networks, Example of commercial applications of Ad hoc networking, Ad hoc wireless Internet, Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks, Classifications of Routing Protocols, Table Driven Routing Protocols - Destination Sequenced Distance Vector (DSDV), On-demand Routing protocols – Ad hoc On-demand Distance Vector Routing (AODV).

UNIT II

SENSOR NETWORKS – INTRODUCTION & ARCHITECTURES

Challenges for Wireless Sensor Networks, Enabling Technologies for Wireless Sensor Networks, WSN application examples, Single-Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes, Network Architecture - Sensor Network Scenarios, Transceiver Design Considerations, Optimization Goals and Figures of Merit.

UNIT III

Specialized Features of WSN

Sensor deployment mechanisms, coverage issues, connectivity, energy consumption of sensor nodes, Issues related to Localization, Data processing and aggregation, Data storage, security challenges.

UNIT IV

WSN NETWORKING CONCEPTS AND PROTOCOLS

MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols and Wakeup Concepts: S-MAC, Contention based protocols - PAMAS, Schedule based protocols – LEACH, IEEE 802.15.4 MAC protocol, Routing Protocols – examples of proactive and reactive, Challenges and Issues in Transport layer protocol.

UNIT V

SENSOR NETWORK PLATFORMS AND TOOLS

Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level software platforms – TinyOS, nesC, CONTIKIOS, Node-level Simulators – NS2 and its extension to sensor networks.

Text Books:

1. C. Siva Ram Murthy and B. S. Manoj, Ad Hoc Wireless Networks Architectures and Protocols, Prentice Hall PTR, May 2004.
2. Holger Karl, Andreas Willig, Protocol and Architecture for Wireless Sensor Networks, John Wiley Publication, Jan 2006.
3. Feng Zhao, Leonidas Guibas, Wireless Sensor Networks: An Information Processing Approach, Elsevier Publication, 2004.

Suggested Reading:

1. Charles E. Perkins, Ad Hoc Networking, Addison Wesley, 2000.
2. I.F. Akyildiz, W. Su, Sankarasubramaniam, E. Cayirci, Wireless Sensor Networks: A survey, Computer Networks, Elsevier, Pp. 394 – 422, 2002.
3. KazemSohraby, Daniel Minoli, &TaiebZnati, "Wireless Sensor Networks-Technology, Protocols, and Applications", John Wiley, 2007.

20EC E33

SPEECH PROCESSING

(Professional Elective-VI)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: Computer Architecture and Microprocessors

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. Distinguish between different speech coding techniques.
4. Use dynamic warping and HMM for real time problems.
5. Design the various applications like recognition, synthesis, and coding of speech

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	1	-	-	1	-	-	-	-	-	-	2	2	1
CO2	2	2	3	1	3	3	-	-	-	-	-	-	3	3	2
CO3	3	3	3	2	3	3	-	-	-	-	-	-	3	3	2
CO4	3	3	3	2	3	3	-	-	-	-	-	-	2	3	3
CO5	3	3	3	2	3	3	-	-	-	-	-	3	3	2	2

UNIT-I

Fundamentals of Speech:

Mechanism of speech production: Vocal track and physiology, LTI Model for Speech Production, Nature of Speech Signal, Phonetics, Types of Speech, Parameters of Speech: Pitch and Formants, Audio File Formats: Nature of WAV File.

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:

Waveform Speech Coding Techniques- 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.

Parametric Speech Coding Techniques- Channel Vocoders, Transform domain coding of speech – Sub band coding.

UNIT-IV

Linear Prediction of Speech:

Lattice Structure realization, Forward Linear Prediction, Autocorrelation Method, and Covariance Method.

Spectral Parameters of Speech:

Homomorphic Processing, Cepstral Analysis of Speech: Complex Cepstrum of speech, Cepstral Coefficients, Pitch detection, Formant estimation, The Auditory System as a Filter bank, Mel Frequency Cepstral Coefficients (MFCCs).

UNIT-V

Speech Processing Applications:

Speech Recognition Systems, Problems in Automatic speech recognition, Dynamic Time Warping, Hidden Markov Models, Applications of the LPC parameters Speaker Recognition, Speech Synthesis – A Text to Speech System, HMM based Synthesis.

Text Books:

1. Dr.Shilpa D. Apte, “Speech and Audio Processing”, Wiley India edition, 2012.
2. Owens F.J., "Signal Processing of Speech", Macmillan New Electronics, 1/e, 2000.

Suggested Reading:

1. Rabiner L.R and Schafer R. W, "Digital Processing of Speech Signals", PHI,1978.
2. Daniel Jurefsky and James H. Martin, " Speech and Language Processing", PHI, 2/e, 2003.
3. Papamchalis, " Practical Approaches to speech coding", PHI, 1987 .

20EC E34

IOT AND ITS APPLICATIONS

(Professional Elective - VI)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: Knowledge of Programming and Problem Solving, Computer Organization, and Embedded systems.

Course Objectives: This course aims to:

1. Provide an insight into the required infrastructure for IoT technology.
2. Introduce Python Programming language and familiarize the IoT concepts, their origin, and methodology.
3. Develop Django Framework and domain-specific applications.

Course Outcomes: Upon completion of this course, students will be able to:

1. Understand the terminology, enabling technologies, and various protocols of IoT.
2. Illustrate the concepts of Machine to Machine, SDN, and NFV and build simple IoT systems using Raspberry Pi board, NodeMCU, and BeagleBone Black.
3. Apply the basics of Python programming language, which is used in many IoT devices.
4. Create the steps involved in IoT system design methodology.
5. Develop web applications using a python-based framework called Django and IoT technologies for domain-specific applications.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	3	-	-	-	1	-	-	-	-	2	2	2
CO2	2	2	2	2	2	-	-	1	-	-	-	-	2	2	2
CO3	2	3	2	2	-	-	-	1	-	-	-	-	2	3	2
CO4	2	2	2	2	-	-	-	1	-	-	-	-	2	2	2
CO5	3	2	3	3	3	-	2	3	-	-	-	3	3	2	3

UNIT-I

Introduction and Concepts: Introduction to Internet of Things, Definitions and Characteristics of IoT, Physical Design of IoT: Things in IoT, IoT Protocols, Concepts of zigbee, BT. Logical Design of IoT, IoT Functional Blocks, IoT Communication Models, IoT Communication APIs, IoT Enabling Technologies, Wireless Sensor Networks, Cloud Computing, Big Data, Communication Protocols, IoT Levels & Deployment Templates.

UNIT-II

MACHINE TO MACHINE and Networking: Introduction, MACHINE TO MACHINE, Differences between IoT and MACHINE TO MACHINE, Software Defined Networking, Network Function Virtualization.

IoT Physical Devices and End Points: Basic building blocks of an IoT device, Raspberry Pi- about the Raspberry Pi board, Raspberry Pi interfaces- Serial, SPI & I2C, Introduction to NodeMCU, Introduction to BeagleBone Black.

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 Servers and Cloud Offerings: Introduction to cloud storage models and Communication APIs, WAMP: AutoBahn for IoT, Xively cloud for IoT.

Python Web Application Framework: Django Framework-Roles of Model, Template, and View

Domain-Specific IoTs: IoT applications for Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, health, Lifestyle, and introduction to IIoT.

Text Books:

1. Arshdeep Bahga 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 da Costa, “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.
3. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", 1st edition, 2017

20EC E35

REMOTE SESING

(Professional Elective -VI)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: A prior knowledge of fundamental concepts of Electromagnetic spectrum, radar and satellite is required.

Course Objectives: This course aims to:

1. To explain the fundamental concepts of remote sensing and digital imaging techniques.
2. To make the students to understand the principles of thermal and microwave remote sensing.
3. To make the students appreciate the significance of image interpretation and processing.

