PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

I. To prepare students to excel in research or to succeed in Communication and Networking domain through global, rigorous post graduate education.
II. To provide students with a solid foundation in mathematical, scientific and engineering fundamentals required to solve problems in Communication and Networking.
III. To train students with good scientific and engineering knowledge so as to comprehend, analyze, design, and create novel products and solutions for the real life problems.
IV. To inculcate students in professional and ethical attitude, effective communication skills, teamwork skills, multidisciplinary approach, and an ability to relate issues in Communication and Networking to broader social context and life-long learning for a successful professional career.

PROGRAMME OUTCOMES (POs):

On successful completion of the programme,

1. Graduates will demonstrate knowledge of mathematics, science and engineering.
2. Graduates will demonstrate an ability to identify, formulate and solve engineering problems.
3. Graduate will demonstrate an ability to design and conduct experiments, analyze and interpret data.
4. Graduates will demonstrate an ability to design a system, component or process as per needs and specifications.
5. Graduates will demonstrate an ability to visualize and work on laboratory and multidisciplinary tasks.
6. Graduate will demonstrate skills to use modern engineering tools, software and equipment to analyze problems.
7. Graduates will demonstrate knowledge of professional and ethical responsibilities.
8. Graduate will be able to communicate effectively in both verbal and written form.
9. Graduate will show the understanding of impact of engineering solutions on the society and also will be aware of contemporary issues.
10. Graduate will develop confidence for self education and ability for life-long learning.
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# ANNA UNIVERSITY, CHENNAI
## UNIVERSITY DEPARTMENTS
### M.E. COMMUNICATION AND NETWORKING
#### REGULATIONS – 2015
##### CHOICE BASED CREDIT SYSTEM
### CURRICULA AND SYLLABI I TO IV SEMESTERS

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**EMPLOYABILITY ENHANCEMENT COURSES (EEC)**

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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 Theory algorithms and understand its 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  

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

UNIT III    GRAPH THEORY AND ALGORITHMS  

UNIT IV    ALGEBRAIC EQUATIONS  

UNIT V    QUEUEING MODELS  
Markovian queues - Steady State analysis of Single and Multi-server Models - Little’s formula - Machine Interference Model - Self Service queue

TOTAL: 60 PERIODS

OUTCOMES:
On successful completion of this course, all students will have developed knowledge and understanding in the fields of Linear Algebra, Special Functions, Graph Theory, Algebraic Equations and Queuing Models.

REFERENCES:
OBJECTIVES:
- To understand the communication system techniques from end-to-end, i.e., from sampling to switching.
- To know the basic parameters that determine the noise performance of a receiver.
- To know the basic structure of various error control coding techniques.
- To understand the various transmission and switching techniques and their limitations.

UNIT I  WAVEFORM CODING TECHNIQUES  9+6
Sampling- Quantization - PCM- DPCM – ADPCM- DM- ADM- LPC-CELP.

UNIT II  NOISE FIGURE & LINK BUDGET  9+6
Thermal Noise –Power Spectral density - Noise temperature - Noise Figure -Link Budget calculations.

UNIT III  ERROR CONTROL TECHNIQUES  9+6
Matrix Parity Check Codes-Linear Block Codes – Error Detection & Correction capability- Cyclic Codes – CRC-Hamming codes – Convolutional codes – Viterbi Decoding algorithm.

UNIT IV  TRANSMISSION TECHNIQUES  9+6
Subscriber Loop Transmission - xDSL, Trunk Transmission Line Coding / Framing / Multiplexing - Signaling- Timing Synchronization —ARQ Protocols.

UNIT V  SWITCHING TECHNIQUES  9+6
Blocking & Non-Blocking Switches- Multistage switches- Space Switching, Time Switching and Combination switching – Erlang B formula-& its applications - Complexity -Path finding times.

TOTAL: 45+30:75 PERIODS

OUTCOMES:
- To acquire skills to design waveform coding techniques and implement the same.
- To acquire skills to design the various error control coding schemes and carry out their implementations.
- To design transmission and switching systems to meet out the required blocking probability.
- To design a receiver to meet out the required Noise performance
- Ability to carry out Link Budget Calculations for the design of communication system

REFERENCES:
OBJECTIVES:

- To enable the student to understand the basic principles of random signal processing, spectral estimation methods and adaptive filter algorithms and their applications.
- To enable the student to understand the different signal detection and estimation methods used in communication system design and the implications of proper synchronization methods for proper functioning of the system.

UNIT I DISCRETE RANDOM SIGNAL PROCESSING


UNIT II SPECTRAL ESTIMATION

Estimation of spectra from finite duration signals, Nonparametric methods – Periodogram, Modified periodogram, Bartlett, Welch and Blackman-Tukey methods, Parametric methods – ARMA, AR and MA model based spectral estimation, Solution using Levinson-Durbin algorithm.

UNIT III ADAPTIVE FILTERS


UNIT IV DETECTION AND ESTIMATION

Detection criteria : Bayes detection techniques, MAP, ML, detection of M-ary signals, Neyman Pearson, minimax decision criteria. Estimation: linear estimators, non-linear estimators, Bayes, Kalman, MAP,ML, properties of estimators, phase and amplitude estimation.

UNIT V SYNCHRONIZATION

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

TOTAL: 45 PERIODS

OUTCOMES:

- The student would be able to demonstrate an understanding of the basic principles of random signal processing, spectral estimation methods and adaptive filter algorithms and their applications.
- The student would be able to demonstrate an understanding of the different signal detection and estimation methods used in communication system design and the implications of proper synchronization methods for proper functioning of the system.
- The student would be in a position to apply his knowledge for designing a baseband system addressing the channel impairments

REFERENCES

OBJECTIVES:
- To understand the basics of RF Engineering.
- To introduce the design of RF and microwave systems.
- To learn the basic simulation tools for the design and analysis of RF components and circuits.

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

OUTCOMES:
- The ability to design RF amplifier, mixer and other related circuits.
- To be able to use Smith Chart to design amplifier and circuits for impedance transformation and transmission line matching.

REFERENCES:
OBJECTIVES:
- To ensure a comprehensive understanding of high speed computer network architectures
- To study mathematical models related to network performance analysis.
- To focus on current and emerging networking technologies.

UNIT I SWITCHING NETWORKS 9+6

UNIT II MULTIMEDIA NETWORKING APPLICATIONS 9+6
Streaming stored Audio and Video, Best effort service, protocols for real time interactive applications, Beyond best effort, scheduling and policing mechanism, integrated services, RSVP-differentiated services.

UNIT III ADVANCED NETWORKS CONCEPTS 9+6

UNIT IV PACKET QUEUES AND DELAY ANALYSIS 9+6
Little’s theorem, Birth and Death process, queueing discipline- Control & stability -, Markovian FIFO queueing system, Non-markovian - Pollaczek-Khinchin formula and M/G/1, M/D/1, self-similar models and Batch-arrival model, Networks of Queues – Burke’s theorem and Jackson Theorem.

UNIT V NETWORK SECURITY AND MANAGEMENT 9+6

TOTAL: 45+30:75 PERIODS

OUTCOMES:
- To design High performance computer networks.
- To design and implement CAC protocols in multimedia networks.
- Design and implement network protocols in HPCN.
- Analyse performance of network related issues using mathematical models.
- Compare the various methods of providing connection-oriented services over an advanced network with reference to MPLS, VPN.

REFERENCES:
OBJECTIVES:

- To understand the functioning of various protocols in Wired and Wireless Environment.
- To perform real time experimentation using the existing infrastructure.
- To impart programming skill using NS2/QUALNET.
- Gain knowledge to construct LAN, WLAN, and VLAN in a real-time environment.

