**SYLLABUS PRESCRIBED FOR**
**MASTER OF ENGINEERING (FULL TIME)**
**ELECTRONICS & TELECOMMUNICATION ENGG.**
**SEMESTER : FIRST**

## 1 ENTC1 ADVANCED OPTICAL COMMUNICATION

**Unit – I:** Introduction to guided optical communication. Optical Fibers, types of fibers & optical Cables, Study of losses during transmission through viz. Attenuation by Absorption & Scattering, Consideration of losses in designing of High Speed / High bandwidth optical communication systems, Selection of fiber for such systems.

**Unit – II:** Optical Sources: Types of LEDs used in optical communication, their construction & operating principle, Types of Lasers. Principle of working of Lasers, solid state & injection Lasers, Optical amplifiers, EDFA, Soliton Systems & design of system required in LAN & WAN type of applications. Calculations of Power budgets and feasibility of system design for above optical sources.

**Unit – III:** Optical Detectors: Introduction & study of type of detectors characteristics. Spectral spread and availability of detectors for 980 nm, 1.3 μm & 1.55 μm _ systems. Calculation of detector sensitivity and design considerations of suitable receivers for LAN, WAN applications Multiplexing Components & Techniques : Concepts of WDM, DWDM system design parameters, Optical multiplex / Demultiplex design considerations- Angular dispersive devices, Dielectric thin film filter type devices,

**Unit – IV:** Hybrid & planer wave guide devices, Active WDM devices, Wavelength non selective devices, System application. Long Haul High Band Width Tx System : Designing systems for long haul high band width consideration-Outage, Bit error rate, Cross connect, Low & high speed interphases, Multiplex / Demultiplex consideration, Regenerator spacing, Degeneration & Allowances, Application consideration.

**Reference Books:**

1. Optical Communication Systems by John Gowar (PHI)
2. Optical Fiber Communication by Gerd Keiser (MGH) .
3. Optical Fiber Communication Principles & Practice by John M. Senior (PHI pub. 1996.)

**Recommended Journals:**

1. IEEE Proceeding In Optics.
2. Journal of Optical Society of America.
3. AT&T, Alcatel Optics Journals.
4. Hand book of Optics Vol I & II (MGH.)
5. Optics & Opto Electrics, vol I & II, Nigihawan & Gupta, (Narsoa publication.)
6. Advance In Light Wave Nypters Research Journals of AT & T ,Vol. 66
7. IIT Rourkee Compiled Seminar Proceeding of Fiber Optics in 1994.

## 1 ENTC2 RANDOM PROCESSES

**Unit – I:** Concepts of Probability: Conditional probability and Baye's theorem, Independence of events, Bernoulli trails,Random variables: Cumulative distribution, Joint probability density function, Statistical properties, Jointly distributed Gaussian random variables, Conditional probability density, properties of sum of random variables, Central limit theorem, Estimate of population means, expected value and variance and covariance, Computer generation of random variables.

**Unit – II:** Multiple Random Variables: joint cumulative distribution function, Joint probability density function statistical properties, Jointly distributed Gaussian random variables, Conditional probability density, properties of sum of random variables, Central limit theorem, Estimate of population means, Expected value and variance and covariance, Computer generation of random variables.

**Unit – III:** Markov Chains: Chapman Kolmogorov equation, Classification of states, Limiting probabilities, Stability of Markov system, Reducible chains, Markov chains with

continuous state space. Queuing Theory: Introduction, Cost equation, steady state probabilities, Models of single server exponential queuing system with no limit and with finite buffer capacity (M/M/I, M/M/N). Queuing system with bulk service, Network of queues with open system and closed system. The M/G/I system and application of work to M/G/I.

**Unit – IV:** Random Processes: Properties, Auto correlation and cross correlation function, Estimate of auto correlation function, Spectral Density: Definition, Properties, white noise, Estimation of auto-correlation function using frequency domain technique, Estimate of spectral density, cross spectral density and its estimation, coherence.

**Reference Books:**

1. Introduction to probability Models,(Third edition) - Sheldon M. Ross.
2. Probability and Random Processes for Electrical Engg.-Alberto Lean-Garcia (Pearson Education.)
3. Stochastic Processes – J. Medhi , (New Age International.)
4. Probability random variables & Stochastic process- Athanasios Papoulis (MGH)
5. Introduction to Probability and Random Processes. By Jorge I. Aunin, V. Chandrashekar.
6. Probability & Statistics- Murrary R. Spiegel – (MGH.)

