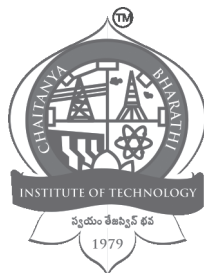


**Scheme of Instruction and Syllabi
for
Choice Based Credit System (CBCS) of
BE / B.TECH VII AND VIII SEMESTERS
OF
FOUR YEAR DEGREE COURSE
IN
ELECTRONICS & COMMUNICATON ENGINEERING**



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: SwayamTejaswin Bhava

Vision, Mission and Quality Policy of the Institute

VISION

To be a centre of excellence in technical education and research.

MISSION

To address the emerging needs through quality technical education and advanced research.

QUALITY POLICY

Chaitanya Bharathi Institute of Technology imparts value based technical education and training to meet the requirements of student, industry, trade/profession, research and developmental organisations for self-sustained growth of society.

Vision and Mission of Dept. of ECE

VISION

To develop the department into a full-fledged center of learning in various fields of Electronics & Communication Engineering, keeping in view the latest developments.

MISSION

To impart value based technical education and train students and to turn out full pledged engineers in the field of Electronics & Communication Engineering with and overall background suitable for making a successful career either in industry/research or higher education in India/Abroad.



DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

Program Educational Objectives of B.E (ECE) Program

- PEO1 Student will excel in analysing, design and development of systems in the area of Electronics and Communications.
- PEO2 Student will have hand on experience in executing software related applications pertaining to Electronics and Communication Engineering.
- PEO3 Student will carry out research in new technologies with modern relevant tools.
- PEO4 Student will develop with professional ethics, effective communication skills and knowledge of societal impacts of computing technologies.

Program Specific Outcomes of B.E (ECE) Program

- PSO1 Student will demonstrate the knowledge and understanding of basic principles of mathematics, science, electronic devices, networks and signal processing procedures in simulation, modelling, and describing the behaviour of analog and digital electronic circuit or system.
- PSO2 Student will be able to select and apply appropriate techniques, resources and Hardware and Software tools for design, analysis and testing the various analog and digital electronic circuits and networks.
- PSO3 Student will demonstrate self-confidence to work independently or in a team and his/her ability to Analyze, synthesize, design and test analog & digital components, process, system or sub-systems of electronics and communication Engineering used in peace as well as war applications as per the specifications.



DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

Program Outcomes of B.E (ECE) Program

Engineering graduate will be able to:

1. Engineering Knowledge Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to 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 Team Work 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 Kanagement 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 Recognise 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)
Choice Based Credit System (With Effect from Academic Year 2019-20)
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	16EC C32	Data Communication and Computer Networks	3	-	3	30	70	3
2	16EC C33	Principles of GNSS	3	-	3	30	70	3
3	16EC C34	Radar and Satellite Communication	3	-	3	30	70	3
4	16EC C35	VLSI Design	3	-	3	30	70	3
5		Elective – IV	3	-	3	30	70	3
6		Elective – V	3	-	3	30	70	3
PRACTICALS								
7	16EC C36	Advanced Simulation Lab	-	3	3	25	50	2
8	16EC C37	Electronic Design and Automation Lab	-	3	3	25	50	2
9	16EC C38	Project Seminar	-	3	-	50	-	2
Total			18	9	-	280	520	24

Elective –IV		Elective – V	
Course Code	Title of the Course	Course Code	Title of the Course
16EC E08	Principles of Computational Electromagnetics	16EC E12	Applications of IoT in ECE
16EC E09	Real Time Operating Systems	16EC E13	Digital Image Processing
16EC E10	Speech Processing	16EC E14	Principles of Optimization Techniques
16EC E11	Spread Spectrum Communication	16EC E15	Principles of Wireless Sensor Networks

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

16EC C32**DATA COMMUNICATION AND COMPUTER NETWORKS**

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: The student must have taken a course on digital communication.

Course Objectives: This course aims to:

1. Provide a conceptual foundation for the study of data communications using the Open Systems Interconnect (OSI) model for layered architecture.
2. Understand the concepts of switched communication networks, performance of data link layer protocols for error and flow control.
3. Study and understand the principles of network protocols, routing algorithms and internetworking, Network security, Internet applications

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

1. Identify different tasks of computer communications networks and protocol architectures.
2. Analyze and compare circuit switching and packet switching concepts and understand ATM network concepts and the performance of various Data link control protocols for flow control and error control.
3. Analyze the services and functions of the networks layer and recognize the different internetworking devices and their functions.
4. Understand how routing is carried out in large open networking environment and the operations of major internet routing protocols such as ICMP, ARP, OSPF and BGP.
5. Understand the importance of basic network security measures such as encryption, Authentication protocols and study standard Internet applications protocols.

UNIT – I

Introduction: Data Communication and Networking for Today's Enterprise, a Communications Model, Data Communications, Networks. The Need for Protocol Architecture and Standardization, the TCP/IP Protocol Architecture, the OSI reference Model, Line Configurations. Basic concepts of networking. Network topologies. Types of Network: LAN, MAN, WAN.

UNIT – II

Switched Communications Networks: Circuit-Switching Networks, Circuit-Switching Concepts Soft switch Architecture, Packet-Switching Principles, X.25, Frame relay. ATM Networks-Protocol Architecture, ATM Logical Connections, ATM Cells, Transmission of ATM Cells, and ATM Service Categories.

UNIT – III

Data Link Layer: Design issues, Services provided to the Network layer, framing, Error Control, Flow Control. Elementary Data Link Control protocols: Stop and Wait, Sliding Window, Go Back-N, and Selective Repeat. High-Level Data Link Control (HDLC).

MAC Sub Layer: Multiple Access Protocols: ALOHA, CSMA, Comparison of IEEE Standards IEEE 802.3, 802.4, 802.11, 802.15, 802.16.

UNIT – IV

Network Layer: Network Layer Design Issues, Routing algorithms: Shortest Path Routing, Flooding, Distance Vector Routing, Hierarchical routing, Broadcast, Multicast, Congestion Control- Congestion Control Algorithms. Quality of service. Inter-Networking. The Network Layer in Internet-IP Version 4 protocol, IP Addressing, Comparison of IPV4 and IP V6, Internet Control Protocols-ICMP, ARP, OSPF and BGP.

UNIT – V

Transport Layer: The transport Service, Elements of Transport Layer, TCP and UDP protocol header formats. **Network Security and Internet Applications:** Cryptography techniques, Authentication Protocols. Applications layer protocols: Domain Name System, SNMP, Electronic Mail, and World Wide Web.

Text Books:

1. W. Stallings, “Data and Computer Communications”, eight Edition, Prentice Hall - 2007.
2. A. Tanenbaum and D. Wetherall, “Computer Networks”, fifth Edition, Prentice-Hall, 2011.

Suggested Reading:

1. Behrouz A. Forouzan, “Data Communication and Networking”, Fourth Edition, McGraw-Hill Forouzan Networking Series, McGraw-Hill, 2007.
2. S. Keshav, “An Engineering Approach to Computer Networking”, Second Edition, AddisonWesley Professional Pearson Education, 2001.

16EC C33**PRINCIPLES OF GNSS**

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Fundamental concepts of communication are required.

Course Objectives: This course aims to:

1. Explain the basic principle of operation of GPS, GPS ephemerides and signal structure.
2. Make the students to understand various coordinate systems and highlight the effect of various errors affecting GPS signals.
3. Make the students to appreciate the significance of other GNSS systems, principle of DGPS and augmentation systems.

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

1. Understand the principle of operation of GPS and GPS ephemerides.
2. Analyze GPS signal structure and significance of various coordinate systems
3. Estimate the various errors and their effect on position estimation.
4. Compare other global and regional navigational systems
5. Apply DGPS principle and also analyze various augmentation systems. Use of GPS in Surveying, Mapping and Navigation.

UNIT-I

GPS Fundamentals: GPS System Segments: space, control and user segments, Principle of operation, Current status of GPS satellite constellation. Orbital Mechanics: GPS ephemeris data, algorithm for computation of satellite's position from ephemeris data. Time References: solar and sidereal days, UTC time, GPS time.

UNIT-II

GPS Signals: Legacy GPS signals: Signal structure, Operating frequencies, C/A and P-Code, Navigation message, Modernized GPS signals: list of signals and their significance. Range measurements: code and carrier measurements, User position estimation with PRN codes.

Coordinate systems: Earth Centered Earth Fixed (ECEF) coordinate system, Earth Centered Inertial (ECI) coordinate system, Geodetic coordinate system, Ellipsoid and Geoid, Regional and Global Datum, World Geodetic System (WGS-84).

UNIT-III

GPS Error Sources: Satellite clock error, ephemeris error, Receiver clock errors, satellite and receiver instrumental bias, Multipath error, receiver measurement noise, ionospheric error and tropospheric error, Klobuchar model, ionospheric delay estimation using dual frequency measurements and UERE. Dilution of precision: HDOP, VDOP, TDOP, PDOP & GDOP.

UNIT-IV

Data Formats: RINEX Observation and Navigation Data formats

GNSS: architecture, operation and signals of other global satellite systems such as Galileo, Beidou, GLONASS and regional systems such as IRNSS, QZSS.

UNIT-V

Differential GPS (DGPS): Principle of DGPS, Types of DGPS: Local Area DGPS (LADPS), Wide Area DGPS (WADGPS). **GPS Augmentation Systems:** Principle of operation of Satellite Based Augmentation system (SBAS) and Ground Based Augmentation System (GBAS): **GNSS Applications** Surveying, Mapping, Marine, air and land Navigation, Military and Space Application.

Text Books:

1. Elliot D Kaplan and Christopher J Hegarty, "Understanding GPS principles and applications", Artech House Publishers, 2/e Boston & London 2005.
2. PratapMisra and Per Enge, "Global Positioning System Signals, Measurement and Performance", Ganga- Jamuna Press, 2/e, Massachusetts, 2010.

