

ANNA UNIVERSITY, CHENNAI

AFFILIATED INSTITUTIONS

R - 2009

CURRICULUM I SEMESTER (FULL TIME)

M.E. COMMUNICATION SYSTEMS

SEMESTER I

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	MA9218	Applied Mathematics for Communication Engineers	3	1	0	4
2	CU9211	Advanced Radiation Systems	3	0	0	3
3	CP9211	Modern Digital Communication Techniques	3	0	0	3
4	AP9211	Advanced Digital Signal Processing	3	0	0	3
5	CU9213	Optical Communication Networks	3	0	0	3
6	E1	Elective I	3	0	0	3
PRACTICAL						
7	CU9216	Communication System Lab I	0	0	4	2
TOTAL			18	1	4	21

LIST OF ELECTIVES M.E. COMMUNICATION SYSTEMS

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
1	AP9258	RF System Design	3	0	0	3
2	CU9251	Communication protocol Engineering	3	0	0	3
3	VL9265	DSP Processor Architecture and programming	3	0	0	3
4	VL9264	Digital Speech Signal Processing	3	0	0	3
5	CU9256	Network Routing Algorithms	3	0	0	3
6	CU9253	Global Positioning Systems	3	0	0	3
7	CU9257	Communication Network Security	3	0	0	3
8	CP9254	Soft Computing	3	0	0	3
9	CU9254	Digital Communication Receivers	3	0	0	3
10	AP9213	Advanced Microprocessors and Microcontrollers	3	0	0	3
11	AP9251	Digital Image Processing	3	0	0	3
12	CU9255	Internetworking multimedia	3	0	0	3
13	AP9256	Electromagnetic Interference and Compatibility in System Design	3	0	0	3
14	CP9212	High Performance Computer Networks	3	0	0	3
15	AP9224	Embedded systems	3	0	0	3
16	CP9253	High Speed Switching Architectures	3	0	0	3
17		Special Elective	3	0	0	3

UNIT I SPECIAL FUNCTIONS 12

Bessel's equation – Bessel function – Recurrence relations - Generating function and orthogonal property for Bessel functions of first kind – Fourier-Bessel expansion.

UNIT II MATRIX THEORY 12

Some important matrix factorizations – The Cholesky decomposition – QR factorization – Least squares method – Singular value decomposition - Toeplitz matrices and some applications.

UNIT III ONE DIMENSIONAL RANDOM VARIABLES 12

Random variables - Probability function – moments – moment generating functions and their properties – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions – Function of a Random Variable.

UNIT IV TWO DIMENSIONAL RANDOM VARIABLES 12

Joint distributions – Marginal and Conditional distributions – Functions of two dimensional random variables – Regression Curve – Correlation.

UNIT V QUEUEING MODELS 12

Poisson Process – Markovian queues – Single and Multi-server Models – Little's formula - Machine Interference Model – Steady State analysis – Self Service queue.

L +T: 45+15 = 60 PERIODS

REFERENCES:

1. Grewal, B.S., Numerical methods in Engineering and Science, 40th edition, Khanna Publishers, 2007.
2. Moon, T.K., Sterling, W.C., Mathematical methods and algorithms for signal processing, Pearson Education, 2000.
3. Richard Johnson, Miller & Freund, Probability and Statistics for Engineers, 7th Edition, Prentice – Hall of India, Private Ltd., New Delhi (2007).
4. Taha, H.A., Operations Research, An introduction, 7th edition, Pearson education editions, Asia, New Delhi, 2002.
5. Donald Gross and Carl M. Harris, Fundamentals of Queueing theory, 2nd edition, John Wiley and Sons, New York (1985)

UNIT I ANTENNA FUNDAMENTALS 9

Antenna fundamental parameters , . Radiation integrals ,Radiation from surface and line current distributions – dipole, monopole, loop antenna; Mobile phone antenna- base station, hand set antenna; Image; Induction ,reciprocity theorem, Broadband antennas and matching techniques, Balance to unbalance transformer, Introduction to numerical techniques

UNIT II RADIATION FROM APERTURES 9

Field equivalence principle, Radiation from Rectangular and Circular apertures, Uniform aperture distribution on an infinite ground plane; Slot antenna; Horn antenna; Reflector antenna, aperture blockage, and design consideration.

UNIT III ARRAY ANTENNA 9

Linear array –uniform array, end fire and broad side array, gain, beam width, side lobe level; Two dimensional uniform array; Phased array, beam scanning, grating lobe, feed network,; Linear array synthesis techniques – Binomial and Chebyshev distributions.

UNIT IV MICRO STRIP ANTENNA 9

Radiation Mechanism from patch; Excitation techniques; Microstrip dipole; Rectangular patch, Circular patch, and Ring antenna – radiation analysis from cavity model; input impedance of rectangular and circular patch antenna; Microstrip array and feed network; Application of microstrip array antenna.

UNIT V EMC ANTENNA AND ANTENNA MEASUREMENTS 9

Concept of EMC measuring antenna; Rx and Tx antenna factors; Log periodic dipole, Bi-conical, Ridge guide, Multi turn loop; Antenna measurement and instrumentation – Gain, Impedance and antenna factor measurement; Antenna test range Design.

TOTAL: 45 PERIODS

REFERENCES:

1. Balanis.A, "Antenna Theory Analysis and Design", John Wiley and Sons, New York, 1982.
2. Krauss.J.D, "Antennas", II edition, John Wiley and sons, New York, 1997.
3. I.J. Bahl and P. Bhartia," Microstrip Antennas",Artech House,Inc.,1980
4. W.L.Stutzman and G.A.Thiele,"Antenna Theory and Design", 2nd edition,John Wiley& Sons Inc.,1998.

UNIT I	CONSTANT ENVELOPE MODULATION	9
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Advantages of Constant Envelope Modulation; Binary Frequency Shift Keying-Coherent and Non-coherent Detection of BFSK; Minimum Shift Keying-; Gaussian Minimum Shift Keying; M-ary Phase Shift Keying; M-ary Quadrature Amplitude Modulation; M-ary Frequency Shift Keying.

UNIT II OFDM 9

Generation of sub-carriers using the IFFT; Guard Time and Cyclic Extension; Windowing; OFDM signal processing; Peak Power Problem: PAP reduction schemes-Clipping, Filtering, Coding and Scrambling.

UNIT III BLOCK CODED DIGITAL COMMUNICATION 9

Architecture and performance – Binary block codes; Orthogonal; Biorthogonal; Transorthogonal – Shannon’s channel coding theorem; Channel capacity; Matched filter; Concepts of Spread spectrum communication – Coded BPSK and DPSK demodulators – Linear block codes; Hamming; Golay; Cyclic; BCH ; Reed – Solomon codes.

UNIT IV CONVOLUTIONAL CODED DIGITAL COMMUNICATION 9

Representation of codes using Polynomial, State diagram, Tree diagram, and Trellis diagram – Decoding techniques using Maximum likelihood, Viterbi algorithm, Sequential and Threshold methods – Error probability performance for BPSK and Viterbi algorithm, Turbo Coding.

UNIT V	EQUALIZATION TECHNIQUES	9
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Band Limited Channels- ISI – Nyquist Criterion- Controlled ISI-Partial Response signals- Equalization algorithms – Viterbi Algorithm – Linear equalizer – Decision feedback equalization – Adaptive Equalization algorithms.

TOTAL: 45 PERIODS

REFERENCES:

1. M.K.Simon, S.M.Hinedi and W.C.Lindsey, Digital communication techniques; Signalling and detection, Prentice Hall India, New Delhi. 1995.
2. Simon Haykin, Digital communications, John Wiley and sons, 1998
3. Bernard Sklar., 'Digital Communications', second edition, Pearson Education, 2001.
4. John G. Proakis., 'Digital Communication', 4 th edition, Mc Graw Hill Publication, 2001
5. Theodore S.Rappaport., 'Wireless Communications', 2nd edition, Pearson Education, 2002.
6. Stephen G. Wilson., 'Digital Modulation and Coding', First Indian Reprint ,Pearson Education, 2003.
7. Richard Van Nee & Ramjee Prasad., 'OFDM for Multimedia Communications' Artech House Publication. 2001.

UNIT I DISCRETE RANDOM SIGNAL PROCESSING 12

Discrete Random Processes- Ensemble Averages, Stationary processes, Bias and Estimation, Autocovariance, Autocorrelation, Parseval's theorem, Wiener-Khintchine relation, White noise, Power Spectral Density, Spectral factorization, Filtering Random Processes, Special types of Random Processes – ARMA, AR, MA – Yule-Walker equations.

UNIT II SPECTRAL ESTIMATION 12

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 LINEAR ESTIMATION AND PREDICTION 12

Linear prediction – Forward and Backward prediction, Solution of Prony's normal equations, Least mean-squared error criterion, Wiener filter for filtering and prediction, FIR and IIR Wiener filters, Discrete Kalman filter

UNIT IV ADAPTIVE FILTERS 12

FIR adaptive filters – adaptive filter based on steepest descent method- Widrow-Hopf LMS algorithm, Normalized LMS algorithm, Adaptive channel equalization, Adaptive echo cancellation, Adaptive noise cancellation, RLS adaptive algorithm.

UNIT V MULTIRATE DIGITAL SIGNAL PROCESSING 12

Mathematical description of change of sampling rate – Interpolation and Decimation, Decimation by an integer factor, Interpolation by an integer factor, Sampling rate conversion by a rational factor, Polyphase filter structures, Multistage implementation of multirate system, Application to subband coding – Wavelet transform

L: 45 + T : 15 = 60 PERIODS

REFERENCES:

1. Monson H. Hayes, 'Statistical Digital Signal Processing and Modeling', John Wiley and Sons, Inc, Singapore, 2002
2. John J. Proakis, Dimitris G. Manolakis, : Digital Signal Processing', Pearson Education, 2002
3. Rafael C. Gonzalez, Richard E. Woods, " Digital Image Processing", Pearson Education Inc., Second Edition, 2004 (For Wavelet Transform Topic)

UNIT I OPTICAL SYSTEM COMPONENTS 9

Light propagation in optical fibers – Loss & bandwidth, System limitations, Non-Linear effects; Solitons; Optical Network Components – Couplers, Isolators & Circulators, Multiplexers & Filters, Optical Amplifiers, Switches, Wavelength Converters.

UNIT II OPTICAL NETWORK ARCHITECTURES 9

Introduction to Optical Networks; SONET / SDH, Metropolitan-Area Networks, Layered Architecture ; Broadcast and Select Networks – Topologies for Broadcast Networks, Media-Access Control Protocols, Testbeds for Broadcast & Select WDM; Wavelength Routing Architecture.

UNIT III WAVELENGTH ROUTING NETWORKS 9

The optical layer, Node Designs, Optical layer cost tradeoff, Routing and wavelength assignment, Virtual topology design, Wavelength Routing Testbeds, Architectural variations.

UNIT IV PACKET SWITCHING AND ACCESS NETWORKS 9

Photonic Packet Switching – OTDM, Multiplexing and Demultiplexing, Synchronisation, Broadcast OTDM networks, Switch-based networks; Access Networks – Network Architecture overview, Future Access Networks, Optical Access Network Architectures; and OTDM networks.

UNIT V NETWORK DESIGN AND MANAGEMENT 9

Transmission System Engineering – System model, Power penalty - transmitter, receiver, Optical amplifiers, crosstalk, dispersion; Wavelength stabilization ; Overall design considerations; Control and Management – Network management functions, Configuration management, Performance management, Fault management, Optical safety, Service interface.