### Sl. No. | Details of Experiment | Details of System/ software/Hardware Required for a batch of 25 Students
--- | --- | ---
1. | AODV/DSR routing | 4 hours | NS2/ QUALNET | 25
2. | Security algorithms in wired network | 4 hours | NS2/ QUALNET | 25
3. | MAC protocols Wired and wireless | 8 hours | NS2/ QUALNET/Hardware | 25
4. | Configuration of LAN | 4 hours | Router, switches, (Hardware) | 5+10
5. | Configuration of VLAN - Tunneling | 8 hours | Router, switches, (Hardware) | 5+10
6. | Configuration of WLAN | 8 hours | Layer 3 switches, routers, Wifi Access Point, PDA (Hardware) | 2+2+1+10
7. | MINI PROJECT | 8 hours | NS2/QUALNET/NS3/OMNET | 

TOTAL: 60 PERIODS

OUTCOMES

- Ability to design MAC and routing protocols in Wired and Wireless Environment using NS2/QUALNET.
- To acquire the technical competence to meet out the industry expectation on the state – of the art wired / wireless technologies.
- To acquire the ability to design WLAN/ LAN systems meeting out real time requirements.

OBJECTIVES:

- To give strong fundamentals on Random process.
- To have a comprehensive knowledge of the various signalling schemes.
- To have an in depth knowledge of synchronization and equalization.
- To understand the theoretical limits set by the Information Theory.

UNIT I  RANDOM PROCESS  9+6

UNIT II  SIGNALING SCHEMES  9+6
UNIT III  SIGNAL ACQUISITION & SYNCHRONIZATION  9+6
Receiver structure for BPSK- QPSK-QAM- Carrier Synchronization- Bit synchronization.

UNIT IV  EQUALIZATION  9+6
Channel Models- ISI-Eye Diagram-Receiver Front End-ML Sequence estimation-Linear Equalization-Decision Feedback Equalization.

UNIT V  INFORMATION THEORETIC LIMITS  9+6

TOTAL: 45+30:75 PERIODS

OUTCOMES:
- To be able to make a right choice on the signalling scheme based on their relative performance.
- To be able to arrive at detailed specification for the synchronization and equalization techniques.
- To design and implement Synchronization and Equalization systems.
- To apply the concepts of Random Process to communication system design.

REFERENCES:

NE7203  NEXT GENERATION NETWORKS  L T P C  3 0 0 3

OBJECTIVES:
- To learn the technical, economic and service advantages of next generation networks.
- To learn the basic architecture of a next generation network (NGN) with reference
- To understand NGN services
- To learn the role of P Multimedia Sub-system (IMS), network attachment and admission control functions.
- To learn and compare the various methods of providing connection-oriented services over a NGN with reference to MPLS, MPLS-TE and T-MPLS.

UNIT I  INTRODUCTION  9

UNIT II  IMS AND CONVERGENT MANAGEMENT  9
IMS Architecture - IMS services, QoS Control and Authentication, Network and Service management for NGN, IMS advantages, Next Generation OSS Architecture - standards important to OSS architecture, Information framework, OSS interaction with IMS, NGN OSS function/ information view reference model, DMTF CIM.
UNIT III  MPLS AND VPN  9
Technology overview –MPLS & QoS, MPLS services and components –layer 2 VPN, layer 2 internetworking, VPN services, signaling, layer 3 VPN –Technology overview, Remote Access and IPsec integration with MPLS VPN.

UNIT IV  MULTICAST  9
MPLS Multicast VPN overview – Applications, examples, IPv6 and MPLS- Technology overview, Future of MPLS –Integrating IP and optical networks, Future layer 3 services, future layer 2 services.

UNIT V  NGN MANAGEMENT  9

TOTAL: 45 PERIODS

OUTCOMES:
- To be able to design routing mechanism meeting the desired QoS in NGN.
- To be able to design network management protocols in NGN.
- To be able to compare various methods of providing connection-oriented services over a NGN with reference to MPLS, MPLS-TE and T-MPLS.
- To be able to compare various NGN virtual network services with reference to VPNs, VLANs, pseudo wires, VPLS and typical applications.

REFERENCES:

NE7201  ADVANCED OPTICAL COMMUNICATION  3 2 0 4

OBJECTIVES:
- Understand the concepts of optical communications and various systems
- Know the recent developments in optical components and their applications
- Understand the non linearities and dispersion issues in optical transmission.
- Be able to identify the merits and demerits of different modulation and detection schemes

UNIT I  REVIEW OF OPTICAL COMMUNICATIONS SYSTEMS  9+6
Optical fibers, dispersion, link budget, Time Division Multiplexing, Sub Carrier Multiplexing and code division multiplexing. Systems: Passive optical Network, Hybrid fiber coax architectures, Radio over fiber technologies, free space optics

UNIT II  MODERN OPTICAL COMPONENTS  9+6
VCSEL, QW lasers, Multi section DFB lasers, Tunable lasers, Electro absorption modulator, Integrated transmitters and receivers, optical switches and routers, WDM components, Optical schemes for microwave generation
UNIT III  NON LINEAR FIBER OPTICS AND APPLICATIONS  9+6
Non linear optics – basics, Brilluion, Raman effects, Four wave mixing, optical phase conjugation. Raman and Brilluion amplifiers, DRFA, fiber lasers, Solitons, Communication using solitons, WDM solitons

UNIT IV  DISPERSION COMPENSATION SCHEMES  9+6
Pre, post and mixed compensation schemes, Optical filters for compensation, Delay line filters, Dispersion slope compensation, Dispersion and Non linearity, Dispersion maps, multichannel compensation schemes.

UNIT V  ADVANCED MODULATION AND DETECTION TECHNIQUES  9+6
Limitations of direct modulation, ASK,PSK,FSK modulations in coherent systems, Analog schemes: QPSK, QAM, DQPSK, Carrier suppressed schemes. External modulators, single and Dual drive MZM, performance. Non coherent and coherent detection.

OUTCOMES:
• A thorough knowledge of different optical communication systems
• A thorough knowledge of optical components and its performances
• Details of impairments in optical fiber links and schemes to mitigate them

REFERENCES:

NE7204  WIRELESS MOBILE COMMUNICATION  L T P C
3 0 2 4

OBJECTIVES
• To understand the issues involved in mobile communication system design and analysis.
• To understand the concept of frequency reuse.
• To understand the characteristics of wireless channels.
• To acquire knowledge in different modulation schemes and its error probability in wireless system.
• To know the fundamental limits on the capacity of wireless channels.
• To understand the diversity concepts.

UNIT I  THE WIRELESS CHANNEL  10+6
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 Distribution Information known – Channel Side Information at Receiver – Channel Side Information at Transmitter and Receiver – Capacity with Receiver diversity – Capacity comparisons – Capacity of Frequency Selective Fading channels.

UNIT II  PERFORMANCE OF DIGITAL MODULATION OVER WIRELESS CHANNELS  7+6
### UNIT III  MULTIANTENNA COMMUNICATION  9+6

### UNIT IV  MULTICARRIER MODULATION  10+6
Data Transmission using Multiple Carriers – Multicarrier Modulation with Overlapping Subchannels – Mitigation of Subcarrier Fading – Discrete Implementation of Multicarrier Modulation – Peak to average Power Ratio- Frequency and Timing offset – Case study IEEE 802.11a

### UNIT V  CELLULAR CONCEPTS  9+6

**TOTAL: 45+30: 75 PERIODS**

**OUTCOMES:**
- To apply diversity techniques in wireless systems.
- To design cellular systems to achieve a given GoS (Grade of Service) in coverage and blocking probability.
- To design digital radio links considering various analytical and empirical models.
- To carry out link budget calculations.
- To be able to design frequency reuse patterns for cellular communication.