Suggested Reading:

1. B.Hofmann, Wellenhof, H.Lichtenegger, and J.Collins, "GPS Theory and Practice," Springer Verlag, 5/e, 2008.
2. Ahmed El-Rabbany, "Introduction to GPS", Artech House Publishers, 2/e, Boston 2006.
3. Bradford W.Parkinson and James J. Spilker, "Global Positioning system: Theory and Application", Vol.II, American Institution of Aeronautics and Astronautics Inc., Washington, 1996.

16EC C34**RADAR AND SATELLITE COMMUNICATION**

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: To study this course, knowledge of Communication, Electromagnetic theory and antennas is required.

Course Objectives: This course aims to:

1. To learn the principles of operation of Radar systems.
2. To know the various types of tracking Radars.
3. To develop awareness about launching a satellite, communication system and the orbital effects of a satellite.

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

1. Identify various building blocks of pulse Radar, analyze its operation and predict the range performance.
2. Measure the speed and direction of moving targets in spite of blind speeds.
3. Compare various tracking Radar mechanisms.
4. Understand basic satellite construction, sub systems, launching mechanisms and its operation.
5. Analyze LOS propagation and calculate the path loss in a satellite link. Calculation of G/T and C/N ratios of a path link and understand.

UNIT-I

Introduction to Radar, Radar block diagram and operation, Radar frequencies, Applications of Radar, Prediction of range performance, minimum detectable signal, receiver noise, probability density function, SNR, Integration of Radar pulses, Radar cross-section of targets, PRF and range ambiguities, transmitter power, system losses.

UNIT-II

Doppler effect, CW Radar, FM CW Radar, multiple frequency CW radar. MTI Radar, delay line canceller, range gated MTI Radar, blind speeds, staggered PRF, limitations to the performance of MTI Radar, non-coherent MTI Radar.

UNIT-III

Tracking Radar: Sequential lobbing, conical scan, Monopulse: amplitude comparison and phase comparison methods, Low angle tracking, tracking in range, comparison of various trackers, Radar antennas.

UNIT-IV

Orbital Mechanics and Launchers: Orbital elements, Locating the satellite with respect to the earth, sub- satellite point, look angles, Orbital effects in communication system performance, Satellite sub-systems: Attitude and Orbit control systems, Telemetry, Tracking and command control system, Power supply system, Communications subsystems (transponders), Space craft antennas.

UNIT-V

Introduction to satellite link design, considerations for design of satellite system, basic transmission theory, system noise temperature and G/T ratio, design of down link and uplink, design of satellite links for specified C/N, overall C/N for uplink and downlink.

Text Books:

1. Merril. I. Skolnik, "Introduction to Radar Systems", 3/e, MGH, 2001.
2. Timothy Pratt and Charles Bostian, "Satellite Communications", John Wiley, 1986.
3. Dennis Roddy, "Satellite Communication Systems", McGraw Hill publications, 4th Edition, 2017.

Suggested Reading:

- 1 M. Richharia, "Satellite Communication Systems: Design Principles", MacMillan, 2/e, 2003.

16EC C35**VLSI DESIGN**

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: A prior knowledge of Verilog HDL and MOS Transistor Theory.

Course Objectives: This course aims to:

1. Study the concepts of Verilog HDL, simulation and synthesis process/concepts.
2. Learn the various characteristics of MOS transistor, process steps in IC fabrication.
3. Learn the various concepts required to obtain the digital logic layout diagrams. To know various subsystem design concepts.

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

1. Simulate and synthesize digital logic designs.
2. Understand characteristic behavior of MOSFET and layout design rules.
3. Analyze the process steps in IC fabrication
4. Design CMOS based logic circuits.
5. Understand the design concepts of memories and VLSI testing.

UNIT – I

Advanced Verilog HDL: Functions and tasks, Switch level Modeling, UDP, Design of Mealy and Moore state models using Verilog, Logic Synthesis, Synthesis Design flow, Gate level Netlist.

UNIT – II

Introduction to MOS Technology, Basic MOS Transistor action: Enhancement and Depletion Modes. Basic electrical properties of MOS, Threshold voltage and Body Effect.

MOS and CMOS circuit Design Process: MOS Layers, Stick diagrams, Lambda based Design rules and Layout diagrams.

UNIT – III

Process steps in IC fabrication Crystal growth and wafer preparation Czochralski process- apparatus- silicon shaping, slicing and polishing- Diffusion, Ion

implantation- Annealing process- Oxidation process- Lithography- Photolithography, electron beam and x-ray lithography- Chemical vapour deposition (CVD)- epitaxial growth- reactors- metallisation and packaging.

UNIT –IV

Design of MOS inverters with different loads. Basic Logic Gates with CMOS: INVERTER, NAND, NOR, AOI and OAI gates. Transmission gate logic circuits, BiCMOS inverter, D flip flop using Transmission gates.

UNIT –V

Subsystem Design: Multiplexor, Comparator, Shifters, Programmable Logic Arrays. Memories: 1T, 3T Dynamic RAM Cell, 6T Static RAM Cell. NOR and NAND based ROM Memory Design.

Testing: Introduction to Testing, Fault models, Controllability, Observability.

Text Books:

1. Samir Palnitkar, “Verilog HDL: A guide to Digital design and synthesis”, 2/e, Pearson Education, 2008.
2. Kamran Eshraghian, Douglas A. Pucknell, Sholeh Eshraghian, “Essentials of VLSI circuits and systems”, PHI, 2011.
3. Neil H E Weste, David Harris, Ayan Banerjee “CMOC VLSI Design A circuit and System Perspective”, 3/e, Pearson Education, 2006.

Suggested Reading:

1. Michael D. Ciletti, “Advanced Digital Design with Verilog HDL”, PHI, 2005.
2. John P. Uyemura, “Introduction to VLSI Circuits and systems”, John Wiley & Sons, 2011.
3. Morris Mano M. and Michael D.Ciletti, “Digital Design with an Introduction to Verilog HDL”, 5th edition, Pearson 2013.

16EC E08**PRINCIPLES OF COMPUTATIONAL ELECTRO MAGNETICS**

(Elective-IV)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Student must have completed a course on Electromagnetic waves and transmission lines.

Course Objectives: This course aims to:

1. Learn the fundamental concepts of computational electromagnetics
2. Understand variational methods for simplifying the integral/differential equations.
3. Study MoM and FEM for solving static and scatter problems.

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

1. Understand the basic concepts of computational Electromagnetics.
2. Get familiar with variational methods.
3. Experience the process of taking moments by multiplying with appropriate weighing functions.
4. Solve Quasi Static, Scattering and Radiation problems using Method of Moments.
5. Solve the Laplace's equation, Poisson's equation and wave equations using finite element methods.

UNIT-I

Analytical methods and numerical methods; Low frequency and high frequency methods; Full-wave Electromagnetics; Frequency versus Time domain methods, Differential versus Integral equation methods. Time varying potentials, time harmonic fields and boundary conditions.

UNIT-II

Variational Methods: Introductions, Operators in Linear Spaces, Calculus of Variations, Construction of Functionals from PDEs, Rayleigh-Ritz Method, Galerkin's Method.

UNIT-III

Moment Methods: Introduction, Differential Equations, Integral Equations, Differential and Integral Equations, Greens Functions.

UNIT-IV

Applications of Moment Method: Quasi Static Problems and Scattering Problems, Radiation Problems: Hallen's and Pocklington's Equations.

UNIT-V

Finite Element Method: Introduction, Solution for Laplace's Equations, Poisson's Equation and Wave Equation. Automatic Mesh generation: Rectangular Domains.

Text Book:

1. Matthew N.O.Sadiku, "Computational Electromagnetics with MATLAB", CRC Press, Taylor & Francis Group, Fourth Edition, 2019.

Suggested Reading:

1. C A Balanis, "Advanced Engineering Electromagnetics", John Wiley & Sons, Inc, 2nd Edition, 2012.
2. Walton C. Gibson, "The Method of Moments in Electromagnetics", Champan&Hall/CRC Taylor & Francis Group, Second Edition, 2014.

16EC E09**REAL TIME OPERATING SYSTEMS**
(Elective-IV)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisites: Prior knowledge of Computer Organization and Architecture is required.

Course Objectives: This course aims to:

1. Learn about the fundamental need of Real Time operating systems.
2. Understand the concepts of different RTOS.
3. Study the linux based target system design process.

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

1. Understand Real-time operating system requirements and applications.
2. Categorize different scheduling approaches for real time scheduler.
3. Compare different real time systems.
4. Analyze the inter task communication in RTOS.
5. Apply the linux based embedded system design process.

UNIT-I

Introduction to Operating Systems: Operating System objectives and functions, Evolution of operating systems, Developments leading to modern Operating Systems, Virtual machines, OS design consideration for multiprocessor and multicore, Overview on traditional and modern Unix OS, Differences between GPOS and RTOS

UNIT-II

Real Time System Basics: Basic model of a real time system, characteristics, applications, types of real time tasks, timing constraints, Uniprocessor Scheduling: Criteria for scheduling, scheduling algorithms: FCFS, SJF, Priority, Round Robin. **Real Time Task Scheduling:** Earliest Deadline First (EDF): Implementation, shortcoming. Rate Monotonic Algorithm (RMA): Implementation, issues associated with RMA

UNIT-III

Commercial Real Time Operating System: Time services, Features of RTOS, Unix as a RTOS, Non pre-emptive kernel, dynamic priority levels, POSIX: genesis

of POSIX, Overview, Real Time POSIX standard, Priority inversion, priority ceiling and priority Inheritance protocols , a survey of contemporary RTOS: PSOS, VRTX, QNX, μ C-OS-II and RT-Linux,

UNIT-IV

Introduction to Vxworks: Salient Features, Multitasking, Task state transition, Task Control: Task Creation and Activation, Task Stack, Task Names and IDs, Task Options, Task Information, Task Deletion and Safety, Semaphore and message queues related functions

UNIT-V

Linux Development Process: Types of Host /Target Development and debug setup, Generic Architecture of an Embedded Linux System, System start up, Types of Boot configurations, System Memory Layout, Development Tools: Project Workspace, IDE, GNCC cross platform, selecting and configuring kernel, setting up boot loader.