## 1 ENTC3 DIGITAL COMMUNICATION TECHNIQUES

**Unit – I:** Baseband and Bandpass Digital Transmission: Baseband modulation, Correlative coding, Detection of binary signals in Gaussian Noise, ISI, Eye pattern and equalization, Bandpass modulation techniques, coherent and noncoherent detection of signals in Gaussian noise, error performance for binary and M-ary signals.

**Unit – II:** Error Control Coding: Linear block codes, error detecting and correcting capability, cyclic codes, convolution codes, properties of convolution codes, Viterbi decoding algorithm, Turbo code concepts, Trellis codes.

**Unit – III:** Synchronization, Multiplexing and Multiple Access: Carrier and Symbol synchronization, Frequency Division Multiplexing/Multiple Access, Time Division Multiplexing/Multiple Access, performance comparison of FDMA & TDMA, Code Division Multiple Access, capacity of multiple access methods, Access algorithms: ALOHA, Slotted ALOHA, Reservation ALOHA, Carrier sense systems and protocols.

**Unit – IV:** Spread Spectrum Techniques: Model of spread spectrum digital communication system, direct sequence spread spectrum system, frequency hopped spread spectrum system, generation of PN sequences, synchronization of spread spectrum systems.

**Reference Books:**

1. J. G. Proakis, “Digital Communications”, Fourth Edition, McGraw Hill Inc.
2. Bernard Sklar, “Digital Communications: Fundamentals and Applications”, Second Edition, Pearson Education Asia (LPE)
3. Simon Haykin, “Digital Communications”, John Wiley and Sons
4. K Sam Shanmugam, “Digital Communications”, John Wiley and Sons

## 1 ENTC4 DIGITAL SIGNAL PROCESSING AND APPLICATIONS

**Unit – I:** Representation of deterministic signals, orthogonal representation of signals. Dimensionality of signals spaces, construction of orthogonal basis functions. Time bandwidth relationship: RMS duration and bandwidth, uncertainty relations.

**Unit – II:** Introduction: Review of Discrete time signals and systems, Different transforms, use of DFT in linear filtering, filtering of long data sequences, Algorithm for convolution and DFT.

**Unit – III:** LS and LMS, spectral estimation, adaptive filters DSP Algorithm, Multirate Digital Signal Processing and its applications.

**Unit – IV:** Issues involved in DSP processor design, Architecture and applications of TMS 320 C6XX, Multiprocessing with DSP processors, Applications of DSP to speech & radar signal processing.

**Reference Books:**

1) Advanced Digital Signal Processing, Proakis, McMillan
2) Discrete time Signal Processing, A.V. Oppenheim and Schafer, PHI, 1989
3) Digital Signal Processing – Principles, Algorithms and Applications, John G. Proakis, PHI, 1997
4) Digital Signal Processing, S.K. Mitra, TMH (2nd Edition)
5) Texas Instruments Application reports
6) Adaptive Filter Theory, Simon Haylein Jhon Wiley
7) Theory and Applications of Digital Signal Processing by Rabiner & Gold, Prentice –Hall

**1 ENTC4** **Elective-I**

## 1. REAL TIME EMBEDDED SYSTEM

**Unit – I:** Fundamentals of Real-Time Theory : Real-time, embedded multitasking systems challenges, Best effort, Hard real-time, Soft real-time, Best Effort scheduling (Round- Robin Time slice Scheme - Review), Introduction to Fixed priority preemptive
Scheduling, Introduction to Dynamic priority scheduling, Utility Curves, Real-Time Services: Service Release Timeline, The CPU, I/O, Memory Resource Space (Characterizing RT Applications), Introduction to Timing diagrams (interference),
Introduction to Hard real-time safe resource utilization bounds, The hard real-time requirements and performance

**Unit – II:** Rate Monotonic Policy and Feasibility Overview: Rate Monotonic Assumptions and Constraints, More on Fixed priority preemptive scheduling, Hard real-time safe resource utilization bounds, EDF and LLF Overview, Introduction to Feasibility Tests, Deadline Monotonic Policy and Feasibility Overview, HW and HW+FW Implementations of RT Services, SW Implementations of RT Services Synchronization and Resource Issues : Problems with Blocking (resources other than CPU, e.g. I/O), Break up into more threads (better scheduling control), Interrupt driven/O - e.g. Programmable FIFOs, Model Blocking Time, Priority inversion (general concept), Unbounded priority inversion problem (mutex C.S.), Priority inheritance, Priority ceiling.

