VISION OF DEPARTMENT OF ELECTRONICS ENGINEERING

The Department of Electronics Engineering is committed to produce globally competitive and socially sensitized graduates in Electronics & Communication Engineering. We seek to instill the spirit of creativity and leadership skills enabling the students to make a global impact towards the availability of technology to mankind from all walks of life.

MISSION OF DEPARTMENT OF ELECTRONICS ENGINEERING

- To impart high quality technical education to students from socially and economically diverse backgrounds
- Give solid foundation on Mathematical skills and allied fields of Electronics & Communication
- To produce students with technical competence to design sophisticated systems in Electronics & Communication
- To make high quality research contribution in the field of Electronics, Communication, Networking, VLSI & Signal Processing
- To collaborate with industries in Electronics & Communication in the indigenous product development
- To inculcate qualities of leadership and entrepreneurship in students
- To facilitate adequate exposure to the faculty enabling them to be synchronized with the Cutting edge technology
1. PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):
   I. Provide students with a solid foundation in mathematical, scientific and engineering fundamentals required to solve problems in Signal Processing, Wireless Communication and Networking.
   II. Serve in research establishments and contribute towards the development of sophisticated Wireless Technologies systems.
   III. Provide consultancy and offer networking solutions for next generation networks.
   IV. Prepare students to excel in research or to succeed in Wireless Communication and Networking domain through global, rigorous post graduate education.
   V. Become entrepreneurs and contribute towards indigenous product development to compete in global market.

2. PROGRAMME OUTCOMES (POs):

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<td>1.</td>
<td>Research aptitude</td>
<td>An ability to independently carry out research/investigation and development work to solve practical problems</td>
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<td>An ability to write and present a substantial technical report/document</td>
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<td>3.</td>
<td>Technical competence</td>
<td>Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program</td>
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<td>Engineering Design</td>
<td>An ability to apply various advanced tools and techniques to develop efficient signal processing, wireless communication and networking systems</td>
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<td>The engineer and society</td>
<td>Apply technical knowledge towards the development of socially relevant products</td>
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3. PROGRAMME SPECIFIC OUTCOMES (PSOs):
   I. Foundation of wireless communication systems: Ability to understand the basics principles involved in the operation of wireless communication systems and thereby provide solutions due to channel impairments in real time implementation
   II. Foundation of networking systems: Ability to understand the various technologies behind the recent wireless communication standards and work towards to provide improved solutions.
   III. Foundations of Mathematical concepts: Ability to apply mathematical knowledge to develop new protocols, algorithms, interfaces to address networking issues and to develop new protocols, and algorithms for cyber security issues.
   IV. Applications of Communication and networking and Research ability: Ability to use knowledge in various domains to identify research gaps and provide innovative solutions.
4. PEO/PO Mapping:

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L – Low  M- Medium  H-High

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### ANNA UNIVERSITY, CHENNAI

UNIVERSITY DEPARTMENTS

M.E. WIRELESS TECHNOLOGIES

REGULATIONS 2019

CHOICE BASED CREDIT SYSTEM

I TO VI SEMESTERS CURRICULA AND SYLLABI

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## AUDIT COURSES (AC)

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OBJECTIVES:
- To encourage students to develop a working knowledge of the central ideas of Linear Algebra.
- To develop the ability to use the concepts of Special Functions for solving problems related to Networks.
- To analyze the Graph algorithms and understand their applications in Networks.
- To impart knowledge on Numerical Methods that will come in handy to solve numerically the problems that arise in engineering. This will also serve as a precursor for future research.
- To acquire skills in analyzing Queuing Models.

UNIT I  LINEAR ALGEBRA  12

UNIT II  SPECIAL FUNCTIONS  12
Bessel’s equation – Bessel function – Recurrence relations - Generating function and orthogonal property for Bessel functions of first kind – Fourier-Bessel expansion.

UNIT III  GRAPH ALGORITHMS  12

UNIT IV  ALGEBRAIC EQUATIONS  12

UNIT V  RANDOM PROCESSES  12
Classification – Auto correlation - Cross correlation - Stationary random process – Markov process -- Markov chain - Poisson process – Gaussian process

TOTAL: 60 PERIODS

COURSE OUTCOME:
At the end of the course, students will be able to
CO1: Work with vector spaces and linear transformations and their applications.
CO2: Use the ideas of Special Functions in solving special types of problems.
CO3: Apply Graph Theory algorithms in networks.
CO4: Use various methods of solving systems of Algebraic Equations and eigenvalue problems.
CO5: Apply the ideas of random processes.

REFERENCES:
WT5101

OBJECTIVES:
- To study the various network layer and transport layer protocols for wireless networks
- To study the architecture and interference mitigation techniques in 3G standards
- To learn about 4G technologies and LTE-A in mobile cellular network.
- To learn about the layer level functionalities in interconnecting networks.
- To study the emerging techniques in 5G network.

UNIT I  WIRELESS PROTOCOLS
Mobile network layer- Fundamentals of Mobile IP, data forwarding procedures in mobile IP, IPv4, IPv6, IP mobility management, IP addressing - DHCP, Mobile transport layer-Traditional TCP, congestion control, slow start, fast recovery/fast retransmission, classical TCP improvements- Indirect TCP, snoping TCP, Mobile TCP

UNIT II  3G EVOLUTION

UNIT III  4G EVOLUTION
Introduction to LTE-A – Requirements and Challenges, network architectures – EPC, E- UTRAN architecture - mobility management, resource management, services, channel -logical and transport channel mapping, downlink/uplink data transfer, MAC control element, PDU packet formats, scheduling services, random access procedure.

UNIT IV  LAYER-LEVEL FUNCTIONS
Characteristics of wireless channels - downlink physical layer, uplink physical layer, MAC scheme -frame structure, resource structure, mapping, synchronization, reference signals and channel estimation, SC-FDMA, interference cancellation – CoMP, Carrier aggregation, Services - multimedia broadcast/multicast, location-based services.

UNIT V  5G EVOLUTION

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon completion of the course, the student would be able to
CO1: Design and implement the various protocols in wireless networks.
CO2: Analyze the architecture of 3G network standards.
CO3: Analyze the difference of LTE-A network design from 4G standard.
CO4: Design the interconnecting network functionalities by layer level functions.
CO5: Explore the current generation (5G) network architecture.
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WT5102

WIRELESS COMMUNICATION TECHNIQUES

OBJECTIVES:
- To understand the basic concepts in cellular communication
- To understand the characteristics of wireless channels.
- To know the impact of digital modulation techniques in fading
- To get exposed to diversity techniques in wireless communication.
- To acquire knowledge in multicarrier systems

UNIT I  CELLULAR CONCEPTS

UNIT II  THE WIRELESS CHANNEL
Overview of wireless systems – Physical modeling for wireless channels – Time and Frequency coherence – Statistical channel models – Capacity of wireless Channel- Capacity of Flat Fading Channel – Channel Side Information at Receiver – Channel Side Information at Transmitter and Receiver –Capacity comparisons – Capacity of Frequency Selective Fading channels.

UNIT III  PERFORMANCE OF DIGITAL MODULATION OVER WIRELESS CHANNELS
UNIT IV     DIVERSITY TECHNIQUES

UNIT V     MULTICARRIER MODULATION
Data Transmission using Multiple Carriers – Multicarrier Modulation with Overlapping Sub channels – Mitigation of Subcarrier Fading – Discrete Implementation of Multicarrier Modulation – Peak to average Power Ratio- Frequency and Timing offset.

COURSE OUTCOMES:
CO1: To be able to design solutions for cellular communication
CO2: To be able to compute the capacity of wireless channels
CO3: To be able to analyze the performance of the digital modulation techniques in fading channels.
CO4: To apply various diversity techniques in wireless communication.
CO5: To design multicarrier systems in wireless communication

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NE5151     RF ENGINEERING

OBJECTIVES:
- To model high frequency circuit using scattering matrixes
- To acquire knowledge on the RF filter design
- To design microwave amplifier
- To get familiar with design of RF oscillator
- To learn about the high frequency antennas
UNIT I  NETWORKS AND MATRICES  9

UNIT II  HIGH FREQUENCY CIRCUIT DESIGN  9

UNIT III  MICROWAVE AMPLIFIER DESIGN  9
Types of amplifiers, Power gain equations. Introduction to narrow band amplifiers basic concepts, Maximum gain design. Low noise design. High power design, Negative resistance, reflection amplifiers – various kinds – stability considerations, Microwave transistor amplifier design – input and output matching networks – constant noise figure circuits.

UNIT IV  MICROWAVE TRANSISTOR OSCILLATOR DESIGN  9
One port and two port negative resistance oscillators. Oscillator configurations, Oscillator design using large signal measurements, Introduction to Microwave CAD packages, Microwave integrated circuits, MIC design for lumped elements

UNIT V  RF AND MICROWAVE ANTENNAS  9
Radiation from surface current and line current distribution, Basic Antenna parameters, Feeding structure-Patch Antenna, Ring Antenna, Micro strip dipole, Micro strip arrays, Traveling wave Antenna, Antenna System for Mobile Radio-Antenna Measurements and Instrumentation. Propagation characteristics of RF and Microwave signals, Introduction to EBG structures.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
On completion of the course the student should be able to
CO1: Apply scattering parameters in RF circuit and systems
CO2: Develop filters for high frequency applications
CO3: Design amplifiers for RF transceivers
CO4: Understand the RF oscillator design techniques
CO5: Develop antennas for high frequency applications.

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Page 18 of 76
OBJECTIVES:

- To understand the fundamentals of wireless sensor network
- To gain knowledge on the MAC and Routing Protocols of WSN
- To get exposed to 6LOWPAN technology
- To acquire knowledge on the protocols required for developing real time applications using WSN and 6LOWPAN.
- To gain knowledge about operating system related to WSN and 6LOWPAN

UNIT I - INTRODUCTION

Principle of Wireless Sensor Network - Introduction to wireless sensor networks - Challenges, Comparison with ad hoc network, Node architecture and Network architecture, design principles, Service interfaces, Gateway, Short range radio communication standards-IEEE 802.15.4, Zigbee and Bluetooth. Physical layer and transceiver design considerations.