Text Books:

1. William Stallings, “Operating Systems Internals and Design Principles,” 7/e, Pearson Education, 2014.
2. Rajib Mall, “Real Time Systems”, Pearson Education, 2/e, 2007.
3. Karim Yaghmour, “Building Embedded Linux Systems” O’Reilly, 2003.

Suggested Reading:

1. Silberschatz, Galvin, Gange” Operating Systems Concepts” 8/e , Wiley Education, 2007.
2. Wind River Systems Inc., ”VxWorks Programrs Guide”, 1997.

16EC E10**SPEECH PROCESSING**
(Elective-IV)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: The student should have knowledge of digital signal processing.

Course Objectives: This course aims to:

1. Provide students with the knowledge of basic characteristics of speech signal in relation to production and hearing of speech by humans.
2. Describe basic algorithms of speech analysis and pitch extraction.
3. Learn the various algorithms for speech recognition like HMM and Dynamic warping.

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

1. Understand the basic characteristics of speech signal in relation to production and hearing of speech by humans.
2. Analyze speech and extract features for speech applications.
3. Design the various applications like recognition, synthesis, and coding of speech.
4. Use HMM for speech recognition.
5. Implement dynamic warping technique in real time problems.

UNIT – I

Fundamentals of Digital speech processing: Discrete time signals and systems, Transform representation of signals and systems (Z-transform, FT and DFT), fundamentals of digital filters (IIR and FIR), Sampling theorem. Decimation and interpolation of sampled waveforms, Mechanism of speech production: Vocal track and physiology.

UNIT - II

Time Domain Models of Speech Processing: Time dependent processing of speech, Short –time Energy and average magnitude, short time average Zero crossing rate, Speech versus Silence Discrimination using Energy and Zero crossing, Pitch period estimation, short time auto correlation estimation, Short time average magnitude difference function, median smoothing and speech processing.

UNIT–III

Digital Representation of the Speech Waveform: Sampling speech signals, review of statistical model of speech signal, Instantaneous Quantization, Adaptive Quantization, Differential quantization. Qualitative treatment for Delta modulation and Differential PCM. Comparison of systems, LDM to PCM conversion and PCM to ADPCM conversion.

UNIT-IV

Homomorphic Speech Processing: Introduction, Homomorphic systems for convolution - properties of the complex Cepstrum, computational considerations, complex cepstrum of speech, Pitch detection, Formant estimation, The homomorphic Vocoder. Introduction to Text-to-speech and Articulator speech synthesis.

UNIT-V

Linear Predictive Analysis: Solution of the LPC equations, Comparisons between the methods of the solutions of LPC Analysis equations, Frequency Domain interpretation of LPA, Applications of the LPC parameters Speaker recognition systems, Problems in Automatic speech recognition, Dynamic warping, Hidden Markov models, speaker Identification / verification.

Text Books

1. Rabiner L.R and Schafer R. W, “Digital Processing of Speech Signals”, PHI, 1978.
2. Owens F.J., “Signal Processing of Speech”, Macmillan, New Electronics, 1/e, 2000.

Suggested Reading:

1. Daniel Jurefsky and James H. Martin, “Speech and Language Processing”, PHI, 2/e, 2003.
2. Papamchalil, “Practical Approaches to speech coding”, PHI, 1987.
3. Rabiner and Bernard Gold, “Theory and Application of Digital Signal Processing”, 2nd edition, PHI, 1988.

16EC E11**SPREAD SPECTRUM COMMUNICATION**
(Elective-IV)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: A prior knowledge of digital communication is required.

Course Objectives: This course aims to:

1. Introduce the fundamental concepts of Spread Spectrum Communication Systems
2. Train the students with various key issues related to synchronization in Spread Spectrum Communication Systems.
3. Enable the students to assess the performance of spread Spectrum Communication Systems.

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

1. Understand the fundamental concepts of Spread Spectrum Communication Systems
2. Design code generators and will be able to estimate tracking loops.
3. Infer the concept of synchronization in Spread Spectrum Communication.
4. Model the fading channel and will be able to interpret the requirement of diversity in fading channels.
5. Analyze the performance of Spread Spectrum Communication Systems by understanding various key issues like jamming, noise and error probability.

UNIT-I

Introduction to Spread Spectrum Communication Systems: Direct Sequence Spread Spectrum: BPSK Direct Sequence Spread Spectrum. Frequency Hop Spread Spectrum: Coherent Slow Frequency Hop Spread Spectrum, Non Coherent Slow Frequency Hop Spread Spectrum, Non Coherent Fast Frequency Hop Spread Spectrum.

UNIT-II

Binary Shift Register Sequences for Spread Spectrum Systems: Maximal Length Sequences: Properties of m-Sequences, Power Spectrum of m-Sequences,

Gold Codes, Code Tracking Loops: Optimum Tracking of Wide Band Signals, Tau-Dither Noncoherent Tracking Loop.

UNIT-III

Synchronization of the Receiver Spreading Code: Problem Definition and the Optimum Synchronizer, Serial Search Synchronization Techniques: Calculation of Mean and Variance of Synchronization Time, Modified Sweep Strategies, Generalized Analysis of Average Synchronization Time, Synchronization Using a Matched Filter.

UNIT-IV

Fading Channels: Statistical Model of Fading: General Fading Channel Model, WSSUS Fading Channels, Doubly Spread Channels, Requirement for Diversity in Fading Channels: Diversity Approaches, Diversity Combining Methods, Performance of Maximal Ratio Combining, The Rake Receiver.

UNIT-V

Performance of Spread Spectrum Systems: Spread Spectrum Communication System Model, Performance of Spread Spectrum Systems Without Coding: Performance in AWGN, Performance in Pulsed Noise Jamming, Low Probability of Intercept Methods: Energy Detection in AWGN.

Text Books:

1. R. L. Peterson, R. Ziemer and D. Borth, "Introduction to Spread Spectrum Communications", PHI, 1995.
2. Vijay K Garg "IS95CDMA and cdma 2000", Low price Edition, 2002.

Suggested Reading:

1. J. Viterbi, "CDMA - Principles of Spread Spectrum Communications", Addison-Wesley, 1997.
2. M. K. Simon, J. K. Omura, R. A. Scholtz and B. K. Levitt, "Spread Spectrum Communications Handbook", McGraw Hill, 1994.
3. G. R. Cooper and C. D. McGillem, "Modern Communications and Spread Spectrum", McGraw- Hill, 1985.

16EC E12**APPLICATIONS OF IoT IN ECE**

(Elective-V)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

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

Course Objectives: This course aims to:

1. Provide an overview of Internet of Things, building blocks of IoT and the real-world applications.
2. Introduce Python Programming language and packages.
3. Introduce Raspberry Pi device, its interfaces and Django Framework.

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

1. Understand the terminology, enabling technologies and applications of IoT
2. Apply the concept of M2M (machine to machine) and describe the differences between M2M and IoT.
3. Understand the basics of Python Scripting Language which is used in many IoT devices
4. Describe the steps involved in IoT system design methodology
5. Design simple IoT systems using Raspberry Pi board with sensors, actuators and develop web applications using python based framework called Django.

UNIT-I

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

UNIT-II

Domain Specific IoTs: IoT applications for Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, health and Lifestyle

IoT and M2M: Introduction, M2M, Differences between IoT and M2M, Software Defined Networking, Network Function Virtualization.

UNIT-III

Introduction to Python: Motivation for using Python for designing IoT systems, Language features of Python, Data types: Numbers, Strings, Lists, Tuples, Dictionaries, Type Conversions, Data Structures: Control of flow-if, for, while, range, break/continue, pass, functions, modules, packaging, Python packages of Interest for IoT: JSON, XML, HTTPLib, URLLib, SMTPLib.

UNIT-IV

IoT Platforms Design Methodology: Introduction, IoT Design Methodology Steps-Purpose and Requirements Specification, Process Specification, Domain Model Specification, Information Model Specification, Service Specifications, IoT Level Specification, Functional View Specification, Operational View Specification, Device and Component Integration, Application Development, Case Study on IoT System for Weather Monitoring.

UNIT-V

IoT Physical Devices and End Points: Basic building blocks of an IoT device, Raspberry Pi-About the Raspberry Pi board, Raspberry Pi interfaces-Serial, SPI, I2C.
IoT Physical Servers and Cloud Offerings: Introduction to cloud storage models and Communication APIs, WAMP: AutoBahn for IoT, Xivelycloud for IoT.
Python Web Application Framework: Django Framework-Roles of Model, Template and View

Text Books:

1. ArshdeepBahga and Vijay Madiseti, “Internet of Things - A Hands-on Approach”, Universities Press, 2015.
2. Tony Gaddis, “Starting out with Python”, 3rd edition, Pearson, 2015.

Suggested Reading:

1. Francis daCosta, “Rethinking the Internet of Things: A Scalable Approach to Connecting Everything”, 1st edition, press Publications, 2013.
2. Matt Richardson, Shawn Wallace, O’Reilly, “Getting Started with Raspberry Pi”, SPD, 2014.

16EC E13**DIGITAL IMAGE PROCESSING**

(Elective-V)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: This course requires the knowledge of Digital Signal Processing.

Course Objectives: This course aims to:

1. Understand the image formation and its digital representation.
2. Learn representation of images in frequency domain and enhancement techniques.
3. Students would be able to solve the problems related to image compression and restoration.

