Unit VI: High-Speed Measurement Techniques, Digital Oscilloscope, Time Domain Reflectometry, Vector Network Analyzer.

Text Books :

1. "High-Speed Digital System Design: A Handbook of Interconnect Theory and Design Practices" Stephen H. Hall Garrett W. Hall, James A. McCall, John Wiley & Sons, Inc.
2. "High-Speed Digital Design: A Handbook of Black Magic" Howard Johnson, Prentice Hall publication

Reference Books:

1. "High Speed Signal Propagation: Advanced Black Magic" Howard W. Johnson, Prentice Hall
2. " Signal Integrity Issues and Printed Circuit Board Design" Douglas Brooks, Prentice Hall
3. "Signal Integrity, Simplified" Eric Bogatin, Prentice Hall
4. " Noise Reduction Techniques in Electronic Systems" Henry Ott -John Wiley & Sons.

SYLLABUS PRESCRIBED FOR TWO YEAR P.G.DEGREE COURSE IN

ME (ELECTRONICS & TELECOMMUNICATION ENGG.)

(Full Time) (Credit Grade System)

SEMESTER - I

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.

Unit III: 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 IV: Optical Detectors: Introduction & study of type of detectors characteristics. Spectral spread and availability of detectors for 980 nm, 1.3 ìm & 1.55 ìm _ systems. Calculation of detector sensitivity and design considerations of suitable receivers for LAN, WAN applications

Unit V: 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 VI: Optical fiber measurements:Fiber attenuation measurements, Fiber dispersion measurements, Fiber refractive index profile measurements, fiber cutoff

wavelength measurements, numerical aperture measurements, Fiber diameter measurements

References:

1. "Optical Communication Systems", John Gowar, PHI.
2. "Optical Fiber Communication" Gerd Keiser, MGH.
3. "Optical Fiber Communication Principles & Practice", John M. Senior, PHI pub. 1996.
4. "Data Warehousing", Reema Thareja, Oxford Unviersity Press.
5. "Data Warehousing Fundamentals", Paulraj Ponniah, John Wiley.

1ENTC2 RANDOM PROCESSES

UNIT- I: Probability and Random Variables:

Axioms of probability, Conditional probability, Total probability, Baye's theorem, Concept of random variable, Discrete random variable, Continuous random variable, CDF & PDF, Expectations & Moments, Characteristics functions, Moment generation function.

UNIT - II: Standard Distributions:

Binomial, Poisson, Geometric, Negative Binomial, Uniform, Exponential, Gamma, Weibull and Normal distributions and their properties, Functions of a random variable, Central Limit Theorem (CLT), Generation of random numbers.

UNIT- III: Multi-dimensional Random Variables:

Joint distribution function, Joint density function, Marginal distribution function, Conditional distribution, Covariance & Covariance matrix, Expectations & Moments, Mean and Variance of weighted sum of Random Variables, Joint Gaussian Random Variables.

UNIT- IV: Random Processes and Characterization:

Concept of random process, Characterization and Classification, Gaussian Random Processes. Poision

Process, Wiener Process, Stationery Process, Introduction to White noise, Random Walks, Brownian motion.

UNIT- V Correlation of Random Processes:

Correlation function, Properties of Auto Correlation function, Relationship between two Random Processes, Properties of Cross Correlation function.

UNIT- VI: Power Spectral Density (PSD): -

Concept of Power Spectral Density, Properties of PSD, Power Spectral Estimation, Cross Spectral Density, Power Spectrum in Laplace Domain

References:

1) "Probabilistic Random Signals and Statistics", X Rong Li, CRC Press
2) "Random Signals and Systems", Bernard Picnicbono, PHI.
3) "A First Course in Probability", Shelabo Ross, Pearson Education.

1ENTC3 DIGITAL COMMUNICATION TECHNIQUES

Unit I: Characterization of Communication Signal and Optimum Receiver for AWGN Channel: Signal Space representation, Memory less Modulation methods, Linear Modulation with memory, Non- linear Modulation methods with memory, CPFSK & CPM, Power Spectra of Linear Modulated signal, Power Spectra of CPFSK & CPM Signals, Correlation Demodulator, Match Filter Demodulator, Optimum Detector, Probability of Error for Binary & M-array signals

Unit II: Source Coding: Average mutual information & Entropy, Coding of discrete memory-less sources, Discrete Stationary Sources, Lempel-Ziv algorithm; Coding of analog sources, Rate distortion function, Scalar Quantization & Vector Quantization,

Unit III: Channel Coding: Temporal and Spectral Waveform Coding, BCH codes, Reed Soloman codes, Reed Muller Codes, Convolution Codes, Transfer function of convolution codes, Viterbi decoding algorithm, stack algorithm(No problems expected)., trellis coded modulation.