**Unit – III:** Scalable Embedded Systems Architectures: Intro to PCI Architecture and I/O Architectures, PCI Plug and Play Concept, Embedded System PCI Form Factors and
Standards, Device Drivers and Characterization of Embedded I/O : I/O interfaces, Digital, Analog (ADC, DAC interfaces), Microprocessor interface types (word or block), Register-based control, status, data, Higher rate FIFO I/O, Block-oriented 1st/3rd party DMA tx/rx between I/O interfaces and memory, Bus burst transfers and block transfers, system memory map for MMIO devices - DRAM/SDRAM/DDR, BOOTROM, Flash, External interface types, CPU local bus IO/MMIO E.g. PCI 2.x, GPIO, DRAM, Flash, Point-topoint or switched devices E.g. RS-232, RS-422, PCI-Express, Network multi-access devices E.g. Ethernet Device interfaces- introduction to drivers: Top half (driver entry point interface to tasks), bottom half (interface to devices), ring buffers, blocking/non-blocking, ioctl, ISRs and signals/semaphores, scheduled I/O (handle buffering and processing in task).

**Unit – IV:** PowerPC Architecture: PowerPC 8xx architecture review, Power PC 8xx and 82xx Architecture Power Point Overviews, Xscale Architecture: Xscale Architecture Docs, x86 Architecture:, IA32 Architecture Docs,Estimating/Measuring Performance Based on CPU Architecture: Measuring / Controlling CPU Efficiency, Trace Ports (e.g. IBM PowerPC 4xx series, Strong Arm), Built-in PMU (Performance Monitoring Units) (e.g. Intel Pentium, Xscale), External Methods, Logic Analyzer Memory Traces (Cache Misses, DMA, Un-cached access), Memory Port Markers (Writes to Un-cached Memory), Profiling Code by Function or Block, Software in Circuit Methods (e.g. CodeTest Trace SW In-Circuit, gprof), Hardware Supported Profiling (e.g. Intel Vtune, CodeTest HW In-Circuit), Cycle-based profiling, Event-based profiling, Cache Coherency, Harvard I-Cache, D-cache Architecture,

Cache Invalidate, Flush, Lock, Pre-fetch, Measuring/Controlling I/O Efficiency, Bus Analyzers - e.g. PCI Event Traces, Logic Analyzer with Support Package.

**Reference Books:**
1. Real-Time Embedded Systems and Components: Sam Siewert, ISBN 1584504684 Books, Barnes & Noble
2. PCI System Architecture (Paperback) Mindshare Inc Tom Shanleyr, Don Anderson

**1 ENTC4 Elective-I**

## 2. DIGITAL DATA COMPRESSION

**Unit – I:** Introduction to Data Compression: Data compression, Loss less compression, Lossy Compression, Performance Measures, Coding, Modeling, Grading Compression Algorithms, Minimum Redundancy Coding: The Shannon-Fano algorithm, The Huffman Algorithm, Adaptive coding: Adaptive Huffman Coding, Updating The Huffman trace, Decoding, The overflow problem, Rescaling Bonus, Arithmetic Coding: Difficulties, Practical Matters, a complication, Decoding.

**Unit – II:** Statistical Modeling: Higher order modeling, finite context modeling, adaptive modeling, Escape code as a fall back, Improvements. Highest order modeling, updating the model, Escape probabilities, score boarding, data structures, modes flushing and implementation. Static v/s Adaptive Compression: Adaptive Methods, Sliding window compression: The algorithm and encoding problem. Speech compression: Digital audio concepts, fundamentals, sampling variables,

**Unit – III:** PC- Based sound, Lossless compression of sound, problem and result, Lossy compression, silence compression, companding and other techniques. Lossy Graphics Compression: Statistical and Dictionary compression methods, Lossy Compression, Differential modulation, JPEG-overview, JPEG-Enhancement, Loss less JPEG, JPEG Compression, The discrete cosine transform, Implementing The DCT, Matrix Multiplication, Improvements, output of the DCT, quantization methods, selection of quantization of coding: zigzag sequence, entropy encoding and about color.

**Unit – IV:** Speech Compression: MPEG, MP3.Video compression: Pixel details, Motion estimation, quantization and bit packing, MPEG-2. Fractal Image compression: History, Iterated function system (IFS), Basic IFS, Image compression with IFS and with partitioned IFS. Fractal Image decoding, Resolution independence. Introduction to Wavelet based compression Techniques.

**Reference Books:**
1) The Data Compression- Mark Nelson, Jean-Ioup Gailly, 2nd edition, (M&T pub.)
2) Data Compression: The complete Reference-David Saloman, D., 3rded, (Springer Publication.)
3) Introduction to Data Compression-Khalid Sayood, 2nd ed. (Academic press ltd.)
4) Introduction to Information Theory and Data Compression- Darrel Hankerson, 2nd ed, (Chapman and Hall/CRC publications.)
5) Handbook of Image and video Processing-Al Bovik(Academic press ltd. Publication.)
6) Compression Algorithms for Real Programmers- Peter Wayner (Academic press ltd.)