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

1. Understand how images are formed, sampled and quantized.
2. Apply various transforms like Fourier, DCT, Haar, DWT and Hadamard Transform to different applications.
3. Apply image enhancement techniques for practical applications
4. Implement the image restoration techniques.
5. Implement image compression techniques by removing the redundancy.

UNIT-I

Elements of Digital Image Processing Systems, Digital image representation, elements of visual perception, Image sampling and Quantization, Basic Relationships between pixels.

UNIT-II

Properties and Applications of Fourier Transform: FFT, Discrete cosine transform, Hadamard transform, Haar transform, Slant transform, DWT and Hotelling transform.

UNIT-III

Spatial Enhancement Techniques: Histogram equalization, direct histogram specification, Local enhancement. Frequency domain techniques: Low pass, High pass and Homomorphic Filtering, Image Zooming Techniques.

UNIT – IV

Image Degradation model, Algebraic approach to restoration, inverse filtering, Least mean square filter, Constrained least square restoration and interactive restoration. Speckle noise and its removal techniques.

UNIT – V

Redundancies for image compression, Huffman Coding, Arithmetic coding, Bit-plane coding, loss less and lossy predictive coding. Transform coding techniques: Zonal coding and Threshold coding.

Text Books:

1. Gonzalez R.C. and Woods R.E., “Digital Image Processing” 2/e, PHI, 2005.
2. A.K.Jain, “Fundamentals of Digital Image processing”, PHI, 1989.

Suggested Reading:

1. Madhuri A, Joshi, “Digital Image Processing: An algorithmic Approach”, PHI, 2006.
2. U Qidwai, C.H.Chen, “Digital Image Processing”, CRC Press, (Taylor & Francis), YesdeePublications, First Indian Reprint 2013.

16EC E14**PRINCIPLES OF OPTIMIZATION TECHNIQUES**

(Elective-V)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Knowledge about Engineering mathematics and problem solving skills with programming languages.

Course Objectives: This course aims to:

1. Understand LPP and NLPP techniques.
2. Understand the difference between local and global optimization methods.
3. Compare different optimization methods.

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

1. Take optimal decision to increase the production.
2. Take optimal decision to get more profit.
3. Take appropriate decision for selection of an industry.
4. Apply NLP techniques to design IC's.
5. Apply Genetic Algorithm for design of IC's.

UNIT-I

Introduction To Optimization, Applications of optimization techniques, statement of the problem, linear programming-standard form of LPP, Motivation of the simplex method, simplex algorithm, two phases of simplex method, sensitivity Analysis.

UNIT-II

Non Linear Programming (NLP): One Dimensional: Unrestricted search, exhaustive search, Fibonacci method, golden section method-Newton and secant methods. Unconstrained optimization: direct search method, simplex method. Gradient of a function, steepest Descent search method (Cauchy) method, Conjugate gradient method.

UNIT-III

NLP-Constrained Optimization: Characteristic of a constrained problem, Direct methods-Random search methods, Sequential linear programming

method. Indirect methods: Transformation techniques, interior and exterior penalty function methods.

UNIT-IV

Further Topics in Optimization: Multi objective Optimization-Utility function method, Invariant and utility function methods, global criterion method. Simulated Annealing, Optimization of Fuzzy systems.

UNIT-V

Genetic Algorithm (GA): Introduction, optimization of a simple function-Representation, Initial population, Genetic operators: Crossover and Mutation. Travelling salesman problem (TSP), Comparison between Hill climbing, Simulated annealing and Genetic algorithms. How do GAs work- Chromosome selection, Selection process, Recombination operators, Example of maximization of a nonlinear function.

Text Books:

1. Singiresu S. Rao, "Engineering Optimization: Theory and Practice", 3rd edition, New Age International (P) Limited, 2013.
2. Zbigniew Michalewicz, "Genetic Algorithms + Data structures = Evolution Programs", Third Revised and Extended Edition, Springer, 2013.

Suggested Reading:

1. Kalyanmay Deb, "Optimization for Engineering Design-Algorithms and Examples", Second edition, PHI, 2012.
2. Merriam C.W., "Optimum theory and the design of feedback control systems", McGraw Hill, 1964.

16EC E15**PRINCIPLES OF WIRELESS SENSOR NETWORKS**

(Elective-V)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: The student must have taken a course on data communication and computer networks.

Course Objectives: This course aims to:

1. Know about the architecture and characteristics of wireless sensor networks and sensor nodes.
2. Understand different constraints of wireless sensor network, like coverage, power management etc. and the principles of data transmission, clustering algorithm and routing protocols.
3. Design and development of new network architecture and MAC protocols.

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

1. Compare different sensor networks.
2. Understand the principles of sensor nodes, network deployment and architectures.
3. Evaluate the performance of different MAC protocols and clustering algorithm.
4. Analyze data processing, aggregation and routing in a WSN.
5. Demonstrate the performance of different WSN in terms of collision throughput and security.

UNIT – I

Introduction to Wireless Sensor Networks.: Features, Design challenges, Network architecture, Applications, Sensor deployment mechanism, Topologies and characteristics of Wireless Sensor Networks, Advantages of WSN.

UNIT – II

Network and Component Technologies: Mobile Adhoc Networks (MANETs), Sensors, Coverage, Physical layer, Sensor platforms, Reliable data transport, Radio energy consumption model, Power management, Synchronization, Localization.

UNIT – III

Data Transmission and Routing: Data processing and aggregation, Data storage, Node discovery algorithms, Wireless sensor network routing, Proactive and reactive routing.

UNIT – IV

Protocols: Frame structure, Network clustering protocols, Medium access control protocols, Multi-hop communication protocols, Congestion control and rate control protocols, Protocol overheads.

UNIT – V

Dependability Issues: Collisions, Collision avoidance mechanism, Hidden node and exposed node problems, Data congestions, Throughput, Security challenges. Design Principles of WSNs, Concepts of Gateway.

Text Books:

1. Holger Karl and Andreas Willig, “Protocols and Architectures for Wireless Sensor Networks”, Wiley-2011.
2. Yan Zhang, JijunLuo, Honglin Hu, “Wireless Mesh Networking, Architecture, Protocols and Standards”, 1st edition, Auerbach Publications, 2006.
3. Edgar H. Callaway Jr. and Edgar H. Callaway, “Wireless Sensor Networks: Architectures and Protocols”, 1st edition, Auerbach Publications, 2003.

Suggested Reading:

1. Yang, Shuang-Hua, “Wireless Sensor Networks Principles, Design and Applications”, Springer, 2014.
2. Kazem Sohraby, Daniel Minoli, Taieb Znati, “Wireless Sensor Networks: Technology, Protocols and Applications”, Wiley, 2007.
3. Mohammad S. Obaidat, SudipMisra, “Principles of Wireless Sensor Networks”, Cambridge University Press, 2014.

16EC C36**ADVANCED SIMULATION LAB**

Instruction	3 P Hours per Week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	25 Marks
Credits	2

Prerequisite: A prior knowledge of Digital logic, Signal processing, Communication and DCCN is required.

Course Objectives: This course aims to:

1. Understand the importance and applications of virtual instrumentation and computer networks.
2. Learn the basic programming concepts in LabVIEW and Network Simulator.
3. Develop real time applications using LabVIEW.

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

1. Learn how to develop basic applications in the LabVIEW graphical programming environment.
2. Develop ability for programming in LabVIEW using various data structures, program structures, plotting the graphs and charts for system monitoring, processing and controlling.
3. Apply knowledge of mathematics and engineering to formulate and study or solve engineering problems, including problems at the interface of engineering.
4. Develop LabVIEW skills to engineer basic computer-based instrumentation.
5. Develop applications that are scalable, readable, maintainable and reliable.

LAB EXPERIMENTS

1. Familiarization with simulation tools: LabVIEW and Network Simulator2 (NS2).
2. Loops, Structures and Math-script in LabVIEW.
3. Implementation of Combinational circuits (Multiplexer, Demultiplexer, Decoder and Encoder, Priority Encoder) using myRIO.
4. Design of Sequential circuits (Flip flops, counters and registers).
5. Convolution and correlation of signals.

6. FIR and IIR Filter design.
7. Implementation of Analog modulation and Demodulation schemes (AM and FM) using my RIO.
8. Digital carrier modulation and demodulation schemes (ASK, FSK and PSK)
9. Time domain analysis (State variable analysis).
10. Frequency domain analysis (Nyquist and Bode plots).
11. Creation of a wired network and data transmission between the nodes with at least four nodes using NS2.
12. Creation of a wireless network and data transmission between the nodes with at least four nodes using NS2.
13. Simulation of the data transfer between the nodes using TCP/UDP using NS2.
14. Sensor data acquisition using my DAQ.
15. Voltage / Current Sweep generation using my DAQ.

Mini Project cum Design Exercises

Design and development of any one of the following applications.

- a) Digital IIR Notch filter
- b) Multistage design of decimator and interpolator
- c) Discrete multitone transmitter and receiver
- d) ALU Design using Lab VIEW
- e) Universal shift registers using Lab VIEW
- f) Code converters using Lab VIEW
- g) Design of PLL using Lab VIEW

Suggested Reading:

1. Jeffrey Travis and Jim Kring, “Lab VIEW for Everyone: Graphical Programming Made Easy and Fun”, 3rd Edition, Prentice Hall, 2007.
2. TeerawatIssariyakul and EkramHossain, “Introduction to Network Simulator NS 2”, 2nd Edition, Springer, 2012.

16ECC37**ELECTRONIC DESIGN AND AUTOMATION LAB**

Instruction	3 P Hours per Week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	25 Marks
Credits	2

Prerequisite: Digital design fundamentals and synthesis & simulation concepts.