Course Outcomes: Upon completion of this course, students will be able to:

1. Understand the fundamental concepts of remote sensing.
2. Appreciate types of remote sensing and digital imaging.
3. Apply Microwave remote sensing techniques and understand the process of photogrammetry
4. Interpret images visually.
5. Apply Digital image processing techniques.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PSO2	PSO3
CO1	3	1	1	1	1	1	1	2	-	1	-	2	2	-	-
CO2	3	1	1	1	1	1	1	2	-	1	-	2	2	-	-
CO3	3	1	1	1	1	1	1	2	-	1	-	2	2	-	-
CO4	2	1	1	1	1	1	1	2	-	1	-	2	2	-	-
CO5	3	1	1	1	1	1	1	2	-	1	-	2	2	-	-

UNIT I

Concept of Remote Sensing

Remote sensing – definition, data, process, EM bands used in remote sensing. Interactions and recording of energy– Interaction with atmosphere, interaction with earth surface features (soil, water, vegetation), recording of energy by sensors. Transmission, reception and processing, Image interpretation and analysis, Characteristics of Images, Remote Sensing satellites and their Orbital characteristics,.

UNIT II

Types of Remote Sensing and Digital Imaging

Types of Remote sensing, Swath and Nadir, Sensor Resolutions Digital Image, Sensor components, Principle of along-track and across-track scanning, Hyperspectral Imaging, Thermal Remote Sensing.

UNIT III

Microwave Remote Sensing and Photogrammetry

Active and Passive Microwave Remote Sensing, Radar Imaging - Key components of imaging radar, viewing geometry, spatial resolution, principle of RAR, SAR and their range resolution, Satellite Radar Imaging, Photogrammetry – definition and process, photogrammetry and LIDAR, radargrammetry and radar interferometry.

UNIT IV

Visual Image Interpretation

Image interpretation, elements of visual image interpretation, Interpretation keys, Thermal image interpretation and Radar

image interpretation.

UNIT V

Digital Image Processing and GIS

Image processing systems, Pre-processing, Image enhancement Image transformation and classification.
GIS, Key components of GIS, functions, advantages and applications of GIS, Indian remote sensing satellites

Text Books:

1. Basudeb Bhatta., Remote Sensing and GIS, Oxford University Press, 2nd Edition, 2012.
2. Lillesand T.M., and Kiefer,R.W. Remote Sensing and Image interpretation, John Wiley & Sons-2000,6th Edition

Suggested Reading:

1. James B. Campbell & Randolph H. Wynne., Introduction to Remote Sensing, The Guilford Press, 2011.
2. Michael N DeMers, Fundamentals of GIS, John Wiley, 2nd Edition, 2008.

20EC E36

NETWORK SECURITY

(Professional Elective-VI)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: A course Computer Networks is required.

Course Objectives: This course aims to:

1. Learn the basic concepts of Security Attacks, Services, and mechanisms.
2. Understand the Symmetric Key Encryption and Public key Cryptography algorithms.
3. Learn the Network Security and System Security approaches.

Course Outcomes: Upon completion of this course, students will be able to:

1. Familiarize the basic concepts of Computer Security and Security Attacks, Services, Mechanisms, Design principles.
2. Understand the Symmetric Encryption and Message Confidentiality principles and operation.
3. Demonstrate the Public-Key Cryptography and Message Authentication algorithms
4. Examine the Key Distribution using symmetric and asymmetric encryption and User Authentication using Public-Key Infrastructure.
5. Apply Network Security and System Security approaches for different applications.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	3	1	2	3	1	1	2	1	1	3	3	1	3
CO2	3	3	3	2	3	3	2	2	1	1	1	3	2	3	2
CO3	3	3	3	2	3	3	2	1	2	1	1	2	3	3	3
CO4	3	3	2	1	3	3	1	1	2	1	1	3	3	2	2
CO5	3	3	3	2	3	3	1	1	1	1	1	3	3	3	3

UNIT-I

Introduction to network security: Computer Security Concepts, the OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms, Fundamental Security Design Principles, Attack Surfaces and Attack Trees, A Model for Network Security, Standards.

UNIT-II

Symmetric Encryption and Message Confidentiality: Symmetric Encryption Principles, Symmetric Block Encryption Algorithms, Random and Pseudorandom Numbers, Stream Ciphers and RC4, Cipher Block Modes of Operation.

UNIT-III

Public-Key Cryptography and Message Authentication: Approaches to Message Authentication Secure Hash Functions, Message Authentication Codes, Public-Key Cryptography Principles, Public-Key Cryptography Algorithms: The RSA Public-Key Encryption Algorithm, Diffie–Hellman Key Exchange, Digital Signatures.

UNIT-IV

Key Distribution and User Authentication: Symmetric Key Distribution Using Symmetric Encryption, Kerberos, Key Distribution Using Asymmetric Encryption , X.509 Certificates , Public-Key Infrastructure , Federated Identity Management.

UNIT-V

Network Security: Wireless Network Security: Wireless Security, Mobile Device Security, IEEE 802.11i Wireless LAN Security, Electronic mail security.

System Security: Intruders, Intrusion Detection. Firewalls: The Need for Firewalls, Firewall Characteristics, Types of Firewalls

Text Books:

1. William Stallings, "Network security Essentials: Applications and standards", 6th Edition, Pearson Education Limited, 2017.
2. Atul Kahate, "Cryptography and Network Security", 4th Edition, McGraw Hill, 2019
3. Kaufman, c., Perlman, R., and Speciner, M., "Network Security, Private Communication in a public world", 2nd Edition, Prentice Hall PTR, 2002.

Suggested Reading:

1. Stallings, W. "Cryptography and Network Security: Principles and Practice", 3rd Edition, Prentice Hall PTR.2003.
2. Behrouz A Forouzan, "Cryptography and Network Security", 4th Edition, McGraw Hill, 2019.
3. Calabrese Thomson, "Information Security Intelligence: Cryptographic Principles and Applications", Delmar Cengage Learning, 2003.

20CE O02

DISASTER RISK REDUCTION AND MANAGEMENT

(Open Elective-II)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: Environmental Sciences & General knowledge about natural calamities.

Course Objectives: This course aims to:

1. Reduce the risk of disasters caused by human error, deliberate destruction, and building or equipment failures.
2. Be better prepared to recover from a major natural catastrophe. Ensure the organization's ability to continue operating after a disaster.
3. Recover lost or damaged records or information after a disaster

Course Outcomes: Upon completion of this course, students will be able to:

1. Identify and understand the concepts of hazards, causes and impacts of disasters.
2. Develop a critical capacity to evaluate the principles and practices of disaster risk reduction and management;
3. Develop a deep awareness of disaster resilience, risk mitigation, and recovery policies as they arise from natural hazards around the globe;
4. Apply knowledge about existing global frameworks and existing agreements and role of community in successful Disaster Risk Reduction
5. Evaluate DM study including data search, analysis and presentation as a case study.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	2	2	2	2	1	2	2	2	1	1	1	1
CO2	1	1	2	2	2	3	3	1	2	1	1	1	1	1	-
CO3	2	2	2	2	2	2	3	2	1	1	2	1	1	-	-
CO4	2	2	2	2	3	2	1	1	1	1	1	1	-	-	-
CO5	2	1	2	1	2	3	1	2	2	2	2	1	1	1	1

UNIT I

Hazard and disaster-concepts: Vulnerability and risk, Hazard and disaster type: Natural, Water- related, Pandemic and Human induced hazards disasters, Causes and Impacts of disasters: Impacts on natural eco systems: physical, psychological and social impact, Disaster and financial resilience, GIS and remote sensing, Disaster vulnerability profile of India, Specific to geographical regions and states (as per regional significance)

UNIT 2

Disaster Management Cycle: Rescue, Relief, Rehabilitation, Prevention, Mitigation and Preparedness, Disaster risk reduction {DRR) Community based DRR, institutions concerned with safety, disaster mitigation and construction techniques as per Indian standards, Early warning systems

UNIT 3

Trauma and stress management: First aid and emergency procedures, Awareness generation strategies for the community on safe practises in disaster (as per regional significance)

UNIT 4

Components of disaster management: Preparedness of rescue and relief, mitigation, rehabilitation &reconstruction, Institutional frame work of disaster management in India (NDMA-SDMA, NDRF, Civic volunteers and NIDM), Phases of

disaster/risk management and post-disaster responses, Compensation and insurance, Applications of remote sensing &GIS in disaster management

UNIT 5

Capacity building for disaster/damage mitigation: Structural and non-structural measures, Disaster risk reduction strategies and national disaster management guidelines, Disaster management Act -2005, Regional issues as per regional requirement/university can take minimum two topics as per high powered committee

Text Books:

1. Singh, R. (2017), "Disaster management Guidelines for Earth quakes, Landslides, Avalanches and Tsunami". Horizon Press publications.
2. Taimpo (2016), "Disaster management and preparedness". CRC Press Publications
3. Nidhi, G.D. (2014), "Disaster management preparedness" .CBS Publications Pvt. Ltd.