**REFERENCES:**

### NE7205  WIRELESS NETWORKS  
**L T P C**  3 0 0 3

**OBJECTIVES:**
- To understand the fundamentals of wireless networks.
- To learn the concepts of various wireless technologies.
- To gain adequate exposure to the emerging technologies and their potential impact.

### UNIT I  WIRELESS LAN and PAN  9
Introduction, fundamentals of WLAN –technical issues, network architecture, IEEE 802.11-physical layer, Mac layer mechanism, CSMA/CA,RTS/CTS, Polling, Bluetooth- User scenarios, Architecture, Radio layer, Baseband layer, Link manager protocol, L2CAP, Security, SDP, IEEE 802.15.3.
UNIT II  WIRELESS INTERNET

UNIT III  AD-HOC SENSOR NETWORK

UNIT IV  3G NETWORKS

UNIT V  4G - LTE
Overview of LTE Networks - Need for LTE- From LTE to LTE-Advanced SAE :- LTE Architecture, Radio Protocol stack, Interfaces, Concept of HetNET, Quality of Service and Bandwidth Reservation - QoS metrics, Signaling for Bandwidth Requests and Grants, Bandwidth Allocation and Traffic Handling, Mobility Management, Security Protocols.

TOTAL: 45 PERIODS

OUTCOMES:
- To design the various wireless networks.
- To be able to design the 4G and LTE networks.
- To design application sensor networks.
- To design Heterogeneous networks.

REFERENCES:
OBJECTIVE:
- To develop skills for implementing various modulations, coding and equalization schemes on a SDR platform.

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<th>Details of Equipment / Instrument Required for a batch of 25 Students</th>
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<td>Pulse Shaping, Timing &amp; Frequency Synchronization</td>
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<td>BPSK Modulation and Demodulation</td>
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<td>Decision Feedback Equalizer</td>
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<td>OFDM -Synchronization &amp; Channel estimation</td>
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TOTAL: 60 PERIODS

OUTCOMES:
- To be able to design and implement synchronization schemes for communication system. To be able to design and implement equalization schemes.
- To be able to design and implement various digital modulation schemes. To be able to design and implement OFDM systems.
- To be able to use SDR platform for design of communication systems.
OBJECTIVES:
- To provide an in-depth coverage of the adaptive filter theory.
- To provide the mathematical framework for the understanding of adaptive statistical signal processing.
- To know the basic tools of vector spaces and discrete-time stochastic process.
- To understand the various issues involved in adaptive filtering.
- To Various types of adaptive filters will be introduced and their properties will be studied, specifically convergence, tracking, robustness and computational complexity.
- Learn to apply adaptive filter theory using prescribed case studies.

UNIT I STOCHASTIC PROCESSES AND SPECTRUM ESTIMATION

UNIT II WIENER FILTERS

UNIT III GRADIENT-BASED ADAPTIVE FILTERS

UNIT IV KALMAN FILTERS & TRACKING

UNIT V APPLICATIONS

TOTAL: 45 PERIODS

OUTCOMES:
- To be able to solve the problems related to optimal design, convergence, and recursiveness.
- To carry out time/frequency domain implementations of adaptive filters.
- To be able to apply the concepts of stochastic processes to adaptive filters.
- To be able design adaptive filter algorithms.
- To be able to apply adaptive filter theory to applications such as echo cancelation, noise cancellation and channel equalization.

REFERENCES:
OBJECTIVES:
- To understand the behaviour of MOS Transistor.
- To learn the concepts of amplifiers, current mirrors and reference generator circuits.
- To understand data converters.
- To study the feedback and frequency compensation techniques.

UNIT I MODELS FOR IC ACTIVE DEVICES 9
Introduction- Large signal behavior of MOS transistor- small signal behavior of the MOS transistor – Short channel effect in MOS transistor – Weak inversion in MOS transistor – Large signal and small signal analysis of single stage MOS amplifiers (CS, CG and CD) - SPICE simulation for MOS circuits.

UNIT II CMOS OPERATIONAL TRANSCODUCTANCE AMPLIFIER 9
Introduction – Difference between Op-Amp and OTA- Differential OTA – slew rate, PSRR, CMRR and Dynamic range of the OTA-Design of Telescopic Cascode and Folded Cascode OTAs. Design of two-stage amplifier- Miller compensation method for two-stage OTA- Noise in feedback OTAs- SPICE frequency simulation for CMOS OTA.

UNIT III CURRENT MIRROR AND REFERENCES 9

UNIT IV ANALOG COMPARATORS AND OUTPUT STAGES 9

UNIT V ANALOG DESIGN WITH MOS TECHNOLOGY 9
Design of 8-bit flash type ADC- Design of 10-bit successive approximation (SAR) & pipelined ADC- A Systematic Design approach of DAC- SPICE simulations for the above designs – Introduction to concepts of power integrity, substrate noise, and reliability.

OUTCOMES:
- To be able to design various OTAs.
- To be able to design different kinds of data converters.
- To be able to carry out SPICE simulation of various analog circuits.

REFERENCES:
OBJECTIVES:
- To revise the concepts of electromagnetic wave theory, Maxwell's equations, electromagnetic fields, charges, currents.
- To understand the fundamentals of applied electromagnetism by emphasizing physical and practical applications in modern communication systems.

UNIT I  FUNDAMENTALS OF ELECTROMAGNETIC THEORY REVISITED  9
Electric and magnetic fields; Maxwell's equations in integral form; Maxwell's equations in differential form; Boundary conditions; Poynting's vector and energy storage; Static fields and circuit elements; Quasi-static fields and frequency behaviour of circuit elements.

UNIT II  ELECTROMAGNETIC INTERFERENCE  9
Electromagnetic Environment, Practical concerns, Frequency spectrum conservation, Sources of EMI: Lightning, ESD, EMP, EMI from apparatus and circuits. Modelling of Interferences, Test sites and measurements.

UNIT III  ELECTROMAGNETIC COMPATIBILITY  9
Methods of solution of EMC problems; Capacitive and inductive couplings; Crosstalk on transmission lines; Common impedance coupling; EMI filters, Grounding and Shielding; Cables and connectors, EMC standards.

UNIT IV  ELECTROMAGNETIC WAVE PROPAGATION  9
EM Waves and Radiation. Overview of propagation effects; Ground wave, Sky wave Tropospheric Ionospheric propagation effects; Propagation prediction models for satellite and Mobile links.

UNIT V  ELECTROMAGNETICS FOR LIGHTWAVE & RADAR SYSTEMS  9
Reflection, refraction, Interference and diffraction of plane waves; Dielectric slab waveguide; Pulse broadening in a dispersive medium. RADAR, LIDAR range equations, Radar cross section (RCS). Introduction to electromagnetic field computation.

TOTAL: 45 PERIODS

OUTCOMES:
- To be able to apply Maxwell's equations for electromagnetic systems.
- To able to design systems to mitigate the effects of Electromagnetic Interference.
- To design systems with Electromagnetic compatibility

REFERENCES:
OBJECTIVES:
- To provide the basic concepts of image & pattern recognition.
- To give an exposure to basic image processing and modeling techniques.
- To provide an understanding of various concepts related to video object extraction.
- To prepare students for development and implementation of algorithms

UNIT I  IMAGE FUNDAMENTALS AND TRANSFORMS  9
Image Representation- Sampling and Quantization - Two dimensional DFT- Discrete cosine Transform - Walsh - Hadamard transform - Wavelet transform - Construction of Wavelets-Types of wavelets - principal component analysis.