Course Objectives: This course aims to:

1. Simulate and synthesize combinational and sequential logic circuits
2. Simulate switch level modules
3. Learn implementation procedure for any design on FPGA and To study the speed, power and area constraints of FPGA/CPLD

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

1. Analyze simulation and synthesis reports of combinational and sequential logic circuits
2. Obtain gate level net-list and RTL diagrams
3. Implement sequence detector using FSM on FPGA
4. Design adders using UDP and Tasks & Functions.
5. Implement mini projects on FPGA/CPLD

Part A

Write VERILOG Code, Simulate and Implement the following on FPGA.

1. Code Converters.
2. Encoders, Decoders, Priority Encoder and Comparator.
3. Registers/Counters.
4. Sequence Detector using Mealy and Moore type state machines.
5. Any application of UDP.
6. Tasks and Functions.

Note:

1. All the codes should be implemented appropriately using Gate level, Dataflow and Behavioral Modeling.
2. All the programs should be simulated using test benches.

Part B**Switch Level Modeling of CMOS Circuits**

1. Basic Logic Gates: Inverter, NAND and NOR.

2. Half Adder and Half Subtractor.
3. 4:1 Multiplexer.
4. 2:4 Decoder.
5. Design of inverter circuit using Simulation tool.
6. Design of NAND Gate using Simulation tool.
7. Design of NOR Gate using Simulation tool.

Mini Project: Simulation and implementation of various digital designs on FPGA.

Suggested Reading:

1. Michal D.Ciletti, “Advanced digital design with Verilog HDL”, Pearson Edition, 2011.
2. Samir Palnitkar, “Verilog HDLA Guide to Digital Design and Synthesis”, Pearson 2nd edition, 2003.
3. Cadence Design Systems (Ireland) Ltd., “Cadence manual”, 2013.

16EC C38**PROJECT SEMINAR**

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

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

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

Guidelines for the award of Marks:Max.

Marks: 50

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

CHAITANYABHARATHI INSTITUTE OF TECHNOLOGY (A)
Choice Based Credit System (With Effect from Academic Year 2019-20)
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		Elective – VI	3	-	3	30	70	3
2		Elective – VII (Open)	3	-	3	30	70	3
3		Elective – VIII (Open)	3	-	3	30	70	3
PRACTICALS								
4	16EC C39	Seminar	-	3	-	50	-	2
5	16EC C40	Project	-	6	Viva- Voce	50	100	6
Total			9	9	-	190	310	17

Elective – VI		Elective – VII (Open)		Elective – VIII (Open)	
Course Code	Title of the Course	Course Code	Title of the Course	Course Code	Title of the Course
16EC E16	DSP Processors and Architectures	16CS O10	Basics of Machine Learning Using Python	16CE O02	Disaster Mitigation and Management
16EC E17	Software Defined Radio	16ME O01	Entrepreneurship	16CS O06	Fundamentals of DBMS
16E CE18	VLSI Technology	16EG O02	Gender Sensitization	16ME O04	Intellectual Property Rights
16EC E19	Voice over IP	16PY O01	History of Science and Technology	16CS O05	Principles of Virtual Reality
		16ME O02	Robotics	16EG O01	Technical Writing Skills

Note: Students undergoing internships during the semester processed through training and placement office are permitted to take up equivalent courses through NPTEL / MOOCS / SWAYAM to earn required credits. However such students should seek a prior permission from the Chairman, BoS.

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

116EC E16**DSP PROCESSORS AND ARCHITECTURES**

(Elective-VI)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Course on Digital Signal Processing.**Course Objectives:** This course aims to:

1. Learn the architectural differences between DSP and General purpose processor.
2. Study the fixed point.
3. Study the various applications of DSP Processors.

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

1. Differentiate between DSP Processor and General Purpose processor.
2. Select the most appropriate processor for the given application.
3. Design and implement various signal processing algorithms using 55xx processor.
4. Interface the TMS320C55XX processor to external devices.
5. Take up research projects using DSP processors.

UNIT-I

Introduction to DSP Processors: Differences between DSP and other microprocessor architectures. Number formats- Fixed point, Floating point and block Floating point formats, IEEE-754 Floating point, Dynamic range and precision, Relation between data word size and instruction word size, Q-notation. Basic elements of real time DSP systems, DSP Hardware

UNIT-II

Fundamentals of Programmable DSPs: Multiplier and Multiplier Accumulator, Modified Bus structures and memory access in PDSPs – Multiple access memory, multiport memory, SIMD, VLIW Architectures, Pipelining, Special addressing modes in PDSPs, On-chip peripherals.

UNIT-III

Overview of TMS320C55X: Architecture of TMS320C55X Processor, Buses, Memory map, addressing modes, Instruction set, Pipeline and parallelism, Mixed C and Assembly language programming and on-chip peripherals.

UNIT-IV**Interfacing Memory and Parallel I/O Peripherals to Programmable DSP**

Devices: Memory space organization, External bus interfacing signals, Memory interface, Parallel I/O interface, Program I/O, Interrupts and I/O, Direct Memory Access (DMA). Software Development tools-Code Composer Studio (CCS), C compiler, Assembler and Linker.

UNIT-V

Application Programs: Implementation of algorithms on DSP processors, Sinewave generators, Convolution, Correlation, FFT, FIR filter, IIR filter, Decimation and Interpolation and sub band coding of signals.

Text Books:

1. Sen M. Kuo and WoonSergGan, “Digital Signal Processors Architectures, Implementation and Application”, Pearson Practice Hall, 2013.
2. Avatar Singh and S. Srinivasan, “Digital Signal Processing Implementations Using DSP Microprocessors”, Thomson Brooks, 2012.

Suggested Reading:

1. B.Ventakaramani, M. Bhaskar, “Digital Signal Processors Architecture Programming and Applications”, Tata McGraw Hill, 10th reprint, 2015.
2. RulphChassaing, “Digital Signal Processing and Application with the C6713 and C6416 DSK”, A John Wiley & sons, Inc, Publication, 2005.

16EC E17**SOFTWARE DEFINED RADIO**

(Elective-VI)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: The students should have the knowledge of analog and digital communication

Course Objectives: This course aims to:

1. Make the students understand the differences between Super-heterodyne Radio, SoftwareDefined Radio (SDR) and Cognitive Radio (CR).
2. Give the Knowledge to students about FPGA based architectures and processors with low power consumption.
3. Understand the single node Cognitive radio techniques and basics of Co-operative spectrum sensing and the applications of CR.

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

1. Understand the difference between the Super-heterodyne receiver, SDR and CR.
2. Know the different architectures of SDR.
3. Learn the various signal processing devices of SDR.
4. Understand the difference between single node and multi node spectrum sensing technique.
5. Understand the Energy based sensing technique.

UNIT-I

Introduction to SDR: What is Software-Defined Radio, The Requirement for Software-Defined Radio, Legacy Systems, The Benefits of Multi-standard Terminals, Economies of Scale, Global Roaming, Service Upgrading, Adaptive Modulation and Coding, Operational Requirements, Key Requirements, Reconfiguration Mechanisms, , Handset Model, New Base-Station and Network, Architectures, Separation of Digital and RF, Tower-Top Mounting, BTS Hoteling, Smart Antenna Systems, Smart Antenna System Architectures, Power Consumption Issues, Calibration Issues, Projects and Sources of Information on Software Defined Radio.

UNIT-II

Basic Architecture of a Software Defined Radio: Software Defined Radio Architectures, Ideal Software Defined Radio Architecture, Required Hardware Specifications, Digital Aspects of a Software Defined Radio, Digital Hardware, Alternative Digital Processing Options for BTS Applications, Alternative Digital Processing Options for Handset Applications, Current Technology Limitations, A/D Signal-to-Noise Ratio and Power Consumption, Derivation of Minimum Power Consumption, Power Consumption Examples.

UNIT-III

Signal Processing Devices and Architectures: General Purpose Processors, Digital Signal Processors, Field Programmable Gate Arrays, Specialized Processing Units, Tiler Tile Processor, Application-Specific Integrated Circuits, Hybrid Solutions, Choosing a DSP Solution, Comparison of all processors.

UNIT-IV

Cognitive Radio: Techniques and signal processing History and background, Communication policy and Spectrum Management, Cognitive radio cycle, Cognitive radio architecture, SDR architecture for cognitive radio, Spectrum sensing Single node sensing: energy detection. Introduction and challenges of Co-operative spectrum sensing.

UNIT-V

Cognitive Radio: Hardware and applications, Spectrum allocation models. Spectrum handoff, Cognitive radio performance analysis. Hardware platforms for Cognitive radio (USRP, WARP), details of USRP board, Applications of Cognitive radio.

Text books:

1. Eugene Grayver, "Implementing Software Defined Radio", Springer, New York Heidelberg Dordrecht London, ISBN 978-1-4419-9332-8, 2013.
2. Bruce A. Fette, "Cognitive Radio Technology", Elsevier, ISBN 10: 0-7506-7952-2, 2/e, 2006.

Suggested Reading:

1. Peter B. Kenington, "RF and Baseband Techniques for Software Defined Radio", Artech House Publishers, Inc © 2005.
2. Hüseyin Arslan, "Cognitive Radio, Software Defined Radio and Adaptive Wireless Systems", Springer, ISBN 978-1-4020-5541-6 (HB), 2007.

16EC E18**VLSI TECHNOLOGY**

(Elective-VI)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: A prior knowledge of Semiconductor Properties.

Course Objectives: This course aims to:

1. Understand the procedure for preparing silicon wafer and its cleaning.
2. Know the various fabrications steps involved.
3. Learn the concepts of packaging and Testing of ICs.

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

1. Analyze the functions of various layers in IC fabrication.
2. Demonstrate the concepts of preparing silicon wafer from the raw material.
3. Understand and analyzation of chemical reactions in the formation of various layers.
4. Compare various lithography process steps.
5. Understand concepts of involved in packaging of VLSI circuits and testing.