**1 ENTC4 Elective-I**

## 3. ARTIFICIAL INTELLIGENCE

**Unit – I:** Fuzzy set Theory, Introduction to Fuzzy sets, Fuzzy relation, Membership functions, fuzzification, defuzzification, fuzzy logic, fuzzy rule based system fuzzy inference system.

**Unit – II:** Fuzzy Decision Making, Fuzzy modeling, Adaptive neuro fuzzy inference system, cognitive neurofuzzy modelling, Neuro fuzzy control, Application of neuro fuzzy control.

**Unit – III:** Fundamental of Artificial Neural Network: Artificial Neuron model. Learning process, Single layer and multilayer feed forward network, training by back propagation, Hop-field model basic concept of bidirectional associative memory, self organization map, and optimization model.

**Unit – IV:** Recurrent Networks, Hamming Net and MAXNET, Feature mapping, counter propagation networks, cluster discovery Network (ART), Applications of Neural Network Characters Recognition Network, Neural Network control Application, Network for Robot kinematics, Hand written Numeral recognition.

**Reference Books:**


1) "Neural Networks in Computer Intelligence", Limin Fu , McGraw Hill Inc., 1994.
2) "Neural Network Fundamentals", N. K. Bose, P. Lling , McGraw Hill.
3) "Artificial Neural Networks", Zurada
4) " Fuzzy Logic with Engg. Applications", Timothy J. Ross ,McGraw Hill.
5) "Neuro Fuzzy and Soft computing", Jang, Sun, Mezutani
6) "Fuzzy Engineering", Bart Kasko, PHI
7) "Neural Networks", S. Hykin ,Pearson Education.


**1 ENTC4** **Elective-I**

## 4. CRYPTOGRAPHY & NETWORK SECURITY

**Unit – I:** Overview: Services, Mechanisms, and attacks, The OSI Security Architecture. A model for network security, Classical Encryption Techniques: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Rotor Machines, Steganography, Block Ciphers and the Data Encryption Standard: Simplied DES, Block Cipher Principles, The Data Encryption Standard, The Strength of DES, Differential Linear Cryptanalysis, Block Cipher Design Principles, Block Cipher Modes of Operation, Contemporary symmetric Ciphers: Triple DES, Blowfish, RC5, Characteristics of Advanced Symmetric Block Ciphers, Confidentially using symmetric Encryption: Placement of Encryption Function, Traffic Confidentiality, Key Distribution, Random Number Generation.

**Unit – II:** Public Key Cryptography and RSA: Principles of Public Key cryptosystems, The RSA Algorithm, Key Management, other Public Key Cryptosystems key Management, Diffle- Hellman Key exchange. Message Authentication and hash functions: Authentication Requirements, Authentication Function, Message Authentication Codes, Hash Functions, Security of Hash Functions and MACs.

**Unit – III:** Hash Algorithms: MD5 Message Digest Algorithm, Secure Hash Algorithm, Authentification Applications: Kerberos, X. 509 Authentication Service.

**Unit – IV:** Electronic Mail Security: Pretty Good Privacy, S/MIME, IP Security Overview, IP Security Architecture, Authentifications, Header, Encapsulating Security Payload, Combining Security Associations, Key Management, Web Security: Web Security Considerations, System Security: Intruders, Malicious Software, Viruses, Viruses and Related Threats, Firewalls: Firewall Design Principles.

**Reference Books:**


1. Willam Stallings, Cryptography and Network Security, Third Edition, Pearson Education
2. Cbarlie Kaufman, Radia Perlman, Mike Speciner, Network Security, Provate Communication in a public world, Second Edition, Pearson Education Asia, 2002.
3. Atul Kahate, Cryptography and Network Security, Tata McGrawhill, 2003.

## SEMESTER : SECOND

## 2 ENTC1 ADAPTIVE SIGNAL PROCESSING

**Unit – I: General Introduction**
Adaptive systems-Definition and characteristics, areas of applications, general properties, Open and closed loop adaptation, applications of closed loop adaptation. The adaptive liner combiner-General description, input signal and weight vectors, desired Response and error, the performance function, gradient and minimum mean square error. Example of performance surface, alternative expression of the gradient, decorrelation of Error and input components.