Suggested Reading:

1. Gupta, A.K.,Nair, S.S., Shiraz, A. and Dey, S. (2013), "Flood Disaster Risk Management-CBS Publications Pvt Ltd.
2. Singh, R. (2016), "Disaster management Guidelines for Natural Disasters" Oxford University Press Pvt. Ltd.

20ME O04

PRINCIPLES OF ENTREPRENEURSHIP

(Open Elective-II)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: No prerequisite is required.

Course Objectives: This course aims to:

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

Course Outcomes: Upon completion of this course, students will be able to:

1. Understand the concept and essence of entrepreneurship.
2. Identify business opportunities and nature of enterprise.
3. Analyze the feasibility of new business plan.
4. Apply project management techniques like PERT and CPM for effective planning and execution of projects
5. Use behavioral, leadership and time management aspects in entrepreneurial journey

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	2	-	-	1	-	-	2	2	2	2	1	1	2
CO2	3	3	3	3	3	-	-	-	-	1	2	2	1	-	2
CO3	3	3	3	2	3	-	-	-	-	1	2	2	1	-	2
CO4	3	3	2	1	2	-	-	-	-	-	1	2	1	-	3
CO5	3	3	2	3	3	2	-	2	-	2	1	2	1	-	3

UNIT-I

Entrepreneurship: Definition, functions of entrepreneurship, qualities of entrepreneurs, identification and characteristics of entrepreneurs, entrepreneur vs. intrapreneur, first generation entrepreneurs, women entrepreneurs, conception and evaluation of ideas and their sources.

UNIT-II

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-III

Business plan: Introduction, elements of business plan and its salient features, business model canvas, technical analysis, profitability and financial analysis, marketing analysis, feasibility studies, executive summary, selection of technology and collaborative interactions.

UNIT-IV

Project management: During construction phase, project organization, project planning and control usingCPM, 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, 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, 2015.

Suggested Reading:

1. Robert D. Hisrich, Michael P. Peters, Entrepreneurship, 5th edition, Tata Mc Graw Hill Publishing Company Ltd., 2005.
2. Stephen R. Covey and A. Roger Merrill, First Things First, Simon and Schuster Publication,1994.

20CS O01

FUNDAMENTALS OF VIRTUAL REALITY

(Open Elective-II)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Pre-requisites: Fundamentals of C++.

Course Objectives: This course aims to:

1. To introduce hardware and software components of virtual reality.
2. To provide knowledge about geometry of virtual worlds.
3. To give an overview of visual physiology, perception and audio in VR.
4. To explore the applications of VR in areas like defense and education.

Course Outcomes: Upon completion of this course, students will be able to:

1. Define Virtual Reality and describe the components of a VR system, input and output devices of virtual reality systems.
2. Apply geometric modeling to model real world scenarios.
3. Develop interfaces by using visual physiology, visual perception and audio.
4. Evaluate virtual reality systems for usability.
5. Explore the applications of VR systems in defense and telerobotics.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	1	1	1	1	1	-	-	1	2	1
CO2	2	3	3	3	3	1	1	1	-	-	-	-	2	1	-
CO3	1	2	3	2	2	1	1	1	-	-	-	-	2	1	1
CO4	1	2	2	1	2	3	3	-	-	-	-	1	1	1	2
CO5	1	1	1	1	2	2	1	-	-	-	-	1	2	2	2

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, Gesture interfaces.
Output Devices: Graphics displays, sound displays and haptic feedback.

UNIT - II

Modeling: Geometric modeling, kinematics modeling, physical modeling, behaviour modeling, model management.
Human Factors: Methodology and terminology, user performance studies, VR health and safety issues, VR and Society.

UNIT - III

Light and Optics: Basic Behaviour of light, Lenses, Optical aberrations, The Human eye, Cameras, Displays.
Physiology of Human Vision: From the Cornea to Photoreceptors, From Photoreceptors to the Visual Cortex, Eye movements, Implications for VR. **Visual Perception:** Depth perception, Motion perception, Color Perception.

UNIT - IV

Audio: The Physics of Sound, the Physiology of Human Hearing, Auditory Perception, Auditory Rendering.
Evaluating VR Systems and Experiences: Perceptual Training, Recommendations for Developers, Comfort and VR Sickness, Experiments on Human Subjects.

UNIT – V

Applications of Augmented and Virtual Reality: Gaming and Entertainment, Architecture and Construction, Science and Engineering, Health and Medicine, Aerospace and Defense, Education, Information control and Big Data Visualization,

Telerobotics and Telepresence. Human Factors Considerations, Legal and Social Considerations, the Future: Short-term Outlook and Long-term Outlook

Text Books:

1. Gregory C. Burdea and Philippe Coiffet, “Virtual Reality Technology”, Second Edition, John Wiley & Sons, Inc., 2003.
2. Steven M. LaVelle, “Virtual Reality”, Cambridge University Press, 2019.
3. Steve Aukstakalnis, “Practical Augmented Reality”, Addison-Wesley, 2016.

Suggested Reading:

1. George Mather,”Foundations of Sensation and Perception”, Second Edition, Psychology Press, 2009.
2. Peter Shirley, Michael Ashikhmin, and Steve Marschner, “Fundamentals of Computer Graphics”, Third Edition, A K Peters/CRC Press, 2009.
3. K. S. Hale and K. M. Stanney, “Handbook on Virtual Environments”, 2nd edition, CRC Press, 2015.

Online Resources:

1. http://msl.cs.uiuc.edu/vr/
2. https://nptel.ac.in/courses/106106139/

20AD O01

INTRODUCTION TO PYTHON PROGRAMMING

(Open Elective-II)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: Programming for problem solving.

Course Objectives: This course aims to:

1. To introduce the python programming environment.
2. To impart knowledge basics data types and operation.
3. To familiarize with function, tuple, dictionary to process the data.
4. To introduce various packages in python
5. To familiarize class, object, exception handling and working with files.

Course Outcomes: Upon completion of this course, students will be able to:

1. Explore data operations on list, tuple and dictionary in python.
2. Understand deployment of models on different datasets.
3. Apply supervised, unsupervised, resembling and NLP models on different datasets.
4. Perform data analysis using python packages.
5. Build and evaluate the models using python programming.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	1	1	-	-	-	1	1	1	1	1	1	-
CO2	2	1	2	1	2	-	-	-	-	-	1	-	-	1	1
CO3	2	1	2	2	1	-	-	-	-	-	-	-	-	1	1
CO4	2	1	1	1	1	-	-	-	-	-	-	1	1	1	-
CO5	2	1	1	1	1	-	-	-	-	-	-	1	1	1	1

UNIT-I:

Introduction: Historical introduction to python, Installing Python, python interpreter and its environment: Argument passing and interactive mode, source encoding; Informal introduction to python: Python as calculator: Numbers, Strings, Lists, Programming steps.