UNIT II - MAC AND ROUTING PROTOCOLS

MAC protocols - fundamentals, low duty cycle protocols and wakeup concepts, contention and Schedule-based protocols - SMAC, BMAC, TRAMA, Routing protocols – Requirements, Classification - SPIN, Directed Diffusion, COUGAR, ACQUIRE, LEACH, PEGASIS.

UNIT III - 6LOWPAN


UNIT IV - APPLICATION

Design Issues, Protocol Paradigms - End-to-end, Real-time streaming and sessions, Publish/subscribe, Web service paradigms, Common Protocols - Web service protocols, MQ telemetry transport for sensor networks (MQTT-S), ZigBee compact application protocol (CAP), Service discovery, Simple network management protocol (SNMP), Real-time transport and sessions, Industry- Specific protocols.

UNIT V - TOOLS

TinyOS – Introduction, NesC, Interfaces, modules, configuration, Programming in TinyOS using NesC, TOSSIM, Contiki – Structure, Communication Stack, Simulation environment – Cooja simulator, Programming

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1: To be able to design solutions for WSNs applications
CO2: To be able to develop efficient MAC and Routing Protocols
CO3: To be able to design solutions for 6LOWPAN applications
CO4: To be able to develop efficient layered Protocols in 6LOWPAN
CO5: To be able to use Tiny OS and Contiki OS in WSNs and 6LOWPAN applications

REFERENCES:

OBJECTIVES:
To impart knowledge and skills required for research and IPR:
- Problem formulation, analysis and solutions.
- Technical paper writing / presentation without violating professional ethics
- Patent drafting and filing patents.

UNIT I RESEARCH PROBLEM FORMULATION
Meaning of research problem- Sources of research problem, criteria characteristics of a good research problem, errors in selecting a research problem, scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, necessary instrumentations

UNIT II LITERATURE REVIEW
Effective literature studies approaches, analysis, plagiarism, and research ethics.

UNIT III TECHNICAL WRITING/PRESENTATION
Effective technical writing, how to write report, paper, developing a research proposal, format of research proposal, a presentation and assessment by a review committee.

UNIT IV INTRODUCTION TO INTELLECTUAL PROPERTY RIGHTS (IPR)

UNIT V INTELLECTUAL PROPERTY RIGHTS (IPR)

TOTAL: 30 PERIODS

COURSE OUTCOMES:
CO1: Ability to formulate research problem
CO2: Ability to carry out research analysis
CO3: Ability to follow research ethics
CO4: Ability to understand that today’s world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity
CO5: Ability to understand about IPR and filing patents in R & D.
REFERENCES:

NE5161 RF SYSTEM DESIGN LABORATORY

OBJECTIVES:
- To enable the student to design and develop RF components and systems
- To enable the student to learn RF measurements
- To design and develop RF filters
- To design and develop antennas for RF applications
- To design and characterize the RF systems

LIST OF EXPERIMENTS
1. Measurement of transmission line parameters using network analyzer
   (a) Inductor (b) Capacitor
2. Measurement of transmission line parameters using network analyzer
   (a) Reflection coefficient (b) VSWR
3. Design of Microstrip transmission line
   (a) λ/2 line (b) λ/4 line (c) λ/8 line
4. Design and characterization of RF filters
5. Design of impedance matching network
6. Measurement of RF signals and their spectrum
7. Design and characterization of antennas
8. Design and characterization of LNA
9. Design and characterization of Mixer
10. Design and characterization of VCO

TOTAL: 60 PERIODS

COURSE OUTCOMES:
On completion of the course the student should be able to

CO1: Measure the RF network parameters
CO2: Design and develop RF filters
CO3: Design and develop antennas for RF applications
CO4: Construct new circuit and systems for high frequency applications
CO5: Test RF components and systems.
WT5111 WIRELESS SENSOR NETWORK DESIGN LABORATORY L T P C 0 0 4 2

OBJECTIVES:
- To understand the working mechanism of Routing and Mac protocol of WSN
- To gain knowledge on 6LOWPAN routing protocol and its impact on topology control
- To understand characteristics features of zigbee and Bluetooth
- To learn to interface sensors and other peripheral interfaces
- To impart programming skill in networking simulation tools related to WSN and 6LOWPAN.

LIST OF EXPERIMENTS
1. Routing protocol of WSN
2. Characteristics Analysis of ZIGBEE
3. Characteristics Analysis of Bluetooth
4. MAC protocol of WSN
5. Study of 6LOWPAN OS and Simulator
6. RPL analysis
7. Topology Analysis of 6LOWPAN
8. RFID based application using zigbee/Bluetooth/6lowpan
9. Proximity based application using zigbee/Bluetooth/6lowpan
10. MINI PROJECT

TOTAL: 60 PERIODS

COURSE OUTCOMES:
CO1: To be able to understand the working mechanism of Routing and Mac protocol of WSN
CO2: To be able to design 6LOWPAN routing protocol
CO3: To be able to rectify the problems involved in zigbee and Bluetooth based applications
CO4: To be able to design real time applications in WSN, 6LOWPAN
CO5: To be able to develop protocols and interfaces required for WSN and 6LOWPAN applications.
OBJECTIVES:

- To understand the fundamental concepts related to access technologies.
- To understand the current and emerging wired and wireless access technologies.
- To understand the knowledge about the cable modems.
- To study and exposure to different systems standards for next generation access technologies.
- To study about the broadband wireless technologies.

UNIT I  REVIEW OF ACCESS TECHNOLOGIES  9
Phone-Line modem, cable-access, ISDN, Emerging Broad band Technologies. Cable DSL, Fiber and Wireless, Standards for access network.

UNIT II  DIGITAL SUBSCRIBER LINES  9
Asymmetric Digital subscriber lines (ADSL) – Rate Adaptive subscriber line (RADSL)-ISDN Digital subscriber line (IDSL) - High bit rate DSL (HDSL)-Single line DSL (SDSL) - very high bit rate DSL (VDSL) - Standards for XDSL & Comparison.

UNIT III  CABLE MODEM  9

UNIT IV  FIBER ACCESS TECHNOLOGIES  9

UNIT V  BROADBAND WIRELESS  9
Fixed Wireless, Direct Broadcast Satellite (DBS), Multi channel multi point distribution services (MMDS), Local multi point distribution services (LMDS), and Wideband integrated Digital Interactive Services (WIDIS).

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1: To be able to explore the fundamental concepts and emerging broadband technologies
CO2: To be able to design the systems meeting out the requirements of the recent standards.
CO3: To be able to design the cable modem in next generation Access technologies.
CO4: To be able to analyze the systems standards for next generation access technologies.
CO5: To be able to explore the various services of wireless broadband technologies.

REFERENCES:

WT5202 FREE SPACE OPTICAL COMMUNICATION L T P C 3 0 0 3

OBJECTIVES:
- To understand the concept of free space optical communication
- To know the challenges involved in designing a FSO system
- To understand the importance of FSO System
- To provide an adequate exposure to emerging FSO technology
- To study about the principles of FSO network

UNIT - I FUNDAMENTALS OF FSO TECHNOLOGY

UNIT - II OPTICAL COMPONENTS AND SUBSYSTEMS

UNIT – III FREE SPACE OPTICAL CHANNEL MODELS

UNIT IV OPTICAL BEAM PROPAGATION
Various mechanism of propagation - Propagation channel - Modeling - Additional power required to reach a given bit error rate - Optical noise - BER performance of FSO System - Link Performance Improvement Techniques - Link Feasibility Study - Concept of quality of service and availability - Regulation of FSO equipment - Safety and Confidentiality

UNIT V INTEGRATION OF FSO IN OPTICAL NETWORKS
Revolution of Optical Networking - Next Generation Optical Networking - Classifying the Global Optical Network - Driving FSO from the EDGE - FSO in Metropolitan Optical Networks - FSO Market - Installation of Free space Optical Systems - Free space optics and Laser safety.

TOTAL: 45 PERIODS
COURSE OUTCOMES:
CO1: To be able to design and analyze the free space optical communication systems.
CO2: To be able to identify and select suitable components for building a FSO system
CO3: Complete understanding of FSO channels with their mathematical representation
CO4: To be able to understand the networking principles of FSO technology
CO5: To be able to understand the beam propagation mechanism.

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WT5203 PRINCIPLES OF NETWORK SECURITY L T P C 3 0 0 3

OBJECTIVES:
- To learn the mathematics behind cryptography.
- To understand the network security mechanisms and security algorithms for wireless networks.
- To study the fundamental security protocols involved in wireless network security.
- To understand the fundamentals of WiFi and mobile Telecommunication networks
- To study different system and mobile IP security

UNIT I INTRODUCTION 9
Security Services and Mechanism, Mathematics of cryptography - integer arithmetic, modular arithmetic, Matrices, Linear congruence, algebraic structures ,GF(2n), primes, Euler's phi & totient functions, Fermat's and Euler's theorem, primality testing, factorization, CRT, quadratic congruence, exponentiation and logarithm.