UNIT-I:

Introduction: Integrated Circuits Review of history of VLSI technology progress, Silicon as the Base Material and its advantages, various Layers of ICs: Substrate, Active Layer, Oxide/Nitride Layers, Metal/Poly Silicon Layers. Functions of each of the Layers. Introduction to clean room technology.

UNIT-II

Silicon Wafer Preparation: Electronic Grade Silicon, CZ and FZ Methods of Single Crystal Growth, Silicon Shaping, Mechanical Operations, Chemical Operations.

Wafer-Cleaning Technology: Introduction, basic concepts of wafer cleaning, Wet-cleaning technology, Dry-cleaning technology.

UNIT-III

Oxide Growth: Structure of 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 and sputtering.

Packaging and Metallization: Die, Bonding and Packaging, Testing.

Text Books:

1. J. D. Plummer, M. D. Deal and P. B. Griffin, "The Silicon VLSI Technology Fundamentals, Practice and modeling", Pearson Education 2009.
2. S.M. Sze, "VLSI Technology", McGrawhill International Editions, 2017.

Suggested Reading:

1. CY Chang and S.M. Sze, "VLSI Technology", Tata McGraw-Hill Companies Inc. with effect from the academic year 2016-2017.
2. Stephen A, "The Science and Engineering of Microelectronic Fabrication", Campbell Oxford 2001.

16EC E19**VOICE OVER IP**
(Elective-VI)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: A prior knowledge of Data communication and computer networks is required.

Course Objectives: This course aims to:

1. Provide the switching technology, traditionally used to transport voice over the telephone system.
2. Examine the emerging trend of using packet-switching network to transport voice - especially over the Internet Protocol (IP) network.
3. Provide students the theory of “IP Telephony”. Students will also get the bigger picture of how VoIP technology is changing the telecom

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

1. Identify architectures used in the enterprise environment and interpret the key VoIP industry protocols
2. Apply and rephrase the different protocol like SIP, H.323 and VoIP.
3. Examine the importance of QoS with regard to availability and reliability of a voice network.
4. Relate the technologies, architectures, and protocols used in the VoIP environment.
5. Familiarize with Voice over IP Benefits, Applications and Services.

UNIT I

Overview of the PSTN and Comparisons to Voice over IP: The Beginning of the PSTN, Understanding PSTN, Basics, PSTN Services and Application, Drivers Behind the Convergence Between Voice and Data Networking, Packet Telephony, New PSTN Network Infrastructure Model.

UNIT II

Basic Telephony Signaling: Signaling Overview, E&M Signaling, CAS, ISDN, QSIG, DPNSS; Signaling System 7, SS7 Network Architecture, SS7 Protocol Overview, SS7 Examples, List of SS7 Specifications.

UNIT III

IP Transport Mechanisms: An In-Depth Analysis Delay/Latency Jitter. Pulse Code Modulation, Voice Compression, Echo, Packet Loss, Voice Activity Detection, Dial-Plan Design, End Office Switch, Call-Flow Versus IP Phone Call. Voice over IP Configuration Issues: Dial-Plan Considerations, Feature Transparency.

UNIT-IV

Quality of Service:QoS Network Toolkit, Edge Functions, Traffic Policing, Backbone Networks, Rules of Thumb for QoS; IP Signaling Protocols H.323, H.323 Elements, H.323 Protocol Suite, H.323 Call-Flows, Session Initiation Protocol, SIP Overview, SIP Messages, Basic Operation of SIP, Gateway Control Protocols Simple Gateway Control Protocol, Media Gateway Control Protocol.

UNIT V

Voice over IP Benefits, Applications and Services: Key Benefits of VoIP Packet Telephony Enterprise Applications and Benefits Enterprise VoIP Case Study: B.A.N.C. Financing International. Call Centers Service Provider Calling-Card Case Study Value-Added Services Enterprise Case Study: Acme Corporation

Text Books:

1. Jonathan Davidson, James Peters, “Voice over IP Fundamentals”, Cisco Press, Packet Guide to Voice over IP,2000.
2. Bruce Hartpence, “Packet Guide to Voice over IP”, Oreilly Publications, 2013.

Suggested Reading:

1. Daniel Collins, “Carrier Grade Voice over IP”, 2nd edition, TMH, 2002.

16CS O10**BASICS OF MACHINE LEARNING USING PYTHON**

Elective-VII (Open)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course aims to:

1. Get an idea of Machine Learning algorithms to solve real world problems.
2. Study various machine learning algorithms.
3. Analyze data using machine learning techniques.

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

1. Understand the basics concepts of Machine Learning and Python.
2. Apply feature engineering techniques and visualization tools to the data.
3. Analyze the various types of data by using python based machine learning techniques.
4. Identify and evaluate various recommender systems.
5. Design solutions to real world problems using deep learning algorithms.

UNIT - I

Introduction to Machine Learning: Introduction, Machine Learning process.

Introduction to Python: Features, sources and installation of Python, IDEs, Basics of Python, Data Structures and loops.

UNIT - II

Feature Engineering: Introduction to Features and need of feature Engineering, Feature extraction and selection, Feature Engineering Methods, Feature Engineering with Python. **Data Visualization:** Various charts, histograms, plots.

UNIT - III

Regression: Simple and multiple regressions, Model assessment, various types of errors, errors, ridge regression, Lasso regression, non-parameter regression.

Classification: Linear classification, logistic regression, Decision Trees, Random Forest, Naïve Bayes.

UNIT -IV

Unsupervised Learning: Clustering, K-Means clustering, Hierarchical clustering.

Text Analysis: Basic text analysis with Python, regular expressions, NLP, text classification. **Time Series Analysis:** Date and time handling, window functions, correlation, time series forecasting.

UNIT -V

Neural Network and Deep Learning: Neural network- gradient descent, activation functions, parameter initialization, optimizer, loss function, deep learning, deep learning architecture, memory, deep learning framework.

Recommender System: Recommendation engines, collaborative filtering.

Text Books:

1. AbhishekVijavargia “Machine Learning using Python”, BPB Publications, 1st Edition, 2018
2. Tom Mitchel “Machine Learning”, Tata McGraWHill, 2017
3. ReemaThareja “Python Programming”, Oxford Press, 2017.

Suggested Reading:

1. Yuxi Liu, Python Machine Learning by Example, 2nd Edition, PACT, 2017

Online Resources:

1. <https://www.guru99.com/machine-learning-tutorial.html>
2. https://www.tutorialspoint.com/machine_learning_with_python/index.htm
3. <https://www.tutorialspoint.com/python/>
4. <https://docs.python.org/3/tutorial/>
5. <https://www.geeksforgeeks.org/machine-learning/>

16ME 001**ENTREPRENEURSHIP**

Elective-VII (Open)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course aims to:

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

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

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

UNIT-I

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

UNIT-II

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

UNIT-III

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

UNIT-IV

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

UNIT-V

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

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

Text Books:

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

Suggested Reading:

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

16EG 002**GENDER SENSITIZATION**

Elective-VII (Open)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course aims to:

1. Develop students' sensibility with regard to issues of gender in contemporary India.
2. Provide a critical perspective on the socialization of men and women.
3. Expose the students to debates on the politics and economics of work. To help students reflect critically on gender violence.

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

1. Develop a better understanding of important issues related to what gender is in contemporary India.
2. Be sensitized to basic dimensions of the biological, sociological, psychological and legal aspects of gender. This will be achieved through discussion of materials derived from research, facts, everyday life, literature, and film.
3. Attain a finer grasp of how gender discrimination works in our society and how to counter it. Students will acquire insight into the gendered division of labour and its relation to politics and economics.
4. Understand what constitutes sexual harassment and domestic violence and be made aware of New forums of Justice.
5. Draw solutions as to how men and women, students and professionals can be better equipped to work and live together as equals.

UNIT-I**Understanding Gender:**

Gender: Why Should We Study It? (*Towards a World of Equals*: Unit -1)

Socialization: Making Women, Making Men (*Towards a World of Equals*: Unit -2), Introduction. Preparing for Womanhood. Growing up Male. First lessons in Caste. Different Masculinities.

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.

Textbooks:

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 Textbook on Gender” published by Telugu Akademi, Hyderabad, Telangana State, 2015.

Suggested Reading:

1. Menon, Nivedita. Seeing like a Feminist. New Delhi: Zubaan-Penguin Books, 2012
2. AbdulaliSohaila. "I Fought For My Life. . .and Won." Available online at: <http://www.thealternative.in/lifestyle/i-fought-for-my-lifeand-won-sohaila-abdulal/>

Web Resources:

1. <https://aifs.gov.au/publications/gender-equality-and-violence-against-women/introduction>
2. <https://theconversation.com/achieving-gender-equality-in-india>

Note: Since it is an Interdisciplinary Course, Resource Persons can be drawn from the fields of English Literature or Sociology or Political Science or any other qualified faculty who has expertise in this field from engineering departments.

16PY O01**HISTORY OF SCIENCE AND TECHNOLOGY**

Elective-VII (Open)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course aims to:

1. Enable students to understand science as a socio-cultural product in specific socio-historical contexts.
2. Expose students to philosophical, historical and sociological perspectives to look at science as a practice deeply embedded in culture and society.
3. Inculcate the scientific culture and ethics in the development of technologies.

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

1. Demonstrate knowledge of broad concepts in the history of science, technology ranging over time, space and cultures.
2. Recognize the values of a wide range of methodologies, conceptual approaches and the impact of competing narratives within the history of science, technology.
3. Identify, locate and analyze relevant primary and secondary sources in order to construct evidence-based arguments.
4. Think independently and critically, using appropriate methodologies and technologies to engage with problems in the history of science, technology.
5. Demonstrate academic rigor and sensitivity to cultural and other diversity, and understanding of the ethical implications of historical and scientific enquiry within a global context.