UNIT - II

Control Statements and functions: control flow tools: if statement**,** for statements, range function, break and continue statements, else clauses on loops, pass and match statements; Defining function: default and keywords argument valuses, special parameters: positional-or-keywords arguments, positional parameters, keywords arguments, function examples, Arbitrary and Unpacking argument lists, lambda expression, documentation strings, function annotations, coding style, Input and output, reading and writing files.

UNIT - III

Data structures and Modules: More on lists: Lists as stack and queues, list comprehensions, nested list comprehensions, del statement, Tuples and sequences, sets and operations, Dictionaries, looping and conditional statements on dictionary; Modules: Executing modules as scripts, module search path, compiled python files, standards modules, dir() function, packages: Importing * from packages, intra packages references, packages in multiple directories, error and exception handling.

UNIT - IV

Design with Classes: Classes and Objects, python scopes and namespaces, class defining syntax: class objects, instances, method objects, instances variables, Inheritance, private variables, odds and ends, Iterators, generators and their expressions, standards library: OS interfaces and string pattern matching, virtual environment and packages, pip, floating point arithmetics: issue and limitations, error representation.

UNIT - V

Graphical User Interfaces: 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. Simple Graphics and Image Processing: Overview of Turtle Graphics, Two dimensional Shapes, Colors and RBG System, Image Processing, GUI case studies.

Text Book:

1. Kenneth A. Lambert, The Fundamentals of Python: First Programs, 2011, Cengage Learning. 2. Think Python First Edition, by Allen B. Downey, O'reilly publishing

Suggested Reading:

1. Introduction to Computation and Programming Using Python. John V. Guttag, The MIT Press.
2. James Payne, Beginning Python using Python 2.6 and Python 3, Wrox publishing
3. Paul Gries, Practical Programming: An Introduction to Computer Science using Python 3,The Pragmatic Bookshelf, 2nd edition (4 Oct. 2013)

Web Resources:

1. https://python.org/tutorial/
2. Joy of computing Nptel course by prof. Sudersan Iyengar, IIT Roper
3. https://www.udemy.com/course/python-programming-beginner-to-advanced/

20EG O01

TECHNICAL WRITING SKILLS

(Open Elective-II)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: Basic knowledge of reading and writing English are required.

Course Objectives: This course aims 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: Upon 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

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	-	2	2	2	-	-	-	-
CO2	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-	2	-	-	-	-	-	2	-	-	2	-	-	-	-
CO5	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-

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 :

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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

20CS O02

INTRODUCTION TO WEB TECHNOLOGY

(Open Elective-II)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives: This course aims to:

1. To acquire knowledge on XHTML, Java Script and XML to develop client side web applications.
2. To learn developing web applications using PHP.
3. To understand the database access through the web.

Course Outcomes: Upon completion of this course, students will be able to:

1. Understand the technologies required for developing web application.
2. Identify and choose XHTML tags, CSS and java scripts to develop well-structured and easily maintained web pages.
3. Design and Develop interactive and innovative web pages using various platforms/technologies like XHTML, CSS, XML, JAVASCRIPT.
4. Create and deploy web applications in web server by using server-side programming concepts like PHP
5. Build a data driven web site using Databases.
6. Evaluate different web applications to implement optimal solutions for real time problems

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	1	-	-	-	-	1	-	-	-	-	-	-
CO2	2	1	1	1	-	-	-	-	1	-	-	-	-	-	-
CO3	2	2	2	2	3	-	-	-	1	-	-	-	-	-	2
CO4	2	2	2	2	3	-	-	-	1	3	1	3	-	-	-
CO5	2	2	2	2	3	3	-	-	1	-	1	3	-	-	2

UNIT - I

Fundamentals: Introduction to the Internet, WWW Browsers, Web Servers, URL, MIME, HTTPS.
Introduction XHTML: Basic Syntax Standard XHTML Document Structure, Basic Text Markup, Images, Hypertext Links, Lists Tables, Forms, Cascading Style Sheets.

UNIT - II

Bootstrap: Introduction to bootstrap.
XML: Introduction, uses of XML, the Syntax of XML, XML Document Structure, DTD, Namespaces, XML schemas, displaying Raw XML Documents, displaying XML documents with CSS, XSLT style Sheets.

UNIT - III

The Basics of Java script: Primitive operations and Expressions, Arrays, Functions, Pattern Matching Using Regular Expressions, Document Object Model, Element Access in JavaScript, Events and Event Handling, Handling Events from Body, Button, Text Box and Password Elements.
Dynamic Documents with Java Script: Positioning Elements, Moving Elements, Changing Colors and Fonts, Dynamic Content.

UNIT - IV

Introduction to PHP: Overview of PHP, General Syntactic Characteristics, Primitives, Operations, and Expressions, Output, Control Statements. Arrays, Functions, Pattern Matching, Form Handling, Cookies, Session Tracking.

UNIT - V

Database Access through the Web: Relational Databases, an Introduction to the Structured Query Language, Architectures for Database Access, the MySQL Database System.
Introduction to PHP MyAdmin, connection to MySQL server from PHP, execution of MySQL queries from PHP, receiving data from database server and processing it on webserver using PHP.

Text Books:

1. M. Deitel, P.J. Deitel, A. B. Goldberg, “Internet and World Wide Web How to program”, Pearson Education, 3rd edition, 2003.
2. Robert W. Sebesta, “Programming the World Wide Web”, Pearson Education, 4th Edition, 2008.
3. Adams, “PHP Programming the Complete Guide”, 2022.

Suggested Reading:

1. Chris Bates, “Web Programming: building internet applications”, Wiley, Second edition, 2002.
2. Steven Holzner, “The Complete Reference PHP”, McGraw Hill Education; Raunak PHP study edition, 2017.

20EG M04

GENDER SENSITIZATION

Instruction	2 L Hours per Week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	0 Marks
Credits	0

Prerequisite: No specific prerequisite is required

Course Objectives: This course aims to:

1. Sensibility regarding issues of gender in contemporary India.
2. A critical perspective on the socialization of men and women.
3. Popular debates on the politics and economics of work while helping them reflect critically on gender violence.

Course Outcomes: Upon completion of this course, students will be able to:

1. Understand the difference between "Sex" and "Gender" and be able to explain socially constructed theories of identity.
2. Recognize shifting definitions of "Man" and "Women" in relation to evolving notions of "Masculinity" and "Femininity".
3. Appreciate women's contributions to society historically, culturally and politically.
4. Analyze the contemporary system of privilege and oppressions, with special attention to the ways gender intersects with race, class, sexuality, ethnicity, ability, religion, and nationality.
5. Demonstrate an understanding of personal life, the workplace, the community and active civic engagement through classroom learning.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-
CO2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	2	2	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	2	2	-	2	-	-	-

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, Duggirala Vasanta, Rama Melkote, Vasudha Nagaraj, Asma Rasheed, Gogu Shyamala, Deepa Sreenivas and Susie Tharu "Towards a World of Equals: A Bilingual Text book 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
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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.

20EC C29

COMPUTER NETWORKS LAB

Instruction	2 P Hours per Week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1

Prerequisite: Knowledge on Digital communications and familiarity with anyone programming language like C.

Course Objectives: This course aims to:

1. Understand Link layer concepts.
2. Understand routing algorithms in Network layer.
3. Understand the network simulator environment and visualize a network topology and observe its performance.