UNIT II CRYPTOGRAPHIC ALGORITHMS 9
UNIT III SECURITY PROTOCOLS 9

UNIT IV WIRELESS SECURITY 9

UNIT V SYSTEM & IP BASED NETWORK SECURITY 9

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Students will be able to
CO1: To be able to formulate mathematical models for security algorithms
CO2: To be able to design security algorithms
CO3: To be able to develop new security protocols
CO4: Analyze security threats in both Wi-Fi and mobile telecommunication network
CO5: Analyze security threats in mobile internet

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OBJECTIVES:

- To understand the functioning of various protocols in Wired Environment.
- To understand the functioning of various protocols in Wireless Environment.
- To perform real time experimentation using the existing infrastructure.
- To get exposed to open source networking tools.
- To gain knowledge in constructing LAN, WLAN, and VLAN

LIST OF EXPERIMENTS

1. Wired and Wireless network scenario creation.
2. Study of Routing Protocols
3. Analysis of Network Security Algorithms
4. Study of ZigBee Energy Model and MAC protocols
5. Queuing mechanism.
7. Call establishment in cellular network
8. Handover in cellular network
9. Throughput performance for various terrain models, transmission modes, loading conditions, traffic profiles in LTE network.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

CO1: Ability to design MAC and routing protocols in Wired Environment
CO2: Ability to design MAC and routing protocols in Wireless Environment
CO3: Acquire the technical competence to meet out the industry expectation in the wired technologies
CO4: Ability to meet out requirements of industries related to wireless technologies
CO5: Acquire the ability to design WLAN/ LAN systems meeting out real time requirements.

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OBJECTIVES:

- To measure antenna parameters
- To design and develop Yagi antenna
- To design and develop Microstrip antenna
- To design and develop antennas for WiFi and mobile applications
- To design and characterize the Microwave antenna
LIST OF EXPERIMENTS
1. Measurement of return loss of different antenna using network analyzer
2. Design and development of Yagi antenna by using software
3. Design and development of microstrip patch antenna
4. Characteristics of Horn antenna
5. Radiation pattern and gain measurement of antenna
6. Design and characterization of reflector antenna
7. Design and development of wire antenna
8. Design and characterization of WiFi and Cell phone antenna
9. Mini Project

TOTAL: 60 PERIODS

COURSE OUTCOMES:
On completion of the course the student should be able to
CO1: Measure the antenna parameters
CO2: Design and develop Yagi antenna
CO3: Design and develop antennas for mobile applications
CO4: Construct antennas for high frequency applications
CO5: Test and characterize the antennas.

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WT5001 MULTIRATE SIGNAL PROCESSING FOR COMMUNICATION L T P C
3 0 0 3

OBJECTIVES:
- To understand discrete signals and basic signal processing - filters.
- To understand and implement multistage filters.
- To get exposed to various filter bank techniques.
- To get knowledge about uniform filter banks.
- To understand the various applications of Multirate signal processing.

UNIT I DECIMATION AND INTERPOLATION

UNIT II DECIMATION WITH POLYPHASE FILTERS
Interpolation with polyphase filters – Decimation and Interpolation with Rational sampling factors - Multistage implementations of decimators and interpolators.
UNIT III  TWO CHANNEL FILTER BANKS  9
Analysis and synthesis filter banks – Quadrature mirror filter banks – Filter banks with perfect reconstruction – Paraunitary filter banks – Biorthogonal and linear phase filter banks – Transmultiplexer filter banks

UNIT IV  UNIFORM M-CHANNEL FILTER BANKS  9

UNIT V  APPLICATIONS  9

COURSE OUTCOMES:
CO1: To be able to understand the concepts of signal processing filters.
CO2: To be able to implement polyphase filters.
CO3: To be able to design various filter banks.
CO4: To be able to design various filter banks.
CO5: To be able to design speech/ audio systems related applications.

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NE5072  ELECTROMAGNETIC INTERFERENCE AND ELECTROMAGNETIC COMPATIBILITY  L T P C
OBJECTIVES:
- To develop an understanding of basics of Electromagnetic interference in Electronic systems
- To acquire knowledge on the EMI coupling mechanisms
- To impart concepts of EMI control schemes
- To get acquainted with design PCB incorporating EMC principles
- To know about the current EMC standards and measurement techniques
UNIT I  EMI/EMC CONCEPTS
EMI/EMC Concepts - EMI-EMC definitions and Units of parameters; Sources and victim of EMI; Conducted and Radiated EMI Emission and Susceptibility; Transient EMI, ESD; Radiation Hazards.

UNIT II  EMI COUPLING PRINCIPLES
EMI Coupling Principles - Conducted, radiated and transient coupling; Common ground impedance coupling; Common mode and ground loop coupling; Differential mode coupling; Near field cable to cable coupling, cross talk; Field to cable coupling; Power mains and Power supply coupling.

UNIT III  EMI CONTROL TECHNIQUES
EMI Control Techniques Shielding, Filtering, Grounding, Bonding, Isolation transformer, Transient suppressors, Cable routing, Signal control.

UNIT IV  EMC DESIGN OF PCBs
EMC Design Of PCBs - Component selection and mounting; PCB trace impedance; Routing; Cross talk control; Power distribution decoupling; Zoning; Grounding; VIAs connection; Terminations.

UNIT V  EMI MEASUREMENT AND STANDARDS
EMI Measurements And Standards- Open area test site; TEM cell; EMI test shielded chamber and shielded ferrite lined anechoic chamber; Tx /Rx Antennas, Sensors, Injectors / Couplers, and coupling factors; EMI Rx and spectrum analyzer; Civilian standards-CISPR, FCC, IEC, EN; Military standardsMIL461E/462.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
On completion of the course the student should be able to
CO1: Understand EMI and susceptibility
CO2: Identify EMI coupling mechanisms
CO3: Use appropriate EMI control schemes in electronic systems
CO4: Design PCBs with EMC
CO5: Conduct EMI measurements according to standards.

REFERENCES:
1. David A Weston, "Electromagnetic Compatibility – Methods, Analysis, circuits and measurements" CRC press, Boca raton 2017

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OBJECTIVES:
- To acquire the knowledge on Space time wireless technology using multiple antennas.
- To understand Space time wireless propagation and space time channel.
- To understand diversity and capacity performance of space time wireless communication.
- To exploit the channel knowledge at the transmitter.
- To realize space time multiuser communication and system design.

UNIT I  MULTIPLE ANTENNA PROPAGATION AND ST CHANNEL CHARACTERIZATION
Wireless channel, Scattering model in macrocells, Channel as a ST random field, Scattering functions, Polarization and field diverse channels, Antenna array topology, Degenerate channels, reciprocity and its implications, Physical scattering model, sampled signal model, ST multiuser and ST interference channels.

UNIT II  CAPACITY OF MULTIPLE ANTENNA CHANNELS
Capacity of frequency flat deterministic MIMO channel: Channel unknown to the transmitter, Channel known to the transmitter, capacity of random MIMO channels, Influence of ricean fading, fading correlation, XPD and degeneracy on MIMO capacity, Capacity of frequency selective MIMO channels.

UNIT III  SPATIAL DIVERSITY
Diversity gain, Receive antenna diversity, Transmit antenna diversity, Diversity order and channel variability, Diversity performance in extended channels, Combined space and path diversity, Indirect transmit diversity, Diversity of a space-time-frequency selective fading channel.

UNIT IV  MULTIPLE ANTENNA CODING AND RECEIVERS
Coding and interleaving architecture, ST coding for frequency flat channels, ST coding for frequency selective channels, Receivers(SISO,SIMO,MIMO),Iterative MIMO receivers, Exploiting channel knowledge at the transmitter: linear pre-filtering, optimal pre-filtering for maximum rate, optimal pre-filtering for error rate minimization, selection at the transmitter, Exploiting imperfect channel knowledge.

UNIT V  OFDM, SPREAD SPECTRUM AND MIMO MULTIUSER DETECTION
SISO-OFDM modulation, MIMO-OFDM modulation, Signaling and receivers for MIMO-OFDM,SISO-SS modulation, MIMO-SS modulation, Signaling and receivers for MIMO-S S.MIMO-MAC,MIMO-BC, Outage performance for MIMO-MU,MIMO-MU with OFDM.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1: To be able to apply the knowledge of wireless technology using multiple antennas.
CO2: To be able to analyze space time wireless propagation and space time channel.
CO3: To be able to evaluate the performance of space time wireless communication.
CO4: To be able to utilize the channel knowledge at the transmitter.
CO5: To be able to understand space time multiuser communication.

REFERENCES:
COURSE OBJECTIVES:

- To enable the student to understand the evolving paradigm of cognitive radio communication and the enabling technologies for its implementation.
- To enable the student to understand the essential functionalities and requirements in designing software defined radios and their usage for cognitive communication.
- To expose the student to the evolving next generation wireless networks and their associated challenges.

UNIT I  SOFTWARE DEFINED RADIO AND ITS ARCHITECTURE
Definitions and potential benefits, software radio architecture evolution, technology tradeoffs and architecture implications. Essential functions of the software radio, basic SDR, hardware architecture, Computational processing resources, software architecture, top level component interfaces, interface topologies among plug and play modules.

UNIT II  COGNITIVE RADIOS AND ITS ARCHITECTURE

UNIT III  SPECTRUM SENSING AND IDENTIFICATION

UNIT IV  USER COOPERATIVE COMMUNICATIONS

UNIT V  INFORMATION THEORETICAL LIMITS ON CR NETWORKS

TOTAL : 45 PERIODS
COURSE OUTCOMES:
CO1: The student would be able to appreciate the motivation and the necessity for cognitive radio communication strategies.
CO2: The student would be able to evolve new techniques and demonstrate their feasibility using mathematical validations and simulation tools.
CO3: The student would be able to demonstrate the impact of the evolved solutions in future wireless network design.

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NE5251 ADAPTIVE SIGNAL PROCESSING TECHNIQUES

OBJECTIVES:
- To understand the basic principles of discrete random signal processing
- To understand the principles of spectral estimation
- To learn about the weiner and adaptive filters
- To understand the different signal detection and estimation methods
- To acquire skills to design synchronization methods for proper functioning of the system

UNIT I DISCRETE RANDOM SIGNAL PROCESSING

UNIT II SPECTRAL ESTIMATION

UNIT III WEINER AND ADAPTIVE FILTERS
UNIT IV DETECTION AND ESTIMATION

UNIT V SYNCHRONIZATION
Signal parameter estimation, carrier phase estimation, symbol timing estimator, joint estimation of carrier phase and symbol timing.