UNIT II  PROCESSING AND MODELING OF IMAGES  9
Pre-processing -Point operations – contrast stretching – Histogram - Histogram equalization - Image segmentation- pixel based, edge based, region based segmentation - Morphological image processing - Edge and texture models - Image registration - Colour Image Processing

UNIT III  SPATIAL FEATURE EXTRACTION  9
Feature selection - Localized feature extraction- Boundary Descriptors - Moments - Texture Descriptors - Co-occurrence features

UNIT IV  CLASSIFIERS  9
Kernel based approaches - clustering methods - Maximum Likelihood Estimation- Bayesian approach- Pattern Classification

UNIT V  VIDEO OBJECT EXTRACTION  9
Back ground subtraction – Frame difference - Static and dynamic background modeling - optical flow techniques-Handling occlusion- scale and appearance changes - Shadow removal

TOTAL: 45 PERIODS

OUTCOMES:
- To be able to design pattern recognition systems.
- To design and implement feature extraction techniques for a given application.
- To design a suitable classifier for a given application.

REFERENCES:
NE7078 INFORMATION THEORY AND CODING

OBJECTIVES:
- To understand the concepts of Information theory and Coding.
- To understand the fundamental limits prescribed by the information theory.
- To learn the various coding schemes in detail.

UNIT I QUANTITATIVE STUDY OF INFORMATION

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

UNIT III CHANNEL CAPACITY
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
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
Galois Fields, Fundamental Theorem of Galois Theory (FTGT), Reed-Solomon Codes, Turbo Codes, LDPC Codes, TCM.

TOTAL: 45 PERIODS

OUTCOMES
- The student will be in a position to quantify information.
- To be able to design and implement various coding schemes.
- To be able to apply coding techniques to information sources like video, audio and so on.

REFERENCES:

NE7008 PARALLEL PROCESSING

OBJECTIVES:
- To understand the architectures for parallel processing.
- To learn the concepts of pipelining and multithreading.

UNIT I THEORY OF PARALLELISM
Parallel computer models- the state of computing, Multiprocessors and multi computers and multivectors and SIMD computers, PRAM and VLSI models, Architecture development tracks Program and network properties.
UNIT II  PARALLEL PROCESSING APPLICATIONS  9

UNIT III  HARDWARE TECHNOLOGIES  9
Processor and memory hierarchy- advanced processor technology, superscalar and vector processors, memory hierarchy technology, virtual memory technology, bus cache and shared memory, backplane bus systems, cache memory organizations, shared memory Organizations, sequential and weak consistency models.

UNIT IV  INSTRUCTION LEVEL PARALLEL PROCESSING  9

UNIT V  PARALLEL ALGORITHMS  9
Classification of Parallel Algorithms: Synchronized and Asynchronized parallel algorithms, Performance of Parallel algorithms- Elementary parallel algorithms: Searching, Sorting, Matrix Operations

OUTCOMES:
- Apply the problem solving techniques in parallel computing.
- To be able to solve problems related to memory management.
- To be able to design efficient parallel algorithms.

REFERENCES:

NE7010  PRINCIPLES OF CRYPTOGRAPHY AND NETWORK SECURITY  L T P C
3 0 0 3

OBJECTIVES:
- To learn the fundamentals of cryptography and its application to network security.
- To understand the mathematics behind cryptography.
- To study about network security threats, security services, and counter measures.
- To learn about the principles and protocols that enables its application to wired and wireless networks.
- To develop an understanding of security policies such as authentication, integrity and confidentiality as well as protocols to implement such policies.
UNIT I INTRODUCTION AND NUMBER THEORY 9

UNIT II SYMMETRIC AND ASYMMETRIC CRYPTOSYSTEMS 9
Modern Symmetric Block Ciphers – DES, 3DES, AES and Mode of operations, Stream Ciphers, Asymmetric Cryptosystem- RSA, ElGamal, ECC, Key Management using Exponential Ciphers - Diffie-Hellman.

UNIT III AUTHENTICATION, DIGITAL SIGNATURES AND CERTIFICATES 9

UNIT IV TRUSTED IDENTITY 9

UNIT V SECURITY AT LAYERS 9

TOTAL: 45 PERIODS

OUTCOMES:

- To design cryptographic algorithms and carry out their implementation.
- To be able to do cryptanalysis on cipher.
- To be able to design and implement security protocols.

REFERENCES:
OBJECTIVES:

- To understand the fundamentals of RF integrated circuits operating at microwave frequencies.
- To learn RFIC design techniques, including system architecture, key building blocks design methodologies in CMOS technology.

UNIT I  BASIC RF IC COMPONENTS  9
Skin effect, Resistors, Capacitor, Inductor and Transformers at high frequency, Interconnect options. S-parameters with Smith chart, Impedance matching networks, Transmission lines, finite length effects, MOSFET characteristics, Noise: Two port Noise theory, Noise Figure, THD, IP2, IP3, Sensitivity, SFDR.

UNIT II  RECEIVERS ARCHITECTURE AND LOW NOISE AMPLIFIERS  9
Homodyne Receiver, Heterodyne Receiver, Image reject, Low IF Receiver Architectures Direct up conversion Transmitter, Two step up conversion Transmitter, CMOS amplifiers, Single ended and Differential LNAs, Terminated with Resistors and Source Degeneration LNAs, OC Time constants in bandwidth estimation and enhancement, Power match and Noise match.

UNIT III  FEEDBACK SYSTEMS AND POWER AMPLIFIERS  9

UNIT IV  PLL AND FREQUENCY SYNTHESIZERS  9
Linearised PLL Model, Noise properties, Phase detectors, Loop filters and Charge pumps, PLL Design examples. Integer-N frequency synthesizers, Direct Digital Frequency synthesizers.

UNIT V  MIXERS AND OSCILLATORS  9
Mixer characteristics, Non-linear based mixers, Multiplier based mixers, Single balanced and double balanced mixers, sub sampling mixers, Oscillators describing Functions, Resonators, Phase noise, Chip Design Examples: GPS Receiver, WLAN receiver.

TOTAL: 45 PERIODS

OUTCOMES:

- The ability to analyze and design the high frequency effects on basic circuit components.
- To design RF LNAs and receivers.
- To design RF power amplifiers.
- To design PLL and frequency synthesizers.

REFERENCES:

OBJECTIVES:
- To understand the basic characteristics of speech
- To know the details of algorithms, techniques and limitations of state of the art speech systems.
- To investigate speech processing applications like speech synthesis and speech recognition

UNIT I BASIC CONCEPTS

UNIT II SPEECH ANALYSIS
Features, Feature Extraction and Pattern Comparison Techniques; Spectral distortion measures- mathematical and perceptual – Log Spectral Distance, Cepstral Distances, Weighted Cepstral Distances and Liftering, Likelihood Distortions, Spectral Distortion using a Warped frequency Scale, LPC, PLP and MFCC Coefficients, Time Alignment and Normalization – Dynamic Time Warping, multiple Time – Alignment Paths.

UNIT III SPEECH MODELLING

UNIT IV SPEECH RECOGNITION
Large Vocabulary Continuous Speech Recognition: Architecture of a large vocabulary Continuous Speech Recognition system – acoustics and language models, Sub-word units- models for phonemes, syllables, triphones, Language models, n-grams, context dependent sub-word units.

UNIT V SPEECH SYNTHESIS
Text-to-speech synthesis: Concatenative and waveform synthesis methods, sub-word units for TTS, intelligibility and naturalness-role of prosody, Applications.