Unit IV: Signal Design for Band Limited Channel: Design of band limited signal for zero ISI, Nyquist Criterion, Design of band limited signal for controlled ISI, partial response signaling, Data detection for controlled ISI

Unit V: Linear Equalization Techniques : Peak Distortion Criterion, Mean Square Error (MSE) criterion, Decision Feedback Equalization, Coefficient Optimization, Adaptive Linear Equalizer, Zero Forcing Algorithm, LMS Algorithm.

Unit VI: Spread Spectrum Techniques: Generation of PN sequence, direct sequence spread spectrum system, processing gain, jamming margin, application of direct sequence spread spectrum signal, frequency hopped spread spectrum signal, time hopping spread spectrum signal, synchronization of spread spectrum signal – acquisition & tracking.

Text Books:

1. "Digital Communication Fundamentals and Applications", Bernard Sklar, 2nd Ed, Pearson Education Asia
2. "Digital Communication", J.G. Proakis, Fourth Ed, Mc Graw Hill
3. " Error Control Coding: Fundamentals & Applications", Shu Lin & Costell , Addison Wessley Pub.

Reference Books:

1. "Digital Communication Techniques", Simon Haykin, John Wiley & Sons.
2. "Advanced Digital Communication System and Signal Processing Techniques", Dr. Kemilo Feher Prentice Hall International.

1ENTC 4 DIGITAL SIGNAL PROCESSING & APPLICATIONS

Unit-I: Overview of Digital Filters:

Filter specifications, Magnitude & Phase response of digital filter, Linear Phase filters: Type I, Type II, Type III, & Type IV, Analog filter basics: Butterworth, Chebyshev, Inverse Chebyshev filters, Elliptic filters.

Unit -II: Design of Digital FIR filters:

FIR filter design using Fourier Series Method : Low pass, High pass & Band pass filter, FIR design using Hamming, Hanning, Blackman & Kaiser window, Differentiators, Hilbert transforms, Equi-ripple FIR filter design.

Unit -III: Design of Digital IIR filters:

IIR filter design using Impulse Invariance method, Matched Z-transform, Bilinear Transform, Differentiation method (Backward difference method), Design of analog filters: Butterworth, Chebyshev. Frequency transformations in Analog and Digital domain, Finite word length effect in digital filters.

Unit IV: Multi-rate Digital Signal Processing:

Decimation & Interpolation, Linear filtering with decimation and interpolation, Poly-phase filters, Filter banks, sub-band processing, Decimated filter banks, Uniform DFT filter banks, Quadrature mirror filters.

Unit V: DSP Processors and its Application:

Issues involved in DSP processor design, Features of TMS 320C67XX, Architecture of TMS 320C67XX, Memory Organization, Addressing Modes, Pipeline operations, Assembly language instructions, Applications of DSP to Biomedical Signal Processing, Speech signal processing, Radar signal processing.

UNIT VI: Wavelets:

Time-Frequency Analysis and Continuous Wavelet Transform, an introduction to Hilbert Space Theory, Wavelet Properties, Discrete Wavelets, Scaling Function, Subband Coding, Discrete Wavelet Transform.

Text Books:

1. 'Digital Signal Processing Principles, Algorithm and Applications", J. G. Proakis and D.G.Manolakis Fourth Ed Prentice Hall 1997.
2. "A Course in Digital Signal Processing ", Boaz Porat John Wiley & Sons.
3. "Digital Signal Processing", Nagoor Kani, Tata-Mc-Graw-Hill.Publication.
4. "Digital Signal Processors", B. Venkatramani and M. Bhaskar, 2nd Ed., Mc-Graw Hill.
5. "Wavelet Transforms: Introduction to Theory and Applications", Bopardikar and Rao.