COURSE OUTCOMES:
On successful completion of this course, students will be able to
CO1: Analyze the basic principles of discrete random signal processing
CO2: Analyze the principles of spectral estimation
CO3: Analyze the Weiner and adaptive filters
CO4: Analyze the different signal detection and estimation methods
CO5: Design the synchronization methods for proper functioning of the system

TOTAL: 45 PERIODS

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WT5003 RADIO FREQUENCY INTEGRATED CIRCUIT DESIGN

OBJECTIVES:
- To introduce the integrated circuit design for Amplifiers at radio frequency.
- To get exposed to microwave oscillator design.
- To impart the concepts of RF IC
- To analyze and focus on circuits for radio frontends for mobile phone handsets.
- To understand noise amplifiers, mixers, power amplifiers, frequency synthesizers (phase locked loops) and modern radio architectures.

UNIT I AMPLIFIERS
UNIT - II  RF OSCILLATORS  

UNIT – III  RADIO FREQUENCY IC  

UNIT – IV  MICROWAVE POINT TO POINT SYSTEM DESIGN  

UNIT – V  TRANSMISSION LINE EQUIPMENT  

TOTAL: 45 PERIODS

COURSE OUTCOMES:
On completion of the course the student should be able to
CO1: Design amplifier by using RF IC
CO2: Develop RF oscillator for high frequency applications
CO3: Apply RF technology in the high frequency IC design
CO4: Understand the RF point to point system design
CO5: Apply IC design techniques in the transmission line equipment

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OBJECTIVES:
- To learn the fundamentals of VLSI design
- To understand the IC Manufacturing Process
- To familiarize with VLSI combinational logic circuits design
- To familiarize with VLSI sequential logic circuits design
- To learn the various arithmetic circuits and testing methodologies

UNIT - I  MOS TRANSISTOR PRINCIPLES  9

UNIT - II  COMBINATIONAL LOGIC CIRCUITS  9

UNIT – III  SEQUENTIAL LOGIC CIRCUITS AND MEMORY ARRAY STRUCTURES  9
Static and Dynamic Latches and Registers, Timing Issues, Pipelines, Clocking strategies, Memory core and peripheral circuitry, memory reliability and power dissipation. Case Studies: PLA, SRAM and NAND flash memories.

UNIT – IV  DESIGNING ARITHMETIC BUILDING BLOCKS & TESTING  9

UNIT – V  IMPLEMENTATION STRATEGIES  9
Full custom and semicustom design – cell based design – array based implementation - Programmable ASIC logic cells - Actel ACT - Xilinx LCA - Altera FLEX and MAX.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of the course students will be
CO1: Able to familiarize the basics of VLSI design.
CO2: Able to design combinational logic circuits.
CO3: Able to design sequential logic and memory circuits.
CO4: Able to analyze the various design techniques involved in arithmetic building blocks.
CO5: Able to analyze the implementation strategies in circuit design.

REFERENCES:
OBJECTIVES:

- To introduce the concept of spread spectrum modulation.
- To understand the generation of PN sequence and their properties.
- To understand the performance of spread spectrum in jamming environment.
- To understand the way in which spread spectrum is applied to CDMA and GPS systems.
- To get expose to the applications of spread spectrum.

UNIT - I  SPREADING CODES


UNIT - II  SPREAD SPECTRUM SYSTEMS


UNIT – III  SYNCHRONIZATION IN SPREAD SPECTRUM

Sources of synchronization Uncertainty, Carrier Synchronization - Code Synchronization & Acquisition - Matched Filter Acquisition, Serial Search Acquisition, Sequential Acquisition, Code Tracking- Delay Lock Tracking loop, Noncoherent Tracking loop.

UNIT – IV  SPREAD SPECTRUM IN CELLULAR COMMUNICATION


UNIT – V  APPLICATIONS OF SPREAD SPECTRUM METHODS


TOTAL: 45 PERIODS

OUTCOMES:

- To be able to arrive at detailed specifications of the spread spectrum systems.
- To be able to realize the generation of PN sequence.
- To be able to analyze synchronization issues in spread spectrum.
- To design systems based on spread spectrum to mitigate the jamming.
- To be able to design GPS system.
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NE5078 PATTERN RECOGNITION AND MACHINE LEARNING L T P C 3 0 0 3

OBJECTIVES:
- To understand the basics of data processing and dimensionality reduction techniques
- To understand different learning models for classification
- To understand the principles and applications of ANN architectures
- To study the different Deep convolutional networks
- To learn deep generative models

UNIT - I BASICS OF PROBABILITY AND RANDOM PROCESS 9
Probability Theory - Conditional and Joint Probability - Stationary and non-stationary process - Expectation - Auto correlation - Cross Correlation - Eigen values - Eigen vectors - Singular values - Singular vectors - Decision Theory - Information Theory

UNIT - II DIMENSIONALITY REDUCTION 9
Introduction - Features, feature vectors - Feature selection and ranking - Discriminant functions - Fisher’s Discriminant analysis - Principal Component Analysis - Kernel PCA - Independent component analysis

UNIT – III LEARNING MODELS 9
Linear models for Classification and Regression - Classifiers based on Bayes Decision theory – Naïve Bayes - Nearest neighbor rules - Mixture models - Mixture of Gaussian - Hidden Markov Model

UNIT – IV ARTIFICIAL NEURAL NETWORKS 9
Supervised Learning - Unsupervised Learning - Reinforcement Learning – Feed Forward and Feedback architectures - Multilayer Perceptron - Backpropagation Algorithm - Radial Basis Function networks - Support vector Machines
UNIT – V  DEEP LEARNING NETWORKS  9


TOTAL: 45 PERIODS

COURSE OUTCOMES:
On successful completion of this course, students will be able to
CO1: Employ different feature extraction and dimensionality reduction techniques
CO2: Design different learning models
CO3: Implement different neural network architectures
CO4: Realize basic Deep neural network architectures
CO5: Test and implement deep generative models for various data processing applications

REFERENCES:

WT5005  MICRO ELECTRO MECHANICAL SYSTEM FOR WIRELESS COMMUNICATION  3 0 0 3

OBJECTIVES:
• To introduce the importance of micro electro mechanical systems for wireless scenario.
• To know the fabrication techniques of MEMS components.
• To make the student familiar with the mechanical and the electrostatic design and the associated systems.
• To know the integration issues in a single platform of electrical and mechanical system.
• To understand the critical physical dimensions of MEMS devices

UNIT - I  FUNDAMENTALS & SWITCHES  9
UNIT - II  TUNNABLE MEMS

UNIT – III  FILTERS

UNIT – IV  MEMS DEVICES

UNIT – V  MICROMACHINED ANTENNA

TOTAL: 45 PERIODS

OUTCOMES:
- The student would be able to understand the fabrication techniques in MEMS technology.
- The student would be able to analyze different type of MEMS based devices, circuits and subsystems.
- The student would be able to demonstrate an understanding of the different aspects of microsystem design.
- The student would be capable of applying his knowledge and design tools and will be well practiced in design skills.
- The student would be able to solve the integration issues in mechanical and electrical microsystem components.

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OBJECTIVES:
- To introduce the relevance of this course to the existing technology
- To understand the basic concepts and design factors of GPS
- To enable the student to understand the necessity for GPS, the essential elements involved and the transmission methodologies
- To enable the student to understand the fundamentals of coordinate systems, different interferences and attenuation mechanisms affecting the satellite motion
- To get exposed to the environmental factors involved in the design of GPS and the different application scenarios.

UNIT - I GPS FUNDAMENTALS

UNIT - II CO-ORDINATE SYSTEM AND SATELLITE MOTION

UNIT – III TRACKING TECHNIQUES

UNIT – IV ATMOSPHERIC EFFECTS

UNIT – V APPLICATION
Iner Disciplinary Applications – Crystal Dynamics – Gravity Field Mapping – Atmospheric Occulation – Surveying – Geophysics – Air borne GPS – Ground Transportation – Space borne GPS – Metrological and Climate Research using GPS.

COURSE OUTCOMES:
Upon completion of the course, students will be able to:
CO1: Design GPS and ability to comprehend and appreciate the significance and role of this course in the present contemporary world
CO2: Explain the necessity for GPS, the essential elements involved and the transmission methodologies
CO3: Analyze the fundamentals of coordinate systems, different interferences and attenuation mechanisms affecting the satellite motion
CO4: Demonstrate an understanding the necessity for GPS, the essential elements involved and the transmission methodologies
CO5: Demonstrate an understanding the environmental factors involved in the design of GPS and the different application scenarios and their implementation.
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NE5075 INFORMATION THEORY AND CODING L T P C

OBJECTIVES:
- To understand the concepts of Information theory and Coding.
- To analyze the various techniques to improve the capacity of the channel.
- To understand the fundamental limits prescribed by the information theory.
- To get exposed to the gaussian channel
- To learn the various coding schemes in detail.

UNIT I QUANTITATIVE STUDY OF INFORMATION 9
Entropy, Relative Entropy, Mutual information, Chain rule, Relationship Bounds on entropy, Fisher information, Cramer Rao inequality, Entropy rates of a Stochastic process.

UNIT II CAPACITY OF NOISELESS CHANNEL 9
Fundamental theorem for a noiseless channel, Data compression, Kraft inequality, Shannon-Fano codes, Huffman codes, Asymptotic equi partition, Rate distortion theory.

UNIT III CHANNEL CAPACITY 9
Properties of channel capacity, jointly typical sequences, Channel Coding Theorem, converse to channel coding theorem, Joint source channel coding theorem.

UNIT IV DIFFERENTIAL ENTROPY AND GAUSSIAN CHANNEL 9
AEP for continuous random variables, relationship between continuous and discrete entropy, properties of differential entropy, Gaussian channel definitions, converse to coding theorem for Gaussian channel, channels with colored noise, Gaussian channels with feedback.