TOTAL: 45 PERIODS

OUTCOMES:
- To be able to analyse speech signal
- To design speech recognition systems
- To design speech synthesis systems

REFERENCES:
OBJECTIVES

- To give clear idea about VLSI Design Cycle and Physical Design Cycle.
- Study of different architectures of FPGA from different families.
- To learn the algorithmic concepts and complexity in physical design automation.
- To understand the algorithms used for Partitioning in Physical design.
- To understand the faults in System and causes for occurrence of faults.

UNIT I INTRODUCTION AND LOGICAL DESIGN AUTOMATION


UNIT II PHYSICAL DESIGN AUTOMATION


UNIT III PARTITIONING, FLOORPLANNING, PLACEMENT, ROUTING AND AUTOMATION OF FPGAs AND MCMs


UNIT IV MODELLING, SIMULATION AND VERIFICATION

Modelling - Register transfer level (RTL) – Structural - Gate level, switch level and high level modelling - High-level modeling of VLSI Systems - System Verilog and SystemC concepts- Simulation & Verification – Event driven and continuous analog simulation methods - Analog and mixed signal simulation and verification – SPICE – Introduction to assertion-Based-Verification (ABV) and Formal Verification (FV).

UNIT V TESTING & VERIFICATION

Design for Testability, Boundary scan test, Fault simulation – ATPG – Application of ASICs – Analog and Mixed signal (AMS) test and DFT – Case Studies.

OUTCOMES:

- To be able to carry out Physical Design Flow.
- To be able to carry out product quality diagnosis.
- To acquire the expertise to meet out the expectation of industries in various processes related to chip development.
- To be able to carry out complete design flow using CAD tools.
REFERENCES:

NE7075 DETECTION AND ESTIMATION THEORY L T P C 3 0 0 3

OBJECTIVES:
- To understand the concepts of detection and estimation.
- To learn the basics of multi-user detection theory
- To understand the theory behind various estimation techniques.
- To understand Wiener filter and Kalman filter in detail.

UNIT I REVIEW OF PROBABILITY AND STOCHASTIC PROCESS 9

UNIT II SINGLE AND MULTIPLE SAMPLE DETECTION 9
Hypothesis Testing and the MAP Criterion, Bayes Criterion, Minimax Criterion, Neyman-Pearson Criterion, Sequential Detection, The Optimum Digital Detector in Additive Gaussian Noise, Performance of Binary Receivers in AWGN.

UNIT III FUNDAMENTALS OF ESTIMATION THEORY 9

UNIT IV WIENER AND KALMAN FILTERS 9

UNIT V APPLICATIONS 9
Detector Structures in Non-Gaussian Noise, Examples of Noise Models, Receiver Structures, and Error-Rate Performance, Estimation of Non-Gaussian Noise Parameters Fading Multipath Channel Models, Receiver Structures with Known Channel Parameters, Receiver Structures without Knowledge of Phase, Receiver Structures without Knowledge of Amplitude or Phase, Receiver Structures and Performance with No Channel Knowledge.

TOTAL: 45 PERIODS

OUTCOMES:
- To be able to apply detection and estimation theory to solve communication problems.
- To apply probability and stochastic process concepts in detection and estimation.
- To design Wiener and Kalman filters to solve linear estimation problems.
REFERENCES:

AP7252 DIGITAL IMAGE PROCESSING L T P C 3 0 0 3

OBJECTIVES:
- To provide an introduction to basic concepts and methodologies for digital image processing.
- To develop engineering skills and intuitive understanding of the most important concepts, techniques and algorithms for digital image processing.
- To understand the general processes of image acquisition, storage, enhancement, segmentation, representation and description.
- To implement filtering and enhancement algorithms for monochrome as well as color images.
- To appreciate the challenges and understand the principles and applications of visual pattern recognition.

UNIT I DIGITAL IMAGE FUNDAMENTALS 9
Elements of digital image processing systems, Digital Camera working principles, Elements of visual perception, brightness, contrast, hue, saturation, Mach Band effect, Image sampling, Quantization, Dither, Two dimensional mathematical preliminaries.

UNIT II IMAGE TRANSFORMS 9
1D DFT, 2D transforms - DFT, DCT, Discrete Sine, Walsh, Hadamard, Slant, Haar, KLT, SVD, Wavelet transform.

UNIT III IMAGE ENHANCEMENT AND RESTORATION 9

UNIT IV IMAGE SEGMENTATION AND MORPHOLOGY 9
Image segmentation - Edge detection, Edge linking and boundary detection, Region growing, Region splitting and Merging, Image Recognition - Patterns and pattern classes, Matching by minimum distance classifier, Matching by correlation, Morphological Image Processing - Basics, SE, Erosion, Dilation, Opening, Closing, Hit-or-Miss Transform, Boundary Detection, Hole filling, Connected components, convex hull, thinning, thickening, skeletons, pruning, Geodesic Dilation, Erosion, Reconstruction by dilation and erosion.

UNIT V IMAGE COMPRESSION 9
Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, Vector Quantization, Block Truncation Coding, Transform coding, JPEG, MPEG.

TOTAL : 45 PERIODS
OUTCOMES:
At the end of the course, the student should be able to:
• Develop an overview of the field of image processing.
• Outline and implement the fundamental algorithms
• Gain experience in applying image processing algorithms to real problems

REFERENCES:

NE7073 BROADBAND ACCESS TECHNOLOGIES L T P C
OBJECTIVES:
• To give fundamental concepts related to broad band access technologies.
• To understand the current and emerging wired / wireless access technologies.
• To acquire knowledge about cable modems and fiber access technologies.
• To have an exposure to different system standards for next generation broadband access networks.

UNIT I REVIEW OF ACCESS TECHNOLOGIES 5
Phone-Line modem, cable-access, ISDN, Emerging Broad band Technologies, Cable DSL, Fiber and Wireless.

UNIT II DIGITAL SUBSCRIBER LINES 10
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 10

UNIT IV FIBER ACCESS TECHNOLOGIES 10

UNIT V BROAD BAND WIRELESS 10
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), Mobile Wireless 3G – IMT 2000.

TOTAL:45 PERIODS
OUTCOMES:
- To be able to design systems meeting out the requirements of the recent standards.
- To meet out the industry requirements for man power in Next generation networks.
- To be able to contribute towards the enhancement of the existing wireless technologies.

REFERENCES:

NE7002 COMPUTATIONAL ELECTROMAGNETICS 3 0 0 3

OBJECTIVES:
- To understand the concepts and mathematical methods to analyze the electromagnetic fields and wave phenomena.
- To learn the analytical and numerical techniques to solve the electromagnetic problems.
- To understand the importance of computational techniques to analyze the field propagation in mediums.

UNIT I INTRODUCTION

UNIT II ANALYTICAL TECHNIQUES
Limitation of the conventional design procedure — Need for field analysis based design — problem definition — Direct Integration Method — Variable Separable Method — Method of Images — Conformal Mapping.

UNIT III NUMERICAL TECHNIQUES

UNIT IV FIELD COMPUTATION FOR BASIC STRUCTURES

UNIT V APPLICATIONS

TOTAL :45 PERIODS
OUTCOMES:

- To be able to contribute to development of new methods, software for finite difference and finite element differential equation models as well as integral equation models for frequency domain models.
- To be able to use commercial application software with insight into fundamental properties and limitations.
- To be able to apply the concepts for the design of Photonic and electromagnetic band gap structures.

REFERENCES:


NE7003 DIGITAL AUDIO AND VIDEO BROADCASTING TECHNOLOGY

OBJECTIVES:

- To understand the basics of audio and video broadcasting technology.
- To learn the principle of audio and video coding methods.
- To understand the technology of digital TV transmission.

UNIT I INTRODUCTION
Basic television, analog and digital TV, standards for analog and digital TV, scanning on original black and white picture, synchronization, horizontal and vertical synchronization, adding colour information, transmission methods, distortion and interference, measurements on analog video standards.