Reference Books:

1. "Digital Signal Processing- A Computer based Approach", Sanjit K. Mitra, 4th Ed, Mc- Graw Hill.
2. "Discrete Time Signal Processing : A Practical Approach", E.C. Ifeacher & B.W. Jarvis Pearson Education 3rd Edition.
3. "Digital Signal Processing", Thomas J. Cavicchi, John Wiley
4. "DSP Handbook", Vijay Medisetti & D.B. Williams, CRC Press
5. "Discrete Wavelet Transform', Robi Polikar.
6. "Wavelets and Subband Coding", Valterli & Kovaceric, PHI.
7. "Analog Devices & Texas Instruments", Users Manuel of TMS320C4X and ADSP 2106X.

1ENTC5 ELECTIVE – I

(1) REAL TIME EMBEDDED SYSTEM

Unit I: Embedded System hardware : Embedded systems overview, Hardware components like microcontroller, GPP, ASSP, AISP, SOC, Details of 32 bit ARM**7 core based** SoC architecture, Organisation, analog, digital & high speed I/O for embedded systems, interfacing SRAM, DRAM, flash memories with microcontroller, memory management

Unit II: Embedded System Software : Techniques of writing efficient C code for microcontroller C data types for ARM, Signed & unsigned data types, limitation of char & char & data types, storage class – static & extern, volatile keyword, operation on bits, functions, ARM / Thumb procedural call standard, pointers & arrays, conditional statements – if-else, switch, structure, conditional loops – for & while, preprocessing, compiling, cross compiling, compiler driver, startup code and board support packages, calling assembly routines in C, interrupt handling in C, interrupt latency.

Unit III: ARM Philips NXP LPC2148 Microcontroller: *Programming & Interfacing:*Programming on – chip components like ADC, UART, Timers, External Interrupts and interfacing external peripherals like keyboard, LCD, Stepper motor.

Unit IV: Uniprocessor Real Time Operating Systems – I: Real time systems, goals and services, tasks and its states, task assignment & scheduling, Task Control Blocks, Context & Context Switching, ISRs, Security Issues, inter- task communication, semaphore.

Unit V: Uniprocessor Real Time Operating Systems – II: Task Scheduling models**,** scheduling algorithms – rate monotonic and earliest deadline first, priority inheritance protocol, priority ceiling protocol, real time operating system features, features of micro COS – II RTOS.

Unit VI:Embedded System Architecture & Design : Architecture styles, implementation aspects, estimation modeling, embedded system architecture, validation and debugging of embedded systems, hardware – software co-design in an embedded system

Text Books:

1. "Embedded Systems", Rajkamal, 2nd Edi., Tata Mc-Graw Hill.
2. "Embedded Real-time System Programming", Iyer & Gupta, Tata Mc-Graw Hill.

Reference Books:

1. "ARM System on Chip Architecture", Furber, 2nd Edi Pearson India.
2. "Introduction to Embedded System", K. V. Shibu, MGH.
3. "Philips NXP LPC 2148" user manual
4. "Scheduling in Real Time Systems", Cottet, Delacroix & Mammeri, John Wiley & Son.
5. "Real Time Systems", Rajib Mall, Pearson, India.

1ENTC5 ELECTIVE – I

(2) DATA COMPRESSION

Unit I: Introduction and Mathematical background: Introduction to different compression techniques (Lossless, Lossy, Measure of performance), Modeling and Coding, Physical model, Probability model, Markov model, Composite Source model, Uniquely decodable codes, Prefix codes, Kraft-McMillan inequalityHuffman coding: Minimum variance, optimal, length, Extended Huffman codes, Non-binary Huffman codes, Adaptive Huffman coding, Application of Huffman codes.

Unit II: Arithmetic coding, Dictionary Techniques: Arithmetic coding: Coding a sequence, generating binary codes, Comparison of Huffman and Arithmetic Coding , Adaptive arithmetic coding, Application of arithmetic codingStatic and

adaptive dictionary coding techniques, Repetition Finder, Application related to file compression and Image Compression, V.42 bis Standard, CRC, EXE Compressors, Various LZ Applications

Unit III: Image compression: Context based Compression: Prediction with Partial Match (PPM), Burrows Wheeler Transform, Associative coder. Dynamic Markov CompressionLossless Image Compression: JPEG, JPEG-LS, Run-length coding, facsimile coding standards, progressive Image transmission, Differential Lossless CompressionTransform Coding: K L Transform, DCT, DST, Discrete Walsh-Hadamard transform, Applications of Transform coding to Image and Audio.