UNIT V CHANNEL CODING TECHNIQUES 9
Galois Fields, Fundamental Theorem of Galois Theory (FTGT), Reed-Solomon Codes, Turbo Codes, LDPC Codes, TCM.

TOTAL: 45 PERIODS
COURSE OUTCOMES:
CO1: The student will be in a position to quantify information.
CO2: To be able to implement various coding schemes.
CO3: To be able to design efficient channel.
CO4: To be able to apply coding techniques to information sources like video, audio and so on.
CO5: To able to implement the information theory and coding technique for effective communication

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WT5007 MODELING AND SIMULATION OF WIRELESS COMMUNICATION SYSTEMS 3 0 0 3

OBJECTIVES:
• To understand the requirement of simulation and modeling.
• To understand random signals and process
• To get exposed to simulation methods for wireless systems
• To know modeling procedures for various channels.
• To understand the versatility of simulation and apply simulation intelligently.

UNIT I INTRODUCTION 9
Role of Simulation: Examples of complexity- multi disciplinary aspects of simulation - models - deterministic and stochastic simulations; simulation sampling frequency-low pass simulation models for band pass – low pass complex envelope for band pass signals -linear band pass systems- multi carrier signals-non linear and time - varying systems.

UNIT II GENERATING AND PROCESSING RANDOM SIGNALS 9
Stationary and Ergodic Processes: Uniform random number generators - mapping uniform RVs to an arbitrary PDF - generating uncorrelated Gaussian random numbers - generating correlated Gaussian random numbers - PN sequence generators; Establishing a PDF and a PSD Post Processing: Basic graphical techniques - estimation - coding.

UNIT III METHODOLOGY FOR SIMULATING A WIRELESS SYSTEM 9
UNIT IV  MODELING AND SIMULATION OF TIME-VARYING SYSTEMS

Introduction: Models for LTV systems - random process models - simulation models for LTV systems; Wired and guided wave - radio channels - multipath fading channels - modeling multipath fading channels; Random process models - simulation methodology; Discrete Channel Models: Discrete memory less channel models - Markov models for discrete channels with memory-example HMMs - Gilbert and Fritchman models - estimation of Markov model parameters.

UNIT V  EFFICIENT SIMULATION TECHNIQUES

Tail Extrapolation: PDF estimators- importance sampling; Case study of a cellular radio system; Cellular radio system - simulation methodology - modeling co-channel interference - two example simulations; A code-division multiple access system - FDM system with a nonlinear satellite transponder - preprocessors for CDMA application.

COURSE OUTCOMES:

CO1: To be able to design various models for wireless communication.
CO2: To be able to simulate various channels.
CO3: To apply simulations for various wireless communication technologies.
CO4: Choose appropriate simulation techniques to reduce run time.
CO5: To differentiate between wireless and wired systems with respect to simulation requirements.

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OBJECTIVES:
- To understand the basic concepts of various compression algorithms related to multimedia which includes Text, speech, audio, image and Video.
- To understand the principles of underlying technologies and study its performance parameters.
- To study and compare different coding schemes.
- To learn about the importance of compression methods and its applications
- To study and understand the design issues involved in emerging compression standards.

UNIT - I FUNDAMENTALS OF COMPRESSION

UNIT - II TEXT COMPRESSION

UNIT – III IMAGE COMPRESSION

UNIT – IV AUDIO COMPRESSION

UNIT – V VIDEO COMPRESSION

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon Completion of the course, the students should be able to
CO1: Analyze the pros and cons of different coding schemes
CO2: Design and implement text and image compression approaches.
CO3: Examine audio and video compression in real time environment
CO4: Design compression algorithms using MATLAB or equivalent open source software.
Co5: Analyze and apply the concepts of compression algorithms in multimedia applications
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VE5151 REAL TIME EMBEDDED SYSTEM

OBJECTIVES:
- To have a detailed knowledge about the process involved in the design and development of real-time embedded system.
- To develop a programmable embedded platform from scratch on ARM Processor.
- To develop an integrated approach in low-power systems with hardware, software, sensors, actuators and controllers.
- To improve the knowledge base of students in Real time operating system, Systems modeling and Verification.
- To study about the different methods involved in software development, Emulation and Debugging.

UNIT - I INTRODUCTION 9

UNIT - II ARM PROCESSOR 9

UNIT – III REAL TIME OPERATING SYSTEM 9

UNIT – IV EMBEDDED SYSTEM MODELING AND VERIFICATION 9
UNIT – V SOFTWARE DEVELOPMENT, EMULATION AND DEBUGGING

Compilation process - Native vs Cross-Compilers - Run-time libraries - Writing a library - Using Standard and alternative libraries - Porting Kernels - C extensions - Downloading - Debugging techniques - Emulation techniques

COURSE OUTCOMES:
CO1: To be able to design and program for real time embedded system application.
CO2: To be able to model and design on embedded platform.
CO3: To be able to design a system in different hardware and software platforms.
CO4: To be able to port an operating system in Embedded Systems.
CO5: Complete understanding of real-time embedded platform.

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WT5009 ULTRA WIDEBAND COMMUNICATION

OBJECTIVES:
- To understand the basics principles behind the UWB concepts.
- To learn the design of pulse shaper as a digital filter
- To understand the unique UWB channel
- To understand when to use and when not to use UWB technology
- To enable the student to understand the design and implementation of UWB transceiver

UNIT I INTRODUCTION TO ULTRA-WIDEBAND
Introduction, UWB Modulation Options - UWB Signaling Techniques - Data Mapping - Spectral Characteristics - Data Mapping and Transceiver Complexity - Modulation Performances in Practical Conditions

UNIT II ULTRA-WIDEBAND PULSE SHAPER DESIGN
UNIT III    ULTRA-WIDEBAND CHANNEL MODELING
Principles and Background of UWB Multipath Propagation Channel Modeling - Channel Sounding Techniques - UWB Statistical-Based Channel Modeling - Impact of UWB Channel on System Design - Potential Benefits of MIMO.

UNIT IV    UWB TRANSCIEVER DESIGN CONSIDERATIONS

UNIT V    MULTIBAND OFDM SYSTEM

COURSE OUTCOMES:
CO1: The student should be able to develop a comprehensive overview of UWB system design.
CO2: The student would be able to understand the distinct UWB channel
CO3: The student should be able to design UWB pulse shaper
CO4: The student should be able to understand difference between UWB and legacy systems
CO5: The student should be able to understand the future directions of UWB technology

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## OBJECTIVES:

- To understand the basics and foundations of routing algorithms
- To design basic routing protocols and routing protocols for internet.
- To design multicast routing protocols for next generation networks.
- To understand the reservation oriented network routing and PSTN routing.
- To analyze the routing protocols of GSTN and VoIP technologies.

### UNIT I  INTRODUCTION TO ROUTING ALGORITHMS


### UNIT II  ROUTING PROTOCOL

Routing protocols – routing algorithm, routing table, routing information representation and protocol messages, DSR, LSR, path vector routing protocol. Internet Routing Protocol – basics, static routes, RIP, IGRP, EIGRP, OSPF.

### UNIT III  MULTICAST ROUTING

Multicast IP addressing, IGMP, MLD, RPF, DVMRP, Multicast OSPF, protocol independent multicast. Inter domain multicast routing – BGMP, Multiprotocol Extension of BGMP.

### UNIT IV  ROUTING IN RESERVATION ORIENTED NETWORKS


### UNIT V  ROUTING IN GSTN AND VOIP


### TOTAL: 45 PERIODS

## COURSE OUTCOMES:

CO1: To be able to understand the various network routing algorithms.
CO2: To be able to differentiate and design routing protocols of internet.
CO3: To be able to design routing protocols for multicast transmission.
CO4: To be able to understand routing protocols in reservation oriented networks.
CO5: To be able to analyze routing protocols of mobile network and VoIP network.

## REFERENCES:

OBJECTIVES:

- To expose neural network learning techniques and architectures
- To study and understand fuzzy concepts and models
- To expose the students to hybrid neuro-fuzzy techniques
- To learn the basic concepts in Deep Learning networks
- To understand different optimization techniques and apply the same in different scenarios

UNIT I - NEURAL NETWORKS

Biological Neurons Networks - Artificial Neural Networks - Supervised -.unsupervised learning - Reinforcement Learning - Activation functions - Perceptrons - Back Propagation networks - Radial Basis Function Networks - Adaptive Resonance architectures - Support Vector Machines

UNIT II - FUZZY LOGIC


UNIT III - NEURO-FUZZY MODELING


UNIT IV - DEEP LEARNING NETWORKS


UNIT V - EVOLUTIONARY ALGORITHMS

Heuristic search and optimization techniques -Random search - Introduction to Genetic Algorithms - Social Algorithms

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1: To be able to design systems based on neural network architectures
CO2: To be able to perform basic operations in fuzzy
CO3: To be able to implement fuzzy models and work on fuzzy tool box
CO4: To be able to design and implement deep learning architectures
CO5: To be able to design optimization based algorithm for a given application
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NE5073 GAME THEORY FOR WIRELESS COMMUNICATION AND NETWORKING

OBJECTIVES:
- To give an overview of a broad range of models that is studied in game theory
- To attain understanding on concepts related to non-cooperative games
- To understand a range of mathematical models of conflict and co-operation between two or more agents
- To attain understanding on concepts related to Bayesian games
- To discuss the application of game theory in wireless communication and networking

UNIT I INTRODUCTION
Introduction to theory of games- conflict, strategy, utility theory, games in extensive and normal forms, Examples.

UNIT II NON CO-OPERATIVE GAMES

UNIT III COOPERATIVE GAMES

UNIT IV BAYESIAN GAMES
Overview of Bayesian Games, Bayesian Games in extensive form, Cournot duopoly model with incomplete information, Super-Modular games, Learning in games: Fictitious play, and Regret minimization, Vickrey-Clarke-Groves Auction, Optimal Auction.
UNIT V APPLICATIONS TO NETWORKING


TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1: To be able to understand new concept in game theory
CO2: To be able to design non cooperative game theory based models
CO3: To be able to design cooperative game theory based models
CO4: To be able to design Bayesian game theory based models
CO5: To be able to apply game theory to solve network related issues.