**Unit – II: Theory of adaptation with stationary signals.**
Properties of the quadratic performance surface-Normal form of the input correlation Matrix, eigen values and eigen vectors of the input correlation matrix, an example with two weights, geometrical significance of eigen vectors and eigen values. Searching the performance surface-Methods of searching the performance surface, basic ideas of gradient search methods, a simple gradient search algorithm and its solution, stability and rate of convergence, Gradient estimation and its effects on adaptation – Gradient component estimation by derivative measurement, the performance penalty, derivative measurement and performance penalties with multiple weights, variance of the gradient estimate.

**Unit – III: Stochastic processes and models: Partial Characterization of a Discrete-Time Stochastic**
Process, Mean Ergodic Therom, Correlation Matrix, Correlation Matrix of Sine Wave Plus Noise, Stochastic Models, World Decomposition, Asymptotic Stationary of an Autoregressive Process, Yule-Walker Equations, Computer Experiment: Autoregressive Process of Order Two, Selecting the Model Order, Complex Gaussian Process, Power Spectral Density, Properties of Power Spectral Density, Transmission of a Stationary Process Through a Liner Filter, Cramer Spectral Representation for a Stationary Process, Power Spectrum Estimation, Other Statistical Characteristics of a Stochastic Process, Polyspectra, Spectral-Correlation Density.

**Unit – IV:** Wiener filters: Linear Optimum Filtering, Statement of the problem, Principle of Orthogonally, Minimum Mean-Square Error Adaptive algorithms and structures: The LMS algorithms, The z-transform in ASP, Other adaptive algorithms and structures, RLS adaptive filters: Some Preliminaries, The Matrix Inversion Lemma, The
Exponentially Weighted Recursive Least-Squares Algorithm, Selection of The Regularizing Parameter, Update Recursion for the sum of weighted Error Squares, Example, Single-weight Adaptie noise canceller, convergence analysis of the RLS
Algorithm, Computer Experiment on Adaptive Equalization, Robustness of RLS filter

**Text Books:**
1. Adaptive Filter Theory- S. Haykin, (Pearson edition 4th Edition)
2. Adaptive Signal Processing, - B. Windrow, S.D. Sterns, (Pearson Education).

**Reference Books:**
1. Digital Signal Processing, S. K. Mitra, TMH
2. Digital Signal Processing: Principles, Algorithms & Applications, John G Prokis, D. G. Manolakis, PHI

## 2 ENTC2 WIRELESS COMMUNICATION

**Unit – I:** Review: 2G, 3G wireless networks, WLL, Cellular Concept Mobile Radio Propagation: Large Scale Path Loss: Introduction to Radio Wave propagation, Free Space propagation model, Relating Power to Electric Field, The Three Basic Propagation Mechanisms, Reflection, Ground Reflection (Two-Ray) Model, Diffraction, Scattering, Practical Link Budget Design Using Path Loss Models, Outdoor Propagation Models, Indoor Propagation Models, Signal Penetration into Buildings, Ray Tracing And Site Specific Modeling, Problem.

**Unit – II:** Mobile Radio Propagation- Small-Scale Fading and Multipath : Small-Scale Multipath Propagation, Impulse Response Model of a Multipath Channel, Small-Scale

Multipath Measurements, Parameters of Mobile Multipath Channels, Types of small-Scale Fading, Rayleigh and Ricean Distributions, Statistical Models for Multipath Fading Channels, Theory of Multipath shape factor for small- Scale Fading wireless Channels, Summary, Problem.

**Unit – III:** Multi Access Technique for wireless communication: Introduction, Frequency Division multiple Access (FDMA), Time Division Multiple Access (TDMA) Spread Spectrum Multiple Access, Space Division Multiple Access (SDMA) Packet Radio, Capacity of cellular Systems, Problems. Wireless Networking: Introduction to wireless Networks, Difference between Wireless and Fixed Telephone Networks, Development of Wireless Networks, Fixed Network Transmission Hierarchy, Traffic Routing in Wireless Networks, Wireless Data Services, Common Channel Signaling (CCS), Integrated services Digital networks (ISDN), Signaling System No. 7 (SS7), An Example of SS7-Global Cellular Network

**Unit – IV:** Interoperability, Personal Communication services / Networks (PCS/PCNs), protocols for Network Access, Network Databases, Universal Mobile Telecommunication System (UMTS), Summary, Wireless Systems & Standards: AMPS and ETACS, United States Digital Cellular (IS-54 ad IS-136) Global System for Mobile (GSM) CDMA digital Cellular Standard (IS-95), CT2 standard for cordless Telephones, Digital European Cordless Telephones (DECT) PACS- Personal Access Communication Systems, Pacific Digital Cellular (PDC), Personal Handy phone System (PHS), US PCS and ISM Bands, US wireless Cable Television, Summary Of Standards throughout the world, problems. IEEE 802.11