UNIT II VIDEO CODING
Video compression, MPEG-2 data stream, coding, modulation of moving pictures, DPCM of moving pictures, DCT and quantization, Huffman coding, structure of video elementary system, recent compression methods, MPEG-4 –H.263-advanced video coding. HDTV.

UNIT III AUDIO AND VIDEO COMPRESSION
Digital audio signal, MPEG and dolby digital, subband coding, transform coding for MPEG, multi channel sound, Comparison digital video signal, MPEG- 1, MPEG-- 2, VCD, DVD, MPEG 3, MPEG-4, MPEG- 7 and MPEG- 21, measurement of MPEG-2 transport system, picture quality analysis.

UNIT IV DIGITAL AUDIO BROADCASTING
Digital audio broadcasting (DAB), comparing DAB and DVB, physical layer of DAB, forward error correction of DAB, modulator and transmitter for DAB, single frequency networks, DAB data broadcasting.
UNIT V  DIGITAL TV SIGNAL TRANSMISSION  9
Digital TV signal transmission by satellite, DVB-S/S2, parameters, modulator, signal processing in satellite, receiver, satellite transmission link, DVB-S measurement of CNR, SNR and Eb/No, noise power, broadcast cable transmission, DVB-C, modulator and receiver, DVB-T and DVB-H standards.

OUTCOMES:
- To be able to explain principles of analog and digital TV technologies.
- To be able to design and implement digital compression techniques.
- To be able to design and develop various digital modulation techniques used in audio and video broadcasting.
- To identify issues and provide solutions for digital TV transmission.

REFERENCES:

NE7005  FUNDAMENTALS OF CLOUD COMPUTING  L T P C
3 0 0 3

OBJECTIVES
- To Introduce the fundamentals of Cloud Computing and virtualization.
- To familiarize various standards related to cloud computing.

UNIT I  INTRODUCTION TO CLOUD  9

UNIT II  CLOUD BASED WEB SERVICES  9
Understanding Private and Public cloud environments – Communication as a Service (CaaS)-Infrastructure as a Service (IaaS) – On-demand, Amazon's Elastic, Amazon EC2, Mosso–Monitoring as a Service (MaaS) –Platform as a Service (PaaS) – On-Premises model, new cloud model – Software as a Service (SaaS) –implementation issues, characteristics, SaaS model.

UNIT III  CLOUD COMPUTING FOR EVERYONE  9
Centralizing Email Communications – Collaborating on Schedules – Collaborating on To-Do Lists – Collaborating Contact Lists – Cloud Computing for the Community – Collaborating on Group Projects and Events – Cloud Computing for the Corporation

UNIT IV  USING CLOUD SERVICES  9
UNIT V  FUTURE DIRECTIONS TO CLOUD


OUTCOMES:
- To be able to build custom made clouds.
- To be able to develop remote access applications, alert generation using cloud.
- To be able to work with commercial cloud packages.

REFERENCES:

NE7077  GAME THEORY FOR WIRELESS COMMUNICATION AND NETWORKING  L T P C

OBJECTIVES:
- To give an overview of a broad range of models that is studied in game theory.
- To understand a range of mathematical models of Conflict and cooperation between two or more agents.
- To discuss the main concepts in the game theory and to explain the classes of games.
- To discuss the application of game theory in wireless communication and networking

UNIT I  INTRODUCTION
Introductions 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

OUTCOMES:
- To be able to design game theory based models.
- To be able to apply game theory to solve network related issues.

REFERENCES:

NE7006 MICROWAVE PHOTONICS L T P C
OBJECTIVES:
- To understand the role of optical fiber to transmit RF and microwave signal for wireless communication applications.
- To learn different optoelectronic and all optical techniques for microwave signal generation and microwave signal processing.
- To learn the applications of radio over fiber in the field of mobile communication networks, CATV and RADAR.

UNIT I RADIO OVER FIBER (ROF) LINK
Introduction to microwave photonics, Radio over fiber, figure of merit and performance of microwave photonics, gain and frequency response, noise figure, distortion in RF links, directly modulated optical links, RF subcarrier link for local access networks.

UNIT II MODULATION TECHNIQUES FOR MICROWAVE PHOTONICS
Laser diode fundamentals, rate equation analysis, small signal analysis, microwave loss, modulation effect on link performance frequency modulation, intensity modulation, External modulation, LiNbO₃ modulator, broad band travelling wave modulator, Electro absorption modulator and polymer modulator.

UNIT III OPTO-ELECTRONIC OSCILLATOR AND MICROWAVE GENERATION
Basics of opto-electronic oscillators, signal generation for RF photonic systems, multi loop opto electronic oscillator, photonic link technique for microwave frequency conversion, benefits of frequency converting, optical local oscillator signal generation, microwave frequency converting photonic links.
UNIT IV ROF FOR CELLULAR SYSTEMS 9
Analysis of analog fiber optic link, fiber optic remote antenna feeding links, comparison of fiber optic and coaxial remote antenna feeding links, ROF for micro cellular system, fiber optic micro cell repeater, performance evaluation, WCDMA for 3G cellular systems, WCDMA based ROF system performance, ROF for micro cellular communication networks

UNIT IV ROF FOR RADAR AND CATV APPLICATIONS 9
ROF for mobile communications, antenna remoting applications, phased array antennas, wide band photonic phased array antenna, photonic beam steering, ROF for CATV applications, mobile CATV, ROF application for multiservice wireless communication systems, fixed and integrated multi service mobile communication.

TOTAL : 45 PERIODS

OUTCOMES:
- To be able to design microwave photonic systems.
- To be able to carry out power- bandwidth budget calculations.
- To be able to design photonic and microwave systems.
- To be able solve issues related to loss, bandwidth, crosstalk and nonlinearities.

REFERENCES:

NE7007 OPTICAL NETWORKS L T P C
3 0 0 3

OBJECTIVES:
- To gain an understanding of various issues in designing a high speed, high data rate and huge bandwidth optical network.
- To acquire knowledge of architecture and standards of optical networks.
- Thorough understanding of the scientific and engineering principles underlying the photonics technology.

UNIT I OPTICAL SYSTEM COMPONENTS 9
Light propagation in optical fibers-Loss& Bandwidth, System limitations, Non-Linear effect, Solitons, Optical Network \ Components- Couplers, Isolators & Circulators, Multiplexers & Filters Optical Amplifiers, Switches Wavelength Converters.

UNIT II OPTICAL NETWORK ARCHITECTURES 9
UNIT III WAVELENGTH ROUTING NETWORKS
The Optical layer, Node Designs, Optical layer cost tradeoff, Routing and Wavelength Assignment algorithms, Virtual Topology design, Architectural variations

UNIT IV PACKET SWITCHING AND ACCESS NETWORKS

UNIT V NETWORK DESIGN AND MANAGEMENT
Transmission system Engineering-system model, Power penalty-transmitter, receiver, Optical amplifiers, crosstalk, dispersion, wavelength stabilization; overall design consideration; Control and Management-Network management functions, Configuration management, Performance management, Fault management. Optical safety, Service interface.

TOTAL: 45 PERIODS

OUTCOMES:
- To be able to apply design state-of-the-art optical networks.
- To be able to implement optical network protocols.

REFERENCES:

NE7011 RECONFIGURABLE COMPUTING

OBJECTIVES:
- To study the different architectures of FPGA.
- To understand the concepts of reconfigurable systems and OS support.
- To understand the issues of scheduling and memory in reconfigurable processors.