Unit IV: Quantization: Scalar Quantization, Quantization problem, Uniform quantization, Adaptive quantization, Non-uniformQuantization, Entropy Coded Quantization. Vector Quantization (VQ): Advantages over Scalar Quantization, The Linde-Buzo-Gray algorithm, Tree Structured Vector Quantization, Structured VQ., Variations on the Theme

Unit V: Sub-band Coding, Wavelets method: Sub band Coding: Filters, Basic Sub-band coding, algorithm, design of Filter Banks, Application to speech coding audio coding and Image compression.Wavelets: Fourier Transform, Frequency Domain, Uncertainty Principle, Fourier Image Compression, CWT and Its Inverse, Haar Transform, Filter Banks, DWT, Multi-resolution Decomposition, Various Image Decompositions, IWT

Unit VI: Audio, Image and Video Compression: Spectral masking, Temporal masking, Psychoacoustic model, MPEG Audio coding, MPEG Advanced Audio coding, Dolby digital. Image Compression : Predictive techniques like PCM, DPCM and DM.Video compression: Video signal representation, H.261 Standard by ITU-T, model based coding MPEG-1 and MPEG- 2 Video Standards, ITU-T H.263 and H.264 Standards, Packet Video

Referencs:

1. "Introduction to Data Compression", Khalid Sayood, 2nd Ed. Academic Press
2. "Data Compression: The complete Reference", David Saloman, 3rd Ed, Springer 2004.
3. "Digital Image Processing", S Jayaraman, S. Esakkirajan, T Veerakumar, Tata Mc-Graw Hill.
4. "Digital Image Processing", R. C.Gonzalez and Woods 3rd Ed, pearson Education

1ENTC5 ELECTIVE – I

(3) ARTIFICIAL INTELLIGENT SYSTEM

Unit I: **Introduction to Fuzzy Set Theory**: Fuzzy set theory, classical set theory, properties of fuzzy sets, operations on fuzzy sets, fuzzy relations, operation on fuzzy relations, extension principle, fuzzy arithmetic membership functions, fuzzification & defuzzification.

Unit II: **Fuzzy Rules, Reasoning & Decision Making**:**Fuzzy reasoning:** introduction, linguistic variables, fuzzy propositions.**Fuzzy rules**: fuzzy rule based system, fuzzy if-then rules, fuzzy inference system. **Fuzzy decision making**: individual, multiperson, multicriterion and multistage decision making fuzzy ranking methods.

Unit III: **Hybrid Systems**:**Fuzzy controller:** construction of FLC, fuzzy PD controller, fuzzy PI controller. **Neuro-fuzzy control:** introduction, inverse learning, specialized learning.**Fuzzy pattern recognition:** introduction, single sample identification, multi-feature recognition.

Unit IV: **rtificial Neural Networks:** Introduction, biological neuron, Artificial neural models, Perceptron Learning rule, Single layer perception, multilayer perceptron network, error back propagation algorithm.

Unit V: **Unsupervised Learning:** Winner-Take-All learning algorithm, hamming net and Maxnet , self organization

feature map, Adaptive Resonance Theory (ART) network, Counter propagation network,**Associative Memories**: Linear associator, Hopfield recurrent associative memory, storage and retrieval algorithm, basic concept of bidirectional associative memory (BAM).

Unit VI: **Support vector machines (SVM):** Optimal hyperplane for linearly separable and non-separable patterns, SVM as a Kernel machine, design of SVM.

Genetic algorithm: Introduction, encoding, fitness function, reproduction, crossover, mutation. Simulated annealing Applications of neural network in character recognition, forecasting, robot kinematics, biomedical signals. Optical neural network

Text Books :

1. “Neural Networks”, S. Hykin ,Pearson Education.
2. “Fuzzy sets and Fuzzy logic Theory and Applications”, George J. Klir, Bo Yuan, PHI
3. “Fuzzy Logic With Engineering Applications”, Timothy Ross, McGraw Hill International.

Reference Books :

1. “Artificial Neural Networks”, Zurada
2. “Neuro Fuzzy and Soft computing”, Jang, Sun, Mezutani
3. “Introduction to Neural networks using MATLAB 6.0”,S.N.Sivanandan, S. Sumathi, S.N. Deepa, McGraw Hill.
4. “Neural networks, Fuzzy logic and genetic algorithms synthesis and applications”, S. Rajasekaran, G.A. Vijayalakshmi Pai, PHI
5. Intelligent Systems & controls, Laxmidhar Behera, Indrani kar (Oxford)

1ENTC5 ELECTIVE – I

(4) CRYPTOGRAPHY AND NETWORK SECURITY

Unit I: **Introduction:** The OSI Security Architecture, Classical Encryption Techniques: Cipher principles, data encryption standard, block cipher design principle and modes of

operation, evolution cryteria for AES, AES cipher – Tripal DES- placement of encryption function- traffic confidentiality.