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WT5011 WIRELESS TRANSCEIVER DESIGN L T P C

OBJECTIVES:
- To understand the basics of system
- To acquire knowledge on the receiver architecture
- To analyze the receiver characteristics
- To get familiar with transmitter system design
- To learn about the high frequency transceivers

UNIT I FUNDAMENTALS OF SYSTEM DESIGN
Linear systems and transformation, Non-linear system representation, Noise and Random process, elements of Digital base band system: Sampling, jitter, modulation techniques, pulse shaping, error probability detection

UNIT II RADIO ARCHITECTURES AND DESIGN CONSIDERATIONS
Super heterodyne architecture, direct conversion architecture, Low IF architecture, band-pass sampling radio architecture
UNIT III  RECEIVER SYSTEM ANALYSIS AND DESIGN  9
Sensitivity and noise figure of receiver, intermodulation characteristics, single tone desensitization, adjacent channel selectivity and blocking characteristics, receiver dynamic range and AGC system, system design and performance evaluation

UNIT IV  TRANSMITTER SYSTEM ANALYSIS AND DESIGN  9
Transmission power and spectrum, modulation accuracy, adjacent and alternate channel power, noise emission.

UNIT V  CASE STUDY  9
Multimode and multiband superheterodyne transceiver: selection of frequency plan, receiver system and transmitter system design - Direct conversion transceiver: receiver system and transmitter system design.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
On completion of the course the student should be able to
CO1: Apply knowledge in transceiver design
CO2: Understand the receiver architecture
CO3: Analyze the system parameters in receiver
CO4: Understand the transmitter system design
CO5: Apply design techniques in the RF transceivers

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WT5012  ADVANCED ANTENNA SYSTEMS  L T P C  3 0 0 3

OBJECTIVES:
• To acquire knowledge on antenna fundamentals
• To develop an understanding of antenna array concepts
• To impart principles of radiation from apertures
• To know about the principles of microstrip antenna
• To get acquainted with recent trends in antenna design
UNIT - I  
**ANTENNA FUNDAMENTALS**  
9  

UNIT - II  
**ANTENNA ARRAYS**  
9  
One Dimensional Arrays: Linear array –uniform array, end fire and broad side array, gain, beam width, side lobe level; Linear array synthesis techniques – Binomial and Chebyshev distributions; Two dimensional uniform arrays;smart antennas,switched beam and adaptive arrays, Mutual Coupling in Finite Arrays.  

UNIT – III  
**RADIATION FROM APERTURES**  
9  
Field equivalence principle, Radiation from Rectangular and Circular apertures, Uniform aperture distribution on an infinite ground plane; Babinets principle, Slot antenna; Horn antenna; Reflector antenna, aperture blockage, and design consideration.  

UNIT – IV  
**MICROSTRIP ANTENNA**  
9  
Radiation Mechanism and Excitation techniques : Microstrip dipole; Patch, Rectangular patch, Circular patch, and Ring antenna – radiation analysis from cavity model; input impedance of rectangular and circular patch antenna; Microstrip array and feed network; Reconfiguration Mechanisms; Computer Aided Design of Microstrip Antennas, Microstrip Reflectarray Antennas.  

UNIT – V  
**MODERN ANTENNAS**  
9  

TOTAL:  45 PERIODS  

COURSE OUTCOMES:  
At the end of the course, the student should be able to:  
CO1: Understand the basic antenna theory  
CO2: Identify the concepts of antenna arrays  
CO3: Apply the theory of aperture for antenna design  
CO4: Design microstrip antennas  
CO5: Develop antennas for various applications  

REFERENCES:  
WT5013 ADVANCED WIRELESS COMMUNICATION TECHNIQUES  L T P C  3 0 0 3

OBJECTIVES:
- To understand the evolving paradigm of cooperative communication
- To understand concepts related to green wireless communication
- To enable the student to understand the different power saving strategies and energy efficient signal, system and network design.
- To expose the student to the energy saving techniques adopted in existing wireless components
- To provide understanding on protocols and networks related to green future wireless communication technologies.

UNIT I  COOPERATIVE COMMUNICATIONS AND GREEN CONCEPTS  9
Network architectures and research issues in cooperative cellular wireless networks; Cooperative communications in OFDM and MIMO cellular relay networks: issues and approaches; Fundamental trade-offs on the design of green radio networks, Green modulation and coding schemes.

UNIT II  COOPERATIVE TECHNIQUES  9
Cooperative techniques for energy efficiency, Cooperative base station techniques for cellular wireless networks; Turbo base stations; Antenna architectures for cooperation; Cooperative communications in 3GPP LTE-Advanced, Partial information relaying and Coordinated multi-point transmission in LTE-Advanced.

UNIT III  RELAY-BASED COOPERATIVE CELLULAR NETWORKS  9
Distributed space-time block codes ; Collaborative relaying in downlink cellular systems ; Radio resource optimization; Adaptive resource allocation ; Cross-layer scheduling design for cooperative wireless two-way relay networks ; Network coding in relay-based networks.

UNIT IV  GREEN RADIO NETWORKS  9

UNIT V  ACCESS TECHNIQUES FOR GREEN RADIO NETWORKS  9
Cross-layer design of adaptive packet scheduling for green radio networks; Energy-efficient relaying for cooperative cellular wireless networks; Energy performance in TDD-CDMA multihop cellular networks; Resource allocation for green communication in relay-based cellular networks; Green Radio Test-Beds and Standardization Activities.

TOTAL: 45 PERIODS
COURSE OUTCOMES:
CO1: The student would be able to appreciate the necessity and the design aspects of cooperative communication.
CO2: The student would be able to appreciate the necessity and the design aspects of green wireless communication.
CO3: The student would be able to evolve new techniques in wireless communication.
CO4: The students would be able to demonstrate the feasibility of using mathematical models using simulation tools.
CO5: The student would be able to demonstrate the impact of the green engineering solutions in a global, economic, environmental and societal context.

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NE5076 IoT FUNDAMENTALS L T P C 3 0 0 3

OBJECTIVES:
- To assess the vision and introduction of IoT.
- To Implement Data and Knowledge Management and use of Devices in IoT Technology.
- To Understand State of the Art - IoT Architecture.
- To build a small low-cost embedded system using Single Board Computers
- To learn the various case study of IoT systems.

UNIT – I INTRODUCTION AND APPLICATIONS 9
UNIT - II  IoT DESIGN & SYSTEM MANAGEMENT  9

UNIT – III  IoT PROTOCOLS & SYSTEM  9

UNIT – IV  IoT CLOUD & DATA ANALYTICS  9

UNIT – V  IoT SECURITY  9
IoT attacks - Phase attacks, Attacks as per architecture, Attacks based on components. Security Protocols - Time-Based Secure Key Generation and Renewal - Security access algorithms for unidirectional data transmissions, Security access algorithms for bidirectional data transmissions.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon the completion of the course the student will be able to
CO1: Interpret the vision of IoT from a global context.
CO2: Compare and Contrast the use of Devices, Gateways and Data Management in IoT.
CO3: Design a portable IoT using any Single Board Computer and relevant protocols
CO4: Analyze applications of IoT in real time scenario
CO5: Deploy an IoT application and connect to the cloud.

REFERENCES:
OBJECTIVES:
- To know about the fundamentals of optical fiber transmission and its limitations.
- To develop an understanding of basics of optical transmitters and receivers
- To acquire knowledge on fiber loss and dispersion compensation schemes
- To impart concepts of passive optical networks
- To get acquainted with various wire line technologies

UNIT – I
RAY THEORY ANALYSIS & TRANSMISSION CHARACTERISTICS
Fibre Optic Guides, Light wave generation systems, systems components, optical fibers, SI, GI fibre, modes, Dispersion in fibers limitations due to dispersions, fibre loss, non linear effects.

UNIT – II
OPTICAL TRANSMITTERS & RECEIVERS
Optical Transmitters and Fibres, Basic concept, spectral distribution, semiconductor lasers, gain coefficients, modes. Transmitter design, Receive PIN and APD diodes, SNR. Switches, Coherent, homodyne and Hetro dyne keying formats, BER in synchronous and Asynchronous.

UNIT – III
COMPENSATION TECHNIQUES
Amplifiers, Basic concepts, Semiconductor laser amplifiers Raman and Brillouin-fibre amplifiers, Erbium doped-fibre and amplifiers, pumping phenomenon Dispersion Compensation Limitations, post and pre-compensation techniques, equalizing filters, SONET/SDH.

UNIT – IV
PASSIVE OPTICAL NETWORKS: ARCHITECTURES AND PROTOCOLS

UNIT – V
WIRE LINE TECHNIQUES
Wire line Narrowband, XDSL, Wire line broad band, Very High Bit Rate Digital Subscriber Line (VDSL), Cable MODEM Home Networks, & VDSL Transmission Protocols. DOCSIS-Standards.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
On completion of the course the student should be able to
CO1: Understand optical fiber characteristics
CO2: Design optical transmitters and receivers
CO3: Use appropriate compensation techniques in a optical fiber link
CO4: Identify the architectures and protocols in PON
CO5: Apply wireline techniques in the optical network design

REFERENCES:
OBJECTIVES:

- To provide basic understanding about satellite communication technologies.
- To have an exposure to orbital mechanics, launching techniques and satellite link design.
- To know the basic satellite link parameters.
- To get exposed to modulation, antennas and mobile terminals for mobile satellite communication system.
- To understand various applications of mobile satellite.

UNIT - I BASIC PRINCIPLES
General features - frequency allocation for satellite services, properties of satellite communication systems, Kepler’s laws - orbital dynamics, orbital characteristics, satellite spacing and orbital capacity, GSO & LEO Satellites - Launch Vehicle Technology-GSLV.