**Reference Books**

1. Wireless Communications Principals & Practice- Theodore S. Rappaport, (P.E.)
2. Wireless & Mobile Network Architecture- Yi-Bing Lin, Imrich Chiamtac (John Wiley)
3. Fundamental of Wireless Communication- David Tse, Pramod Viswanath (Cambridge)

## 2 ENTC3 ADVANCE COMPUTER NETWORKS AND PROGRAMMING

**Unit – I :** Review of computer networking concepts, Topology, LAN, WAN, MAN, Internet, OSI/ISO, TCP/IP reference models, Point to point protocols. ARQ: Retransmission strategies. Functional elements : Multiplexing, Switching , Networks Management & traffic controls. Delay models in Data Networks Switching techniques: Performance measures & architectural issues.

**Unit – II :** Internetworking, TCP/IP Internet architecture, IPV4, IPV6, IP addressing & related issues, IP address resolution techniques (ARP). IP datagram & forwarding, routing algorithms.

**Unit – III :** Multiple access techniques, ALOHA, CSMA, CSMA/CD, CSMA/CA, CDMA, OFDM, Delay throughput characteristics, WLAN-Protocols, multiple access, Ad-hoc networks, Bluetooth Specifications, WAP.

**Unit – IV :** Network security issues, Ciphers, DES, Public key cryptography, RAS algorithm, Digital Watermarking, Attacks and Counter Measures, Service Authentication Proforma.

**Reference Books:**

1)“Data Networks” Dimitri Bertisekas & Robert Gallager, PHI
2)“Local Area Networks”, Gerd E Kieser – Mc-Graw-Hill
3)“Computer Networks and Internetworking”D.E.Comer, Pearson Education
4)“Cryptography and Network Security: Principles and Practice”,William Stallings, Pearson Education
5)“GSM, CDMA and 3G Systems” , Steele,, Wiely Students Edition
6)“Communication Networking” An analytical approach” Anurag kumar, D. Manjunath & Joy Kuri– Morgn – Kaufmann publishers

## 2 ENTC4 RF & MICROWAVE CIRCUIT DESIGN

**Unit – I:** Review of EM Theory : Maxwell's equations, Plane waves in dielectric & conducting media, Energy & Power, Transmission lines, Solid state devices, Monolithic Microwave Integrated Circuits & Technology : History of Monolithic Microwave Integrated Circuits, Monolithic circuit components planner, Transmission Lines, Lumped and Distributed, Passive Elements, GaAs MESFET, Other active devices.Metal Semi-conductor Functions, and their characterization, Physical characteristics, modeling of GaAs MESFET & HEMT.

**Unit – II:** Material and fabrication techniques of GaAs MESFET. Properties of GsAs. Electron Beam and X-ray lithography, Plasma assisted deposition, Molecular beam epitaxy & MOCVD, Ion milling, S-Parameter measurements and their use in GaAs MESFET, S-Parameter measurements : General concept, measurements, utilization of S-Parameters in circuit design, Amplifiers (Narrow band/Broad band), Oscillators, Mixers, Active & Passive Phase shifters, Monolithic Microwave Integrated circuit Process, Optical Control of MMIC's.

**Unit – III:** RF And Microwave Circuit Design: Single & multi port network, Basic definitions, interconnecting networks, network properties, & applications, scattering parameters. RF filter design, filter configurations, special filter realizations, filter implementation, coupled filter, Active components: Semiconductor basics, RF diodes, bipolar junction transistor, RF field effect transistors, High electron mobility transistors.

**Unit – IV:** Active RF components modeling : Diodes models, transistor models, measurement of active devices, scattering parametric device characterization. Matching & biasing network: Impedance matching using discrete components, micro strip line matching networks, amplifier class of operation, biasing networks. RF transistor amplifier design, amplifier power relations, stability considerations, constant gain, noise figure circles, constant VSWR circles, broadband, high power & multistage amplifiers, Oscillators & Mixer: basic oscillator model, High Frequency oscillator configuration, basic characteristics of mixers.

**Reference Books:**

1. RF circuit design, theory & applications- Reinhold Ludwig, Pavel Bretchko, (Pearson Education – LPE)
2. Microwave Engineering-David M. Pozar (John Wiley & Sons)
3. Microwave Amplifier Design- Samuel Y. Liao, (PHI)
4. Microwave Engineering- Sisodiya and Raghuvanshi, (PHI)
5. Microwave Devices & Circuit Design"-Gupta & Shrivastava(PHI)

**2 ENTC5 Elective-II**

## 1. MOBILE COMPUTING

**Unit – I:** Wireless network technology : Global System for Mobile Communication (GSM) , Wireless media access control protocols; Wireless LAN, TDMA, PRMA, CDMA, etc 2. Routing in wireless networks: Unicast routing protocol, Dynamic source routing, DSR optimization, route caching, Relative distance micro discovery routing, On-demand distance vector routing, power aware routing, Hybrid protocols (5)

**Unit – II:** Location management: Location management in internet, Location management in cellular phone network and PCN, performance issues, future research directions. Transport protocols in mobile environments: I-TCP, snooping protocols, Multicast transport services.