UNIT-I

Science - The Beginning (through 599 BC): The Stone Ages, Knowledge among hunter gatherers, Agricultural Revolution and other revolutions, Civilization, Major advances.

Science in Antiquity (600 BC - 529 AD): Philosophy, a precursor to science, Hellenistic world and the Roman Empire, Other cultures of the period, major advances.

UNIT-II

Medieval Science (530 AD - 1452 AD): The decline of science in Europe , Science in China, Science and mathematics in India, Arab science, revival of science in Europe, technology revolution of the Middle ages, Major advances.

The Renaissance and the Scientific Revolution (1453 AD – 1659 AD): Renaissance, Scientific Revolution, Technology, Major advances.

UNIT-III

Scientific Method: Measurement and Communication (1660 AD – 1734): European domination, The scientific method, Major advances.

The Industrial Revolution (1735 AD – 1819 AD): Industrial Revolution, Rise of the engineer, Major Advances.

UNIT-IV

Science and Technology in the 19th Century (1820 AD – 1894 AD): philosophical basis of 19th-century science, Science and the public, Science and technology, Major advances.

Rise of Modern Science and Technology (1895 AD – 1945 AD): The growth of 20th century science, New philosophies, Quantum reality, Energy sources, Electricity: a revolution in technology, Major advances.

UNIT-V

Big Science and the Post-Industrial Society (1946 AD – 1972 AD): Big science, Specialization and changing categories, Technology changes society, Major advances.

The Information Age (1973 AD – 2015 AD): Information and society, Globalization, The post-industrial society, Problems of the Information age, Major Advances

Text Books:

1. Bryan Bunch and Alexander Hellemans, “The History of Science and Technology”, Houghton Mifflin Company, New York, 2004.
2. JD Bernal, “Science in History”, 4 Volumes, Eklavya Publishers, 2012.

Suggested Reading:

1. “The 100 Most Influential Scientists of All Time”, Edited by Kara Rogers, Britannica Educational Publishing, 2010.
2. Alberto Hernandez, “A Visual History of Science and Technology”, The Rosen Publishing Group, 2016.

16ME O02**ROBOTICS**
Elective-VII (Open)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives: This course aims to:

1. The configuration, work envelop and motion controls and applications
2. The kinematics and dynamics of robots.
3. Robot end effectors and their design.
4. Robot Programming Languages and Programming methods of robot.
5. Various Sensors and drives and their applications in robots

Outcomes: Upon completion of this course, the student will be able to:

1. Equipped with the knowledge of robot anatomy, work volume and robot applications
2. Familiarized with the kinematic motions of robot and robot dynamics
3. Having good knowledge about robot end effectors and their design concepts
4. Equipped with the Programming methods & drives used in robots
5. Equipped with the principles of various Sensors and their applications in robots.

Unit I

Introduction to Robotics: History and evolution of robots, basic configuration, degree of freedom, work envelope, motion control methods. Various applications in industry: material handling, loading & unloading, processing, welding & painting, assembly and inspection. Requirements and Specifications of Robots.

Unit II

Rigid Motions and Homogeneous Transformations: Rotation matrix, Homogenous transformation matrix, Denavit-Hartenberg convention, Euler angles, RPY representation, Direct and inverse kinematics for industrial robots for position and orientation.

Unit III

Velocity Kinematics – The Manipulator Jacobian: Joint, End effector velocity, direct and inverse velocity analysis. **Trajectory Planning,** interpolation, cubic

polynomial, linear segments with parabolic blending, static force and moment transformation, solvability, stiffness, singularities.

Unit IV

Robot Dynamics: Lagrangian formulation, link inertia tensor and manipulator inertia tensor. **Newton-Euler** formulation for RR & RP manipulators. **Control:** Individual joint, computed torque.

Unit V

End Effectors: Position and velocity measurement, **Sensors:** Proximity and range, tactile, force and torque, Drives for Robots: Electrical, Hydraulic and Pneumatic. **Robot Vision:** Introduction to technique, image acquisition and processing, introduction to robot programming languages.

Text Books:

1. Spong and Vidyasagar, "Robot Dynamics and Control", John Wiley 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 GonZalezRC., IEEc.S.G, "Robotics, Control Sensing Vision and Intelligence", McGraw Hill, Int. Ed., 1987.
3. Richard S. Paul, "Robot Manipulators: Mathematics, Programming, and Control", MIT Press. and Control", MIT Press.

16CE O02**DISASTER MITIGATION AND MANAGEMENT**

Elective-VIII (Open)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course aims to:

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

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

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

participatory approaches/strategies and their application in disaster management

UNIT-I:

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

UNIT-II:

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

UNIT-III:

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

UNIT-IV:

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

UNIT-V:

Concept of Disaster Management: Disaster management cycle – its phases; prevention, mitigation, preparedness, relief and recovery; risk analysis, vulnerability and capacity assessment; Post-disaster environmental response- water, sanitation, food safety, waste management, disease control; Roles and responsibilities of government, community, local institutions, NGOs and other

stakeholders; Policies and legislation for disaster risk reduction, DRR Programs in India and the activities of National Disaster Management Authority.

Text Books:

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

Suggested Reading:

1. Ministry of Home Affairs”. Government of India, “National disaster management plan, Part I and II”,
2. K. K. Ghosh,” Disaster Management”, APH Publishing Corporation, 2006.
3. http://www.indiaenvironmentportal.org.in/files/file/disaster_management_india1.pdf
4. <http://www.ndmindia.nic.in/> (National Disaster management in India, Ministry of Home Affairs)
5. Hazards, Disasters and your community: A booklet for students and the community, Ministry of home affairs.

16CS 006**FUNDAMENTALS OF DBMS**

Elective-VIII (Open)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: File Structures.**Course Objectives:** This course aims to:

1. Learn data models, conceptualize and depict a database system using E-R diagram.
2. Understand the internal storage structures in a physical DB design.
3. Know the fundamental concepts of transaction processing techniques.

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

1. Understand the find fundamental components of the DBMS.
2. Design the database schema and develop E-R model.
3. Devise queries using relational algebra and SQL.
4. Apply normalization techniques and solve problems using various Indexing techniques.
5. Understand transaction processing, Concurrency control and recovery techniques.

UNIT -I

Introduction: Database System Applications, Purpose of Database Systems, View of Data, Database Languages, Database Users and Administrators Database System Architecture, Application Architectures. **Database Design and E-R Model:** Basic concepts, Constraints, E-R Diagrams, E-R Design Issues, Extended E-R Features, Specialization and Generalization.

UNIT -II

Relational Model: Structure of Relational Databases, Database Schema, Keys, Relational Algebra, Fundamental Operations. **Structured Query Language:** Overviews, SQL Data Types, SQL Queries, Data Manipulation Language Set Operations, Aggregate Functions, Data Definition Language, Integrity Constraints, Null Values, Views, Join Expression. Index Definition in SQL.

UNIT-III

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

UNIT-IV

Indexing: Basic concepts, Dense and Sparse Indices, Secondary Indices, Tree-Structured Indexing, Indexed Sequential Access Method (ISAM), B+ Tree Index Files. **Transaction Management:** Transaction Concept – ACID Properties, States of Transaction, Implementation of Atomicity and Durability, Serializability, Recoverability.

UNIT - V

Concurrency Control: Lock-Based Protocols, Timestamp-Based Protocols, Validation-Based Protocols, Deadlocks Handling: Deadlock Prevention, Deadlock Detection and Recovery, **Recovery System:** Failure Classification, Storage Structure, Recovery and Atomicity, Log-Based Recovery, Recovery with Concurrent Transactions.

Text Books:

1. Abraham Silberschatz, Henry F Korth, S Sudarshan, “Database System Concepts”, Sixth Edition, McGraw-Hill International Edition, 2011.
2. Date CJ, Kannan A, Swamynathan S, “An Introduction to Database Systems”, Eight Edition, Pearson Education, 2006.

Suggested Reading:

1. Raghu Ramakrishnan, Johannes Gehrke, “Database Management Systems”, Third Edition, McGraw Hill, 2003.
2. Ramez Elmasri, Durvasul VLN Somayazulu, Shamkant B Navathe, Shyam K Gupta, “Fundamentals of Database Systems”, Fourth Edition, Pearson Education, 2006.

16ME O04**INTELLECTUAL PROPERTY RIGHTS**

Elective-VIII (Open)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course aims to:

1. Fundamental aspects of IP
2. Aspects of IPR acts.
3. Awareness of multi disciplinary audience
4. Awareness for innovation and its importance
5. The changes in IPR culture and techno-business aspects of IPR

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

1. Will respect intellectual property of others
2. Learn the art of understanding IPR
3. Develop the capability of searching the stage of innovations.
4. Will be capable of filing a patent document independently.
5. Completely understand the techno-legal business angle of IPR and converting creativity into IPR and effectively protect it.

UNIT-I

Overview of Intellectual Property: Introduction and the need for intellectual property right (IPR), IPR in India – Genesis and Development, IPR abroad, Some important examples of IPR. Importance of WTO, TRIPS agreement, International Conventions and PCT

Patents: Macro economic impact of the patent system, Patent and kind of inventions protected by a patent, Patent document, How to protect your inventions. Granting of patent, Rights of a patent, how extensive is patent protection. Why protect inventions by patents. Searching a patent, Drafting of a patent, Filing of a patent, the different layers of the international patent system, (national, regional and international options), compulsory licensing and licensors of right & revocation, Utility models, Differences between a utility model and a patent. Trade secrets and know-how agreements

UNIT-II

Industrial Designs: What is an industrial design. How can industrial designs be protected? What kind of protection is provided by industrial designs? How long does the protection last? Why protect industrial designs?