TOTAL : 45 PERIODS

REFERENCES:

1. Rajiv Ramaswami and Kumar N. Sivarajan, "Optical Networks : A Practical Perspective", Harcourt Asia Pte Ltd., Second Edition 2004.
2. C. Siva Ram Moorthy and Mohan Gurusamy, "WDM Optical Networks : Concept, Design and Algorithms", Prentice Hall of India, 1st Edition, 2002.
3. P.E. Green, Jr., "Fiber Optic Networks", Prentice Hall, NJ, 1993.

1. Channel equalizer design using MATLAB (LMS, RLS)
2. Transform based compression techniques.
3. Antenna Radiation Pattern measurement.
4. Transmission line parameters – Measurement using Network Analyser
5. Performance Evaluation of digital modulation schemes
6. Implementation of Linear and Cyclic Codes.
7. OFDM transceiver design using MATLAB

Performance evaluation of Digital Data Transmission through Fiber Optic Link

TOTAL : 60 PERIODS

**UNIT I CMOS PHYSICS, TRANSCEIVER SPECIFICATIONS
AND ARCHITECTURES**

9

CMOS: Introduction to MOSFET Physics – Noise: Thermal, shot, flicker, popcorn noise
Transceiver Specifications: Two port Noise theory, Noise Figure, THD, IP2, IP3, Sensitivity, SFDR, Phase noise - Specification distribution over a communication link
Transceiver Architectures: Receiver: Homodyne, Heterodyne, Image reject, Low IF Architectures – Transmitter: Direct upconversion, Two step upconversion

UNIT II IMPEDANCE MATCHING AND AMPLIFIERS

9

S-parameters with Smith chart – Passive IC components - Impedance matching networks Amplifiers: Common Gate, Common Source Amplifiers – OC Time constants in bandwidth estimation and enhancement – High frequency amplifier design
Low Noise Amplifiers: Power match and Noise match – Single ended and Differential LNAs – Terminated with Resistors and Source Degeneration LNAs.

UNIT III FEEDBACK SYSTEMS AND POWER AMPLIFIERS

9

Feedback Systems: Stability of feedback systems: Gain and phase margin, Root-locus techniques – Time and Frequency domain considerations – Compensation
Power Amplifiers: General model – Class A, AB, B, C, D, E and F amplifiers – Linearisation Techniques – Efficiency boosting techniques – ACPR metric – Design considerations

PLL: Linearised Model – Noise properties – Phase detectors – Loop filters and Charge pumps

Oscillators: Describing Functions, Colpitts oscillators – Resonators – Tuned Oscillators – Negative resistance oscillators – Phase noise

1. T.Lee, "Design of CMOS RF Integrated Circuits", Cambridge, 2004
2. B.Razavi, "RF Microelectronics", Pearson Education, 1997
3. Jan Crols, Michiel Steyaert, "CMOS Wireless Transceiver Design", Kluwer Academic Publishers, 1997
4. B.Razavi, "Design of Analog CMOS Integrated Circuits", McGraw Hill, 2001

Communication model-software, subsystems, protocol, protocol development methods, Protocol engineering process, Layered architecture, Network services and Interfaces, Protocol functions, OSI model ,TCP/IP protocol suite

Components of protocol, Specifications of Communication service, Protocol entity, Interface, Interactions, Multimedia protocol, Internet protocol, SDL, SDL based protocol-other protocol specification languages

Protocol verification, Verification of a protocol using finite state machines, Protocol validation, protocol design errors, Protocol validation approaches, SDL based protocol verification and validation

Conformance testing methodology and frame work, Conformance test architectures, Test sequence generation methods, Distributed architecture by local methods, Conformance testing with TTCN, systems with semi controllable interfaces - RIP,SDL based tools for conformance testing, SDL based conformance testing of MPLS Performance testing, SDL based performance testing of TCP and OSPF, Interoperability testing, SDL based interoperability testing of CSMA/CD and CSMA/CA protocol using Bridge, Scalability testing

Protocol synthesis, Interactive synthesis algorithm, Automatic synthesis algorithm, Automatic synthesis of SDL from MSC, Protocol Re-synthesis; Requirements of protocol implementation, Object based approach to protocol implementation, Protocol compilers, Tool for protocol engineering

REFERENCES:

1. Pallapa Venkataram and Sunilkumar S.Manvi, "Communication protocol Engineering", Eastern Economy edition, 2004
2. Richard Lai and Jirachiefpattana, "Communication Protocol Specification and Verification", Kluwer Publishers, Boston, 1998.
3. Tarnay, K., "Protocol Specification and Testing", Plenum, New York, 1991.
4. Mohamed G. Gouda, "Elements of Network Protocol Design", John Wiley & Sons, Inc. New York, USA, 1998
5. V.Ahuja, "Design and Analysis of Computer Communication networks", McGraw-Hill, London, 1982.
6. G.J.Holtzmann, "Design and validation of Computer protocols", Prentice Hall, New York, 1991.

Multiplier and Multiplier accumulator – Modified Bus Structures and Memory access in P-DSPs – Multiple access memory – Multi-port memory – VLIW architecture- Pipelining – Special Addressing modes in P-DSPs – On chip Peripherals.

Architecture – Assembly language syntax - Addressing modes – Assembly language Instructions - Pipeline structure, Operation – Block Diagram of DSP starter kit – Application Programs for processing real time signals.

Architecture – Data formats - Addressing modes – Groups of addressing modes-
Instruction sets - Operation – Block Diagram of DSP starter kit – Application Programs
for processing real time signals – Generating and finding the sum of series, Convolution
of two sequences, Filter design

9

UNIT V ADVANCED PROCESSORS

9

TOTAL: 45 PERIODS

1. B.Venkataramani and M.Bhaskar, “Digital Signal Processors – Architecture, Programming and Applications” – Tata McGraw – Hill Publishing Company Limited. New Delhi, 2003.
2. User guides Texas Instrumentation. Analog Devices. Motorola.

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UNIT II TIME DOMAIN METHODS FOR SPEECH PROCESSING

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UNIT III FREQUENCY DOMAIN METHOD FOR SPEECH PROCESSING

9

HOMOMORPHIC SPEECH ANALYSIS:

UNIT IV LINEAR PREDICTIVE ANALYSIS OF SPEECH

10

10

UNIT V APPLICATION OF SPEECH SIGNAL PROCESSING 10
 Algorithms: Spectral Estimation, dynamic time warping, hidden Markov model – Music analysis – Pitch Detection – Feature analysis for recognition –Automatic Speech Recognition – Feature Extraction for ASR – Deterministic sequence recognition – Statistical Sequence recognition – ASR systems – Speaker identification and verification – Voice response system – Speech Synthesis: Text to speech, voice over IP.

TOTAL : 45 PERIODS

REFERENCES:

1. Ben Gold and Nelson Morgan, Speech and Audio Signal Processing, John Wiley and Sons Inc. , Singapore, 2004
2. L.R.Rabiner and R.W.Schaffer – Digital Processing of Speech signals – Prentice Hall -1978
3. Quatieri – Discrete-time Speech Signal Processing – Prentice Hall – 2001.
4. J.L.Flanagan – Speech analysis: Synthesis and Perception – 2nd edition – Berlin – 1972
5. I.H.Witten – – Principles of Computer Speech – Academic Press – 1982

CU9256 NETWORK ROUTING ALGORITHMS L T P C
3 0 0 3
UNIT I INTRODUCTION 7

ISO OSI Layer Architecture, TCP/IP Layer Architecture, Functions of Network layer, General Classification of routing, Routing in telephone networks, Dynamic Non hierarchical Routing (DNHR), Trunk status map routing (TSMR), real-time network routing (RTNR), Distance vector routing, Link state routing, Hierarchical routing.

UNIT II INTERNET ROUTING 10
 Interior protocol : Routing Information Protocol (RIP), Open Shortest Path First (OSPF), Bellman Ford Distance Vector Routing. Exterior Routing Protocols: Exterior Gateway Protocol (EGP) and Border Gateway Protocol (BGP). Multicast Routing: Pros and cons of Multicast and Multiple Unicast Routing, Distance Vector Multicast Routing Protocol (DVMRP), Multicast Open Shortest Path First (MOSPF), MBONE, Core Based Tree Routing.

UNIT III ROUTING IN OPTICAL WDM NETWORKS 10
 Classification of RWA algorithms, RWA algorithms, Fairness and Admission Control, Distributed Control Protocols, Permanent Routing and Wavelength Requirements, Wavelength Rerouting- Benefits and Issues, Lightpath Migration, Rerouting Schemes, Algorithms- AG, MWPG.

UNIT IV MOBILE - IP NETWORKS 9
 Macro-mobility Protocols, Micro-mobility protocol: Tunnel based : Hierarchical Mobile IP, Intra domain Mobility Management, Routing based: Cellular IP, Handoff Wireless Access Internet Infrastructure (HAWAI).

UNIT V MOBILE AD –HOC NETWORKS**9**

Internet-based mobile ad-hoc networking communication strategies, Routing algorithms – Proactive routing: destination sequenced Distance Vector Routing (DSDV), Reactive routing: Dynamic Source Routing (DSR), Ad hoc On-Demand Distance Vector Routing (AODV), Hybrid Routing: Zone Based Routing (ZRP).

TOTAL: 45 PERIODS**REFERENCES:**

1. William Stallings, 'High speed networks and Internets Performance and Quality of Service', IInd Edition, Pearson Education Asia. Reprint India 2002
2. M. Steen Strub, 'Routing in Communication network, Prentice –Hall International, Newyork,1995.
3. S. Keshav, 'An engineering approach to computer networking' Addison Wesley 1999.
4. William Stallings, 'High speed Networks TCP/IP and ATM Design Principles, Prentice- Hall, New York, 1995
5. C.E Perkins, 'Ad Hoc Networking', Addison – Wesley, 2001
6. Ian F. Akyildiz, Jiang Xie and Shantidev Mohanty, "A Survey of mobility Management in Next generation All IP- Based Wireless Systems", IEEE Wireless Communications Aug.2004, pp 16-27.
7. A.T Campbell et al., "Comparison of IP Micromobility Protocols," IEEE Wireless Communications Feb.2002, pp 72-82.
8. C.Siva Rama Murthy and Mohan Gurusamy, "WDM Optical Networks – Concepts, Design and Algorithms", Prentice Hall of India Pvt. Ltd, New Delhi –2002.

CU9253**GLOBAL POSITIONING SYSTEMS****L T P C
3 0 0 3****UNIT I****9**

History of GPS – BC-4 System – HIRAN – NNSS – NAVSTAR GLONASS and GNSS Systems – GPS Constellation – Space Segment – Control Segment – User Segment – Single and Dual Frequency – Point – Relative – Differential GPS – Static and Kinematic Positioning – 2D and 3D – reporting Anti Spoofing (AS); Selective Availability (SA) – DOP Factors.

UNIT II**9**

Coordinate Systems – Geo Centric Coordinate System – Conventional Terrestrial Reference System – Orbit Description – Keplerian Orbit – Kepler Elements – Satellite Visibility – Topocentric Motion – Disturbed Satellite Motion – Perturbed Motion – Disturbing Accelerations - Perturbed Orbit – Time Systems – Astronomical Time System – Atomic Time – GPS Time – Need for Coordination – Link to Earth Rotation – Time and Earth Motion Services.

UNIT III**9**

C/A code; P-code; Y-code; L1, L2 Carrier frequencies – Code Pseudo Ranges – Carriers Phases – Pseudo Ranges – Satellite Signal Signature – Navigation Messages and Formats – Undifferenced and Differenced Range Models – Delta Ranges – Signal Processing and Processing Techniques – Tracking Networks – Ephemerides – Data Combination: Narrow Lane; Wide Lane – OTF Ambiguity.

UNIT IV **9**
 Propagation Media – Multipath – Antenna Phase Centre – Atmosphere in brief – Elements of Wave Propagation – Ionospheric Effects on GPS Observations – Code Delay – Phase Advances – Integer Bias – Clock Error – Cycle Slip – Noise-Bias – Blunders – Tropospheric Effects on GPS Observables – Multipath Effect – Antenna Phase Centre Problems and Correction.

UNIT V **9**
 Inter Disciplinary Applications – Crystal Dynamics – Gravity Field Mapping – Atmospheric Occultation – Surveying – Geophysics – Air borne GPS – Ground Transportation – Space borne GPS – Metrological and Climate Research using GPS.

TOTAL: 45 PERIODS

REFERENCES:

1. B.Hoffman - Wellenhof, H.Lichtenegger and J.Collins, "GPS: Theory and Practice", 4th revised edition, Springer, Wein, New york,1997
 2. A.Leick, "GPS Satellites Surveying", 2nd edition, John Wiley & Sons, New York, 1995
 3. B.Parkinson, J.Spilker, Jr.(Eds), "GPS: Theory and Applications", Vol.I & Vol.II, AIAA, 370 L'Enfant Promenade SW, Washington, DC 20024, 1996
 4. A.Kleusberg and P.Teunissen(Eds), "GPS for Geodesy", Springer-Verlag, Berlin, 1996
 5. L.Adams, "The GPS - A Shared National Asset", Chair, National Academy Press, Washington, DC, 1995
- Websites:
6. <http://www.auslig.gov.au>
 7. <http://igscb.jpl.nasa.gov>
 8. <http://gibs.leipzig.ifag.de>
 9. <http://www.navcen.uscg.mil>

CU9257 **COMMUNICATION NETWORK SECURITY** **L T P C**
3 0 0 3

UNIT I **INTRODUCTION ON SECURITY** **9**
 Security Goals, Types of Attacks: Passive attack, active attack, attacks on confidentiality, attacks on Integrity and availability. Security services and mechanisms, Techniques : Cryptography, Steganography , Revision on Mathematics for Cryptography.

UNIT II **SYMMETRIC & ASYMMETRIC KEY ALGORITHMS** **9**
 Substitutional Ciphers, Transposition Ciphers, Stream and Block Ciphers, Data Encryption Standards (DES), Advanced Encryption Standard (AES), RC4, principle of asymmetric key algorithms, RSA Cryptosystem

UNIT III **INTEGRITY, AUTHENTICATION AND KEY MANAGEMENT** **9**
 Message Integrity, Hash functions : SHA, Digital signatures : Digital signature standards. Authentication : Entity Authentication: Biometrics, Key management Techniques.

UNIT IV NETWORK SECURITY , FIREWALLS AND WEB SECURITY 9

Introduction on Firewalls, Types of Firewalls, Firewall Configuration and Limitation of Firewall. IP Security Overview, IP security Architecture, authentication Header, Security payload, security associations, Key Management. Web security requirement, secure sockets layer, transport layer security, secure electronic transaction, dual signature

UNIT V WIRELESS NETWORK SECURITY 9

Security Attack issues specific to Wireless systems: Worm hole, Tunneling, DoS. WEP for Wi-Fi network, Security for 4G networks: Secure Ad hoc Network, Secure Sensor Network

TOTAL: 45 PERIODS

REFERENCES:

1. Behrouz A. Fourcuzan ,” Cryptography and Network security” Tata McGraw- Hill, 2008
2. William Stallings,”Cryptography and Network security: principles and practice”,2ndEdition,Prentice Hall of India,New Delhi,2002
3. Atul Kahate ,” Cryptography and Network security”, 2nd Edition, Tata McGraw-Hill, 2008
4. R.K.Nichols and P.C. Lekkas ,” Wireless Security”
5. H. Yang et al., Security in Mobile Ad Hoc Networks: Challenges and Solution, IEEE Wireless Communications, Feb. 2004.
6. Securing Ad Hoc Networks,” IEEE Network Magazine, vol. 13, no. 6, pp. 24-30, December 1999.
7. "Security of Wireless Ad Hoc Networks,"
<http://www.cs.umd.edu/~aram/wireless/survey.pdf>.
8. David Boel et.al (Jan 2008) “Securing Wireless Sensor Networks – Security Architecture “ Journal of networks , Vol.3. No. 1. pp. 65 -76.
9. Perrig, A., Stankovic, J., Wagner, D. (2004), “Security in Wireless Sensor Networks”, *Communications of the ACM*, 47(6), 53-57.

CP9254

SOFT COMPUTING

**L T P C
3 0 0 3**

UNIT I INTRODUCTION TO SOFT COMPUTING AND NEURAL NETWORKS 9

Evolution of Computing - Soft Computing Constituents – From Conventional AI to Computational Intelligence - Machine Learning Basics

UNIT II GENETIC ALGORITHMS 9

Introduction to Genetic Algorithms (GA) – Applications of GA in Machine Learning - Machine Learning Approach to Knowledge Acquisition.

UNIT III NEURAL NETWORKS 9

Machine Learning Using Neural Network, Adaptive Networks – Feed forward Networks – Supervised Learning Neural Networks – Radial Basis Function Networks - Reinforcement Learning – Unsupervised Learning Neural Networks – Adaptive Resonance architectures – Advances in Neural networks.

UNIT IV FUZZY LOGIC 9
 Fuzzy Sets – Operations on Fuzzy Sets – Fuzzy Relations – Membership Functions-
 Fuzzy Rules and Fuzzy Reasoning – Fuzzy Inference Systems – Fuzzy Expert Systems
 – Fuzzy Decision Making.

UNIT V NEURO-FUZZY MODELING 9
 Adaptive Neuro-Fuzzy Inference Systems – Coactive Neuro-Fuzzy Modeling –
 Classification and Regression Trees – Data Clustering Algorithms – Rulebase Structure
 Identification – Neuro-Fuzzy Control – Case studies.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, "Neuro-Fuzzy and Soft Computing", Prentice-Hall of India, 2003.
2. George J. Klir and Bo Yuan, "Fuzzy Sets and Fuzzy Logic-Theory and Applications", Prentice Hall, 1995.
3. James A. Freeman and David M. Skapura, "Neural Networks Algorithms, Applications, and Programming Techniques", Pearson Edn., 2003.

REFERENCES:

1. Mitchell Melanie, "An Introduction to Genetic Algorithm", Prentice Hall, 1998.
2. David E. Goldberg, "Genetic Algorithms in Search, Optimization and Machine Learning", Addison Wesley, 1997.
3. S. N. Sivanandam, S. Sumathi and S. N. Deepa, "Introduction to Fuzzy Logic using MATLAB", Springer, 2007.
4. S.N.Sivanandam · S.N.Deepa, " Introduction to Genetic Algorithms", Springer, 2007.
5. Jacek M. Zurada, "Introduction to Artificial Neural Systems", PWS Publishers, 1992.

CU9254 DIGITAL COMMUNICATION RECEIVERS L T P C
3 0 0 3

UNIT I REVIEW OF DIGITAL COMMUNICATION TECHNIQUES 9
 Base band and band pass communication; signal space representation, linear and
 nonlinear modulation techniques, and Spectral characteristics of digital modulation

UNIT II OPTIMUM RECEIVERS FOR AWGN CHANNEL 9
 Correlation demodulator, matched filter , maximum likelihood sequence detector,
 optimum receiver for CPM signals, M-ary orthogonal signals, envelope detectors for M-
 ary and correlated binary signals

UNIT III RECEIVERS FOR FADING CHANNELS 9
 Characterization of fading multiple channels, statistical models, slow fading, frequency
 selective fading,, diversity technique, RAKE demodulator, coded waveform for fading
 channel

Carrier and signal synchronization, carrier phase estimation-PLL, Decision directed loops, symbol timing estimation, maximum likelihood and non-decision directed timing estimation, joint estimation

Zero forcing algorithm, LMS algorithm, adaptive decision-feedback equalizer and Equalization of Trellis-coded signals. Kalman algorithm, blind equalizers and stochastic gradient algorithm.

REFERENCES:

1. Heinrich Meyer, Mare Moeneclacy, Stefan.A.Fechtel, " Digital communication receivers ", Vol I & Vol II, John Wiley, New York, 1997.
2. John.G.Proakis, "Digital communication "4th Edition, McGraw-Hill, New York, 2001.
3. E.A.Lee and D.G. Messerschmitt, "Digital communication ", 2nd Edition, Allied Publishers, New Delhi, 1994.
4. Simon Marvin, "Digital communication over fading channel; An unified approach to performance Analysis ", John Wiley, New York, 2000.

Instruction Set – Data formats –Addressing modes – Memory hierarchy –register file – Cache – Virtual memory and paging – Segmentation- pipelining –the instruction pipeline – pipeline hazards – instruction level parallelism – reduced instruction set –Computer principles – RISC versus CISC

CPU Architecture- Bus Operations – Pipelining – Branch predication – floating point unit- Operating Modes –Paging – Multitasking – Exception and Interrupts – Instruction set – addressing modes – Programming the Pentium processor.

Organization of CPU – Bus architecture –Memory management unit - ARM instruction set- Thumb Instruction set- addressing modes – Programming the ARM processor.

Instruction set addressing modes – operating modes- Interruptsystem- RTC-Serial Communication Interface – A/D Converter PWM and UART.

CPU Architecture – Instruction set – interrupts- Timers- I²C Interfacing –UART- A/D Converter –PWM and introduction to C-Compilers.

16

REFERENCES:

1. Daniel Tabak , " Advanced Microprocessors" McGraw Hill.Inc., 1995
2. James L. Antonakos , " The Pentium Microprocessor " Pearson Education , 1997.
3. Steve Furber , " ARM System –On –Chip architecture " Addison Wesley , 2000.
4. Gene .H.Miller . " Micro Computer Engineering , " Pearson Education , 2003.
5. John .B.Peatman , " Design with PIC Microcontroller , Prentice hall, 1997.
6. James L.Antonakos , " An Introduction to the Intel family of Microprocessors " Pearson Education 1999.
7. Barry.B.Breg," The Intel Microprocessors Architecture , Programming and Interfacing " , PHI,2002.
8. Valvano "Embedded Microcomputer Systems" Thomson Asia PVT LTD first reprint 2001

AP9251

DIGITAL IMAGE PROCESSING

L T P C
3 0 0 3

UNIT I DIGITAL IMAGE FUNDAMENTALS

9

Elements of digital image processing systems, Vidicon and 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

Histogram modification, Noise distributions, Spatial averaging, Directional Smoothing, Median, Geometric mean, Harmonic mean, Contraharmonic and Yp mean filters . Design of 2D FIR filters.

Image restoration - degradation model, Unconstrained and Constrained restoration, Inverse filtering-removal of blur caused by uniform linear motion, Wiener filtering, Geometric transformations-spatial transformations, Gray Level interpolation. .

UNIT IV IMAGE SEGMENTATION AND RECOGNITION

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., Neural networks-Backpropagation network and training, Neural network to recognize shapes.

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 standard, JPEG 2000, EZW, SPIHT, MPEG.

TOTAL: 45PERIODS

REFERENCES:

1. Rafael C. Gonzalez, Richard E. Woods, " Digital Image Processing", Pearson Education, Inc., Second Edition, 2004
2. Anil K. Jain, "Fundamentals of Digital Image Processing", Prentice Hall of India, 2002.
3. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins," Digital Image Processing using MATLAB", Pearson Education, Inc., 2004.
4. D.E. Dudgeon and R.M. Mersereau, "Multidimensional Digital Signal Processing", Prentice Hall Professional Technical Reference, 1990.
5. William K. Pratt, " Digital Image Processing", John Wiley, New York, 2002.
6. Milan Sonka et al, "Image Processing, Analysis and Machine Vision", Brookes/Cole, Vikas Publishing House, 2nd edition, 1999;
7. Sid Ahmed, M.A., " Image Processing Theory, Algorithms and Architectures", McGrawHill, 1995.

CU9255**INTERNETWORKING MULTIMEDIA****L T P C
3 0 0 3****UNIT I INTRODUCTION****9**

Digital sound, video and graphics, basic multimedia networking, multimedia characteristics, evolution of Internet services model, network requirements for audio/video transform, multimedia coding and compression for text, image, audio and video. Multimedia communication in wireless network.

UNIT II SUBNETWORK TECHNOLOGY**9**

Broadband services, ATM and IP , IPV6, High speed switching, resource reservation, Buffer management, traffic shaping, caching, scheduling and policing, throughput, delay and jitter performance.

UNIT III MULTICAST AND TRANSPORT PROTOCOL**9**

Multicast over shared media network, multicast routing and addressing, scaping multicast and NBMA networks, Reliable transport protocols, TCP adaptation algorithm, RTP, RTCP.

UNIT IV MEDIA - ON – DEMAND**9**

Storage and media servers, voice and video over IP, MPEG-2 over ATM/IP, indexing synchronization of requests, recording and remote control.

UNIT V APPLICATIONS**9**

MIME, Peer-to-peer computing, shared application, video conferencing, centralized and distributed conference control, distributed virtual reality, light weight session philosophy.

TOTAL:45 PERIODS**REFERENCES:**

1. Jon Crowcroft, Mark Handley, Ian Wakeman. "Internetworking Multimedia", Harcourt Asia Pvt.Ltd.Singapore, 1998.
2. B.O. Szuprowicz, "Multimedia Networking", McGraw Hill, NewYork. 1995
3. Tay Vaughan,Multimedia making it to work, 4ed,Tata McGrawHill, NewDelhi,2000.
4. Ellen kayata wesel, Ellen Khayata, "Wireless Multimedia Communication: Networking Video, Voice and Data", Addison Wesley Longman Publication, USA, 1998.

UNIT I	EMI/EMC CONCEPTS	9
EMI-EMC definitions and Units of parameters; Sources and victim of EMI; Conducted and Radiated EMI Emission and Susceptibility; Transient EMI, ESD; Radiation Hazards.		
UNIT II	EMI COUPLING PRINCIPLES	9
Conducted, radiated and transient coupling; Common ground impedance coupling ; Common mode and ground loop coupling ; Differential mode coupling ; Near field cable to cable coupling, cross talk ; Field to cable coupling ; Power mains and Power supply coupling.		
UNIT III	EMI CONTROL TECHNIQUES	9
Shielding, Filtering, Grounding, Bonding, Isolation transformer, Transient suppressors, Cable routing, Signal control.		
UNIT IV	EMC DESIGN OF PCBS	9
Component selection and mounting; PCB trace impedance; Routing; Cross talk control; Power distribution decoupling; Zoning; Grounding; VIAs connection; Terminations.		
UNIT V	EMI MEASUREMENTS AND STANDARDS	9
Open area test site; TEM cell; EMI test shielded chamber and shielded ferrite lined anechoic chamber; Tx /Rx Antennas, Sensors, Injectors / Couplers, and coupling factors; EMI Rx and spectrum analyzer; Civilian standards-CISPR, FCC, IEC, EN; Military standards-MIL461E/462.		
TOTAL:45PERIODS		

REFERENCES:

1. V.P.Kodali, "Engineering EMC Principles, Measurements and Technologies", IEEE Press, Newyork, 1996.
2. Henry W.Ott., "Noise Reduction Techniques in Electronic Systems", A Wiley Inter Science Publications, John Wiley and Sons, Newyork, 1988.
3. Bernhard Keiser, "Principles of Electromagnetic Compatibility", 3rd Ed, Artech house, Norwood, 1986.
4. C.R.Paul, "Introduction to Electromagnetic Compatibility", John Wiley and Sons, Inc, 1992.
5. Don R.J.White Consultant Incorporate, "Handbook of EMI/EMC", Vol I-V, 1988.

UNIT I	INTRODUCTION	9
Review of OSI, TCP/IP; Multiplexing, Modes of Communication, Switching, Routing. SONET – DWDM – DSL – ISDN – BISDN, ATM.		

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.

VPN-Remote-Access VPN, site-to-site VPN, Tunneling to PPP, Security in VPN.MPLS-operation, Routing, Tunneling and use of FEC, Traffic Engineering, MPLS based VPN, overlay networks-P2P connections.

Little's theorem, Need for modeling , Poisson modeling and its failure, Non- poisson models, Network performance evaluation.

Principles of cryptography – Authentication – integrity – key distribution and certification – Access control and: fire walls – attacks and counter measures – security in many layers. Infrastructure for network management – The internet standard management framework – SMI, MIB, SNMP, Security and administration – ASN.1

1. J.F. Kurose & K.W. Ross, "Computer Networking- A top down approach featuring the internet", Pearson, 2nd edition, 2003.
2. Walrand .J. Varatya, High performance communication network, Morgan Kauffman – Harcourt Asia Pvt. Ltd. 2nd Edition, 2000.
3. LEOM-GarCIA, WIDJAJA, "Communication networks", TMH seventh reprint 2002.
4. Aunurag kumar, D. MANjunath, Joy kuri, "Communication Networking", Morgan Kaufmann Publishers, 1ed 2004.
5. Hersent Gurle & petit, "IP Telephony, packet Pored Multimedia communication Systems", Pearson education 2003.
6. Fred Halsall and Lingana Gouda Kulkarni, "Computer Networking and the Internet" fifth edition, Pearson education
7. Nader F.Mir ,Computer and Communication Networks, first edition.
8. Larry I.Peterson&Bruce S.David, "Computer Networks: A System Approach"- 1996

LTPC
3003

Embedded Computers, Characteristics of Embedded Computing Applications, Challenges in Embedded Computing system design, Embedded system design process-Requirements, Specification, Architectural Design, Designing Hardware and Software Components, System Integration, Formalism for System Design- Structural Description, Behavioural Description, Design Example: Model Train Controller, ARM processor-processor and memory organization.

UNIT II EMBEDDED PROCESSOR AND COMPUTING PLATFORM 9

Data operations, Flow of Control, SHARC processor- Memory organization, Data operations, Flow of Control, parallelism with instructions, CPU Bus configuration, ARM Bus, SHARC Bus, Memory devices, Input/output devices, Component interfacing, designing with microprocessor development and debugging, Design Example : Alarm Clock. Hybrid Architecture

UNIT III NETWORKS 9

Distributed Embedded Architecture- Hardware and Software Architectures, Networks for embedded systems- I2C, CAN Bus, SHARC link supports, Ethernet, Myrinet, Internet, Network-Based design- Communication Analysis, system performance Analysis, Hardware platform design, Allocation and scheduling, Design Example: Elevator Controller.

UNIT IV REAL-TIME CHARACTERISTICS 9

Clock driven Approach, weighted round robin Approach, Priority driven Approach, Dynamic Versus Static systems, effective release times and deadlines, Optimality of the Earliest deadline first (EDF) algorithm, challenges in validating timing constraints in priority driven systems, Off-line Versus On-line scheduling.

UNIT V SYSTEM DESIGN TECHNIQUES 9

Design Methodologies, Requirement Analysis, Specification, System Analysis and Architecture Design, Quality Assurance, Design Example: Telephone PBX- System Architecture, Ink jet printer- Hardware Design and Software Design, Personal Digital Assistants, Set-top Boxes.

TOTAL: 45 PERIODS

REFERENCES:

1. Wayne Wolf, "Computers as Components: Principles of Embedded Computing System Design", Morgan Kaufman Publishers.
2. Jane.W.S. Liu, "Real-Time systems", Pearson Education Asia.
3. C. M. Krishna and K. G. Shin, "Real-Time Systems", McGraw-Hill, 1997
4. Frank Vahid and Tony Givargis, "Embedded System Design: A Unified Hardware/Software Introduction", John Wiley & Sons.

**CP9253 HIGH SPEED SWITCHING ARCHITECTURES L T P C
3 0 0 3**

UNIT I LAN SWITCHING TECHNOLOGY 9

Switching Concepts, switch forwarding techniques, switch path control, LAN Switching, cut through forwarding, store and forward, virtual LANs.

UNIT II ATM SWITCHING ARCHITECTURE 9

Blocking networks - basic - and- enhanced banyan networks, sorting networks - merge sorting, re-arrangeable networks - full-and- partial connection networks, non blocking networks - Recursive network construction, comparison of non-blocking network, Switching with deflection routing - shuffle switch, tandem banyan switch.

UNIT III QUEUES IN ATM SWITCHES 9

Internal Queueing -Input, output and shared queueing, multiple queueing networks – combined Input, output and shared queueing - performance analysis of Queued switches.

UNIT IV PACKET SWITCHING ARCHITECTURES 9

Architectures of Internet Switches and Routers- Bufferless and buffered Crossbar switches, Multi-stage switching, Optical Packet switching; Switching fabric on a chip; Internally buffered Crossbars.

UNIT V IP SWITCHING 9

Addressing model, IP Switching types - flow driven and topology driven solutions, IP Over ATM address and next hop resolution, multicasting, Ipv6 over ATM.

TOTAL : 45 PERIODS

REFERENCES:

1. Achille Pattavina, "Switching Theory: Architectures and performance in Broadband ATM networks ", John Wiley & Sons Ltd, New York. 1998
2. Elhanany M. Hamdi, "High Performance Packet Switching architectures", Springer Publications, 2007.
3. Christopher Y Metz, "Switching protocols & Architectures", McGraw - Hill Professional Publishing, NewYork.1998.
4. Rainer Handel, Manfred N Huber, Stefan Schroder, "ATM Networks - Concepts Protocols, Applications", 3rd Edition, Addison Wesley, New York. 1999.

AFFILIATED INSTITUTIONS
ANNA UNIVERSITY, CHENNAI
REGULATIONS - 2009

CURRICULUM II TO IV SEMESTERS (FULL TIME)

M.E. COMMUNICATION SYSTEMS

SEMESTER II

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	CU9221	<u>Wireless Mobile Communication</u>	3	0	0	3
2	CU9222	<u>Multimedia Compression Techniques</u>	3	0	0	3
3	CU9223	<u>Microwave Integrated Circuits</u>	2	0	2	3
4	CU9224	<u>Satellite Communication</u>	3	0	0	3
5	E2	Elective II	3	0	0	3
6	E3	Elective III	3	0	0	3
PRACTICAL						
7	CU9228	<u>Communication System Lab II</u>	0	0	4	2
TOTAL			17	0	6	20

SEMESTER III

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	E4	Elective IV	3	0	0	3
2	E5	Elective V	3	0	0	3
3	E6	Elective VI	3	0	0	3
PRACTICAL						
4	CU9234	Project Work (Phase I)	0	0	12	6
TOTAL			9	0	12	15

SEMESTER IV

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
PRACTICAL						
1	CU9241	Project Work (Phase II)	0	0	24	12
TOTAL			0	0	24	12

Total No.of credits to be earned for the award of Degree: 21 +20+15+12 =68

LIST OF ELECTIVES
M.E. COMMUNICATION SYSTEMS

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
1	AP9258	<u>RF System Design</u>	3	0	0	3
2	CU9251	<u>Communication protocol Engineering</u>	3	0	0	3
3	VL9265	<u>DSP Processor Architecture and programming</u>	3	0	0	3
4	VL9264	<u>Digital Speech Signal Processing</u>	3	0	0	3
5	CU9256	<u>Network Routing Algorithms</u>	3	0	0	3
6	CU9253	<u>Global Positioning Systems</u>	3	0	0	3
7	CU9257	<u>Communication Network Security</u>	3	0	0	3
8	CP9254	<u>Soft Computing</u>	3	0	0	3
9	CU9254	<u>Digital Communication Receivers</u>	3	0	0	3
10	AP9213	<u>Advanced Microprocessors and Microcontrollers</u>	3	0	0	3
11	AP9251	<u>Digital Image Processing</u>	3	0	0	3
12	CU9255	<u>Internetworking multimedia</u>	3	0	0	3
13	AP9256	<u>Electromagnetic Interference and Compatibility in System Design</u>	3	0	0	3
14	CP9212	<u>High Performance Computer Networks</u>	3	0	0	3
15	AP9224	<u>Embedded systems</u>	3	0	0	3
16	CP9253	<u>High Speed Switching Architectures</u>	3	0	0	3
17	CU9258	<u>Network Management</u>	3	0	0	3
18	CU9259	<u>Telecommunication System Modeling and Simulation</u>	3	0	0	3
19		Special Elective	3	0	0	3

UNIT I THE WIRELESS CHANNEL 9

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 8

Fading– Outage Probability– Average Probability of Error — Combined Outage and Average Error Probability – Doppler Spread – Intersymbol Interference.

UNIT III DIVERSITY 9

Realization of Independent Fading Paths – Receiver Diversity – Selection Combining – Threshold Combining – Maximal-Ratio Combining – Equal - Gain Combining – Transmitter Diversity – Channel known at Transmitter – Channel unknown at Transmitter – The Alamouti Scheme.

UNIT IV MULTICARRIER MODULATION 10

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 SPREAD SPECTRUM 9

Spread Spectrum Principles – Direct Sequence Spread Spectrum – Spreading Codes- Synchronization- RAKE receivers- Frequency Hopping Spread Spectrum – Multiuser DSSS Systems – Multiuser FHSS Systems.

TOTAL: 45 PERIODS**REFERENCES:**

1. Andrea Goldsmith, Wireless Communications, Cambridge University Press, 2005
2. David Tse and Pramod Viswanath, Fundamentals of Wireless Communication, Cambridge University Press, 2005.
3. W.C.Y.Lee, Mobile Communication Engineering, Mc Graw Hill, 2000
4. A.Paulraj, R.Nabar, D.Gore, Introduction to Space-Time Wireless Communication, Cambridge University Press, 2003.
5. T.S. Rappaport, Wireless Communications, Pearson Education, 2003

UNIT I INTRODUCTION 9

Special features of Multimedia – Graphics and Image Data Representations - Fundamental Concepts in Video and Digital Audio – Storage requirements for multimedia applications -Need for Compression - Taxonomy of compression techniques – Overview of source coding, source models, scalar and vector quantization theory – Evaluation techniques – Error analysis and methodologies

UNIT II TEXT COMPRESSION 9

Compaction techniques – Huffman coding – Adaptive Huffman Coding – Arithmetic coding – Shannon-Fano coding – Dictionary techniques – LZW family algorithms.

UNIT III AUDIO COMPRESSION 9

Audio compression techniques - μ - Law and A- Law companding. Frequency domain and filtering – Basic sub-band coding – Application to speech coding – G.722 – Application to audio coding – MPEG audio, progressive encoding for audio – Silence compression, speech compression techniques – Formant and CELP Vocoders

UNIT IV IMAGE COMPRESSION 9

Predictive techniques – DM, PCM, DPCM: Optimal Predictors and Optimal Quantization – Contour based compression – Transform Coding – JPEG Standard – Sub-band coding algorithms: Design of Filter banks – Wavelet based compression: Implementation using filters – EZW, SPIHT coders – JPEG 2000 standards - JBIG, JBIG2 standards.

UNIT V VIDEO COMPRESSION 9

Video compression techniques and standards – MPEG Video Coding I: MPEG – 1 and 2 – MPEG Video Coding II: MPEG – 4 and 7 – Motion estimation and compensation techniques – H.261 Standard – DVI technology – PLV performance – DVI real time compression – Packet Video.

TOTAL: 45 PERIODS

REFERENCES:

1. Khalid Sayood : Introduction to Data Compression, Morgan Kauffman Harcourt India, 2nd Edition, 2000.
2. David Salomon : Data Compression – The Complete Reference, Springer Verlag New York Inc., 2nd Edition, 2001.
3. Yun Q.Shi, Huifang Sun : Image and Video Compression for Multimedia Engineering - Fundamentals, Algorithms & Standards, CRC press, 2003.
4. Peter Symes : Digital Video Compression, McGraw Hill Pub., 2004.
5. Mark Nelson : Data compression, BPB Publishers, New Delhi, 1998.
6. Mark S.Drew, Ze-Nian Li : Fundamentals of Multimedia, PHI, 1st Edition, 2003.
7. Watkinson, J : Compression in Video and Audio, Focal press, London, 1995.
8. Jan Vozer : Video Compression for Multimedia, AP Profes, New York, 1995

UNIT I INTRODUCTION TO MICROWAVE INTEGRATED CIRCUITS 4

MMIC- technology, advantages and applications, Active device technologies, design approaches, multichip module technology, substrates.

UNIT II PASSIVE COMPONENTS 7

Inductors, capacitors, resistors, microstrip components, coplanar circuits, multilayer techniques, micromachined passive components, switches & attenuators, filter design.

UNIT III AMPLIFIERS 7

Stability & gain analysis, matching techniques, reactively matched amplifier design, LNA

UNIT IV OSCILLATORS 6

Design principles, active device CAD techniques for large signal oscillators design, phase noise, MMIC_VCO, mixers.

UNIT V INTEGRATED ANTENNAS AND MEASUREMENT TECHNIQUES 6

Integrates antenna selection, photonic band gap antennas, micro machined antenna, micro electro mechanical system antennas, test fixture measurements, probe station measurements, thermal and cryogenic measurements, experimental field probing techniques.

(using ADS / IE3D)

1. Design of Phase shifters
2. Design of Directional couplers
3. Design of Filters
4. Design of Impedance matching Networks
5. Design of Branch line couplers
6. Stability analysis using ZY Smith chart
7. Photonic and Electronic band gap antennas design-basics

TOTAL : 60 PERIODS

REFERENCES:

1. Ravender Goyal, "Monolithic MIC; Technology & Design", Artech House, 1989.
2. Gupta K.C. and Amarjit Singh, " Microwave Integrated Circuits", John Wiley, New York, 1975.
3. Hoffman R.K. "Handbook of Microwave Integrated Circuits", Artech House, Boston, 1987.
4. Ulrich L. Rohde and David P.N., " RF / Microwave Circuit Design for Wireless Applications", John Wiley, 2000.
5. C. Gentili, " Microwave Amplifiers and Oscillators", North Oxford Academic, 1986.
6. Annapurna Das and Sisir K Das, " Microwave Engineering", Tata McGraw-Hill Pub. Co. Ltd., 2004.
7. Samuel. Y. Liao, " Microwave Circuit Analysis and Amplifier Design", Prentice Hall. Inc., 1987.
8. Mathew N.O. Sadiku, "Numerical techniques in Electromagnetics", CRC Press, 2001.

UNIT I ELEMENTS OF SATELLITE COMMUNICATION 8

Satellite Systems, Orbital description and Orbital mechanics of LEO, MEO and GSO, Placement of a Satellite in a GSO, Satellite – description of different Communication subsystems, Bandwidth allocation.

**UNIT II TRANSMISSION, MULTIPLEXING, MODULATION,
MULTIPLE ACCESS AND CODING 12**

Different modulation and Multiplexing Schemes, Multiple Access Techniques – FDMA, TDMA, CDMA, and DAMA, Coding Schemes.

UNIT III SATELLITE LINK DESIGN 9

Basic link analysis, Interference analysis, Rain induced attenuation and interference, Ionospheric characteristics, Link Design with and without frequency reuse.

**UNIT IV SATELLITE NAVIGATION AND GLOBAL POSITIONING
SYSTEM 8**

Radio and Satellite Navigation, GPS Position Location Principles, GPS Receivers and Codes, Satellite Signal Acquisition, GPS Receiver Operation and Differential GPS

UNIT V APPLICATIONS 8

Satellite Packet Communications , Intelsat series – INSAT series –VSAT, mobile satellite services, IMMERSAT, Satellite and Cable Television, DBS (DTH), VSAT, Satellite Phones.

TOTAL : 45 PERIODS**REFERENCES:**

1. Wilbur L. Pritchard, H.G. Suyderhoud ,Robert A.Nelson, Satellite Communication Systems Engineering, Prentice Hall, New Jersey, 2006.
2. Timothy Pratt and Charles W.Bostain, Satellite Communications, John Wiley and Sons, 2003.
3. D.Roddy, Satellite Communication, McGrawHill, 2006.
4. Tri T Ha, Digital Satellite Communication, McGrawHill,1990.
5. B.N.Agarwal, Design of Geosynchronous Spacecraft, Prentice Hall, 1993

1. Simulation of Audio and speech compression algorithms
2. Simulation of EZW / SPIHT Image coding algorithm.
3. Simulation of Microstrip Antennas
4. S-parameter estimation of Microwave devices.
5. Study of Global Positioning System.

6. Performance evaluation of simulated CDMA System.
7. Design and testing of a Microstrip coupler.
8. Characteristics of $\lambda/4$ and $\lambda/2$ transmission lines.

TOTAL : 60 PERIODS

AP9258

RF SYSTEM DESIGN

L T P C
3 0 0 3

UNIT I CMOS PHYSICS, TRANSCIVER SPECIFICATIONS AND ARCHITECTURES

9

CMOS: Introduction to MOSFET Physics – Noise: Thermal, shot, flicker, popcorn noise
Transceiver Specifications: Two port Noise theory, Noise Figure, THD, IP2, IP3, Sensitivity, SFDR, Phase noise - Specification distribution over a communication link
Transceiver Architectures: Receiver: Homodyne, Heterodyne, Image reject, Low IF Architectures – Transmitter: Direct upconversion, Two step upconversion

UNIT II IMPEDANCE MATCHING AND AMPLIFIERS

9

S-parameters with Smith chart – Passive IC components - Impedance matching networks Amplifiers: Common Gate, Common Source Amplifiers – OC Time constants in bandwidth estimation and enhancement – High frequency amplifier design
Low Noise Amplifiers: Power match and Noise match – Single ended and Differential LNAs – Terminated with Resistors and Source Degeneration LNAs.

UNIT III FEEDBACK SYSTEMS AND POWER AMPLIFIERS

9

Feedback Systems: Stability of feedback systems: Gain and phase margin, Root-locus techniques – Time and Frequency domain considerations – Compensation Power Amplifiers: General model – Class A, AB, B, C, D, E and F amplifiers – Linearisation Techniques – Efficiency boosting techniques – ACPR metric – Design considerations

UNIT IV PLL AND FREQUENCY SYNTHESIZERS

9

PLL: Linearised Model – Noise properties – Phase detectors – Loop filters and Charge pumps Frequency Synthesizers: Integer-N frequency synthesizers – Direct Digital Frequency synthesizers

UNIT V MIXERS AND OSCILLATORS

9

Mixer: characteristics – Non-linear based mixers: Quadratic mixers – Multiplier based mixers: Single balanced and double balanced mixers – subsampling mixers
Oscillators: Describing Functions, Colpitts oscillators – Resonators – Tuned Oscillators – Negative resistance oscillators – Phase noise

TOTAL:45 PERIODS

TEXT BOOKS:

1. T.Lee, "Design of CMOS RF Integrated Circuits", Cambridge, 2004
2. B.Razavi, "RF Microelectronics", Pearson Education, 1997

3. Jan Crols, Michiel Steyaert, "CMOS Wireless Transceiver Design", Kluwer Academic Publishers, 1997
4. B.Razavi, "Design of Analog CMOS Integrated Circuits", McGraw Hill, 2001

CU9251 COMMUNICATION PROTOCOL ENGINEERING L T P C
3 0 0 3

UNIT I NETWORK REFERENCE MODEL 9

Communication model-software, subsystems, protocol, protocol development methods, Protocol engineering process, Layered architecture, Network services and Interfaces, Protocol functions, OSI model ,TCP/IP protocol suite

UNIT II PROTOCOL SPECIFICATIONS 9

Components of protocol, Specifications of Communication service, Protocol entity, Interface, Interactions, Multimedia protocol, Internet protocol, SDL, SDL based protocol-other protocol specification languages

UNIT III PROTOCOL VERIFICATION/VALIDATION 9

Protocol verification, Verification of a protocol using finite state machines, Protocol validation, protocol design errors, Protocol validation approaches, SDL based protocol verification and validation

UNIT IV PROTOCOL CONFORMANCE/PERFORMANCE TESTING 9

Conformance testing methodology and frame work, Conformance test architectures, Test sequence generation methods, Distributed architecture by local methods, Conformance testing with TTCN, systems with semi controllable interfaces - RIP,SDL based tools for conformance testing, SDL based conformance testing of MPLS Performance testing, SDL based performance testing of TCP and OSPF, Interoperability testing, SDL based interoperability testing of CSMA/CD and CSMA/CA protocol using Bridge, Scalability testing

UNIT V PROTOCOL SYNTHESIS AND IMPLEMENTATION 9

Protocol synthesis, Interactive synthesis algorithm, Automatic synthesis algorithm, Automatic synthesis of SDL from MSC, Protocol Re-synthesis; Requirements of protocol implementation, Object based approach to protocol implementation, Protocol compilers, Tool for protocol engineering

TOTAL: 45 PERIODS

REFERENCES:

1. Pallapa Venkataram and Sunilkumar S.Manvi, "Communication protocol Engineering", Eastern Economy edition, 2004
2. Richard Lai and Jirachiefpattana, "Communication Protocol Specification and Verification", Kluwer Publishers, Boston, 1998.
3. Tarnay, K., "Protocol Specification and Testing", Plenum, New York, 1991.
4. Mohamed G. Gouda, "Elements of Network Protocol Design", John Wiley & Sons, Inc. New York, USA, 1998

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|--------|--|--------------------|
| VL9265 | DSP PROCESSOR ARCHITECTURE AND PROGRAMMING | L T P C
3 0 0 3 |
|--------|--|--------------------|

Multiplier and Multiplier accumulator – Modified Bus Structures and Memory access in P-DSPs – Multiple access memory – Multi-port memory – VLIW architecture- Pipelining – Special Addressing modes in P-DSPs – On chip Peripherals.

Architecture – Assembly language syntax - Addressing modes – Assembly language Instructions - Pipeline structure, Operation – Block Diagram of DSP starter kit – Application Programs for processing real time signals.

Architecture – Data formats - Addressing modes – Groups of addressing modes-
Instruction sets - Operation – Block Diagram of DSP starter kit – Application Programs
for processing real time signals – Generating and finding the sum of series, Convolution
of two sequences, Filter design

Architecture of ADSP-21XX and ADSP-210XX series of DSP processors- Addressing modes and assembly language instructions – Application programs –Filter design, FFT calculation.

Architecture of TMS320C54X: Pipe line operation, Code Composer studio - Architecture of TMS320C6X - Architecture of Motorola DSP563XX – Comparison of the features of DSP family processors.

REFERENCES:

- 9

UNIT I MECHANICS OF SPEECH 8

Speech production mechanism – Nature of Speech signal – Discrete time modelling of Speech production – Representation of Speech signals – Classification of Speech sounds – Phones – Phonemes – Phonetic and Phonemic alphabets – Articulatory features. Music production – Auditory perception – Anatomical pathways from the ear to the perception of sound – Peripheral auditory system – Psycho acoustics

UNIT II	TIME DOMAIN METHODS FOR SPEECH PROCESSING	8
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Time domain parameters of Speech signal – Methods for extracting the parameters
Energy, Average Magnitude – Zero crossing Rate – Silence Discrimination using ZCR
and energy – Short Time Auto Correlation Function – Pitch period estimation using Auto
Correlation Function

UNIT III	FREQUENCY DOMAIN METHOD FOR SPEECH PROCESSING	9
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Short Time Fourier analysis – Filter bank analysis – Formant extraction – Pitch Extraction – Analysis by Synthesis- Analysis synthesis systems- Phase vocoder— Channel Vocoder.

HOMOMORPHIC SPEECH ANALYSIS:

Cepstral analysis of Speech – Formant and Pitch Estimation – Homomorphic Vocoders.

UNIT IV LINEAR PREDICTIVE ANALYSIS OF SPEECH 10

Formulation of Linear Prediction problem in Time Domain – Basic Principle – Auto correlation method – Covariance method – Solution of LPC equations – Cholesky method – Durbin's Recursive algorithm – lattice formation and solutions – Comparison of different methods – Application of LPC parameters – Pitch detection using LPC parameters – Formant analysis – VELP – CELP.

UNIT V	APPLICATION OF SPEECH SIGNAL PROCESSING	10
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Algorithms: Spectral Estimation, dynamic time warping, hidden Markov model – Music analysis – Pitch Detection – Feature analysis for recognition –Automatic Speech Recognition – Feature Extraction for ASR – Deterministic sequence recognition – Statistical Sequence recognition – ASR systems – Speaker identification and verification – Voice response system – Speech Synthesis: Text to speech, voice over IP.

TOTAL : 45 PERIODS

REFERENCES:

1. Ben Gold and Nelson Morgan, Speech and Audio Signal Processing, John Wiley and Sons Inc. , Singapore, 2004
2. L.R.Rabiner and R.W.Schaffer – Digital Processing of Speech signals – Prentice Hall -1978
3. Quatieri – Discrete-time Speech Signal Processing – Prentice Hall – 2001.
4. J.L.Flanagan – Speech analysis: Synthesis and Perception – 2nd edition – Berlin – 1972
5. I.H.Witten – – Principles of Computer Speech – Academic Press – 1982

UNIT I INTRODUCTION**7**

ISO OSI Layer Architecture, TCP/IP Layer Architecture, Functions of Network layer, General Classification of routing, Routing in telephone networks, Dynamic Non hierarchical Routing (DNHR), Trunk status map routing (TSMR), real-time network routing (RTNR), Distance vector routing, Link state routing, Hierarchical routing.

UNIT II INTERNET ROUTING**10**

Interior protocol : Routing Information Protocol (RIP), Open Shortest Path First (OSPF), Bellman Ford Distance Vector Routing. Exterior Routing Protocols: Exterior Gateway Protocol (EGP) and Border Gateway Protocol (BGP). Multicast Routing: Pros and cons of Multicast and Multiple Unicast Routing, Distance Vector Multicast Routing Protocol (DVMRP), Multicast Open Shortest Path First (MOSPF), MBONE, Core Based Tree Routing.

UNIT III ROUTING IN OPTICAL WDM NETWORKS**10**

Classification of RWA algorithms, RWA algorithms, Fairness and Admission Control, Distributed Control Protocols, Permanent Routing and Wavelength Requirements, Wavelength Rerouting- Benefits and Issues, Lightpath Migration, Rerouting Schemes, Algorithms- AG, MWPG.

UNIT IV MOBILE - IP NETWORKS**9**

Macro-mobility Protocols, Micro-mobility protocol: Tunnel based : Hierarchical Mobile IP, Intra domain Mobility Management, Routing based: Cellular IP, Handoff Wireless Access Internet Infrastructure (HAWAII).

UNIT V MOBILE AD-HOC NETWORKS**9**

Internet-based mobile ad-hoc networking communication strategies, Routing algorithms – Proactive routing: destination sequenced Distance Vector Routing (DSDV), Reactive routing: Dynamic Source Routing (DSR), Ad hoc On-Demand Distance Vector Routing (AODV), Hybrid Routing: Zone Based Routing (ZRP).

TOTAL: 45 PERIODS**REFERENCES:**

1. William Stallings, 'High speed networks and Internets Performance and Quality of Service', IInd Edition, Pearson Education Asia. Reprint India 2002
2. M. Steen Strub, 'Routing in Communication network, Prentice –Hall International, Newyork,1995.
3. S. Keshav, 'An engineering approach to computer networking' Addison Wesley 1999.
4. William Stallings, 'High speed Networks TCP/IP and ATM Design Principles, Prentice- Hall, New York, 1995
5. C.E Perkins, 'Ad Hoc Networking', Addison – Wesley, 2001
6. Ian F. Akyildiz, Jiang Xie and Shantidev Mohanty, "A Survey of mobility Management in Next generation All IP- Based Wireless Systems", IEEE Wireless Communications Aug.2004, pp 16-27.
7. A.T Campbell et al., "Comparison of IP Micromobility Protocols," IEEE Wireless Communications Feb.2002, pp 72-82.
8. C.Siva Rama Murthy and Mohan Gurusamy, "WDM Optical Networks – Concepts, Design and Algorithms", Prentice Hall of India Pvt. Ltd, New Delhi –2002.

UNIT I**9**

History of GPS – BC-4 System – HIRAN – NNSS – NAVSTAR GLONASS and GNSS Systems – GPS Constellation – Space Segment – Control Segment – User Segment – Single and Dual Frequency – Point – Relative – Differential GPS – Static and Kinematic Positioning – 2D and 3D – reporting Anti Spoofing (AS); Selective Availability (SA) – DOP Factors.

UNIT II**9**

Coordinate Systems – Geo Centric Coordinate System – Conventional Terrestrial Reference System – Orbit Description – Keplerian Orbit – Kepler Elements – Satellite Visibility – Topocentric Motion – Disturbed Satellite Motion – Perturbed Motion – Disturbing Accelerations - Perturbed Orbit – Time Systems – Astronomical Time System – Atomic Time – GPS Time – Need for Coordination – Link to Earth Rotation – Time and Earth Motion Services.

UNIT III**9**

C/A code; P-code; Y-code; L1, L2 Carrier frequencies – Code Pseudo Ranges – Carriers Phases – Pseudo Ranges – Satellite Signal Signature – Navigation Messages and Formats – Undifferenced and Differenced Range Models – Delta Ranges – Signal Processing and Processing Techniques – Tracking Networks – Ephemerides – Data Combination: Narrow Lane; Wide Lane – OTF Ambiguity.

UNIT IV**9**

Propagation Media – Multipath – Antenna Phase Centre – Atmosphere in brief – Elements of Wave Propagation – Ionospheric Effects on GPS Observations – Code Delay – Phase Advances – Integer Bias – Clock Error – Cycle Slip – Noise-Bias – Blunders – Tropospheric Effects on GPS Observables – Multipath Effect – Antenna Phase Centre Problems and Correction.

UNIT V**9**

Inter Disciplinary Applications – Crystal Dynamics – Gravity Field Mapping – Atmospheric Occultation – Surveying – Geophysics – Air borne GPS – Ground Transportation – Space borne GPS – Metrological and Climate Research using GPS.

TOTAL: 45 PERIODS**REFERENCES:**

1. B.Hoffman - Wellenhof, H.Lichtenegger and J.Collins, "GPS: Theory and Practice", 4th revised edition, Springer, Wein, New york,1997
 2. A.Leick, "GPS Satellites Surveying", 2nd edition, John Wiley & Sons, New York, 1995
 3. B.Parkinson, J.Spilker, Jr.(Eds), "GPS: Theory and Applications", Vol.I & Vol.II, AIAA, 370 L'Enfant Promenade SW, Washington, DC 20024, 1996
 4. A.Kleusberg and P.Teunissen(Eds), "GPS for Geodesy", Springer-Verlag, Berlin, 1996
 5. L.Adams, "The GPS - A Shared National Asset", Chair, National Academy Press, Washington, DC, 1995
- Websites:
6. <http://www.auslig.gov.au>
 7. <http://igscb.jpl.nasa.gov>
 8. <http://gibs.leipzig.ifag.de>
 9. <http://www.navcen.uscg.mil>

UNIT I INTRODUCTION ON SECURITY 9

Security Goals, Types of Attacks: Passive attack, active attack, attacks on confidentiality, attacks on Integrity and availability. Security services and mechanisms, Techniques : Cryptography, Steganography , Revision on Mathematics for Cryptography.

UNIT II SYMMETRIC & ASYMMETRIC KEY ALGORITHMS 9

Substitutional Ciphers, Transposition Ciphers, Stream and Block Ciphers, Data Encryption Standards (DES), Advanced Encryption Standard (AES), RC4, principle of asymmetric key algorithms, RSA Cryptosystem

UNIT III INTEGRITY, AUTHENTICATION AND KEY MANAGEMENT 9

Message Integrity, Hash functions : SHA, Digital signatures : Digital signature standards. Authentication : Entity Authentication: Biometrics, Key management Techniques.

UNIT IV NETWORK SECURITY , FIREWALLS AND WEB SECURITY 9

Introduction on Firewalls, Types of Firewalls, Firewall Configuration and Limitation of Firewall. IP Security Overview, IP security Architecture, authentication Header, Security payload, security associations, Key Management. Web security requirement, secure sockets layer, transport layer security, secure electronic transaction, dual signature

UNIT V WIRELESS NETWORK SECURITY 9

Security Attack issues specific to Wireless systems: Worm hole, Tunneling, DoS. WEP for Wi-Fi network, Security for 4G networks: Secure Ad hoc Network, Secure Sensor Network

TOTAL: 45 PERIODS**REFERENCES:**

1. Behrouz A. Fourcuzan ,” Cryptography and Network security” Tata McGraw- Hill, 2008
2. William Stallings,”Cryptography and Network security: principles and practice”,2ndEdition,Prentice Hall of India,New Delhi,2002
3. Atul Kahate ,” Cryptography and Network security”, 2nd Edition, Tata McGraw-Hill, 2008
4. R.K.Nichols and P.C. Lekkass ,” Wireless Security”
5. H. Yang et al., Security in Mobile Ad Hoc Networks: Challenges and Solution, IEEE Wireless Communications, Feb. 2004.
6. Securing Ad Hoc Networks,” IEEE Network Magazine, vol. 13, no. 6, pp. 24-30, December 1999.
7. "Security of Wireless Ad Hoc Networks,"
<http://www.cs.umd.edu/~aram/wireless/survey.pdf>.
8. David Boel et.al (Jan 2008) “Securing Wireless Sensor Networks – Security Architecture “ Journal of networks , Vol.3. No. 1. pp. 65 -76.
9. Perrig, A., Stankovic, J., Wagner, D. (2004), “Security in Wireless Sensor Networks”, *Communications of the ACM*, 47(6), 53-57.

UNIT I	INTRODUCTION TO SOFT COMPUTING AND NEURAL NETWORKS	9
Evolution of Computing - Soft Computing Constituents – From Conventional AI to Computational Intelligence - Machine Learning Basics		
UNIT II	GENETIC ALGORITHMS	9
Introduction to Genetic Algorithms (GA) – Applications of GA in Machine Learning - Machine Learning Approach to Knowledge Acquisition.		
UNIT III	NEURAL NETWORKS	9
Machine Learning Using Neural Network, Adaptive Networks – Feed forward Networks – Supervised Learning Neural Networks – Radial Basis Function Networks - Reinforcement Learning – Unsupervised Learning Neural Networks – Adaptive Resonance architectures – Advances in Neural networks.		
UNIT IV	FUZZY LOGIC	9
Fuzzy Sets – Operations on Fuzzy Sets – Fuzzy Relations – Membership Functions- Fuzzy Rules and Fuzzy Reasoning – Fuzzy Inference Systems – Fuzzy Expert Systems – Fuzzy Decision Making.		
UNIT V	NEURO-FUZZY MODELING	9
Adaptive Neuro-Fuzzy Inference Systems – Coactive Neuro-Fuzzy Modeling – Classification and Regression Trees – Data Clustering Algorithms – Rulebase Structure Identification – Neuro-Fuzzy Control – Case studies.		

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, "Neuro-Fuzzy and Soft Computing", Prentice-Hall of India, 2003.
2. George J. Klir and Bo Yuan, "Fuzzy Sets and Fuzzy Logic-Theory and Applications", Prentice Hall, 1995.
3. James A. Freeman and David M. Skapura, "Neural Networks Algorithms, Applications, and Programming Techniques", Pearson Edn., 2003.

REFERENCES:

1. Mitchell Melanie, "An Introduction to Genetic Algorithm", Prentice Hall, 1998.
2. David E. Goldberg, "Genetic Algorithms in Search, Optimization and Machine Learning", Addison Wesley, 1997.
3. S. N. Sivanandam, S. Sumathi and S. N. Deepa, "Introduction to Fuzzy Logic using MATLAB", Springer, 2007.
4. S.N.Sivanandam · S.N.Deepa, " Introduction to Genetic Algorithms", Springer, 2007.
5. Jacek M. Zurada, "Introduction to Artificial Neural Systems", PWS Publishers, 1992.

UNIT I REVIEW OF DIGITAL COMMUNICATION TECHNIQUES 9

Base band and band pass communication; signal space representation, linear and nonlinear modulation techniques, and Spectral characteristics of digital modulation

UNIT II OPTIMUM RECEIVERS FOR AWGN CHANNEL 9

Correlation demodulator, matched filter, maximum likelihood sequence detector, optimum receiver for CPM signals, M-ary orthogonal signals, envelope detectors for M-ary and correlated binary signals

UNIT III RECEIVERS FOR FADING CHANNELS 9

Characterization of fading multiple channels, statistical models, slow fading, frequency selective fading, diversity technique, RAKE demodulator, coded waveform for fading channel

UNIT IV SYNCHRONIZATION TECHNIQUES 9

Carrier and signal synchronization, carrier phase estimation-PLL, Decision directed loops, symbol timing estimation, maximum likelihood and non-decision directed timing estimation, joint estimation

UNIT V ADAPTIVE EQUALIZATION 9

Zero forcing algorithm, LMS algorithm, adaptive decision-feedback equalizer and Equalization of Trellis-coded signals. Kalman algorithm, blind equalizers and stochastic gradient algorithm.

TOTAL: 45 PERIODS**REFERENCES:**

1. Heinrich Meyer, Mare Moeneclacy, Stefan.A.Fechtel, " Digital communication receivers ", Vol I & Vol II, John Wiley, New York, 1997.
2. John.G.Proakis, "Digital communication "4th Edition, McGraw-Hill, New York, 2001.
3. E.A.Lee and D.G. Messerschmitt, "Digital communication ", 2nd Edition, Allied Publishers, New Delhi, 1994.
4. Simon Marvin, "Digital communication over fading channel; An unified approach to performance Analysis ", John Wiley, New York, 2000.

UNIT I MICROPROCESSOR ARCHITECTURE 9

Instruction Set – Data formats –Addressing modes – Memory hierarchy –register file – Cache – Virtual memory and paging – Segmentation- pipelining –the instruction pipeline – pipeline hazards – instruction level parallelism – reduced instruction set –Computer principles – RISC versus CISC.

UNIT II HIGH PERFORMANCE CISC ARCHITECTURE – PENTIUM 9
 CPU Architecture- Bus Operations – Pipelining – Branch predication – floating point unit-
 Operating Modes –Paging – Multitasking – Exception and Interrupts – Instruction set –
 addressing modes – Programming the Pentium processor.

UNIT III HIGH PERFORMANCE RISC ARCHITECTURE – ARM 9
 Organization of CPU – Bus architecture –Memory management unit - ARM instruction
 set- Thumb Instruction set- addressing modes – Programming the ARM processor.

UNIT IV MOTOROLA 68HC11 MICROCONTROLLERS 9
 Instruction set addressing modes – operating modes- Interruptsystem- RTC-Serial
 Communication Interface – A/D Converter PWM and UART.

UNIT V PIC MICROCONTROLLER 9
 CPU Architecture – Instruction set – interrupts- Timers- I²C Interfacing –UART- A/D
 Converter –PWM and introduction to C-Compilers.

TOTAL:45 PERIODS

REFERENCES:

1. Daniel Tabak , “ Advanced Microprocessors” McGraw Hill.Inc., 1995
2. James L. Antonakos , “ The Pentium Microprocessor ” Pearson Education , 1997.
3. Steve Furber , “ ARM System –On –Chip architecture “Addision Wesley , 2000.
4. Gene .H.Miller .” Micro Computer Engineering ,” Pearson Education , 2003.
5. John .B.Peatman , “ Design with PIC Microcontroller , Prentice hall, 1997.
6. James L.Antonakos ,” An Introduction to the Intel family of Microprocessors “
 Pearson Education 1999.
7. Barry.B.Breg,” The Intel Microprocessors Architecture , Programming and
 Interfacing “ , PHI,2002.
8. Valvano "Embedded Microcomputer Systems" Thomson Asia PVT LTD first reprint
 2001.

AP9251 DIGITAL IMAGE PROCESSING L T P C
3 0 0 3

UNIT I DIGITAL IMAGE FUNDAMENTALS 9
 Elements of digital image processing systems, Vidicon and 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

Histogram modification, Noise distributions, Spatial averaging, Directional Smoothing, Median, Geometric mean, Harmonic mean, Contraharmonic and Yp mean filters . Design of 2D FIR filters. Image restoration - degradation model, Unconstrained and Constrained restoration, Inverse filtering-removal of blur caused by uniform linear motion, Wiener filtering, Geometric transformations-spatial transformations, Gray Level interpolation. .

UNIT IV IMAGE SEGMENTATION AND RECOGNITION 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., Neural networks-Backpropagation network and training, Neural network to recognize shapes.

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 standard, JPEG 2000, EZW, SPIHT, MPEG.

TOTAL: 45PERIODS

REFERENCES:

1. Rafael C. Gonzalez, Richard E. Woods, " Digital Image Processing", Pearson Education, Inc., Second Edition, 2004
2. Anil K. Jain, "Fundamentals of Digital Image Processing", Prentice Hall of India, 2002.
3. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins," Digital Image Processing using MATLAB", Pearson Education, Inc., 2004.
4. D.E. Dudgeon and R.M. Mersereau, "Multidimensional Digital Signal Processing", Prentice Hall Professional Technical Reference, 1990.
5. William K. Pratt, " Digital Image Processing", John Wiley, New York, 2002.
6. Milan Sonka et al, "Image Processing, Analysis and Machine Vision", Brookes/Cole, Vikas Publishing House, 2nd edition, 1999;
7. Sid Ahmed, M.A., " Image Processing Theory, Algorithms and Architectures", McGrawHill, 1995.

**CU9255 INTERNETWORKING MULTIMEDIA L T P C
3 0 0 3**

UNIT I INTRODUCTION 9

Digital sound, video and graphics, basic multimedia networking, multimedia characteristics, evolution of Internet services model, network requirements for audio/video transform, multimedia coding and compression for text, image, audio and video. Multimedia communication in wireless network.

UNIT II	SUBNETWORK TECHNOLOGY	9
Broadband services, ATM and IP , IPV6, High speed switching, resource reservation, Buffer management, traffic shaping, caching, scheduling and policing, throughput, delay and jitter performance.		
UNIT III	MULTICAST AND TRANSPORT PROTOCOL	9
Multicast over shared media network, multicast routing and addressing, scaping multicast and NBMA networks, Reliable transport protocols, TCP adaptation algorithm, RTP, RTCP.		
UNIT IV	MEDIA - ON – DEMAND	9
Storage and media servers, voice and video over IP, MPEG-2 over ATM/IP, indexing synchronization of requests, recording and remote control.		
UNIT V	APPLICATIONS	9
MIME, Peer-to-peer computing, shared application, video conferencing, centralized and distributed conference control, distributed virtual reality, light weight session philosophy.		

TOTAL:45 PERIODS

REFERENCES:

1. Jon Crowcroft, Mark Handley, Ian Wakeman. "Internetworking Multimedia", Harcourt Asia Pvt.Ltd.Singapore, 1998.
2. B.O. Szuprowicz, "Multimedia Networking", McGraw Hill, NewYork. 1995
3. Tay Vaughan, Multimedia making it to work, 4ed, Tata McGrawHill, NewDelhi, 2000.
4. Ellen kayata wesel, Ellen Khayata, "Wireless Multimedia Communication: Networking Video, Voice and Data", Addison Wesley Longman Publication, USA, 1998.

AP9256	ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY IN SYSTEM DESIGN	L T P C 3 0 0 3
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UNIT I	EMI/EMC CONCEPTS	9
EMI-EMC definitions and Units of parameters; Sources and victim of EMI; Conducted and Radiated EMI Emission and Susceptibility; Transient EMI, ESD; Radiation Hazards.		
UNIT II	EMI COUPLING PRINCIPLES	9
Conducted, radiated and transient coupling; Common ground impedance coupling ; Common mode and ground loop coupling ; Differential mode coupling ; Near field cable to cable coupling, cross talk ; Field to cable coupling ; Power mains and Power supply coupling.		
UNIT III	EMI CONTROL TECHNIQUES	9
Shielding, Filtering, Grounding, Bonding, Isolation transformer, Transient suppressors, Cable routing, Signal control.		

Component selection and mounting; PCB trace impedance; Routing; Cross talk control; Power distribution decoupling; Zoning; Grounding; VIAs connection; Terminations.

Open area test site; TEM cell; EMI test shielded chamber and shielded ferrite lined anechoic chamber; Tx /Rx Antennas, Sensors, Injectors / Couplers, and coupling factors; EMI Rx and spectrum analyzer; Civilian standards-CISPR, FCC, IEC, EN; Military standards-MIL461E/462.

REFERENCES:

1. V.P.Kodali, "Engineering EMC Principles, Measurements and Technologies", IEEE Press, Newyork, 1996.
2. Henry W.Ott., "Noise Reduction Techniques in Electronic Systems", A Wiley Inter Science Publications, John Wiley and Sons, Newyork, 1988.
3. Bemhard Keiser, "Principles of Electromagnetic Compatibility", 3rd Ed, Artech house, Norwood, 1986.
4. C.R.Paul, "Introduction to Electromagnetic Compatibility", John Wiley and Sons, Inc, 1992.
5. Don R.J.White Consultant Incorporate, "Handbook of EMI/EMC", Vol I-V, 1988.

UNIT I INTRODUCTION 9

Review of OSI, TCP/IP; Multiplexing, Modes of Communication, Switching, Routing.
SONET – DWDM – DSL – ISDN – BISDN, ATM.

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.

VPN-Remote-Access VPN, site-to-site VPN, Tunneling to PPP, Security in VPN.MPLS-operation, Routing, Tunneling and use of FEC, Traffic Engineering, MPLS based VPN, overlay networks-P2P connections.

Little's theorem, Need for modeling , Poisson modeling and its failure, Non- poisson models, Network performance evaluation.

Principles of cryptography – Authentication – integrity – key distribution and certification
– Access control and: fire walls – attacks and counter measures – security in many

layers. Infrastructure for network management – The internet standard management framework – SMI, MIB, SNMP, Security and administration – ASN.1

TOTAL: 45PERIODS

REFERENCES:

1. J.F. Kurose & K.W. Ross, "Computer Networking- A top down approach featuring the internet", Pearson, 2nd edition, 2003.
2. Walrand .J. Varatya, High performance communication network, Morgan Kauffman – Harcourt Asia Pvt. Ltd. 2nd Edition, 2000.
3. LEOM-GarCIA, WIDJAJA, "Communication networks", TMH seventh reprint 2002.
4. Aunurag kumar, D. MANjunath, Joy kuri, "Communication Networking", Morgan Kaufmann Publishers, 1ed 2004.
5. Hersent Gurle & petit, "IP Telephony, packet Pored Multimedia communication Systems", Pearson education 2003.
6. Fred Halsall and Lingana Gouda Kulkarni, "Computer Networking and the Internet" fifth edition, Pearson education
7. Nader F.Mir ,Computer and Communication Networks, first edition.
8. Larry I.Peterson&Bruce S.David, "Computer Networks: A System Approach"- 1996

AP9224

EMBEDDED SYSTEMS

L T P C
3 0 0 3

UNIT I EMBEDDED PROCESSORS

9

Embedded Computers, Characteristics of Embedded Computing Applications, Challenges in Embedded Computing system design, Embedded system design process- Requirements, Specification, Architectural Design, Designing Hardware and Software Components, System Integration, Formalism for System Design- Structural Description, Behavioural Description, Design Example: Model Train Controller, ARM processor- processor and memory organization.

UNIT II EMBEDDED PROCESSOR AND COMPUTING PLATFORM

9

Data operations, Flow of Control, SHARC processor- Memory organization, Data operations, Flow of Control, parallelism with instructions, CPU Bus configuration, ARM Bus, SHARC Bus, Memory devices, Input/output devices, Component interfacing, designing with microprocessor development and debugging, Design Example : Alarm Clock. Hybrid Architecture

UNIT III NETWORKS

9

Distributed Embedded Architecture- Hardware and Software Architectures, Networks for embedded systems- I2C, CAN Bus, SHARC link supports, Ethernet, Myrinet, Internet, Network-Based design- Communication Analysis, system performance Analysis, Hardware platform design, Allocation and scheduling, Design Example: Elevator Controller.

UNIT V IP SWITCHING**9**

Addressing model, IP Switching types - flow driven and topology driven solutions, IP Over ATM address and next hop resolution, multicasting, Ipv6 over ATM.

TOTAL : 45 PERIODS**REFERENCES:**

1. Achille Pattavina, "Switching Theory: Architectures and performance in Broadband ATM networks ", John Wiley & Sons Ltd, New York. 1998
2. Elhanany M. Hamdi, "High Performance Packet Switching architectures", Springer Publications, 2007.
3. Christopher Y Metz, "Switching protocols & Architectures", McGraw - Hill Professional Publishing, New York. 1998.
4. Rainer Handel, Manfred N Huber, Stefan Schroder, "ATM Networks - Concepts Protocols, Applications", 3rd Edition, Addison Wesley, New York. 1999.

CU9258**NETWORK MANAGEMENT****L T P C****3 0 0 3****UNIT I FUNDAMENTALS OF COMPUTER NETWORK TECHNOLOGY****9**

Network Topology, LAN, Network node components- Hubs, Bridges, Routers, Gateways, Switches, WAN, ISDN Transmission Technology, Communications protocols and standards

UNIT II OSI NETWORK MANAGEMENT**9**

OSI Network management model-Organizational model-Information model, communication model. Abstract Syntax Notation - Encoding structure, Macros Functional model CMIP/CMIS

UNIT III INTERNET MANAGEMENT(SNMP)**9**

SNMP-Organizational model-System Overview, The information model, communication model-Functional model, SNMP proxy server, Management information, protocol remote monitoring

UNIT IV BROADBAND NETWORK MANAGEMENT**9**

Broadband network s and services, ATM Technology-VP,VC,ATM Packet, Integrated service, ATMLAN emulation, Virtual Lan. ATM Network Management-ATM Network reference model, integrated local management Interface. ATM Management Information base, Role of SNMD and ILMI in ATM Management, M1, M2, M3, M4 Interface. ATM Digital Exchange Interface Management

UNIT V NETWORK MANAGEMENT APPLICATIONS**9**

Configuration management, Fault management, performance management, Event Correlation Techniques security Management, Accounting management, Report Management, Policy Based Management Service Level Management

TOTAL: 45 PERIODS

REFERENCES:

1. Mani Subramanian, "Network Management Principles and practice ", Addison Wesley New York, 2000.
2. Salah Aaidarous, Thomas Plevayk, "Telecommunications Network Management Technologies and Implementations ", eastern Economy Edition IEEE press, New Delhi, 1998.
3. Lakshmi G. Raman, "Fundamentals of Telecommunication Network Management ", Eastern Economy Edition IEEE Press, New Delhi, 1999.

CU9259	TELECOMMUNICATION SYSTEM MODELING AND SIMULATION	L T P C 3 0 0 3
UNIT I	SIMULATION METHODOLOGY	8
Introduction, Aspects of methodology, Performance Estimation, Simulation sampling frequency, Low pass equivalent simulation models for bandpass signals, Multicarrier signals, Non-linear and time-varying systems, Post processing – Basic graphical techniques and estimations.		
UNIT II	RANDOM SIGNAL GENERATION & PROCESSING	8
Uniform random number generation, Mapping uniform random variables to an arbitrary pdf, Correlated and Uncorrelated Gaussian random number generation, PN sequence generation, Random signal processing, Testing of random number generators.		
UNIT III	MONTE CARLO SIMULATION	9
Fundamental concepts, Application to communication systems, Monte Carlo integration, Semianalytic techniques, Case study: Performance estimation of a wireless system.		
UNIT IV	ADVANCED MODELS & SIMULATION TECHNIQUES	10
Modeling and simulation of non-linearities: Types, Memoryless non-linearities, Non-linearities with memory, Modeling and simulation of Time varying systems : Random process models, Tapped delay line model, Modelling a and simulation of waveform channels, Discrete memoryless channel models, Markov model for discrete channels with memory.		
UNIT V	EFFICIENT SIMULATION TECHNIQUES	10
Tail extrapolation, pdf estimators, Importance sampling methods, Case study: Simulation of a Cellular Radio System.		

TOTAL: 45 PERIODS**REFERENCES:**

1. William.H.Tranter, K. Sam Shanmugam, Theodore. S. Rappaport, Kurt L. Kosbar, Principles of Communication Systems Simulation, Pearson Education (Singapore) Pvt. Ltd, 2004.
2. M.C. Jeruchim, P.Balaban and K. Sam Shanmugam, Simulation of Communication Systems: Modeling, Methodology and Techniques, Plenum Press, New York, 2001.
3. Averill.M.Law and W. David Kelton, Simulation Modeling and Analysis, McGeaw Hill Inc., 2000.
4. Geoffrey Gorden, System Simulation, Prentice Hall of India, 2nd Edition, 1992.
5. Jerry Banks and John S. Carson, Discrete Event System Simulation, Prentice Hall of India, 1984.