UNIT - II SATELLITE SUBSYSTEMS AND SATELLITE LINKS
Attitude and orbit control system - telemetry, tracking and command, power systems, communication subsystems, antenna subsystem, equipment reliability and space qualification, Free space loss - Atmospheric effects - Ionospheric scintillation - link design, Power Budget Calculation - System noise temperature - Modulation for satellite communication.

UNIT – III MOBILE SATELLITE NETWORK
GSM signaling and S-PCN signaling protocol architecture, Mobility management - cell location, location management, handover management, Resource Management - Resource allocation strategies, Network operation and procedures.

UNIT – IV ANTENNAS AND MOBILE TERMINALS

UNIT – V APPLICATIONS
GPS, Mobile satellite system for UMTS, GSM/EDGE, MOBILE IP, WLAN, Global Broadband services, ATM, GEO and Non GEO Mobile satellite systems.

COURSE OUTCOMES:
CO1: To able to understand the principles of satellite system
CO2: To be able to design satellite subsystems and satellite link.
CO3: To be able to design mobile satellite network.
CO4: To be able to design new antenna architecture for satellite system.
CO5: To be able to develop new applications in the field of mobile satellite.
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OE5091 BUSINESS DATA ANALYTICS

**OBJECTIVES:**

- To understand the basics of business analytics and its life cycle.
- To gain knowledge about fundamental business analytics.
- To learn modeling for uncertainty and statistical inference.
- To understand analytics using Hadoop and Map Reduce frameworks.
- To acquire insight on other analytical frameworks.

**UNIT I OVERVIEW OF BUSINESS ANALYTICS**


**Suggested Activities:**

- Case studies on applications involving business analytics.
- Converting real time decision making problems into hypothesis.
- Group discussion on entrepreneurial opportunities in Business Analytics.

**Suggested Evaluation Methods:**

- Assignment on business scenario and business analytical life cycle process.
- Group presentation on big data applications with societal need.
- Quiz on case studies.

**UNIT II ESSENTIALS OF BUSINESS ANALYTICS**

Descriptive Statistics – Using Data – Types of Data – Data Distribution Metrics: Frequency, Mean, Median, Mode, Range, Variance, Standard Deviation, Percentile, Quartile, z-Score, Covariance,

Suggested Activities:
- Solve numerical problems on basic statistics.
- Explore chart wizard in MS Excel Case using sample real time data for data visualization.
- Use R tool for data visualization.

Suggested Evaluation Methods:
- Assignment on descriptive analytics using benchmark data.
- Quiz on data visualization for univariate, bivariate data.

UNIT III  MODELING UNCERTAINTY AND STATISTICAL INFERENCE


Suggested Activities:
- Solving numerical problems in sampling, probability, probability distributions and hypothesis testing.
- Converting real time decision making problems into hypothesis.

Suggested Evaluation Methods:
- Assignments on hypothesis testing.
- Group presentation on real time applications involving data sampling and hypothesis testing.
- Quizzes on topics like sampling and probability.

UNIT IV  ANALYTICS USING HADOOP AND MAPREDUCE FRAMEWORK


Suggested Activities:
- Practical – Install and configure Hadoop.
- Practical – Use web based tools to monitor Hadoop setup.
- Practical – Design and develop MapReduce tasks for word count, searching involving text corpus etc.

Suggested Evaluation Methods:
- Evaluation of the practical implementations.
- Quizzes on topics like HDFS and extensions to MapReduce.

UNIT V  OTHER DATA ANALYTICAL FRAMEWORKS

Overview of Application development Languages for Hadoop – PigLatin – Hive – Hive Query Language (HQL) – Introduction to Pentaho, JAQL – Introduction to Apache: Sqoop, Drill and Spark, Cloudera Impala – Introduction to NoSQL Databases – Hbase and MongoDB.

Suggested Activities:
- Practical – Installation of NoSQL database like MongoDB.
- Practical – Demonstration on Sharding in MongoDB.
- Practical – Install and run Pig
- Practical – Write PigLatin scripts to sort, group, join, project, and filter data.
- Design and develop algorithms to be executed in MapReduce involving numerical methods for analytics.

**Suggested Evaluation Methods:**
- Mini Project (Group) – Real time data collection, saving in NoSQL, implement analytical techniques using Map-Reduce Tasks and Result Projection.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**
On completion of the course, the student will be able to:
- **CO1**: Identify the real world business problems and model with analytical solutions.
- **CO2**: Solve analytical problem with relevant mathematics background knowledge.
- **CO3**: Convert any real world decision making problem to hypothesis and apply suitable statistical testing.
- **CO4**: Write and Demonstrate simple applications involving analytics using Hadoop and MapReduce
- **CO5**: Use open source frameworks for modeling and storing data.
- **CO6**: Apply suitable visualization technique using R for visualizing voluminous data.

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OBJECTIVES:
- Summarize basics of industrial safety
- Describe fundamentals of maintenance engineering
- Explain wear and corrosion
- Illustrate fault tracing
- Identify preventive and periodic maintenance

UNIT I  INTRODUCTION
Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

UNIT II  FUNDAMENTALS OF MAINTENANCE ENGINEERING
Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

UNIT III  WEAR AND CORROSION AND THEIR PREVENTION

UNIT IV  FAULT TRACING
Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment’s like, i. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

UNIT V  PERIODIC AND PREVENTIVE MAINTENANCE
Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: i. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

COURSE OUTCOMES:
Students will be able to:
CO1: Ability to summarize basics of industrial safety
CO2: Ability to describe fundamentals of maintenance engineering
CO3: Ability to explain wear and corrosion
CO4: Ability to illustrate fault tracing
CO5: Ability to identify preventive and periodic maintenance

TOTAL: 45 PERIODS
OBJECTIVES:

- Solve linear programming problem and solve using graphical method.
- Solve LPP using simplex method
- Solve transportation, assignment problems
- Solve project management problems
- Solve scheduling problems

UNIT I  LINEAR PROGRAMMING  9
Introduction to Operations Research – assumptions of linear programming problems - Formulations of linear programming problem – Graphical method

UNIT II  ADVANCES IN LINEAR PROGRAMMING  9
Solutions to LPP using simplex algorithm- Revised simplex method - primal dual relationships – Dual simplex algorithm - Sensitivity analysis

UNIT III  NETWORK ANALYSIS – I  9
Transportation problems -Northwest corner rule, least cost method, Voges’s approximation method - Assignment problem -Hungarian algorithm

UNIT IV  NETWORK ANALYSIS – II  9
Shortest path problem: Dijkstra’s algorithms, Floyd’s algorithm, systematic method -CPM/PERT

UNIT V  NETWORK ANALYSIS – III  9
Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Students will be able to:
CO1: To formulate linear programming problem and solve using graphical method.
CO2: To solve LPP using simplex method
CO3: To formulate and solve transportation, assignment problems
CO4: To solve project management problems
CO5: To solve scheduling problems
## Objectives:

- Summarize the costing concepts and their role in decision making
- Infer the project management concepts and their various aspects in selection
- Interpret costing concepts with project execution
- Develop knowledge of costing techniques in service sector and various budgetary control techniques
- Illustrate with quantitative techniques in cost management

### Unit I
**Introduction to Costing Concepts**

Objectives of a Costing System; Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost; Creation of a Database for operational control.

### Unit II
**Introduction to Project Management**

Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomerate of technical and nontechnical activities, Detailed Engineering activities, Pre project execution main clearances and documents, Project team: Role of each member, Importance Project site: Data required with significance, Project contracts.

### Unit III
**Project Execution and Costing Concepts**

Project execution Project cost control, Bar charts and Network diagram, Project commissioning: mechanical and process, Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis, Various decision-making problems, Pricing strategies: Pareto Analysis, Target costing, Life Cycle Costing.

### Unit IV
**Costing of Service Sector and Budgetery Control**

Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis, Budgetary Control: Flexible Budgets; Performance budgets; Zero-based budgets.

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**COST MANAGEMENT OF ENGINEERING PROJECTS**  
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UNIT V QUANTITATIVE TECHNIQUES FOR COST MANAGEMENT 9
Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Learning Curve Theory.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Students will be able to:
CO1 – Understand the costing concepts and their role in decision making
CO2–Understand the project management concepts and their various aspects in selection
CO3–Interpret costing concepts with project execution
CO4–Gain knowledge of costing techniques in service sector and various budgetary control techniques
CO5 - Become familiar with quantitative techniques in cost management

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2. Charles T. Horngren and George Foster, Advanced Management Accounting, 1988

OE5095 COMPOSITE MATERIALS L T P C
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OBJECTIVES:
- Summarize the characteristics of composite materials and effect of reinforcement in composite materials.
- Identify the various reinforcements used in composite materials.
- Compare the manufacturing process of metal matrix composites.
- Understand the manufacturing processes of polymer matrix composites.
- Analyze the strength of composite materials.

UNIT I INTRODUCTION 9
Definition – Classification and characteristics of Composite materials - Advantages and application of composites - Functional requirements of reinforcement and matrix - Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

UNIT II REINFORCEMENTS 9
Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers - Properties and applications of whiskers, particle reinforcements - Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures - Isostrain and Isostress conditions.
UNIT III  MANUFACTURING OF METAL MATRIX COMPOSITES  9

UNIT IV  MANUFACTURING OF POLYMER MATRIX COMPOSITES  9

UNIT V  STRENGTH  9
Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Students will be able to:
- CO1 - Know the characteristics of composite materials and effect of reinforcement in composite materials.
- CO2 – Know the various reinforcements used in composite materials.
- CO3 – Understand the manufacturing processes of metal matrix composites.
- CO4 – Understand the manufacturing processes of polymer matrix composites.
- CO5 – Analyze the strength of composite materials.