UNIT-III

Trademarks: What is a trademark, Rights of trademark? What kind of signs can be used as trademarks. Types of trademark, function does a trademark perform, How is a trademark protected? How is a trademark registered. How long is a registered trademark protected for? How extensive is trademark protection. What are well-known marks and how are they protected? Domain name and how does it relate to trademarks? Trademark infringement and passing off.

UNIT-IV

Copyright: What is copyright. What is covered by copyright. How long does copyright last? Why protect copyright? Related Rights: what are related rights. Distinction between related rights and copyright. Rights covered by copyright? Copy rights in computer programming.

UNIT-V

Enforcement of Intellectual Property Rights: Infringement of intellectual property rights Enforcement Measures Emerging issues in Intellectual property protection. Case studies of patents and IP Protection.

Unfair Competition: What is unfair competition. Relationship between unfair competition and intellectual property laws.

Text Books:

1. Ajit Parulekar and Sarita D' Souza, "Indian Patents Law – Legal & Business Implications", Macmillan India ltd , 2006.
2. B. L. Wadehra; "Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications", Universal law Publishing Pvt. Ltd., India, 2000.
3. P. Narayanan, "Law of Copyright and Industrial Designs", Eastern law House, Delhi 2010.

Suggested Reading:

1. W.R1 Cronish, "Intellectual Property; Patents, copyright, Trad and Allied rights", Sweet & Maxwell, 1993.
2. P. Narayanan, "Intellectual Property Law", Eastern Law Edn., 1997.
3. Robin Jacob and Daniel Alexander, "A Guide Book to Intellectual Property Patents, Trademarks, Copy rights and designs", 4/e, Sweet, Maxwell.

16CS 005**PRINCIPLES OF VIRTUAL REALITY**

Elective-VIII (Open)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course aims to:

1. Introduce hardware and software components of virtual reality.
2. Provide knowledge about geometry of virtual worlds.
3. Understand visual physiology, perception and audio in VR.
4. Study the applications of VR in various domains like military and robotics.

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

1. Define Virtual Reality and acquire knowledge of virtual worlds.
2. Apply modeling techniques to model real world scenarios.
3. Study human factors for developing interfaces.
4. Evaluate virtual reality systems.
5. Address the issues and challenges in virtual reality.

UNIT-I

Introduction: The three I's of virtual reality, commercial VR technology and the five classic components of a VR system. **Input Devices:** Trackers, Navigation and Gesture Interfaces: Three-dimensional position trackers, navigation and manipulation, interfaces and gesture interfaces. **Output Devices:** Graphics displays, sound displays and haptic feedback.

UNIT-II

Geometry of Virtual Worlds: Geometric modeling, Transforming models, Matrix algebra and 2D rotations, 3D rotations and yaw, pitch, and roll, Axis-angle representations, Quaternions, Converting and multiplying rotations, Homogeneous transforms, The chain of viewing transforms, Eye transforms, Canonical view transform, Viewport transform.

UNIT-III

Light and Optics : Three interpretations of light, Refraction, Simple lenses, Diopters, Imaging properties of lenses, Lens aberrations, Optical system of eyes.

Visual Physiology: Photoreceptors, Sufficient resolution for VR, Light intensity, Eye movements, Eye movement issues for VR, Neuroscience of vision, **Visual Perception:** Depth perception, Motion perception, Frame rates and displays.

UNIT -IV

Tracking Systems : Overview, Orientation tracking, Tilt drift correction, Yaw drift correction, Tracking with a camera, Perspective n-point problem, Filtering, Lighthouse approach, **Visual Rendering:** Overview, Shading models, Rasterization, Pixel shading, VR-specific problems, Distortion shading, Post-rendering image warp.

UNIT – V

Audio: Physics and physiology, Auditory perception, Auditory localization, Rendering, Spatialization and display, Combining other senses, **Interfaces:** overview, Locomotion, Manipulation, System control, Social interaction, Evaluation of VR Systems, **Applications:** Medical, Military, Robotics, issues and challenges in virtual reality.

Text Books:

1. John Vince, “Virtual Reality Systems”, Pearson Education Asia, 2007
2. Anad R., “Augmented and Virtual Reality”, Khanna Publishing House, Delhi.

Suggested Reading:

1. George Mather, Foundations of Sensation and Perception: Psychology Press; 2 edition, 2009.
2. Peter Shirley, Michael Ashikhmin, and Steve Marschner, Fundamentals of Computer Graphics, A K Peters/CRC Press; 3 edition, 2009.

Online Resources:

1. <http://msl.cs.uiuc.edu/vr/>

16EG 001**TECHNICAL WRITING SKILLS**

Elective-VIII (Open)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course aims to:

1. 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, the student will be able to:

1. Communicate effectively, without barriers and understand aspects of technical communication.
2. Differentiate between general writing and technical writing and write error free sentences using technology specific words
3. Apply techniques of writing in business correspondence and in writing articles.
4. Draft technical reports and technical proposals.
5. Prepare agenda and minutes of a meeting and demonstrate effective technical presentation skills.

UNIT I

Communication – Nature and process.

Channels of Communication – Downward, upward and horizontal communication. Barriers to communication.

Technical Communication – Definition, oral and written communication. Importance and need for Technical communication. Nature of Technical Communication. Aspects and forms of Technical communication. Technical communication Skills – Listening, Speaking, Reading & Writing.

UNIT II

Technical Writing – Techniques of writing. Selection of words and phrases in technical writing. Differences between technical writing and general writing. Abstract and specific words. Sentence structure and requisites of sentence construction. Paragraph length and structure.

UNIT III

Business correspondence – Sales letters, letters of Quotation, Claim and Adjustment letters.

Technical Articles : Nature and significance, types. Journal articles and Conference papers, elements of technical articles.

UNIT IV

Technical Reports : Types, significance, structure, style and writing of reports. Routine reports, Project reports.

Technical Proposals : Definition, types, characteristics, structure and significance.

UNIT V

Mechanics of Meetings : Preparation of agenda, participation, chairing and writing minutes of a meeting. Memorandum. Seminars, workshops and conferences.

Technical Presentations : Defining purpose, audience and locale, organizing content, preparing an outline, use of Audio Visual Aids, nuances of delivery, importance of body language and voice dynamics.

Text Books:

1. Meenakshi Raman & Sangeeta Sharma, “Technical Communications-Principles and Practice”, Oxford University Press, Second Edition, 2012.
2. M Ashraf Rizvi, “Effective Technical Communication”, Tata McGraw Hill Education Pvt Ltd, 2012.

Suggested Reading:

1. Kavita Tyagi & Padma Misra, “Basic Technical Communication”, PHI Learning Pvt Ltd, 2012.
2. R.C Sharma & Krishna Mohan, “Business Correspondence and Report Writing”, Tata McGraw Hill, 2003

Web Resources:

1. https://onlinecourses.nptel.ac.in/noc18_mg13/preview
2. <https://www.technical-writing-training-and-certification.com/>
3. <https://academy.whatfix.com/technical-writing-skills>

16EC C39**SEMINAR**

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

The goal of a seminar is to introduce students to critical reading, understanding, summarizing, explaining and preparing report on state of the art topics in a broad area of his/her specialization. Seminar topics may be chosen by the students with advice from the faculty members and the student shall read further relevant articles in the domain.

The seminar must be clearly structured and the power point presentation shall include following aspects:

1. Introduction to the field
2. Literature survey
3. Consolidation of available information
4. Summary and Conclusions
5. References

Each student is required to:

1. Submit a one page synopsis of the seminar talk for display on the notice board.
2. Deliver the seminar for a maximum duration of 30 minutes, where the presentation should be for 20 minutes in PowerPoint, followed by Question and Answers session for 10 minutes.
3. Submit the detailed report of the seminar in spiral bound in a précised format as suggested by the department.

Seminars are to be scheduled from 3rd week to the last week of the semester and any change in schedule shall be discouraged.

For the award of sessional marks students are judged by three (3) faculty members and are based on oral and written presentations as well as their involvement in the discussions during the oral presentation.

Note: Topic of the seminar shall preferably be from any peer reviewed recent journal publications.

Guidelines for awarding marks		
Sl No.	Description	Max Marks
1.	Contents and relevance	10
2.	Presentation skills	10
3.	Preparation of PPT slides	05
4.	Questions and answers	05
5.	Report in a prescribed format	20

16EC C40**PROJECT**

Instruction	6P Hours per Week
Duration of SEE	Viva -Voce
SEE	100 Marks
CIE	50 Marks
Credits	6

The object of Project is to enable the student extend further the investigative study, either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry. This is expected to provide a good training for the student(s) in R&D work and technical leadership. The assignment to normally include:

1. In depth study of the topic assigned;
2. Review and finalization of the Approach to the Problem relating to the assigned topic;
3. Preparing an Action Plan for conducting the investigation, including team work;
4. Detailed Analysis/Modelling/Simulation/Design/Problem Solving/ Experiment as needed;
5. Final development of product/process, testing, results, conclusions and future directions;
6. Preparing a paper for Conference presentation/ Publication in Journals, if possible;
7. Preparing a Dissertation in the standard format for being evaluated by the Department.
8. Final Seminar presentation before Departmental Committee.

Guidelines for the award of marks in CIE: (Max. Marks: 50)

Evaluation by	Max. Marks	Evaluation Criteria / Parameter
Department Review Committee	05	Review 1
	08	Review 2
	12	Submission
Supervisor	05	Regularity and Punctuality
	05	Work Progress
	05	Quality of the work which may lead to publications
	05	Report Preparation
	05	Analytical / Programming / Experimental Skills

Guidelines for awarding marks in SEE: (Max. Marks: 100)

Evaluation by	Max. Marks	Evaluation Criteria / Parameter
External and Internal Examiners together	20	Power Point Presentation
	40	Thesis Evaluation
	20	Quality of the project <ul style="list-style-type: none"> ● Innovations ● Applications ● Live Research Projects ● Scope for future study ● Application to society
	20	Viva-Voce