Course Outcomes: Upon completion of this course, students will be able to:

1. Apply fundamental principles of computer networking.
2. Examine the performance of design issues of Link layer.
3. Construct a network and measure its performance with different routing algorithms.
4. Create a wired and wireless Network.
5. Analyze performance of various Network protocols.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	2	1	1	1	2	3	2	3	3	2	3
CO2	3	2	3	2	3	1	1	1	3	3	1	3	3	2	3
CO3	3	3	3	3	3	1	1	1	3	3	2	3	3	2	3
CO4	3	4	3	3	3	1	1	1	3	3	2	3	3	2	3
CO5	3	2	2	3	3	1	1	1	2	3	1	3	3	2	3

List of Experiments

1. Creation of nodes links between nodes, assigning agents and traffic sources to nodes.
2. Implementation of Network Topologies
3. Create a wired network with at least four nodes and monitor the data transmission between any two nodes using TCP/UDP using for loop.
4. Implement Stop & Wait and Sliding Window Protocols.
5. Implement of Go Back N Protocol.
6. Implement Selective Reject/Repeat Protocol.
7. Implement the data link layer framing methods such as character stuffing and bit stuffing.
8. Implementation of Error Detection / Error Correction Techniques.
9. Implement Static Routing Protocol.
10. Implement of Distance Vector Routing Protocol.
11. Implementation of Link State Routing Protocol.
12. Construct Dijkstra's algorithm to compute the shortest path through a graph.
13. Create a static wireless network and data transmission between the nodes with at least four nodes.
14. Create a wireless network with node movement and data transmission between the nodes with at least four nodes using NS2.
- **1.** Construct a broadcast tree using a subnet

Additional Experiments based on

Structured Inquiry

2. Evaluate the performance of Data link/Network/Transport layer protocols.

Open-ended Inquiry

3. Design a Wireless Ad hoc Network and evaluate its performance.

Note:

All the experiments can be implemented using NETSIM, NS2 and MATLAB.

Suggested Reading:

1. Teerawat Issariyakul, Ekram Hossain, "Introduction to Network Simulator NS2", 2nd Edition, Springer, 2012.
2. Eitan Altman, Tania Jimenez, "Network Simulator for beginners", Lecture Notes, 2003-2004, University de Los Andes, Merida, Venezula and ESSI, Sophia-Antipolos, France, December 2003.

20EC C30

IOT AND SIMULATION LAB

Instruction	2 P Hours per Week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1

Prerequisite: Knowledge of Programming and Problem Solving, Computer Organization, and Embedded systems.

Course Objectives: This course aims to:

1. Implement hardware setup for IoT applications.
2. Develop basic programming skills for deploying various IoT protocols on hardware and Virtual instrumentation programming using LabVIEW.
3. Design and develop IoT and LabVIEW environment-based solutions.

Course Outcomes: Upon completion of this course, students will be able to:

1. Analyse various software and hardware components required for IoT technology.
2. Interface analog and digital sensing & actuating equipment using Raspberry Pi.
3. Learn how to build basic applications in the LabVIEW graphical programming environment.
4. Develop an ability for programming in LabVIEW using various program structures, plotting the graphs and charts for system monitoring, processing, and controlling.
5. Apply knowledge of IoT and Virtual Instruments to solve engineering problems.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	-	-	-	2	-	-	3	3	-	2	1	-	1
CO2	2	2	3	-	-	2	-	-	3	3	-	3	3	3	3
CO3	-	2	-	-	-	2	-	-	3	3	-	2	1	-	1
CO4	2	3	3	-	-	2	-	-	3	3	-	3	3	3	3
CO5	2	3	3	-	-	2	-	-	3	3	-	3	3	3	3

List of Experiments:

1. Installation of Raspberry Pi Operating System on Raspberry Pi device.
2. Interfacing an LED and Switch with Raspberry Pi3.
3. Interfacing a Light Sensor with Raspberry Pi3.
4. Interfacing surveillance camera with Raspberry Pi3.
5. Interfacing smoke sensor to give an alert message to the fire department.
6. Implementation of Home Automation System using Wi-Fi Module.
7. Design and development of patient health monitoring system.
8. Design and development of solar power monitoring system.
9. Familiarizing with LabVIEW simulation tools
10. Loops, Structures, and Math-script in LabVIEW.
11. Implementation of Combinational circuits (Multiplexer and DE-multiplexer) using my RIO.
12. FIR and IIR Filter design in LabVIEW.
13. Implementation of Analog modulation and Demodulation schemes (AM and FM) using myRIO.
14. State variable analysis and Frequency domain analysis (Nyquist and Bode plots) with LabVIEW.
15. Sensor data acquisition using myDAQ.

Additional Experiments based on

Structured enquiry

a. Implementation of Smart Agriculture Monitoring System.

Open-ended enquiry

a. Implementation of a Weather Monitoring System by an interfacing temperature sensor, pressure, etc.

Reference Books:

1. Tony Gaddis, “Starting out with Python”, 3rd edition, Pearson, 2015.

20EC C31

MICROWAVE ENGINEERING LAB

Instruction	2 P Hours per Week
Duration of SEE	3Hours
SEE	50 Marks
CIE	50 Marks
Credits	1

Prerequisite: Knowledge of Electromagnetics and Antennas

Course Objectives: This course aims to:

1. To understand the characteristics of Reflex Klystron Oscillator (RKO) and Gunn Oscillator.
2. To learn frequency measurement techniques using cavity wave meters and measuring VSWR.
3. To plot the radiation pattern of any antenna.

Course Outcomes: Upon completion of this course, students will be able to:

1. Examine the characteristics of RKO and Gunn Oscillator.
2. Compare 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. Evaluate unknown impedance of various microwave loads.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	3	1	1	1	2	3	1	1	2	3	2	2
CO2	3	3	2	3	1	2	2	2	3	1	1	2	3	2	2
CO3	3	2	2	2	1	1	1	1	3	1	1	2	3	1	1
CO4	3	2	3	3	1	2	2	2	3	1	1	2	3	1	1
CO5	3	2	2	2	2	1	1	2	3	1	1	2	1	1	1

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.
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.
11. Structured enquiry: Calibration of given component in X-band frequency.
12. Open ended enquiry: Measurement of impedance for inductive /capacitive window in X-band frequency.

References:

1. Department Laboratory Manual.
2. G.S. Raghu Vamsi, “Basic microwave techniques and Laboratory manual", 2nd Edition, New age international publishers, 2009.

20EC C32

PROJECT: PART-1

Instruction	4 P Hours per Week
Duration of SEE	--
SEE	--
CIE	50 Marks
Credits	2

Prerequisite: Knowledge of preparing slides by using power point presentations, Capable of searching for suitable literatureand Presentation skills.

Course Objectives: This course aims to:

1. The student takes up investigative study in the broad field of Engineering / Technology, either fully theoretical/practical or involving both theoretical and practical.
2. The work to be assigned by the Department on an individual basis or two/three students in a group, under theguidance of a supervisor.
3. This is expected to provide a good initiation for the student(s) towards R&D.

Course Outcomes: Upon completion of this course, students will be able to:

1. List the various approaches to the selected problem.
2. Interpret the advantages and disadvantages of various approaches.
3. Apply the selected approach for simulating / modeling / designing the problem.
4. Analyse and write a report on the results of the simulation/modeling of the problem selected.
5. Justify and present the results of the simulation/modeling / design before the departmental committee.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	2	2	2	2	3	3	2	2	2	3	2	2
CO2	2	2	2	2	2	1	1	2	1	1	1	2	1	1	2
CO3	3	2	2	2	3	1	1	2	2	2	2	2	2	3	2
CO4	3	3	3	2	2	2	2	2	2	2	2	2	3	2	2
CO5	3	3	2	3	3	2	1	2	2	3	2	3	2	3	2

The objective of Project Part-1 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 expectedto 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
Departmental Committee	5	Relevance of the Topic
	5	PPT Preparation
	5	Presentation
	5	Question and Answers
	5	Report Preparation

20ECI03

INDUSTRIAL INTERNSHIP

Instruction/Demonstration/Training	5-6 Weeks/135 Hours
Duration of SEE	--
SEE	--
CIE	50 Marks
Credits	3

Prerequisite: Knowledge of Basic Sciences and Engineering Sciences

Course Objectives: This course aims to:

1. Exposing the students to the industrial environment
2. Create awareness with the current industrial technological developments relevant to program domain
3. Provide opportunity to understand the social, economic and administrative considerations in organizations

Course Outcomes: Upon completion of this course, students will be able to:

1. Understand Engineer's responsibilities and ethics
2. Use various materials, processes, products and quality control
3. Provide innovative solutions to solve real world problems
4. Acquire knowledge in technical reports writing and presentation
5. Apply technical knowledge to real world industrial situations

.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	3	3	-	3	-	3	3	-	-	3
CO2	1	1	1	3	3	-	2	1	-	-	-	-	3	3	-
CO3	2	3	3	3	3	2	3	1	1	-	-	-	3	3	-
CO4	-	-	-	-	-	3	-	1	3	3	-	1	-	-	3
CO5	1	3	3	3	3	2	3	-	1	-	-	1	3	3	3

For implementation procedures and letter formats, annexures I and III of Internship document may be referred.
Evaluation of Internship: The industrial training/internship of the students will be evaluated in three stages:

a) Evaluation by the Industry (in the scale of 1 to 10 where 1-Unsatisfactory; 10-Excellent)

b) Evaluation by faculty Mentor on the basis of site visit(s) or periodic communication (15 marks)

c) Evaluation through seminar presentation/Viva-Voce at the Institute by the constituted committee (25 marks)

Evaluation through Seminar presentation/Viva-Voce at the institute: Students shall give a seminar before an E*xpert Committee* constituted by college (Director, HoD/Senior faculty, mentor and faculty expert from the same department) based on his/her training/internship carried out

. The evaluation will be based on the following criteria:

- Quality of content presented
- Proper planning for presentation
- Effectiveness of presentation
- Depth of knowledge and skills
- Attendance record, daily diary, departmental reports shall be analyzed along with the internship Report

Monitoring/ Surprise Visits: During the internship program, the faculty mentor makes a surprise visit to the internship site, to check the student's presence physically. If the student is found to be absent without prior intimation to the concerned industry, entire training/internship may be canceled. Students should inform through email to the faculty mentor as well as the industry supervisor at least one day prior to avail leave.

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

AICTE Model Curriculum with effect from AY 2023-24

B.E (Electronics and Communication 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		Open Elective-III	3	-	-	3	40	60	3
PRACTICALS									
2	20ECC33	Technical Seminar	-	-	2	-	50	-	1
3	20ECC37	Project: Part-2	-	-	12	Viva-Voce	100	100	4
Total			**3**	**-**	**14**	**3**	**190**	**160**	**8**
Clock Hours Per Week: 17									

L: Lecture **D: Drawing** **CIE: Continuous Internal Evaluation**

T: Tutorial **P: Practical/Project Seminar/Dissertation** **SEE: Semester End Examination**

List of Courses in Open Elective-III	
Course code	**Title of the Course**
20CSO10	Basics of Cyber Security
20CSO14	Fundamentals of Computer Vision
20ADO02	Data Analysis and Visualisation
20MEO01	Robotics
20MEO15	Principles of Industry 4.0
20ADO03	Fundamentals of Data Science

20CS O10

BASICS OF CYBER SECURITY

(Open Elective-III)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Pre-requisites: Programming for problem solving.

Course Objectives: This course aims to:

1. To understand how to identify, analyze and remediate computer security breaches by learning and implementing the real-world scenarios in Cyber Investigations
2. To exhibit knowledge to secure corrupted systems, protect personal data, and secure computer networks in an organization.
3. To practice with an expertise in academics to design and implement security solutions.
4. To understand key terms and concepts in Cryptography, Governance and Compliance and Develop cyber security strategies and policies.
5. To understand principles of web security and to guarantee a secure network by monitoring and analyzing the nature of attacks through cyber/computer forensics software/tools.

Course Outcomes: Upon completion of this course, students will be able to:

1. Analyze and evaluate the cyber security needs of an organization.
2. Determine and analyze software vulnerabilities and security solutions to reduce the risk of exploitation.
3. Measure the performance and troubleshoot cyber security systems.
4. Implement cyber security solutions and use of cyber security, information assurance, and cyber/computer forensics software/tools.
5. Applying operational and cyber security strategies and policies.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	3	1	1	1	2	2	-	2	-	-	2	1	2	-
CO2	2	1	2	2	1	-	1	2	-	1	2	1	2	2	-
CO3	3	2	2	3	1	2	-	-	2	-	1	2	2	2	-
CO4	1	3	3	2	1	2	3	2	2	-	-	2	2	2	-
CO5	-	-	2	2	3	-	1	-	-	-	1	3	1	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: How Criminals Plan Them · Introduction · How Criminals Plan the Attacks · Social Engineering · Cyber stalking · Cybercafé and Cybercrimes. Cloud Computing Cybercrime: Mobile and Wireless Devices · Introduction · Proliferation of Mobile and Wireless Devices · Trends in Mobility · Credit Card Frauds in Mobile and Wireless Computing Era ·

UNIT - III

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 · Attacks on Wireless Networks Phishing and Identity Theft · Introduction · Phishing · Identity Theft (ID Theft) Cybercrimes and Cybersecurity: The Legal Perspectives.

UNIT - IV

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 – V

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. Introduction · Cost of Cybercrimes and IPR Issues: Lessons for Organizations · Web Threats for Organizations: The Evils and Perils.

Text Books:

1. Sunit Belapure Nina gobole, "Cyber Security", Wiley, 2011.
2. Lester Evans, "Cyber security: An Essential Guide to Computer and Cyber Security for Beginners", Bravex Publications, 2020.

Suggested Reading:

1. Prof Amit Garg, Dr Krishan Kumar Goyal, "Cyber Security", Laxmi Publications, 2022.
2. Zach Codings, "Cyber Security: Hacking with Kali Linux, Ethical Hacking", 2019.
3. Noah Zhang, Dana Onyshko, "Cyber Security: The Beginners Guide to Learning the Basics of Information Security and Modern Cyber Threats", Kindle Edition.

Online Resources:

1. https://nptel.ac.in/courses/106106129
2. https://uou.ac.in/foundation-course
3. https://nptel.ac.in/courses/106105162

20CS O14

FUNDAMENTALS OF COMPUTER VISION

(Open Elective-III)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives: This course aims to:

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: Upon completion of this course, students will be able to:

1. Recognize the basic fundamentals of vision and describe the scope of challenges.
2. Develop algorithms to analyze feature detection and feature alignment.
3. Analyze images and videos for problems such as tracking and structure from motion.
4. Choose object, scene recognition and categorization algorithms for real time images.
5. Apply various techniques to build computer vision applications.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	2	-	-	-	-	-	-	-	-	1	1	2	1
CO2	2	3	3	1	2	1	-	-	-	-	-	-	2	1	-
CO3	2	2	3	2	2	-	-	1	1	-	-	1	2	1	1
CO4	1	1	2	3	2	2	-	1	2	2	1	-	1	1	2
CO5	1	2	3	2	3	2	-	1	1	2	1	1	2	2	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.

UNIT - II

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

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 - 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

Image Stitching: Motion Models, Global alignment, Sparse and dense corresponding, Global Optimization.

UNIT – V

Recognition: Object detection, Face recognition, Instance recognition, Category recognition, Context and scene understanding.

Text Books:

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

Suggested Reading:

1. Robert J. Schallkoff, “Pattern Recognition: Statistical. Structural and Neural Approaches”, John Wiley and Sons; 1992+.
2. D. A. Forsyth and J. Ponce, “Computer Vision: A Modern Approach”, Pearson Education, 2003.
3. R. Hartley and A. Zisserman, “Multiple View geometry”, Cambridge university Press, 2002.
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 Resources / Weblinks / NPTEL Courses:

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

20AD O02

DATA ANALYSIS AND VISUALISATION

(Open Elective-III)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: Python programming.