UNIT I INTRODUCTION
Goals and motivations - History, state of the art, future trends - Basic concepts and related fields of study - Performance, power, and other metrics - Algorithm analysis and speedup projections - RC Architectures - Device characteristics - Fine-grained architectures - Coarse-grained architectures.

UNIT II PROGRAMMABLE LOGIC DESIGN

UNIT III PARALLEL PROCESSING
RC Application Design - Parallelism - Systolic arrays - Pipelining - Optimizations - Bottlenecks - High-level Design - High-level synthesis - High-level languages - Design tools.

UNIT IV ARCHITECTURES
Hybrid architectures- Communication - HW/SW partitioning - Soft-core microprocessors- System architectures -System design strategies - System services - Small-scale architectures - HPC architectures - HPEC architectures - System synthesis - Architectural design space explorations.
UNIT V  CASE STUDY


TOTAL: 45 PERIODS

OUTCOMES:

- To be able to design FPGA based architectures.
- To design reconfigurable systems.
- To be able to solve issues related to scheduling and memory in reconfigurable processors.

REFERENCES:


NE7013  SATELLITE COMMUNICATIONS AND NAVIGATION SYSTEMS  L T P C  3 0 0 3

OBJECTIVES:

- To provide an in-depth understanding of satellite communication technologies.
- To know the tools necessary for the calculation of basic parameters in a satellite communication system.
- To have an exposure to orbital mechanics, launching techniques and satellite link design.
- To analyze the different satellite access system.
- To understand GPS technology.

UNIT I  BASIC PRINCIPLES  9

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  9

Attitude and orbit control system- telemetry, tracking and command- power systems- communication subsystems- antenna subsystem- equipment reliability and space qualification.

UNIT III  SATELLITE LINKS  9

Free space loss- Atmospheric effects- Ionospheric scintillation- link design- Power Budget Calculation - system noise temperature – Modulation for satellite communication.
UNIT IV  MULTIPLE ACCESS TECHNOLOGIES  

UNIT V  GPS  
Overview of GPS- GPS Signal structure-GPS coordinate frames- Time references- GPS orbits and satellite position determination- GPS Errors & Accuracy- Applications.

TOTAL: 45 PERIODS

OUTCOMES:
- To able to design satellite links- transmitter and receiver design.
- To be able to design various satellite access techniques.
- To be able to design and implement GPS systems.

REFERENCES:

NE7080  SPACE TIME WIRELESS COMMUNICATION  
OBJECTIVES:
- To acquire the knowledge on various modulation and coding schemes for space-time wireless communications.
- To understand transmission and decoding techniques associated with wireless communications.
- To understand multiple-antenna systems such as multiple-input multiple-output (MIMO) and space-time codes.

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, Channel definitions, Physical scattering model, Extended channel models, Channel measurements, sampled signal model, ST multiuser and ST interference channels, ST channel estimation.

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 8
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 10
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 ST OFDM, SPREAD SPECTRUM AND MIMO MULTIUSER DETECTION 10

TOTAL : 45 PERIODS

OUTCOMES:
- To be able to design and evaluate receiver and transmitter diversity techniques.
- To be able to design and develop OFDM based MIMO systems.
- To be able to calculate capacity of MIMO systems.

REFERENCES:

NE7015 SPREAD SPECTRUM TECHNIQUES L T P C 3 0 0 3

OBJECTIVES:
- To understand the basics of spread spectrum communication systems.
- To understand the performance of spread spectrum in multipath environment.
- To understand the way in which spread spectrum is applied to CDMA and GPS systems.

UNIT I SPREADING CODES 9

UNIT II SPREAD SPECTRUM SYSTEMS 9
UNIT III SYNCHRONIZATION IN SPREAD SPECTRUM

Baseband Recovery - Carrier Synchronization - Code Synchronization – Code Acquisition & Tracking.

UNIT IV SPREAD SPECTRUM IN MULTIPATH ENVIRONMENT

Performance in Jamming Environment – Low Probability of Detection – Mitigation of Multipath Effects using spread spectrum-RAKE Receiver-CDMA

UNIT V GLOBAL POSITIONING SYSTEM

GPS Principles-NAVSTAR constellation- Gold codes-Synchronization-Differential GPS

TOTAL: 45 PERIODS

OUTCOMES:

- To be able to arrive at detailed specifications of the spread spectrum systems.
- To design systems based on spread spectrum to mitigate the jamming and multipath effect.
- To design the spread spectrum based systems for CDMA and GPS.

REFERENCES:


NE7017 WIRELESS SENSOR NETWORK DESIGN

L T P C
3 0 0 3

OBJECTIVES:

- To develop an understanding of sensor network architectures from a design and performance perspective.
- To understand the layered approach in sensor networks starting from physical layer to application layer.
- To study the WSN protocols.
- To study TinyOS and Contiki.
- To get adequate exposure to emerging technologies and their potential impact.

UNIT I INTRODUCTION

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  DATA LINK LAYER
MAC protocols – fundamentals, low duty cycle protocols and wakeup concepts, contention-based protocols, Schedule-based protocols - SMAC, BMAC, TRAMA, Link Layer protocols – fundamentals task and requirements, error control, framing, link management, Naming and addressing – address assignment, unique, Content-based and geographical addressing.

UNIT III  NETWORK LAYER

UNIT IV  TRANSPORT LAYER

UNIT V  TOOLS FOR WSN

TOTA L: 45 PERIODS

OUTCOMES:

- To be able to design energy efficient WSNs.
- To design and implement protocols in TinyOS and Contiki.
- To design application dependent WSNs.

REFERENCES:

OBJECTIVES:

- To create an appropriate knowledge base to machine learning and statistical pattern recognition.
- To provide basic ideas and techniques underlying the design of different artificial intelligence models.
- To provide an overview of the state-of-art algorithms used in machine learning.
- To study different optimization based methods and use the same for wide range of applications.

UNIT I INTRODUCTION
Definition of learning systems- Goals and applications of machine learning- Aspects of developing a learning system- training data- concept representation- Function approximation.

UNIT II ARTIFICIAL NEURAL NETWORKS
Neurons and biological motivation- Linear threshold units - Perceptrons- representational limitation and gradient descent training - Multilayer networks and back propagation - Hidden layers and constructing intermediate - distributed representations.

UNIT III ARTIFICIAL INTELLIGENCE MODELS

UNIT IV GAME THEORY
Fundamentals-Conflict- Strategy and Games- Game theory- The Prisoner’s Dilemma- Games in normal and extensive forms – Representation- Examination- Examples.

UNIT V OPTIMIZATION METHODS
Heuristic and Meta - heuristic search techniques - stochastic search methods-social algorithms: ant colony, artificial bee colony, particle swarm optimization-applications.

TOTAL: 45 PERIODS

OUTCOMES:

- To be able to design feature recognition systems tailored to specific applications.
- To design and develop classifiers.
- To design and develop machine learning systems.

REFERENCES:
OBJECTIVES:

- To study the principles, types of radar and its signal processing.
- To understand the theoretical principles underlying microwave sources for RADAR.
- To learn about RADAR tracking.

UNIT I  MICROWAVE SOURCES FOR RADAR

Passive waveguide components, Microstrip line structure and components, Simple theory and operating characteristics of Reflex klystrons, Two cavity Klystrons, Magnetrons, and TWTS - solid state source - TEDS, IMPATTS, TRAPATT, GaAs FETs and Tunnel diode.

UNIT II  RADAR PRINCIPLES


UNIT III TYPES OF RADARS


UNIT IV  RADAR SIGNAL PROCESSING


UNIT V  TRACKING RADAR

Tracking with radar – Monopulse Tracking – conical scan and sequential lobing –limitations to tracking Accuracy- Alpha – Beta Tracker, Kalman Tracker.