Unit II: Public Key Cryptography: Key management – Diffie-Hellman key Exchange- Elliptic curve architecture and Cryptography- Introduction to number theory- confidility using symmetric encryption – Public key cryptography and RSA

Unit III:Authentication and HASH function: Authentication requirement- Authentication function -Message Authentication codes, Hash function, Security of Hash function & MACs- MD5 Message Digest Algorithm, Secure Hash Algorithm- RIPEMD- HMAC digital signature-authentication protocol-digital signature standard.

Unit IV: Network Security:- Authentication Applications: Kerberos X.509, Authentication Service.- Electronic Mail Security: Pretty good privacy, S/MIME- IP Security:- web security

Unit V: System Level Security: Instrusion detection-password management- viruses and related threads – virus counter measures - Firewall design principles-Trusted systems.

Unit VI: 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 relatedthreats Firewalls: Firewall design principles.

Text Book :

1. "Cryptography And Network Security: Principles and Practices", William stallings, Prentice Hall of India, Third Edition, 2003.

Reference Books :

1. "Cryptography And Network Security", Atul Kahate, Tata McGraw-Hill,2003.

2. "Applied Cryptography", Bruce Schneier, John Wiley & Sons Inc, 2001.
3. "Security in Computing", Charles B. Pfleeger, hari Lawrence Pfleeger, Third Edition, Pearson Education, 2003.

1ENTC6 Lab - I (based on 1ENTC1 & 1ENTC3)

1ENTC7 Lab - II (based on 1ENTC4)

SEMESTER-II

2ENTC1 ADAPTIVE SIGNAL PROCESSING

Unit I : Introduction to Random Signals: Random variables, Sequences and Stochastic Process, Random Signals and Distributions, Averages, Stationary Processes, Special Random signals & its Probability Density Functions (PDF) and its properties, non-parametric spectral estimation, parametric methods of power spectral estimations, Spectra-Correlation Density.

Unit II: Wiener Filters: Input signal and weight vectors, desired response and error, Mean Square Error (MSE), Principle of Orthogonality, FIR Wiener Filters, Wiener Hopf equation, Error performance surface, multiple linear regression model, linearity constrained minimum-variance filter.

Unit III : Adaptive Filtering Algorithms: Eigen values and Eigen Vectors of the correlation matrix, one dimensional gradient search algorithm, Steepest Descent algorithm, LMS algorithm, comparison of the LMS with Steepest Descent Algorithm, Modified LMS algorithm and Examples of LMS algorithm, Normalised LMS filter.

Unit IV : Kalman Filters and Square Root Adaptive Filters: Recursive minimum MSE for Scalar random variables, Kalman filtering problem, Innovation process and estimation of state, Kalman filtering, Square root Kalman filters, QRRLS algorithm.

Unit V : **Recursive Least Square Algorithms:** Linear Least Square Estimation Problem, Introduction to Recursive Least-Squares Adaptive filters, Matrix Inversion Lemma, RLS Algorithm, Convergence analysis of RLS algorithm.

Unit VI :Applications of Adaptive filtering: Adaptive Equalization, noise cancellation, linear prediction, Echo Cancellation, Lattice Filters. System identification, , Inverse modeling, Jammer suppression, Adaptive notch filter, Adaptive feedback cancellation in hearing aids, Foetal monitoring, cancelling of maternal ECG during labour, removal of ocular artifacts from electro-encephalogram by adaptive filtering.

Text Book:

1. "Adaptive Filter Theory", Simon Haykin, 3rd Ed, Prentice Hall Inc, 2002.