Course Objectives: This course aims to:

1. To introduce the Numpy library in Python to support storage and operations on large multi- dimensional arrays and matrices
2. To introduce large collection of mathematical functions to operate on multidimensional sequential data structures
3. To demonstrate the functionality of the Pandas library in Python for open source data analysis and manipulation
4. To demonstrate Data Aggregation, Grouping and Time Series analysis with Pandas
5. To introduce the Matplotlib library in Python for resting static, animated and interactive visualizations

Course Outcomes: Upon completion of this course, students will be able to:

1. Efficiently store and manipulate dense data in arrays with Numpy
2. Apply high level mathematical functions to aggregate, broadcast, index and sort multidimensional arrays.
3. Create Series and DataFrame objects to operate on datasets.
4. Perform Data cleaning, transformation, merging, aggregation on datasets.
5. Apply 2-D and 3-D plotting techniques on datasets

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	-	-	-	-	-	-	-	-	3	1	1	-
CO2	3	2	-	1	1	-	-	-	-	-	-	3	1	1	1
CO3	3	1	-	3	1	-	-	-	-	1	-	3	1	1	1
CO4	2	2	-	2	1	-	-	-	-	3	-	3	1	1	1
CO5	3	3	-	1	3	-	-	-	-	2	-	3	1	1	1

UNIT-I

Introduction to Numpy: Data types in Python - Fixed type arrays, creating arrays, array indexing, array slicing, reshaping arrays, array concatenation and splitting, Universal Functions, Aggregations, Broadcasting rules, Comparisons, Boolean Arrays, Masks Fancy Indexing, Fast Sorting using np.sort and np.argsort, partial sorting - partitioning with K-nearest neighbors, Creating Structured Arrays, Compound types and Record Arrays.

UNIT- II

Introduction to Pandas: Series Object, DataFrame Object, Data Indexing and Selecting for Series and DataFrames, Universal Functions for Index Preservation, Index Alignment and Operations between Series and DataFrames, Handling missing data, Operating on Null values, Hierarchical Indexing.

UNIT-III

Combining Datasets: Concat, Append, Merge and Joins, Aggregation and Grouping, Pivot Tables, Vectorized String Operations, Working with Time Series, High-Performance functions - query() and eval()

UNIT-IV

Inferential Statistics - Normal distribution, Poisson distribution, Bernoulli distribution, z-score, p-score, One- tailed and two-tailed, Type 1 and Type-2 errors, Confidence interval, Correlation, Z-test vs T-test, F- distribution, Chi-square distribution, the chi-square test of independence, ANOVA, data mining, titanic survivors dataset analysis

UNIT-V

Visualization with Matplotlib: Simple Line plots, Scatter plots, Visualizing errors, Density and Contour plots, Histograms, Binnings, Multiple subplots, Three-dimensional plotting with Matplotlib, Geographic data with Basemap, Visualization with Seaborn.

Text Books:

1. Jake VanderPlas, "Python Data Science Handbook", O'Reilly Media, 2016.
2. Samir Madhavan, "Mastering Python for Data Science", Packt Publishing, 2015.

Web Resources:

1. https://www.coursera.org/learn/python-data-analysis?specialization=data-science-python
2. https://www.coursera.org/learn/python-plotting

20ME O01

ROBOTICS

(Open Elective-III)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: Engineering mechanics and CAD & Drafting are required.

Course Objectives: This course aims to:

1. Principle of working of a robot, types and specifications, configuration, work envelops and motion controls and applications.
2. Transformations, kinematics and dynamics of robots.
3. Singularities, Jacobian and trajectory planning of a robot to prepare the robot for various tasks
4. Design of end effectors, drives, working of sensors and controllers for finding position and orientation.
5. Robot vision for image acquisition and processing and plan for various tasks and various Languages and Programming methods of robot

Course Outcomes: Upon completion of this course, students will be able to:

1. Describe the basic components, specifications and applications of the Robots.
2. Understand transformations, direct and inverse kinematics of robots.
3. Calculate forces in links and joints of a robot and find the singularities, Jacobian and trajectory planning of a robot for various tasks.
4. Classify drives, sensors and grippers for various applications.
5. Program a robot to predict motions for a given task with machine vision and sensors.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	2	1	1	2	1	1	2	2	1	2	2	1	2
CO2	3	3	3	1	2	2	1	1	1	1	1	2	1	2	2
CO3	3	3	3	1	3	2	1	1	1	1	1	2	1	2	1
CO4	3	3	3	2	3	2	1	1	1	1	1	2	1	2	2
CO5	3	2	2	2	3	2	1	1	2	2	1	2	2	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 effect or 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 for link inertia tensor and manipulator inertia tensor, Newton- Euler formulation for RR & RP manipulators.

Control: Individual, joint and 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 programminglanguages

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.

20ME O15

PRINCIPLES OF INDUSTRY 4.0

(Open Elective-III)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: Workshop/Manufacturing practice is required.

Course Objectives: This course aims to:

1. Understand the concept and applications of Digital Manufacturing and Industry 4.0.
2. Relate different Additive manufacturing processes as a part of Digital Manufacturing
3. Understand the concept of Virtual prototyping, digital design and Importance of reverse engineering in Digital Manufacturing
4. To understand the concept of Industry 4.0 and allied technologies.
5. To Provide an understanding on the challenges faced and relevant industrial applications of Industry 4.0

Course Outcomes: Upon completion of this course, students will be able to:

1. Understand the Basics and applications of Digital Manufacturing and Industry 4.0.
2. Understand the role of Additive Manufacturing, Virtual prototyping and Reverse Engineering processes and their adaptability to Digital Manufacturing.
3. Understand the concepts of digital manufacturing based product life cycle and its management.
4. Understand the concept of Industry 4.0 and allied technologies.
5. Understand the basics of Internet of things and cloud computing pertaining the fourth industrial revolution

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	2	1	1	2	2	2	2	2	1	3	2	1	2
CO2	3	1	3	1	2	2	2	1	2	2	1	2	2	2	2
CO3	3	2	3	1	2	2	1	1	2	2	1	2	2	2	2
CO4	3	2	3	2	3	2	1	1	2	2	1	2	2	2	2
CO5	3	3	3	3	3	2	1	2	2	2	2	3	3	3	3

UNIT-I

Introduction to digital manufacturing: Definition of digital manufacturing, Operation Mode and Architecture of Digital Manufacturing System, Impact on manufacturing careers, Advantages of digital manufacturing and design, Information sharing in the digital thread, Digital twins and Files format (STL, AMF, 3MF), Multiple organizations in the manufacturing process. Introduction of Industry 4.0, case study on car manufacturing by Bosch.

UNIT-II

Additive Manufacturing Processes: Additive Manufacturing processes – Engineering polymers, metals and ceramics. Stereolithography, Selective Laser Sintering, Fused Deposition Modeling, Layered object manufacturing. Electronic Materials, Bio-printing, Food Printing. Preprocessing and Post processing in AM

Virtual Prototyping & Reverse Engineering: Virtual Prototyping, Applications, Virtual Prototyping and Virtual Manufacturing. Reverse Engineering, Application of Reverse Engineering in Digital Manufacturing. Self-Learning of Manufacturing System and Intelligent Manufacturing System.

UNIT-III:

Key Technology of Digital Manufacturing: Various Digital Technologies in Product Lifecycle, Digital Equipment and Digital Processing Technology, Technology of Digital Maintenance and Diagnosis.

Product life cycle management: Introduction, Types of Product Data, Product life cycle management (PLM) systems. Features of PLM System, System architecture, Product information models, Functionality of the PLM Systems.

UNIT-IV:

Industry 4.0: Various Industrial Revolutions, Compelling Forces and Challenges for Industry 4.0, Comparison of Industry 4.0 Factory and Today's Factory, automation, data exchanges, cloud, cyber-physical systems, mobile robots, Big Data, deep machine learning, Production Systems, IoT, Challenges of implementing Industry 4.0, Impact of implementing Industry 4.0 in various sectors, Applications domains and the way forward.