**Unit – III:** Services in wireless networks: Quality of service, Delays, error and packet loss, Error control schemes, Mobile distributed application support: Operating system support, Mobile middleware and object architecture, Mobile transaction, Remote execution and mobile RPC, Cache strategies for wireless networks.

**Unit – IV:** Security issues in mobile computing: security technique s and algorithms, security protocol, public key infrastructure, trust, security model, security frame work, Wireless devises with symbian OS: Symbian OS architecture, control and compound Control, active objects, Localization, security on the symbian OS.

**Reference Books:**
1. Mobile Computing, edited by T. Imielinski and H.F. Korth, Kluwer Academic
2. Mobile computing by Asok Talukdar, Roopa Yawagal, TMH

**2 ENTC5 Elective-II**

## 2. COMMUNICATION SYSTEM DESIGN

**Unit – I:** Designers perspective of communication system: Wireless channel description, path loss, multi path fading Communication concepts, Receiver Architectures: Introduction, Overview of Modulation Schemes, Classical Channel, Wireless Channel Description, Path Losses: Detailed Discussion.

**Unit – II:** Multipath Fading: Channel model and Envelope Fading, Multipath Fading: Frequency Selective and Fast Fading, Summary of Standard Translation, Introduction Receiver Architectures, Receiver front End: general discussion, Filter Design, rest of Receiver Front Eng: Nonideatlites and Design Parameters, Derivation of NF, IIP3 of Receiver Front End, Partitioning of required NFrec_front and IIP3,rec_front into individual.

**Unit – III:** Low Noise Amplifier: Introduction, Wideband LNA, Design, Narrow band LNA:Impedance Matching, Narrowband LNA: Core Amplifier, Active Mixer: Introduction, Balancing, Qualitative Description of The Gilbert Mixer, Conversion Gain, Distortion, Low-Frequency Case: Analysis of Gilbert Mixer, Distortion, High- Frequency Case, Noise, A Complete Active Mixer, References, Problems.

**Unit – IV:** Analog to Digital Converters: Demodulators, A to D Converters used in receivers, Low cost Sigma delta modulators and it's implementation, Design Technology for Wireless Systems: Design entry / simulation, Validation and analysis tools

**Reference Books:**
1. VLSI for Wireless Communication- Bosco Leuing, (PE).
2. The design of CMOS Radio frequency integrated circuits – T Lee (Cambridge University press)
3. Analysis and design of analog integrated circuits – P Gray and R Meyer ( John Wiley & Sons)
4. Microelectronics Transistor Amplifier, Analysis and design G Gonzalez (Prentice Hall)

**2 ENTC5 Elective-II**

## 3. OPTICAL NETWORKS

**Unit – I:** Sonet & SDH : Brief history of Sonet & SDH, Multiplexing hierarchy, Multiplexing structure – Functional components, Problem detection, Virtual tributaries & containers, Concatenation. Architecture of OTN: Digital wrapper, control planes, Control signaling, Multiplexing hierarchies, Current digital hierarchy, revised hierarchies, Optical & Digital Transport hierarchies, Functionality stacks, Encapsulation & Decapsulation, GFP.

**Unit – II:** WDM, DWDM Topologies : Relationship with SONET / SDH, EDF, WDM Amplifiers, Multiplexers, WADM I/P & O/P ports, spanloss & chromatic, dispersion, Tunable DWDM lasers, Network Topologies & Protection schemes : Non-negotiable requirements of robust networks, Line & Path protection switching, Type of Topologies, Optical Channel Concatenation, Meshed topologies, PON's, Optical Ethernets, Wide area Backbones, Metro optical networking.