Reference Books:

1. "Adaptive Filtering Primer with MATLAB", Alexander D. Poulanikas & Zayed M Ramadan, Taylor & Francis Series, CRS Press.
2. "Adaptive Signal Processing", Bernard Widrow, Prentice-Hall Signal Processing Series.
3. "Real Time Digital Signal Processing : Implementation and Applications", Sen M. Kuo, Bob H. Lee and Wenshun Tian, 2nd Ed, John Wiley & Sons, 2006.
4. "Adaptive Digital Filters", Maurice G Bellanger, 2nd Edition,
5. "Adaptive Nonlinear System Identification", Marcel Dekkar Inc. T Ogunfummi, Springer

2ENTC2 WIRELESS COMMUNICATION

Unit I : **Fundamentals of Wireless Communication :** Evolution of wireless networks and challenges Long term fading models: two ray model, diffraction model, scattering model, Shadow fading Short term fading: Impulse

response of time varying channels, Narrow band fading model, wide band fading models, discrete time model. Capacity of wireless channel, Capacity of AWGN channel, Capacity of flat fading channel, Capacity of frequency selective fading channel, Basic diversity combining techniques.

Unit II : **Analog and Digital Cellular Mobile System:** Analog Cellular System: AMPS, NMT Digital Cellular System: GSM, GSM Architecture, TDMA frame structure, Traffic and Control channels, Voice Processing in GSM. IS -95 (CDMA one): Forward Modulation channel, Reverse Modulation channel.

Unit III: **Wireless Sensor Network:** DARPA efforts toward wireless sensor network, other application of wireless sensor network, Fixed wireless sensor network, wireless sensor networks, sensor deployment, network characteristic, and Design issues in sensor network, Secured communication.

Unit IV: **Low power wireless communication systems, Data Networks and protocols:** Cordless Telephony 2 (CT2), Digital Enhanced Cordless Telephony (DECT), PHS, PDC, PCS (Functional Architecture, Radio Specifications, Frame Structure). Protocols: IEEE 802.11, IEEE 802.15.

Unit V : **Wireless Communication Standards:** Bluetooth: Bluetooth network, Bluetooth Protocol stack, Bluetooth MAC layer , Modified version of Bluetooth.Wi Fi: MAC, security enhancement, WAP, Quality of service enhancements, different version of WiFi standards, EDCA, HCCA, Wimax standard : Wimax physical layer interface, Wimax application in competition with WiFi,Wimax modes, Different versions of Wimax standards, Quality of services of Wimax

Unit VI : Private Mobile Radio network and Introduction to 3G Systems: Private Mobile Radio (PMR): Introduction, user community, requirement of PMR services, PMR configurations, PMR standards, TETRA Network Architecture. IMT 2000: Radio aspects, Network Aspects and Regional initiatives Universal Personal Communication: UPT, Concepts and Service aspects, Functional architecture, Routing, Scenarios for partitioning and location of service information, Access security, Basic concepts of UMTS.

References:

1. "Wireless Networks", G. S. Papadimitriou, A. S Pomportisis, P Nicopolitidis, John Wiley & Sons.
2. "Wireless Communication", Upena Dalal, Oxford.
3. "Introduction toWireless and Mobile System", D.P. Agrawal and Qing-An-Zeng , 3rd edition, Oxford,
4. "Wireless Communication", Andrea Goldsmith, Cambridge University Press.
5. "Mobile and Personal Communication: Systems & Service", Raj Pandya, Prentice Hall India.
6. "Digital Mobile Communication and TETRA Systems", John Dunlop, Demessie Girma, James Irvine, John Wiley & Sons.
7. "Wireless communications: Principles and Practice", Theodore S. Rappaport, P.E.
8. "Principles of Mobile Communication", Gordon L Stuber, 2nd Ed, Kluwer Academic Publishers
9. "Mobile Cellular Telecommunication", William C Y Lee , Mc Graw Hill

2ENTC3 ADVANCED COMPUTER NETWORKS AND PROGRAMMING

Unit I: Review of computer networking: ISO-OSI reference model, Point to point Protocol, ARQ techniques, Data network switching techniques.

Unit II: TCP/IP: TCP/IP architecture, TCP Segments, TCP flow control, IPv4 versus IPv6, UDP, Fragmentation, ARP & RARP , ICMP,IGMP, DHCP, Mobile IP, UnIcast and Multicast Routing protocols.

Unit III: Network management: Delay models in data networks, Performance measures & architecturalIssues, Queuing Model (M/M/1, M/M/C, and M/G/1), Network management and congestion control algorithm.

Unit IV: ATM Networks: Need for ATM, B-ISDN reference model, ATM Layers, ATM adaptation Layers, ATM Signalling, PNNI routing, QoS in ATM.

Unit V: Advance Network Architecture: Overlay model, MPLS, Integrated services, Differentiated services, RSVP.

Unit VI: Network Security: Ciphers, DES, public key cryptography, RSA algorithm, Digital water marking, Attack and counter measure.