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OE5096  WASTE TO ENERGY  L T P C  3 0 0 3

OBJECTIVES:
- Interpret the various types of wastes from which energy can be generated
- Develop knowledge on biomass pyrolysis process and its applications
- Develop knowledge on various types of biomass gasifiers and their operations
- Invent knowledge on biomass combustors and its applications on generating energy
- Summarize the principles of bio-energy systems and their features
UNIT I  INTRODUCTION TO EXTRACTION OF ENERGY FROM WASTE
Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors

UNIT II  BIOMASS PYROLYSIS
Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

UNIT III  BIOMASS GASIFICATION

UNIT IV  BIOMASS COMBUSTION
Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

UNIT V  BIO ENERGY
Properties of biogas (Calorific value and composition), Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production -Urban waste to energy conversion - Biomass energy programme in India.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Students will be able to:
CO1 – Understand the various types of wastes from which energy can be generated
CO2 – Gain knowledge on biomass pyrolysis process and its applications
CO3 – Develop knowledge on various types of biomass gasifiers and their operations
CO4 – Gain knowledge on biomass combustors and its applications on generating energy
CO5 – Understand the principles of bio-energy systems and their features

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REFERENCES:
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AX5091 ENGLISH FOR RESEARCH PAPER WRITING L T P C 2 0 0 0

OBJECTIVES
- Teach how to improve writing skills and level of readability
- Tell about what to write in each section
- Summarize the skills needed when writing a Title
- Infer the skills needed when writing the Conclusion
- Ensure the quality of paper at very first-time submission

UNIT I INTRODUCTION TO RESEARCH PAPER WRITING 6
Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

UNIT II PRESENTATION SKILLS 6

UNIT III TITLE WRITING SKILLS 6
Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check

UNIT IV RESULT WRITING SKILLS 6
Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions

UNIT V VERIFICATION SKILLS 6
Useful phrases, checking Plagiarism, how to ensure paper is as good as it could possibly be the first-time submission

TOTAL: 30 PERIODS

COURSE OUTCOMES
CO1 – Understand that how to improve your writing skills and level of readability
CO2 – Learn about what to write in each section
CO3 – Understand the skills needed when writing a Title
CO4 – Understand the skills needed when writing the Conclusion
CO5 – Ensure the good quality of paper at very first-time submission

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REFERENCES
OBJECTIVES

- Summarize basics of disaster
- Explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- Illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- Describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- Develop the strengths and weaknesses of disaster management approaches

UNIT I  INTRODUCTION

Disaster: Definition, Factors and Significance; Difference between Hazard And Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

UNIT II  REPERCUSSIONS OF DISASTERS AND HAZARDS


UNIT III  DISASTER PRONE AREAS IN INDIA

Study of Seismic Zones; Areas Prone To Floods and Droughts, Landslides And Avalanches; Areas Prone To Cyclonic and Coastal Hazards with Special Reference To Tsunami; Post-Disaster Diseases and Epidemics

UNIT IV  DISASTER PREPAREDNESS AND MANAGEMENT

Preparedness: Monitoring Of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological And Other Agencies, Media Reports: Governmental and Community Preparedness.

UNIT V  RISK ASSESSMENT

Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People’s Participation in Risk Assessment. Strategies for Survival

TOTAL : 30 PERIODS

COURSE OUTCOMES

CO1: Ability to summarize basics of disaster
CO2: Ability to explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.
CO3: Ability to illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
CO4: Ability to describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
CO5: Ability to develop the strengths and weaknesses of disaster management approaches

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AX5093 SANSKRIT FOR TECHNICAL KNOWLEDGE

OBJECTIVES
- Illustrate the basic sanskrit language.
- Recognize sanskrit, the scientific language in the world.
- Appraise learning of sanskrit to improve brain functioning.
- Relate sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power.
- Extract huge knowledge from ancient literature.

UNIT I ALPHABETS 6
Alphabets in Sanskrit

UNIT II TENSES AND SENTENCES 6
Past/Present/Future Tense - Simple Sentences

UNIT III ORDER AND ROOTS 6
Order - Introduction of roots

UNIT IV SANSKRIT LITERATURE 6
Technical information about Sanskrit Literature

UNIT V TECHNICAL CONCEPTS OF ENGINEERING 6
Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics

TOTAL: 30 PERIODS

COURSE OUTCOMES
- CO1 - Understanding basic Sanskrit language.
- CO2 - Write sentences.
- CO3 - Know the order and roots of Sanskrit.
- CO4 - Know about technical information about Sanskrit literature.
- CO5 - Understand the technical concepts of Engineering.

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1. “Abhyaspustakam” – Dr. Vishwas, Samskrita-Bharti Publication, New Delhi
2. “Teach Yourself Sanskrit” Prathama Deeksha-Vempati Kutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication
OBJECTIVES
Students will be able to
- Understand value of education and self-development
- Imbibe good values in students
- Let the should know about the importance of character

UNIT I

UNIT II

UNIT III

UNIT IV

TOTAL: 30 PERIODS

COURSE OUTCOMES
Students will be able to
CO1: Knowledge of self-development.
CO2: Learn the importance of Human values.
CO3: Developing the overall personality.

SUGGESTED READING

AX5095 CONSTITUTION OF INDIA

OBJECTIVES
Students will be able to:
- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional
- Role and entitlement to civil and economic rights as well as the emergence nation hood in the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik Revolutionin1917and its impact on the initial drafting of the Indian Constitution.

UNIT I HISTORY OF MAKING OF THE INDIAN CONSTITUTION
History, Drafting Committee, (Composition & Working)
UNIT II  PHILOSOPHY OF THE INDIAN CONSTITUTION
Preamble, Salient Features

UNIT III  CONTOURS OF CONSTITUTIONAL RIGHTS AND DUTIES

UNIT IV  ORGANS OF GOVERNANCE
Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions.

UNIT V  LOCAL ADMINISTRATION

UNIT VI  ELECTION COMMISSION
Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners - Institute and Bodies for the welfare of SC/ST/OBC and women.

TOTAL: 30 PERIODS

COURSE OUTCOMES
Students will be able to:
CO1: Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
CO2: Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
CO3: Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
CO4: Discuss the passage of the Hindu Code Bill of 1956.

SUGGESTED READING
1. The Constitution of India, 1950 (Bare Act), Government Publication.

AX5096  PEDAGOGY STUDIES

OBJECTIVES
Students will be able to:
- Review existing evidence on there view topic to inform programme design and policy
- Making under taken by the DfID, other agencies and researchers.
- Identify critical evidence gaps to guide the development.

UNIT I  INTRODUCTION AND METHODOLOGY:
Aims and rationale, Policy background, Conceptual framework and terminology - Theories of learning, Curriculum, Teacher education - Conceptual framework, Research questions - Overview of methodology and Searching.
UNIT II THEMATIC OVERVIEW
Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries - Curriculum, Teacher education.

UNIT III EVIDENCE ON THE EFFECTIVENESS OF PEDAGOGICAL PRACTICES
Methodology for the in depth stage: quality assessment of included studies - How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? - Theory of change - Strength and nature of the body of evidence for effective pedagogical practices - Pedagogic theory and pedagogical approaches - Teachers’ attitudes and beliefs and Pedagogic strategies.

UNIT IV PROFESSIONAL DEVELOPMENT
Professional development: alignment with classroom practices and follow up support - Peer support - Support from the head teacher and the community - Curriculum and assessment - Barriers to learning: limited resources and large class sizes

UNIT V RESEARCH GAPS AND FUTURE DIRECTIONS
Research design – Contexts – Pedagogy - Teacher education - Curriculum and assessment - Dissemination and research impact.

TOTAL: 30 PERIODS

COURSE OUTCOMES
Students will be able to understand:
CO1: What pedagogical practices are being used by teachers informal and informal classrooms in developing countries?
CO2: What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?
CO3: How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

SUGGESTED READING
OBJECTIVES
- To achieve overall health of body and mind
- To overcome stress

UNIT I
Definitions of Eight parts of yoga. (Ashtanga)

UNIT II
Yam and Niyam - Do’s and Don’t’s in life - i) Ahinsa, satya, astheya, bramhacharya and aparigraha, ii) Ahinsa, satya, astheya, bramhacharya and aparigraha.

UNIT III
Asan and Pranayam - Various yog poses and their benefits for mind & body - Regularization of breathing techniques and its effects - Types of pranayam

COURSE OUTCOMES
Students will be able to:
CO1: Develop healthy mind in a healthy body thus improving social health also
CO2: Improve efficiency

SUGGESTED READING
1. "Yogic Asanas for Group Training-Part-I"; Janardan Swami Yoga bhyasi Mandal, Nagpur
2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata

OBJECTIVES
- To learn to achieve the highest goal happily
- To become a person with stable mind, pleasing personality and determination
- To awaken wisdom in students

UNIT I
Neetisatakam-holistic development of personality - Verses- 19,20,21,22 (wisdom) - Verses-29,31,32 (pride & heroism) – Verses- 26,28,63,65 (virtue) - Verses- 52,53,59 (don’ts) - Verses-71,73,75,78 (do’s)

UNIT II
Approach to day to day work and duties - Shrimad Bhagwad Geeta: Chapter 2-Verses 41, 47,48 - Chapter 3-Verses 13, 21, 27, 35 Chapter 6-Verses 5,13,17,23, 35 - Chapter 18-Verses 45, 46, 48.

UNIT III
Statements of basic knowledge - Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68 Chapter 12 -Verses 13, 14, 15, 16,17, 18 - Personality of role model - shrimad bhagwad geeta - Chapter2-Verses 17, Chapter 3-Verses 36,37,42 - Chapter 4-Verses 18, 38,39 Chapter18 – Verses 37,38,63

TOTAL: 30 PERIODS
COURSE OUTCOMES
Students will be able to
CO1: Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life
CO2: The person who has studied Geeta will lead the nation and mankind to peace and prosperity
CO3: Study of Neet is hatakam will help in developing versatile personality of students.

SUGGESTED READING
1. Gopinath, Rashtriya Sanskrit Sansthanam P, Bhartrihari’s Three Satakam, Niti-sringar-vairagya, New Delhi,2010