UNIT –V

Internet of Things (IoT) - IoT design methods, physical devices and enabling technologies, Industrial Internet of Things (IIoT), Smart Manufacturing.

Cloud Computing and Manufacturing- Cloud models, cloud manufacturing examples, cloud based manufacturing, Cloud service and platforms for manufacturing.

Augmented Reality and Virtual Reality in Manufacturing.

Text Books:

1. Zude Zhou, Shane (Shengquan) Xie and Dejun Chen, Fundamentals of Digital Manufacturing Science, Springer-Verlag London Limited,2012
2. Brent Stucker, David Rosen, and Ian Gibson, Additive Manufacturing Technologies, ISBN 978-1-4419-1120-9, Springer, 2010
3. Chee Kai Chua, Kah Fai Leong, 3D printing and additive manufacturing: principles and Application, 4th edition of rapid prototyping
4. Alasdair Gilchrist, Industry 4.0: The Industrial Internet of Things.

Suggested reading:

1. Lihui Wang and Andrew Yeh Ching Nee, Collaborative Design and Planning for Digital Manufacturing, Springer-Verlag London Limited, 2009
2. Venuvinod, PK; Ma, W; Rapid prototyping – Laser based and other technologies, Kluwer,2004

20AD O03

FUNDAMENTALS OF DATA SCIENCE

(Open Elective-III)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: Python programming & Statistics.

Course Objectives: This course aims to:

1. To understand the fundamentals concepts of Data Science
2. Demonstrate and analyze the different data types and analytic techniques.
3. To learn about various machine learning algorithms.
4. To familiarize with data collection techniques.
5. To study different evaluation techniques.

Course Outcomes: Upon completion of this course, students will be able to:

1. Explain the need of Data Science to analyze the skill sets of data scientists.
2. Describe the Data Science Process and its components interact.
3. Apply basic machine learning algorithms for predictive modeling.
4. Simplify a real-world problem into mathematical terms.
5. Create effective visualization of given data.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	1	-	1	-	-	-	-	-	2	1	1	1	1
CO2	3	3	-	2	-	-	-	-	-	-	1	-	1	1	1
CO3	2	2	3	-	3	-	-	-	-	-	-	3	2	2	2
CO4	3	1	-	2	1	-	-	-	-	-	1	2	2	1	2
CO5	1	1	2	3	3	-	-	-	-	-	-	-	1	1	2

UNIT-I

Introduction: Introduction to Data Science, Evolution of Data Science, Data Science Roles, Stages in a Data Science Project, Information vs Data, Computational Thinking, Skills for Data Science, Tool for Data Science, Issues of Ethics, Bias, Privacy in Data Science.

UNIT-II

Data: Data Types, Data Collection, Data Pre-Processing, Data Analysis and Analytics, Descriptive Analytics, Diagnostic Analytics, Predictive and Perspective Analytics, Explorative Analysis, Mechanistic Analysis.

UNIT-III

Machine Learning for Data Science: Introduction to Machine Learning, Regression, Gradient Descent, Supervised Learning-Introduction, Logistic Regression, Softmax Regression, Classification with KNN, Decision Tree, Random Forest, Naive Bayes, SVM, Unsupervised Learning.

UNIT-IV

Data Collection: Introduction to Data Collection, Surveys, Question Types, Survey Audience, Services, Analyzing Survey Data, Pros and Cons of Surveys, Interview and Focus groups, Pros and Cons of Interview and Focus, Log and Diary Data, User Studies in Lab and Field.

UNIT-V

Analysis and Evaluation, **Jobs:** Introduction to Quantitative methods, Introduction to Qualitative methods, comparing models, Training, Testing and A/B testing, Cross-Validation, Data Science Jobs-Marketing, Data Science Jobs-Retail and Sales, Data Science Jobs-Legal, Data Science Jobs-Health and Human Services.

Text Books:

1. Chirag Shah, A Hands-On Introduction to Data Science. Cambridge: Cambridge University Press, 2020.
2. Rafael A. Irizarry, Introduction to Data Science: Data Analysis and Prediction Algorithms with R, CRC Press, 2020.

Suggested Reading:

1. Joel Grus, Data Science from Scratch: First Principles with Python, O'Reilly Media,2015.
2. Hastie, T., Tibshirani, R., Friedman, J., The Elements of Statistical Learning, 2ndEdition, Springer, 2009.
3. Murphy, K, Machine Learning: A Probabilistic Perspective, MIT Press, 2012.

Web Resources:

1. https://pll.harvard.edu
2. https://www.coursera.org
3. https://www.udemy.com ›

20EC C33

TECHNICAL SEMINAR

Instruction	2 P Hours per Week
Duration of SEE	--
SEE	--
CIE	50 Marks
Credits	1

Prerequisite: Student must have completed Project: Part - 1

Course Objectives: This course aims to:

1. 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.
2. Seminar topics may be chosen by the students with advice from the faculty members and the student shall readfurther relevant articles in the domain.
3. Documenting the seminar report in a prescribed format.

Course Outcomes: Upon completion of this course, students will be able to:

1. Collect, Organize, Analyze and Consolidate information about emerging technologies from the literature.
2. Exhibit effective communication skills, stage courage, and confidence.
3. Demonstrate intrapersonal skills.
4. Explain new innovations/inventions in the relevant field.
5. Prepare and experience in writing the Seminar Report in a prescribed format.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	2	2	1	1	3	2	3	1	2	2	2	2
CO2	3	3	1	2	2	2	1	1	3	2	3	2	2	2	2
CO3	2	2	1	2	2	2	1	2	3	3	2	2	2	1	1
CO4	3	2	3	3	2	2	2	2	2	2	2	2	2	2	2
CO5	3	2	2	2	2	2	3	3	2	3	2	2	2	2	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 in formation
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 inPowerPoint, 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, the 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 be preferably from any peer reviewed recent Journal publications.

Guidelines for awarding marks (CIE): Max. Marks: 50		
S.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

20EC C37

PROJECT: PART-2

Instruction	12 P Hours per Week
Duration of SEE	Viva Voce
SEE	100 Marks
CIE	100 Marks
Credits	4

Prerequisite: Student must have earned the credits of "Project: Part – 1"

Course Objectives: This course aims to:

1. The object of Project: Part2 is to enable the student extend further the investigative study, either fullytheoretical/practical or involving both theoretical and practical work.
2. The work shall be carried out under the guidance of a Supervisor from the Department alone or jointly with aSupervisor drawn from R&D laboratory/Industry.
3. Preparing an Action Plan for conducting the investigation, including team work;

Course Outcomes: Upon completion of this course, students will be able to:

1. Recall the details of the approach for the selected problem.
2. Interpret the approach to the problem relating to the assigned topic.
3. Determine the action plan to conduct investigation.
4. Analyze and present the model / simulation /design as needed.
5. Evaluate, present and report the results of the analysis and justify the same.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	2	1	2	3	3	2	2	2	2	2
CO2	3	3	3	3	3	2	2	3	3	3	2	2	2	2	2
CO3	2	3	3	3	3	2	2	2	2	3	3	2	2	2	2
CO4	3	3	3	2	2	2	2	2	2	2	2	2	2	2	2
CO5	3	3	3	2	2	1	2	3	3	3	3	2	2	2	2

The objective of 'Project: Part-2' is to enable the student extend further the investigative study taken up, 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 awarding marks in CIE: (**Max. Marks: 100**)

Evaluation by	Max. Marks	Evaluation Criteria / Parameter
Department Review Committee	10	Review 1
	15	Review 2
	25	Submission

Supervisor	10	Regularity and Punctuality
	10	Work Progress
	10	Quality of the work which may lead to publications
	10	Report Preparation
	10	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