Text Books :

1. "Communication Networks", Leon Garcia & Wadeja, Tata McGraw Hill Publication.
2. "Data and Computer Communication", William stallings, 8th edition, Pearson Education

Reference Books :

1. “Data Networks” Dimitri Bertisekas & Robert Gallager, PHI.
2. “Local Area Networks”, Gerd E Kieser, Mc-Graw-Hill.
3. “Cryptography and Network Security: Principles and Practice”, William Stallings, Pearson Education.
4. "TCP/IP Protocol Suite", Behrouz Furozan, Mc Graw Hill

2ENTC4 RF AND MICROWAVE CIRCUIT DESIGN

Unit I: Two Port RF Networks-Circuit Refrigeration: Low frequency parameters-impedance, admittance, hybrid and ABCD. High frequency parameters-Formulation of

Sparameters, properties of S parameters-Reciprocal andlossless networks, transmission matrix, Signal Flow Graph:

Unit II: **Matching and Biasing Network:** Impedance matching networks, impedance matching using discrete components, frequency response, T and Π matching networks, microstripline matching networks (unilateral/ bilateral), single stub matching networks, double stub matching networks

Unit III: **RF Transistor Amplifier Design:** Characterstics of Amplifier, Amplifier power relation, stability considerations, constant gain, Noise figure circles, constant VSWR circles, broadband, high power and multistage amplifiers.

Unit IV: **Design of Ooscilators and Mixsers:** Basic oscillator model, negative resistance oscillator, feedback oscillator design, design steps, quarts oscillator, high frequency oscillator configuration, fixed frequency oscillator, voltage controlled oscillator, gunn element oscillator, basic characterstics of mixer, frequency domain considerations, single ended mixer design, single and double balanced mixer.

Unit V: **Introduction to Microwave Integrated Circuits:** Introduction to MIC'S and their technology, components for MIC'S, stripline, general stripline characterstics, modes on stripline, hybrid mode analysis, losses in microstrip, Introduction to coupled Microstrip, Even and odd mode analysis, Directional couplers, branch line couplers,

Unit VI: **MMIC Technology :** Introduction to MMIC, substrates and technologies, passive components, Fabrication process of MMIC, thick and thin film technology, Testing methods, Encapsulation and mounting of Devices.

References:

1. "Microwave Devices & Circuits", Samuel Y Liao, Prentice Hall of India, 2006.
2. "RF Circuit Design", Reinhold.Ludwig and Pavel Bretshko Pearson Education, Inc., 2006
3. "RF & Microwave Electronics Illustrated", M.M.Radmanesh , Pearson Education, 2007.
4. "HandBook of Microwave Intergrated Circuits",, Hoffman R.K.Artech House,Boston,1987.
5. "Microwave Intergrated Circuits", Gupta .K.C and Amarjit Singh, John Wiley,New York,1975.

2ENTC5 ELECTIVE-II
(1) MOBILE COMPUTING

Unit – I: **Wireless network technology:** Introduction to 3G and 4G mobile systems. Global System for Mobile Communication (GSM) , Wireless media access control protocols; Wireless LAN, TDMA, PRMA, CDMA, WCDMA.

Unit – II: **Channel allocation and interference reduction:**Static and Dynamic channel allocation, Fixed channel allocation, centralized and distributed dynamic channel allocation, hybrid channel allocation, flexible channel allocation schemes, allocation in specialized system structure, channel allocation in one dimension system, Reuse partitioning based channel allocation, overlapped cell based channel allocation.Co channel interference, Real time co channel interference measurement, Design of omni directional antenna system in worst case, lowering the antenna system, reduction in co channel interference, umbrella pattern effect, power control, Adjacent channel interference, Near END Far End interference, cross talk, UHF TV interference, long distance interference.

Unit III: **Mobility and Location management:** Introduction, cell admission control, handoff management, Location management for mobile network, Two- Tiered architecture, SS& network and common channel signalling, location update, cell setup and paging, location management for PCS network Traffic calculation: system and traffic parameter, handoff rate calculation.

UnitIV: **Mobile Protocol:** Mobile medium access control protocol, Mobile Internet Protocol, Evolution of mobile IP, working of mobile IP, Packet delivery and handover management, registration, Tunnelling and encapsulation, Routing optimization, Indirect TCP, Snooping TCP, Mobile TCP, TCP Reno, New TCP Reno, Multicast for mobility protocol, Mobicast, RMDP protocol, RM-2 protocol.

Unit V: **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 VI: **Security issues in mobile and wireless:** Traditional Security Issues, Mobile and Wireless Security Issues, Additional Issues(Liability, Fear, uncertainty and doubt, Fraud, Big bucks at stake), Additional Types of Attacks(man in the middle attacks, traffic analysis, Replay attacks, Buffer overflow attacks)Approaches to security: Limit the signal, Encryption, Integrity codes, Ip security, Other Security related Mechanism(Authentication protocols, AAA, Special Hardware)

References:

1. "Mobile Computing", T. Imielinski and H.F. Korth, Kluwer Academic

2. "Wireless Communication and Networking", Jon.W. Mark, Weihau Zhuang, Prentice Hall of India Private Limited
3. "Mobile Computing", Rajkamal, Oxford
4. "Fundamental of Mobile Pervasive Computing", Frank Adelstein, Sandeep K S Gupta Tata. MC. Graw Hill Publishing company limited
5. "Wireless and Cellular Tele Communication", Willium. C. Y. Lee, MC Graw Hill
6. "Introduction toWireless and Mobile System", D.P. Agrawal and Qing-An-Zeng , 3rd edition, Oxford,
7. "Mobile Computing", Asok Talukdar, Roopa Yawagal, TMH

2ENTC5 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

Unit II: Path Losses: Detailed Discussion. Multipath Fading: Channel model and Envelope Fading, Multipath Fading: Frequency Selective and Fast Fading, Summary of Standard Translation

Unit III: Introduction Receiver Architectures, Receiver front End: general discussion, Filter Design, rest of Receiver Front Eng: Non ideatlites and Design Parameters, Derivation of NF, IIP3 of Receiver Front End, Partitioning of required NFrec_front and IIP3,rec_front into individual.

Unit IV: 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 V: Analog to Digital Converters: Demodulators, A to D Converters used in receivers, Low cost Sigma delta modulators and it's implementation,

Unit VI: Design Technology for Wireless Systems: Design entry / simulation, Validation and analysis Tools.

References:

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.

2ENTC5 ELECTIVE-II

(3) OPTICAL NETWORKS

Unit I: **SONET & SDH :** Brief history of SONET & SDH, Multiplexing hierarchy, Multiplexing structure, Frame structure, Functional components, Problem detection, Virtual tributaries & Virtual containers, Concatenation.

Unit II: **Architecture of OTN:** Digital wrapper, control planes, In-band and out of band Control signalling, Current digital transport hierarchy, SONET and SDH Multiplexing hierarchies, revised hierarchies, Optical & Digital Transport hierarchies, OTN Layered model, Encapsulation & De-capsulation, GFP.

Unit III: **WDM, DWDM Topologies:** Relationship with SONET / SDH, EDF, WDM Amplifiers, Add-Drop Multiplexers, Span loss & chromatic dispersion,

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 IV: **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 & Data-planes interworking,

Unit V: **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 VI: **Link Management Protocol (LMP):** Basic function of LMP, LMP messages, LMP message header, Control channel management, Optical Routers: Evolution of switching technologies, Speeds of electronics & photonics, Optical routers, Control element, switching technologies MEMS, Label switched paths (LSP) and OSP, Setting up LSP and OSP, protection paths between nodes, Recovery and use of protection path.

References:

1. "Optical Networks: Third Generation Transport System",Uyless Black, Prentice Hall.
2. "Opto Electronic Computing System", Jordan

2ENTC5 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, an 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.

Unit II: **Homomorphic speech processing:** Homomorphic systems for convolution, Complex cepstrum, Pitch detection, Formant estimation, Homomorphic vocoder. 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.

Unit III: **Speech Synthesis:** 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.

UnitV : **Audio Processing:** Auditory perception and psychoacoustics - Masking, frequency and loudness perception, spatial perception, Digital Audio

Unit VI: **Audio Coding:** High quality, lowbit- rate audio coding standards, MPEG, AC-3, Multichannel audio - Stereo, 3D binaural and Multichannel surround sound.

Text Books:

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

Reference Books:

1. "Speech Recognition: Theory & C++ Implementation", C. Becchetti & L. P. Ricotti, John Wiley & Sons.
2. "Speech Communication: Human & Machine", D. O' Shaughnessy, Universities Press.
3. "Speech & Audio Signal Processing",, B. Gold & N. Morgan, John Wiley & Sons.