**Unit – III:** MPLS & Optical networks : Label switching, FEC, Scalability & granuility : labels & wavelength, MPLS nodes, Distribution & Binding methods, MPLS support of virtual private networks, Traffic Engineering, MPLS, Relationships of OXC, MPLS

operation, MPLS & optical Traffic Engineering, Similarities. Control & Dataplanes interworking, Architecture of IP & MPLS based optical transport Networks : IP, MPLS & Optical control planes- Interworking, The three control planes, Framework for IP Vs. Optical networks, Generalized MPLS use in optical networks, Bidirectional LSP's in optical network, Next horizon of GMPLS, ODVK General communication channels, Traffic parameters

**Unit – IV:** Link Management protocol ( LMP): What is managed, Data Bearing links, Basic function of LMP, LMP messages, LMP message header, TLW's control channel management, LPC, LCV, Fault management, Extending LMP operations to optical links Optical Routers Management : Switching in optical internets: State of art in optical switching, clarification of Key terms, Evolution of switching technologies, Speeds of electronics & photonics, Optical routers, Control element, switching technologies MEMS, OSP, Setting up protection paths between nodes H, G & J, Expanding the Role of nodes G & I, Node failure, Coupling, decoupling, node to node wavelengths, Approach to problem of LSP & OSP interworking, Thermo-optic switches, Bubble switch. Optical compilers: Building blocks, Serial Binary adder with carry delay, Fiber delay line memory loop, Bit serial, optical counter design, Lumped delay design, Distributed delay design, Time multiplex multiprocessor, Time slot interchange with 2 log 2 (N-1) switch, Hatch design support system.

**Reference Books:**

1. Optical Networks– Third generation transport system -Uyless Black (Prentice Hall)
2. Opto Electronic computing system – Jordan

**2 ENTC5 Elective-II**

## 4. SPEECH & AUDIO PROCESSING

**Unit – I:** Digital models for the speech signal: Process of speech production, Acoustic theory of speech production, Lossless tube models, and Digital models for speech signals. Time domain models for speech processing: Time dependent processing of speech, Short time energy and average magnitude, Short time average zero crossing rate, Speech vs silence discrimination using energy & zero crossings, Pitch period estimation, Short time Autocorrelation function, Short time average magnitude difference function, Pitch period Estimation using autocorrelation function, Median smoothing. Digital representations of the speech waveform: Sampling speech signals, Instantaneous quantization, Adaptive quantization, Differential quantization, Delta Modulation, Differential PCM, Comparison of systems, direct digital code conversion.

**Unit – II:** Short time Fourier analysis: Linear Filtering interpretation, Filter bank summation method, Overlap addition method, Design of digital filter banks, Implementation using FFT, Spectrographic displays, Pitch detection, Analysis by synthesis, Analysis synthesis systems. Homomorphic speech processing: Homomorphic systems for convolution, Complex cepstrum, Pitch detection, Formant estimation, Homomorphic vocoder.

**Unit – III:** Linear predictive coding of speech: Basic principles of linear predictive analysis, Solution of LPC equations, Prediction error signal, Frequency domain interpretation, Relation between the various speech parameters, Synthesis of speech from linear predictive parameters, Applications, Speech Enhancement: Spectral subtraction & filtering, Harmonic filtering, parametric re-synthesis, Adaptive noise cancellation. Speech Synthesis: Principles of speech synthesis, Synthesizer methods, Synthesis of intonation, Speech synthesis for different speakers, Speech synthesis in other languages, Evaluation, Practical speech synthesis.

**Unit – IV:** Automatic Speech Recognition: Introduction, Speech recognition vs. Speaker recognition, Signal processing and analysis methods, Pattern comparison techniques, Hidden Markov Models, Artificial Neural Networks, Audio Processing: Auditory perception and psychoacoustics - Masking, frequency and loudness perception, spatial perception, Digital Audio, Audio Coding - High quality, lowbit- rate audio coding standards, MPEG, AC-3, Multichannel audio - Stereo, 3D binaural and Multichannel surround sound.

**Text Books:**

1. L. R. Rabiner and R. W. Schafer, “Digital Processing of Speech Signals," Pearson Education (Asia) Pte. Ltd., 2004.
2. D. O’Shaughnessy, “Speech Communications: Human and Machine,” Universities Press, 2001.
3. L. R. Rabiner and B. Juang, “Fundamentals of Speech Recognition,” Pearson Education (Asia) Pte. Ltd., 2004.
4. Z. Li and M.S. Drew, “Fundamentals of Multimedia,” Pearson Education (Asia) Pvt. Ltd., 2004.

**Reference Book:**

1. C Becchetti & L P Ricotti, “Speech Recognition Theory & C++ Implementation” John Wiley & Sons
2. D. O’Shaughnessy, “Speech Communication Human & Machine”, Universities Press.
3. B. Gold & N. Morga+n “Speech & Audio Signal Processing”, John Wiley & Sons

**3 ENTC1 Seminar & Dissertation**

**4 ENTC1 Seminar & Dissertation**

**As per given scheme**

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