TOTAL: 45 PERIODS

OUTCOMES:

- To be able to design a radar system.
- To be able to design and implement radar tracking algorithms.

REFERENCES:

UNIT I  INTRODUCTION

UNIT II  EMBEDDED/REAL TIME OPERATING SYSTEM

UNIT III  CONNECTIVITY

UNIT IV  REAL TIME UML

UNIT V  SOFTWARE DEVELOPMENT AND CASE STUDY

TOTAL: 45 PERIODS

OUTCOMES:
• To be able to make a choice a suitable embedded processor for a given application.
• To be able to design the hardware and software for the embedded system.
• To be able to design and develop the real time kernel/operating system functions, task control block structure and analyze different task states.
• To be able to implement different types of inter task communication and synchronization techniques.

REFERENCES:
OBJECTIVES:
- To introduce techniques for altering the existing DSP structures to suit VLSI implementations.
- To introduce efficient design of DSP architectures suitable for VLSI

UNIT I INTRODUCTION TO DSP SYSTEMS, PIPELINING AND PARALLEL PROCESSING OF FIR FILTERS

Introduction to DSP systems – Typical DSP algorithms, Data flow and Dependence graphs - critical path, Loop bound, iteration bound, Longest path matrix algorithm, Pipelining and Parallel processing of FIR filters, Pipelining and Parallel processing for low power.

UNIT II RETIMING, ALGORITHMIC STRENGTH REDUCTION


UNIT III FAST CONVOLUTION, PIPELINING AND PARALLEL PROCESSING OF IIR FILTERS


UNIT IV BIT-LEVEL ARITHMETIC ARCHITECTURES

Bit-level arithmetic architectures – parallel multipliers with sign extension, parallel carry-ripple and carry-save multipliers, Design of Lyon’s bit-serial multipliers using Horner’s rule, bit-serial FIR filter, CSD representation, CSD multiplication using Horner’s rule for precision improvement, Distributed Arithmetic fundamentals and FIR filters

UNIT V NUMERICAL STRENGTH REDUCTION, SYNCHRONOUS, WAVE AND ASYNCHRONOUS PIPELINING


TOTAL: 45 PERIODS

OUTCOME:
- Ability to modify the existing or new DSP architectures suitable for VLSI

REFERENCES:
OBJECTIVES:

- To learn the fundamentals of Operating system.
- To gain knowledge on Distributed operating system concepts that includes architecture, Mutual exclusion algorithms, Deadlock detection algorithms and agreement protocols.
- To gain insight on to the distributed resource management components viz. the algorithms for implementation of distributed shared memory, recovery and commit protocols.
- To know the components and management aspects of Real time, Mobile operating systems.

UNIT I OPERATING SYSTEM BASICS

UNIT II DISTRIBUTED OPERATING SYSTEM

UNIT III DISTRIBUTED RESOURCE MANAGEMENT

UNIT IV REAL TIME & MOBILE OPERATING SYSTEMS

UNIT V CASE STUDIES

OUTCOMES:
Upon Completion of the course, the students should be able to:
- Get a complete overview of process management & memory management of Operating system.
- Demonstrate the Mutual exclusion, Deadlock detection and agreement protocols of Distributed operating system

REFERENCES:
OBJECTIVE:
- 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
- To familiarize with the different FPGA architectures

UNIT I MOTS TRANSISTOR PRINCIPLES
MOS Technology and VLSI, Pass transistors, NMOS, CMOS Fabrication process and Electrical properties of CMOS circuits and Device modelling. Characteristics of CMOS inverter, Scaling principles and fundamental limits. Propagation Delays, CMOS inverter scaling, Stick diagram, Layout diagrams, Elmore’s constant, Logical Effort.

UNIT II COMBINATIONAL LOGIC CIRCUITS
Static CMOS logic Design, Design techniques to improve the speed, power dissipation of CMOS logic, low power circuit techniques, Ratioed logic .Pass transistor Logic, Transmission CPL, DCVSL, Dynamic CMOS logic, Domino logic, Dual Rail logic, NP CMOS logic and NOR array logic.

UNIT III SEQUENTIAL LOGIC CIRCUITS
Static and Dynamic Latches and Registers, Timing Issues, Pipelines, Clocking strategies, Memory Architectures, and Memory control circuits

UNIT IV DESIGNING ARITHMETIC BUILDING BLOCKS & TESTING
Datapath circuits, Architectures for Adders, Accumulators, Multipliers, Barrel Shifters, Need for testing- Testers, Text fixtures and test programs- Logic verification- - Manufacturing test – Design for testability – Boundary scan.

UNIT V IMPLEMENTATION STRATEGIES
Full Custom and Semicustom Design, Standard Cell design and cell libraries, FPGA building block architectures, FPGA interconnect routing procedures.

TOTAL:45 PERIODS

OUTCOMES:
- At the end of the course students will be in a position to understand the basics of VLSI design, testing and different FPGA architectures.

REFERENCES:
OBJECTIVES:
- To learn the fundamentals of the ASIC design
- To understand the various fusing technology
- To familiarize with different ASIC architectures
- To learn the various simulation and testing methodologies
- To familiarize with the ASIC interconnects

UNIT I
INTRODUCTION TO ASICS, CMOS LOGIC AND ASIC LIBRARY DESIGN
Types of ASICs - Design flow - CMOS transistors CMOS Design rules - Combinational Logic Cell – Sequential logic cell - Data path logic cell - Transistors as Resistors – Transistor Parasitic Capacitance- Logical effort –Library cell design - Library architecture.

UNIT II
PROGRAMMABLE ASICS, PROGRAMMABLE ASIC LOGIC CELLS AND PROGRAMMABLE ASIC I/O CELLS
Anti fuse - static RAM - EPROM and EEPROM technology - Actel ACT - Xilinx LCA –Altera FLEX - Altera MAX DC & AC inputs and outputs - Clock & Power inputs - Xilinx I/O blocks.

UNIT III
PROGRAMMABLE ASIC INTERCONNECT, PROGRAMMABLE ASIC DESIGN SOFTWARE AND LOW LEVEL DESIGN ENTRY

UNIT IV
LOGIC SYNTHESIS, SIMULATION AND TESTING
Verilog and logic synthesis -VHDL and logic synthesis - types of simulation -boundary scan test - fault simulation - automatic test pattern generation.

UNIT V
ASIC CONSTRUCTION, FLOOR PLANNING, PLACEMENT AND ROUTING
System partitioning - partitioning methods - floor planning - placement - physical design flow – Routing - global routing - detailed routing - special routing - circuit extraction - DRC.

TOTAL:45 PERIODS

OUTCOMES:
At the end of the course students will be familiarized with different ASIC architectures, Fuses, Interconnects and Placement and Routing

REFERENCES:
OBJECTIVES:

- To provide the basic concepts in computational intelligence.
- To give an exposure to neural network learning techniques and architectures.
- To provide a good understanding of fuzzy concepts and models.
- To provide an exposure to different optimization techniques.

UNIT I
INTRODUCTION TO COMPUTATIONAL INTELLIGENCE
Evolution of Computing - Constituents - From Conventional AI to Computational Intelligence - Machine Learning Basics

UNIT II
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 - Advances in Neural networks -SVM

UNIT III
FUZZY LOGIC

UNIT IV
NEURO-FUZZY MODELING

UNIT V
OPTIMIZATION ALGORITHMS
Heurisitic search and optimization techniques – Random search- Introduction to Genetic Algorithms (GA) -Applications of GA – Social Algorithms

OUTCOMES:

- To be able to design systems based on neural network architectures.
- To implement fuzzy models and work on fuzzy tool box.
- To design a suitable optimization algorithm for a given application.

REFERENCES: