M.KUMARASAMY COLLEGE OF ENGINEERING, KARUR

(Autonomous)

CURRICULUM I TO IV SEMESTERS

ELECTRONICS AND COMMUNICATION ENGINEERING

M.E - COMMUNICATION SYSTEMS

REGULATION – 2012

SEMESTER – I

Course Code	Course Title	Hours /Week			Credit	Maximum Marks		
		L	T	P		CIA	ESE	Total
THEORY								
PMA12102	Applied Mathematics for communication Engineers	3	1	0	4	50	50	100
PCM12101	Advanced Radiation Systems	3	0	0	3	50	50	100
PCM12102	Modern Digital Communication Techniques	3	1	0	4	50	50	100
PCM12103	Advanced Digital Signal Processing	3	1	0	4	50	50	100
PCM12104	Optical Communication Networks	3	0	0	3	50	50	100
E1	Elective I	3	0	0	3	50	50	100
PRACTICAL								
PCM12105P	Communication System Lab I	0	0	4	2	50	50	100
				Total	**23**			**700**

SEMESTER – II

Course Code	Course Title	Hours /Week			Credit	Maximum Marks		
		L	T	P		CIA	ESE	Total
THEORY								
PCM12201	Wireless Mobile Communication	3	0	0	3	50	50	100
PCM12202	Multimedia Compression Techniques	3	1	0	4	50	50	100
PCM12203	Microwave Integrated Circuits	2	0	2	3	50	50	100
PCM12204	Satellite Communication	3	0	0	3	50	50	100
E2	Elective II	3	0	0	3	50	50	100
E3	Elective III	3	0	0	3	50	50	100
PRACTICAL								
PCM12205P	Communication System Lab II	0	0	4	2	50	50	100
				Total	**21**			**700**

SEMESTER- III

Course Code	Course Title	Hours/Week			Credit	Maximum Marks		
		L	T	P		CIA	ESE	Total
THEORY								
E4	Elective IV	3	0	0	3	50	50	100
E5	Elective V	3	0	0	3	50	50	100
E6	Elective VI	3	0	0	3	50	50	100
PRACTICAL								
PCM12301P	Project Work Phase I	0	0	12	6	100	100	200
				Total	**15**			**500**

SEMESTER – IV

Course Code	Course Title	Hours /Week			Credit	Maximum Marks		
		L	T	P		CIA	ESE	Total
PRACTICAL								
PCM12401P	Project Work Phase II	0	0	24	12	200	200	400
				Total	**12**			**400**

LIST OF ELECTIVES

S.No	Course Title	Hours /Week			Credit	Maximum Marks		
		L	T	P		CIA	ESE	Total
ELECTIVE I								
PCM12151	Communication Network Security	3	0	0	3	50	50	100
PCM12152	DSP Processor Architecture and programming	3	0	0	3	50	50	100
PCM12153	RF System Design	3	0	0	3	50	50	100
PCM12154	ASIC and FPGA Design	3	0	0	3	50	50	100
ELECTIVE II								
PCM12251	Digital Communication Receivers	3	0	0	3	50	50	100
PCM12252	Internetworking Multimedia	3	0	0	3	50	50	100
PCM12255	Wireless Sensor Networks	3	0	0	3	50	50	100
PCM12256	Cognitive Radio	3	0	0	3	50	50	100
ELECTIVE III								
PCM12253	Global Positioning Systems	3	0	0	3	50	50	100
PCM12254	High Performance Computer Networks	3	0	0	3	50	50	100
PCM12257	Wireless Security	3	0	0	3	50	50	100
PCM12258	Network Processor	3	0	0	3	50	50	100
ELECTIVE IV								
PCM12351	Communication Protocol Engineering	3	0	0	3	50	50	100
PCM12352	Image and Video Processing	3	0	0	3	50	50	100
PCM12353	Network Routing Algorithms	3	0	0	3	50	50	100
PCM12354	Speech and Audio Signal processing	3	0	0	3	50	50	100
ELECTIVE V								
PCM12355	Advanced Microprocessors and Microcontrollers	3	0	0	3	50	50	100
PCM12356	Electromagnetic Interference and Compatibility in System Design	3	0	0	3	50	50	100
PCM12357	Embedded Systems	3	0	0	3	50	50	100
PCM12358	Simulation Of Communication Networks	3	0	0	3	50	50	100
ELECTIVE VI								
PCM12359	Ad hoc Networks	3	0	0	3	50	50	100
PCM123510	Advanced Computing Techniques	3	0	0	3	50	50	100
PCM123511	High Speed Switching Architectures	3	0	0	3	50	50	100
PCM123512	Wireless Embedded Systems	3	0	0	3	50	50	100

PMA12102 APPLIED MATHEMATICS FOR COMMUNICATION ENGINEERS L T P C 3 1 0 4

UNIT I SPECIAL FUNCTIONS 9

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 9

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 9

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 9

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

UNIT V QUEUEING MODELS

9

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

Total Hours: 45+15 = 60

Reference Books:

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)

PCM12101 ADVANCED RADIATION SYSTEMS L T P C 3 0 0 3

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, Biconical, Ridge guide, Multi turn loop; Antenna measurement and instrumentation – Gain, Impedance and antenna factor measurement; Antenna test range Design.

Total Hours: 45

References Books:

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.

PCM12102 MODERN DIGITAL COMMUNICATION TECHNIQUES

L T P C 3 1 0 4

UNIT I CONSTANT ENVELOPE MODULATION 9

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; Hammning; 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

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

Total Hours: 45

Reference Books:

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.

PCM12103 ADVANCED DIGITAL SIGNAL PROCESSING L T P C 3 1 0 4

UNIT I DISCRETE RANDOM SIGNAL PROCESSING 9

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 9

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 9

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 9

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 9

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

Total Hours: 45+15 = 60

Reference Books:

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, Second Edition, 2004 (For Wavelet Transform Topic).

PCM12104 OPTICAL COMMUNICATION NETWORKS L T P C 3 0 0 3

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

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UNIT II OPTICAL NETWORK ARCHITECTURES 9

Introduction to Optical Networks; SONET/SDH, Metropoliton-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, Synchronization, 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 Hours: 45

Reference Books:

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, Ist Edition, 2002.
3. P.E. Green, Jr., “Fiber Optic Networks”, Prentice Hall, NJ, 1993.

PCM12105P COMMUNICATION SYSTEM LABORATORY I L T P C 0 0 4 2

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 Analyzer
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 Hours: 60

PCM12201 WIRELESS MOBILE COMMUNICATION L T P C 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 Hours: 45

Reference Books:

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.

PCM12202 MULTIMEDIA COMPRESSION TECHNIQUES L T P C 3 1 0 4

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 – Huffmann coding – Adaptive Huffmann Coding – Arithmatic 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 Hours: 45

Reference Books:

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, NewYork, 1995.

PCM12203 MICROWAVE INTEGRATED CIRCUITS L T P C 2 0 2 3

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.

Theory Hours: 30
Laboratory Hours: 30

(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 Hours: 60

Reference Books:

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.

PCM12204 SATELLITE COMMUNICATION L T P C 3 0 0 3

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 Hours: 45

Reference Books:

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.

PCM12205P COMMUNICATION SYSTEM LAB II L T P C 0 0 4 2

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 λ/4 and λ/2 transmission lines.

Total Hours: 60

PCM12151 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 Hours: 45

Reference Books:

1. Behrouz A. Forouzan ," Cryptography and Network security" Tata McGraw- Hill, 2008.
2. William Stallings, "Cryptography and Network security: principles and practice",2nd Edition,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.

PCM12152 DSP PROCESSOR ARCHITECTURE AND PROGRAMMING

L T P C 3 0 0 3

UNIT I FUNDAMENTALS OF PROGRAMMABLE DSPs 9

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.

UNIT II TMS320C5X PROCESSOR 9

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.

UNIT III TMS320C3X PROCESSOR 9

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

UNIT IV ADSP PROCESSORS 9

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

UNIT V ADVANCED PROCESSORS 9

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

Total Hours: 45

Reference Books:

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, and Motorola.

PCM12153 RF SYSTEM DESIGN L T P C 3 0 0 3

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 up conversion, Two step up conversion

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 – Linearization 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 – sub sampling mixers Oscillators: Describing Functions, Colpitts oscillators – Resonators – Tuned Oscillators – Negative resistance oscillators – Phase noise

Total Hours: 45

Reference 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.

PCM12154 ASIC AND FPGA DESIGN L T P C 3 0 0 3

UNIT I OVERVIEW OF ASIC AND PLD 9

Types of ASICs - Design flow – CAD tools used in ASIC Design – Programming Technologies: Antifuse – static RAM – EPROM and EEPROM technology, Programmable Logic Devices: ROMs and EPROMs – PLA –PAL. Gate Arrays – CPLDs and FPGAs

UNIT II ASIC PHYSICAL DESIGN 9

System partition -partitioning - partitioning methods – interconnect delay models and measurement of delay - floor planning - placement – Routing: global routing - detailed routing - special routing - circuit extraction - DRC

UNIT III LOGIC SYNTHESIS, SIMULATION AND TESTING 9

Design systems - Logic Synthesis - Half gate ASIC -Schematic entry - Low level design language - PLA tools -EDIF- CFI design representation. Verilog and logic synthesis -VHDL and logic synthesis - types of simulation -boundary scan test - fault simulation - automatic test pattern generation.

UNIT IV FPGA 9

Field Programmable gate arrays- Logic blocks, routing architecture, Design flow technology - mapping for FPGAs, Xilinx XC4000 - ALTERA's FLEX 8000/10000, ACTEL's ACT-1,2,3 and their speed performance Case studies: Altera MAX 5000 and 7000 - Altera MAX 9000 – Spartan II and Virtex II FPGAs - Apex and Cyclone FPGAs

UNIT V SOC DESIGN 9

Design Methodologies – Processes and Flows - Embedded software development for SOC – Techniques for SOC Testing – Configurable SOC – Hardware / Software code sign Case studies: Digital camera, Bluetooth radio / modem, SDRAM and USB

Total Hours: 45

Reference Books:

1. M.J.S .Smith, "Application Specific Integrated Circuits, Addison -Wesley Longman Inc., 1997
2. S. Trimberger, Field Programmable Gate Array Technology, Edr, Kluwer Academic Publications, 1994.
3. John V.Oldfield, Richard C Dore, Field Programmable Gate Arrays, Wiley Publications 1995.
4. P.K.Chan & S. Mourad, Digital Design Using Field Programmable Gate Array, Prentice Hall, 1994.
5. Parag.K.Lala, Digital System Design using Programmable Logic Devices, BSP, 2003.
6. S. Brown, R. Francis, J. Rose, Z. Vransic, Field Programmable Gate Array, Kluwer Pubin, 1992.
7. J. Old Field, R.Dorf, Field Programmable Gate Arrays, John Wiley & Sons, Newyork, 1995.
8. Farzad Nekoogar and Faranak Nekoogar, From ASICs to SOCs: A Practical Approach, Prentice Hall PTR, 2003.
9. Wayne Wolf, FPGA-Based System Design, Prentice Hall PTR, 2004.
10. R. Rajsuman, System-on-a-Chip Design and Test. Santa Clara, CA: Artech House Publishers, 2000.
11. F. Nekoogar. Timing Verification of Application-Specific Integrated Circuits (ASICs). Prentice Hall PTR, 1999.

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 Mary 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 Hours: 45

Reference Books:

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.

PCM12252 INTERNETWORKING MULTIMEDIA L T P C 3 0 0 3

UNIT I NTRODUCTION 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 Hours: 45

Reference Books:

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

PCM12255 WIRELESS SENSOR NETWORKS L T P C 3 0 0 3

UNIT I OVERVIEW OF WIRELESS SENSOR NETWORKS 9

Challenges for Wireless Sensor Networks-Characteristics requirements-required mechanisms, Difference between mobile ad-hoc and sensor networks, Applications of sensor networks- Enabling Technologies for Wireless Sensor Networks.

UNIT II ARCHITECTURES 9

Single-Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes , Operating Systems and Execution Environments, Network Architecture - Sensor Network Scenarios, Optimization Goals and Figures of Merit, Gateway Concepts.

UNIT III NETWORKING OF SENSORS 9

Physical Layer and Transceiver Design Considerations, MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols And Wakeup Concepts - S-MAC , The Mediation Device Protocol, Wakeup Radio Concepts, Address and Name Management, Assignment of MAC Addresses, Routing Protocols- Energy-Efficient Routing, Geographic Routing.

UNIT IV INFRASTRUCTURE ESTABLISHMENT 9

Topology Control, Clustering, Time Synchronization, Localization and Positioning, Sensor Tasking and Control.

UNIT V SENSOR NETWORK PLATFORMS AND TOOLS 9

Operating Systems for Wireless Sensor Networks, Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level software platforms, Node-level Simulators, State-centric programming.

Total Hours: 45

Reference Books:

1. Holger Karl and Andreas Willig, *Protocols And Architectures for Wireless Sensor Networks* , John Wiley, 2005.
2. Feng Zhao and Leonidas J. Guibas, *Wireless Sensor Networks - An Information Processing Approach*, Elsevier, 2007.
3. Kazem Sohraby, Daniel Minoli and Taieb Znati, *Wireless Sensor Networks-Technology, Protocols, And Applications*, John Wiley, 2007
4. Anna Hac, *Wireless Sensor Network Designs*, John Wiley, 2003.
5. Bhaskar Krishnamachari, *Networking Wireless Sensors*, Cambridge Press, 2005.
6. Mohammad Ilyas and Imad Mahgaob, *Handbook of Sensor Networks: Compact Wireless and Wired Sensing Systems*, CRC Press, 2005.
7. Wayne Tomasi, *Introduction to Data Communication and Networking*, Pearson Education, 2007

PCM12256 COGNITIVE RADIO L T P C 3 0 0 3

UNIT I INTRODUCTION TO SDR 9

Definitions and potential benefits, software radio architecture evolution – foundations, technology tradeoffs and architecture implications, Antenna for Cognitive Radio.

UNIT II SDR ARCHITECTURE 9

Essential functions of the software radio, architecture goals, quantifying degrees of programmability, top level component topology, computational properties of functional components, interface topologies among plug and play modules, architecture partitions.

UNITIII INTRODUCTION TO COGNITIVE RADIOS 9

Marking radio self-aware, the cognition cycle, organization of congnition tasks, structuring knowledge for cognition tasks, enabling location and environment awareness in cognitive radios concepts, architecture, design considerations.

UNIT IV COGNITIVE RADIO ARCHITECTURE 9

Primary Cognitive Radio functions, Behaviors, Components, A–Priori Knowledge taxonomy, observe – phase data structures, Radio procedure knowledge encapsulation, components of orient, plan, decide phases, act phase knowledge representation, design rules.

UNIT V NEXT GENERATION WIRELESS NETWORKS 9

The XG Network architecture, spectrum sensing, spectrum management, spectrum mobility, spectrum sharing, upper layer issues, cross – layer design.

Total Hours: 45

Reference Books:

1. Alexander M. Wyglinski, Maziar Nekovee, and Y. Thomas Hou, “Cognitive Radio Communications and Networks - Principles And Practice”, Elsevier Inc. 2010.
2. “E. Biglieri, A.J. Goldsmith., L.J. Greenstein, N.B. Mandayam, H.V. Poor, Principles of Cognitive Radio”, Cambridge University Press, 2013.
3. Kwang-Cheng Chen and Ramjee Prasad,” Cognitive Radio Networks” , John Wiley & Sons, Ltd, 2009.
4. Khattab, Ahmed, Perkins, Dmitri, Bayoumi, Magdy, “Cognitive Radio Networks – From Theory to Practice”, Springer Series: Analog Circuits and Signal Processing, 2009.
5. J. Mitola, “ Cognitive Radio: An Integrated Agent Architecture for software defined radio”, Doctor of Technology thesis, Royal Inst. Technology, Sweden 2000.
6. Simon Haykin, “Cognitive Radio: Brain –empowered wireless communications”, IEEE Journal on selected areas in communications, Feb 2005.
7. Ian F. Akyildiz, Won – Yeol Lee, Mehmet C. Vuran, Shantidev Mohanty, “ NeXt generation /dynamic spectrum access / cognitive radio wireless networks: A Survey Elsevier Computer Networks, May 2006.

PCM12253 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 – Top centric 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 – Carries 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 Oberservables – 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 Hours: 45

Reference Books:

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, NewYork, 1995.
3. B.Parkinson, J.Spilker, Jr.(Eds), "GPS: Theory and Applications", Vol.I & Vol.II, AIAA, L'Enfant Promenade SW, Washington, DC 20024, 1996.
4. A.Kleusberg and P.Teunisen(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.

PCM12254 HIGH PERFORMANCE COMPUTER NETWORKS L T P C 3 0 0 3

UNIT I INTRODUCTION 9

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

UNIT II MULTIMEDIA NETWORKING APPLICATIONS 9

Streaming stored Audio and Video – Best effort service – protocols for real time interactive applications – Beyond best effort – scheduling and policing mechanism – integrated services – RSVP-differentiated services.

UNIT III ADVANCED NETWORKS CONCEPTS 9

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

UNIT IV TRAFFIC MODELLING 8

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

UNIT V NETWORK SECURITY AND MANAGEMENT 10

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 Hours: 45

Reference Books:

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 l.Peterson&Bruce S.David, "Computer Networks: A System Approach"- 1996.

PCM12257 WIRELESS SECURITY L T P C 3 0 0 3

UNIT I ATTACKS ON ROUTING PROTOCOLS 9

Vulnerability of MANET to attack - review of AODV and DSR - type of attack - active and passive - internal and external - behavior of malicious node - black hole, DoS, Routing table overflow, Impersonation, Energy consumption, Information Disclosure - Misuse type – Misuse goals – Security flaw in AODV -attack on AODV - wormhole and rushing attack -Performance analysis of AODV in the presence of malicious node.

UNIT II INTRUSION DETECTION IN WIRELESS AD HOC NETWORKS 9

Problem in current IDS techniques - requirements of IDS - classification of IDS – Network and host based -anamoly detection, misuse detection, specification based - intrusion detection in MANETs using distributed IDS and mobile agents - AODV protocol based IDS - Intrusion resistant routing algorithms - Comparison of IDS.

UNIT III MITIGATING TECHNIQUES FOR ROUTING MISBEHAVIOR 9

Introduction - Assumption and background - Physical layer characteristics – DSR - Watchdog, Parthrater, Packet leashes and RAP.

UNIT IV SECURE ROUTING PROTOCOLS 9

Self organized network layer security in MANETs - mechanism to improve authentication and integrity in AODV using hash chain and digital signatures - on demand secure routing protocol resilent to Byzantine failures - ARIADNE, SEAD, SAR, and ARAN.

UNIT V CHALLENGES IN ROUTING SECURITY 9

Security - Challenges and solutions - Providing Robust and Ubiquitous security support - Adaptive security for multilevel Ad Hoc Network - Denial of service Attack at the MAC layer - Detection and handling of MAC layer Misbehavior.

Reference Books:

1. C.Siva Ram Murthy and B.S.Manoj, *AdHoc Wireless Networks: Architectures and Protocols*, Prentice Hall PTR, 2004.
2. Ivan Stojmenovic, *Handbook of Wireless Networks and Mobile Computing*, Wiley, 2002.
3. Hongmei Deng, Wei Li and Dharma P. Agrawal, *Routing Security in Wireless Ad Hoc Networks*, IEEE Communication Magazine, Oct 2002.
4. Peng Ning, Kun Sun, *How To Misuse AODV: A Case Study of Insider Attacks Again Mobile Ad Hoc Routing Protocols* in proceeding of the 4th annaul IEEE information assurance workshop, page 60 – 67 west point, June 2003.
5. Amitabh Mishra, *Intrusion Detection in Wireless Ad Hoc Networks*, IEEE Wireless Communication, February 2004.
6. S.Marti, *Mitigating Routing Misbehaviour in Mobile Ad Hoc Networks*, ACM MOBICOM, 2000.

PCM12258 NETWORK PROCESSOR L T P C 3 0 0 3

UNIT I INTRODUCTION 9

Traditional protocol processing Systems – Network processing Hardware – Basic Packet Processing Algorithms and data Structures - Packet processing functions – Protocol Software – Hardware Architectures for Protocol processing – Classification and Forwarding – Switching Fabrics.

UNIT II NETWORK PROCESSOR TECHNOLOGY 9

Network Processors: Motivation and purpose - Complexity of Network Processor Design – Network Processor Architectures architectural variety, architectural characteristics Peripheral Chips supporting Network Processors: Storage processors, Classification Processors, Search Engines, Switch Fabrics, Traffic Managers.

UNIT III COMMERCIAL NETWORK PROCESSORS 9

Multi-Chip Pipeline, Augmented RISC processor, Embedded Processor plus Coprocessors, Pipelilne of Flomogeneous processors. Configurable Instruction set processors – Pipeline of Electrogeneous processors – Extensive and Diverse processors – Flexible RISC plus Coprocessors – Scalability issues – Design Tradeuffs and consequences.

UNIT IV NETWORK PROCESSOR: ARCHITECTURE AND PROGRAMMING 9

Architecture: Intel Network Processor: Multiheaded Architecture Overview – Features- Embedded EISC processor - Packet Processor Hardware – Memory interfaces – System and Control Interface Components – Bus Interface. Programming Software Development Kit-IXP Instruction set – register formats – Micro Engine Programming – Intra thread and Inter-thread communication – thread synchronization – developing sample applications – control plane – ARM programming.

UNIT V IOS TECHNOLOGIES 9

CISCO COS – Connectivity and scalability – high availability – IP routing – IP services – IPV6 – Mobile IP – MPLS – IP Multicast 0 Manageability – QoS – Security – Switching – Layer VPN2.

Total Hours: 45

REFERENCES:

1. Douglas E.Comer “Networks Systems Design using Network Processors” Prentice Hall JaN. 2003.
2. Panas C. Lekkas, “Network Processors: Architectgures, Protocols and Paradigms Telecom Engineering)”, McGraw Hill, Professional, 2003.
3. Patrick Crowley, M a Eranklin, H. Hadminglu, PZ Onfryk, “Network Processor Design, Issues and Practices Vol-1” Morgan Kaufman, 2002.
4. Patrick Crowley, M a Frankliln, H. Hadimioglyum PZ Onufryk, Network Processor Design, Issues and Prentices vol.II, Morgan Kaufman, 2003.
5. Erik, J.Johnson and Aaron R.Kunze, “IXP2400/2806 Programming: The Microengine Coding Grade” Intel Press.
6. Hill Carlson, “Intel Internet Exchange Architecture & Applications a Practical Guide to Intel’s Network Processors” Intel press. www.cisco.com

PCM12351 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 Hours: 45

Reference Books:

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. Ahuja V “Design and Analysis of Computer Communication networks”, McGraw-Hill, London, 1982.
6. Holtzmann G.J., —Design and validation of Computer protocols, Prentice Hall, New York, 1991.

PCM12352 IMAGE AND VIDEO PROCESSING L T P C 3 0 0 3

[Review of fundamentals of digital image processing & Image transforms is recommended]

UNIT I SEGMENTATION 9

Edge detection, Thresholding, Region growing, Fuzzy clustering, Watershed algorithm, Active contour methods-Level set method, Texture feature based segmentation, Model based segmentation, Atlas based segmentation, Wavelet based Segmentation methods

UNIT II FEATURE EXTRACTION 9

First and second order edge detection operators, Phase congruency, Localized feature extraction-detecting image curvature, shape features Hough transform, shape skeletonization, Boundary descriptors, Moments, Texture descriptors- Autocorrelation, Co-occurrence features, Run length features, Fractal model based features, Gabor filter, wavelet features.

UNIT III REGISTRATION 9

Registration- Preprocessing, Feature selection-points, lines, regions and templates Feature correspondence-Point pattern matching, Line matching, region matching, Template matching. Transformation functions-Similarity transformation and Affine Transformation. Resampling- Nearest Neighbour and Cubic Splines

UNIT IV IMAGE FUSION 9

Image Fusion-Overview of image fusion, pixel fusion, Multiresolution based fusion discrete wavelet transform, Curvelet transform. Region based fusion.

UNIT V 3D IMAGE VISUALIZATION 9

Sources of 3D Data sets, Slicing the Data set, Arbitrary section planes, The use of color, Volumetric display, Stereo Viewing, Ray tracing, Reflection, Surfaces, Multiply connected surfaces, Image processing in 3D, Measurements on 3D images.

Total Hours: 45

Text Books:

1. John C.Russ, “The Image Processing Handbook”, CRC Press, 2007.
2. Mark Nixon, Alberto Aguado, “Feature Extraction and Image Processing”, Academic Press, 2008.
3. Ardeshir Goshtasby , “ 2D and 3D Image registration for Medical, Remote Sensing and Industrial Applications”, John Wiley and Sons,2005.
4. H.B.Mitchell, “Image Fusion Theories, Techniques and Applications”, Springer, 2010.

Reference Books:

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', Pearson Education, Inc., 2002.
3. Rick S.Blum, Zheng Liu, “Multisensor image fusion and its Applications“, Taylor & Francis, 2006.

PCM12353 NETWORK ROUTING ALGORITHMS L T P C 3 0 0 3

UNIT I INTRODUCTION 7

ISO OSI Layer Architecture, TCP/IP Layer Architecture, Routing in telephone networks, Dynamic Non hierarchical Routing (DNHR), Trunk status map routing (TSMR), real-time network routing (RTNR), Dynamic Alternative Routing, Bellman Ford Distance Vector Routing, Link state routing, Hierarchical routing.

UNIT II INTERNET ROUTING 10

Interior protocol: Routing Information Protocol (RIP), Open Shortest Path First (OSPF), 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, Light path 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).Mobile Network Architecture-Mobility and Routing in Cellular Digital Packet Data(CDPD) Network-Packet Radio Routing.

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 Hours: 45

Reference Books:

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.

PCM12354 SPEECH AND AUDIO SIGNAL PROCESSING L T P C 3 0 0 3

UNIT I MECHANICS OF SPEECH 9

Speech Production Mechanism – Nature of Speech Signal – Discrete Time Modeling 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 9

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

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 9

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 & AUDIO SIGNAL PROCESSING 9

Algorithms: Spectral Estimation, Dynamic Time Warping, Hidden Markov Model – Music Analysis – Pitch Detection – Feature Analysis for Recognition – Music Synthesis – 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 Hours: 45

Text Books:

1. L R Rabiner and R W Schaffer, “Digital Processing of Speech signals”, Prentice Hall, 1978.
2. Ben Gold and Nelson Morgan, “Speech and Audio Signal Processing”, John Wiley and Sons, Inc., Singapore 2004.

References Books:

1. Quatieri, “Discrete time Speech Signal Processing”, Prentice Hall 2001.
2. J L Flanagan, “Speech analysis Synthesis and Perception”, 2nd edition, Berlin 1972.
3. I H Witten, “Principles of Computer Speech”, Academic Press, 1982

PCM12355 ADVANCED MICROPROCESSORS AND MICROCONTROLLERS

L P T C 3 0 0 3

UNIT I MICROPROCESSOR ARCHITECTURE 9

Instruction set – Data formats – Instruction 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 – RISC properties – RISC evaluation – On-chip register files versus cache evaluation.

UNIT II HIGH PERFORMANCE CISC ARCHITECTURE – PENTIUM 9

The software model – functional description – CPU pin descriptions – RISC concepts – bus operations – Super scalar architecture – pipe lining – Branch prediction – The instruction and caches – Floating point unit –protected mode operation – Segmentation – paging – Protection – multitasking – Exception and interrupts – Input /Output – Virtual 8086 model – Interrupt processing – Instruction types – Addressing modes – Processor flags – Instruction set –programming the Pentium processor.

UNIT III HIGH PERFORMANCE RISC ARCHITECTURE – ARM 9

The ARM architecture – ARM assembly language program – ARM organization and implementation – The ARM instruction set – The thumb instruction set – ARM CPU cores.

UNIT IV MOTOROLA 68HC11 MICRO CONTROLLERS 9

Instructions and addressing modes – operating modes – Hardware reset – Interrupt system Parallel I/O ports – Flags – Real time clock – Programmable timer – pulse accumulator – serial communication interface – A/D converter, PWM and UART – hardware expansion – Assembly language Programming.

UNIT V PIC MICRO CONTROLLER 9

CPU architecture – Instruction set – Interrupts – Timers – I/O port expansion – I^2C bus for peripheral chip access – A/D converter, UART and PWM – Introduction to C Compilers.

Total Hours: 45

References Books:

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. John B Peatman, “Design with PIC Microcontroller, Prentice hall. 1997.
5. Valvano, “Embedded Microcomputer System”, Thomson Asia Pvt.Ltd., First Reprint2001.
6. Gene H Miller, “Micro Computer Engineering”, Pearson Education., 2003.
7. James L Antonakos., “An Introduction to the Intel family of Microprocessors”, Pearson Education., 1999.
8. Barry B Breg, “The Intel Microprocessors Architecture, Programming and Interfacing”, Prentice Hall of India., 2002.

PCM12356 ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY IN SYSTEM DESIGN

L T P C 3 0 0 3

UNIT I EMI/EMC CONCEPTS 9

EMI-EMC concepts and definitions, Sources and victim of EMI, Conducted and Radiated EMI, Transient EMI ,Time domain Vs Frequency domain EMI, Units of measurement parameters, ESD, Radiation Hazards.

UNIT II EMI COUPLING PRINCIPLES 9

Conducted, radiated and transient coupling, Common impedance ground coupling, Radiated 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, Motherboard Designs and Propagation Delay Performance Models.

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.Test beds for ESD and EFT.

Total Hours: 45

Reference Books:

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 Wileyand Sons, Inc, 1992.
5. Don R.J.White Consultant Incorporate, “Handbook of EMI/EMC”, Vol I-V, 1988.

PCM12357 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, Embedded systems on a chip (SOC) and the use of VLSI designed circuits 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, USB, CAN Bus, Advanced serial high speed buses, SHARC link supports, Ethernet, Martinet, Internet, Network-Based design- Communication Analysis, system performance Analysis, Hardware platform design, Allocation and scheduling, Design Example: Elevator Controller.

UNIT IV REAL TIME OPERATING SYSTEMS 9

Tasks and Task States, Tasks and Data, Semaphores and Shared Data, Message Queues, Mailboxes and Pipes, Timer functions, Events, Memory Management, Interrupt Routines in RTOS Environment, Case Study of Programming with RTOS.

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 Hours: 45

Reference Books:

1. Wayne Wolf, “Computers as Components - Principles of Embedded Computing System Design”, Morgan Kaufman Publishers, First Indian Reprint, 2001.
2. Jane.W.S. Liu, “Real-Time systems”, Pearson Education Asia.
3. Rajkamal, “Embedded Systems Architecture, Programming and Design”, TMH, First reprint, 2003.
4. C. M. Krishna and K. G. Shin, “Real-Time Systems”, McGraw-Hill, 1997
5. Frank Vahid and Tony Givargis, “Embedded System Design: A Unified Hardware/Software Introduction”, John Wiley & Sons.

PCM12358 SIMULATION OF COMMUNICATION NETWORKS L T P C 3 0 0 3

UNIT I MODELLING OF COMMUNICATION SYSTEM 9

Model of Speech and Picture Signals – Pseudo Noise Sequences – Non Linear Sequences, Analog Channel Model – Noise and Fading, Digital Channel Model – Gilbert Model Of Bursty – Channels –HF, Troposcatter and Satellite Channels – Switched Telephone Channels – Analog and Digital Communication System Models – Light Wave System Models

UNIT II SIMULATION OF RANDOM VARIABLES AND RANDOM PROCESS 9

Univariate and Multivariate Models – Transformation of Random Variables – Bounds and Approximation – Random Process Models – Markov and ARMA Sequences –Sampling Rate for Simulation – Computer Generation and Testing of Random Numbers.

UNIT III ESTIMATION OF PERFORMANCE MEASURES 9

Quality of an Estimator – Estimator for SNR – Probability Density Functions of Analog Communication System – BER of Digital Communication Systems – Monte Carlo Method and Importance of Sampling Method – Estimation of Power Spectral Density.

UNIT IV COMMUNICATION NETWORKS 9

Queuing Models– M/M/I and M/M/I/N Queues – Little Formula– Burke's Theorem –M/G/I Queue– Embedded Markov Chain Analysis of TDM Systems – Polling, Random Access Systems.

UNIT V NETWORK OF QUEUES 9

Queues in Tandem – Store and Forward Communication Networks – Capacity Allocation – Congestion and Flow Chart – Routing Model – Network Layout and Reliability.

Total Hours: 45

Text Books:

1. M C Jeruchim Philip Balaban and K Sam Shanmugam, "Simulation of communication Systems", Plenum Press, New York 1992.
2. J F Hayes, "Modelling and Analysis of Computer Communication networks", Plenum Press, New York, 1984.

Reference Books:

1. A M Law and W David Kelton, "Simulation Modelling and analysis", Mc Graw Hill Inc, New York, 1991.
2. Jerry Banks and John S Carson, "Discrete event System Simulation", Prentice Hall Inc, New Jersey 1984.

PCM12359 AD HOC NETWORKS L T P C 3 0 0 3

UNIT I INTRODUCTION 9

Introduction to Ad Hoc networks – definition, characteristics features, applications. Characteristics of Wireless channel, Adhoc Mobility Models: - entity and group models.

UNIT II NETWORK PROTOCOLS 9

Addressing issues in ad hoc network, Routing Protocols: Design issues, goals and classification. Proactive Vs reactive routing, Unicast routing algorithms, Multicast routing algorithms, hybrid routing algorithm, Power/ Energy aware routing algorithm, Hierarchical Routing, QoS aware routing.

UNIT III TRANSPORT LAYER AND SECURITY PROTOCOLS 9

Introduction - issues in designing a Transport Layer Protocol for Ad Hoc wireless networks – design goals of a transport layer protocol for Ad Hoc wireless networks -classification of transport layer solutions - TCP over Ad Hoc wireless networks -other transport layer protocols for Ad Hoc wireless networks - security in Ad Hoc wireless networks - network security requirements - issues and challenges in security provisioning - network security attacks - key management - secure routing in Ad Hoc wireless networks.

UNITI V CROSS LAYER DESIGN AND INTEGRATION OF ADHOC FOR 4G 9

Cross layer Design: Need for cross layer design, cross layer optimization, parameter optimization techniques, Cross layer cautionary perspective, Co-operative networks:- Architecture, methods of co-operation, co-operative antennas, Integration of ad hoc network with other wired and wireless networks.

UNIT – V QoS AND ENERGY MANAGEMENT 9

Introduction - issues and challenges in providing QoS in Ad Hoc wireless networks classifications of QoS solutions - MAC layer solutions - network layer solutions - QoS frameworks for Ad Hoc wireless networks energy management in Ad Hoc wireless networks –Introduction - need for energy management in Ad Hoc wireless networks - classification of energy management schemes – battery management schemes - transmission power management schemes - system power management.

Total Hours: 45

Reference Books:

1. C.Siva Ram Murthy and B.S.Manoj, “Ad hoc Wireless Networks Architectures and protocols”, 2nd edition, Pearson Education. 2007.
2. Charles E. Perkins, “Ad hoc Networking”, Addison – Wesley, 2000 .
3. Stefano Basagni, Marco Conti, Silvia Giordano and Ivan stojmenovic, “Mobile adhoc networking”, Wiley-IEEE press, 2004.
4. Mohammad Ilyas, “The handbook of adhoc wireless networks”, CRC press, 2002.
5. T. Camp, J. Boleng, and V. Davies “A Survey of Mobility Models for Ad Hoc Network Research,” Wireless Communication and Mobile Comp., Special Issue on Mobile Ad Hoc Networking Research, Trends and Applications, vol. 2, no. 5, 2002, pp. 483–502.
6. Fekri M. Abduljalil and Shrikant K. Bodhe , “A survey of integrating IP mobility protocols and Mobile Ad hoc networks”, IEEE communication Survey and tutorials, v 9.no.1 2007.
7. V.T.Raisinhani and S.Iyer “Cross layer design optimization in wireless protocol stacks”, Computer communication, vol 27 no. 8, 2004.
8. V.T.Raisinhani and S.Iyer, “ÉCLAIR; An Efficient Cross-Layer Architecture for wireless protocol stacks”, World Wireless cong., San Francisco, CA, May 2004.
9. C.K. Toh, Ad Hoc Mobile Wireless Networks: Protocols and Systems, Prentice Hall PTR 2001
10. Charles E. Perkins, Ad Hoc Networking, Addison Wesley, 2000.

PCM123510 ADVANCED COMPUTING TECHNIQUES L P T C 3 0 0 3

UNIT I FUZZY SYSTEMS & NEURO FUZZY MODELLING 9

Fuzzy Sets–Fuzzy Rules and Reasoning – Fuzzy Inference Systems – Mamdani Model – Sugeno Model – Tsukamoto Model– Fuzzy decision Making – Multiobjective Decision Making – Fuzzy Classification– Fuzzy Automata and languages – Fuzzy Control Methods. Adaptive Neuro Fuzzy Based Inference Systems – Classification and Regression Trees: Decision Tress – Cart Algorithm – Data Clustering Algorithms: K Means Clustering, Fuzzy C Means Clustering, Mountain Clustering, Subtractive Clustering, Rule Base Structure Identification.

UNIT II ARTIFICIAL NEURAL NETWORKS 9

Basic concepts – Knowledge based processing – Single Layer Perception – Multi Layer Perception – Adaline – Madaline – Learning Rules – Supervised Learning – Unsupervised Learning – Feed Forward, Back Propagation and Counter Propagation Networks – Kohonen self organizing networks – Learning Vector Quantization – Hebbian Learning – Hopfield Network – Adaptive Resonance Theory – Bidirectional Associative Memory – Principle Component Analysis.

UNIT III GRID COMPUTING & APPLICATIONS 9

Introduction - Definition - Scope of grid computing-Grid Computing Organizations and their roles – Grid Computing analog – Grid Computing road map-Merging the Grid sources – Architecture with the Web Devices Architecture.

UNIT IV INTRODUCTION TO CLOUD COMPUTING 9

Introduction to Cloud Computing- The Evolution of Cloud Computing – Hardware Evolution – Internet Software Evolution – Server Virtualization - Web Services Deliver from the Cloud – Communication-as-a-Service – Infrastructure-as-a-Service – Monitoring as a Service – Platform as a Service – Software as a Service – Building Cloud Network.

UNIT V SECURITY IN CLOUD COMPUTING 9

Federation in the Cloud - Presence in the Cloud - Privacy and its Relation to Cloud- Based Information Systems – Security in the Cloud - Common Standards in the Cloud – End-User Access to the Cloud Computing.

Total Hours: 45

Reference Books:

1. Timothy J Ross, “Fuzzy Logic Engineering Applications”, McGraw-Hill New York, 1997.
2. Jang J S R, Sun C T and Mizutani E, “Neuro Fuzzy and soft computing”, Pearson Education, (Singapore) 2004.
3. David E Goldberg, “Genetic Algorithms in Search Optimization and Machine Learning”, Pearson Education, Asia, 1996.
4. Laurene Fauseett, “Fundamentals of Neural Networks” Prentice Hall, India, New Delhi, 1994.
5. S Rajasekaran and G A Vijayalakshmi Pai, “Neural networks Fuzzy logics and Genetic algorithms”, Prentice Hall of India, 2003.
6. George J Klir and Bo Yuan, “Fuzzy Sets and Fuzzy Logic”, Prentice Hall Inc, New Jersey, 1995.
7. John W. Rittinghouse and Ames F. Ransome, “Cloud Computing Implementation, Management and Security”, CRC Press, Taylor & Francis Group, Boca Raton London New York. 2010.
8. Alfredo Mendoza, “Utility Computing Technologies, Standards, and Strategies”, Artech House INC, 2007.
9. Joshy Joseph & Craig Fellenstein, “Grid Computing”, PHI, PTR-2003.
10. Ahmar Abbas, “Grid Computing: A Practical Guide to technology and Applications”, Charles River media – 2003.

PCM123511 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-arrangable 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 Hours: 45

Reference Books:

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.

PCM123512 WIRELESS EMBEDDED SYSTEMS L T P C 3 0 0 3

UNIT I WIRELESS MEDIUM AND ACCESS **9**

Overview of wireless systems - Air Interface Design – Radio propagation mechanism – Path loss modeling and Signal Coverage – Effect of Multipath and Doppler – Channel Measurement and Modelling – Simulation of Radio Channel. Fixed Assignment Access for Voice Networks – Random Access for Data Networks – Integration of Voice and Data Traffic.

UNIT II WIRELESS LAN **9**

Introduction to wireless LANs – IEEE 802.11 – WPAN IEEE 802.15 –Mobile AdHoc Networks(MANET)- Principle and operation - Wireless Home Networking – Concepts of Bluetooth Technology – Wireless Geolocation.

UNIT III EMBEDDED NETWORK REQUIREMENTS **9**

Embedded networking – code requirements – Communication requirements – Introduction to CAN open – CAN open standard – Object directory – Electronic Data Sheets & Device – Configuration files – Service Data Objectives – Network management CAN open messages – Device profile encoder.

UNIT IV CAN OPEN **9**

CAN open configuration – Evaluating system requirements choosing devices and tools – Configuring single devices – Overall network configuration – Network simulation – Network Commissioning – Advanced features and testing.
CAN: Controller Area Network – Underlying Technology CAN Overview – Selecting a CAN Controller – CAN development tools.

UNIT V IMPLEMENTATION OF CAN OPEN **9**

Implementing CAN open Communication layout and requirements – Comparison of implementation methods – Micro CAN open – CAN open source code – Conformance test – Entire design life cycle. Physical layer – Data types – Object dictionary – Communication object identifiers – Emerging objects – Node states.

Total Hours: 45

Reference Books

1. Glaf P.Feiffer, Andrew Ayre and Christian Keyold, “Embedded networking with CAN and CAN open”, Embedded System Academy 2005.
2. Kaveth Pahlavan, K.Prasanth Krishnamurthy, “Principles of Wireless Networks”, Pearson Education Asia, 2002.
3. William Stallings, “Wireless Communications and Networks”, Second Edition Prentice Hall, India2007.
4. Jon W Mark, Weihua Zhuang,”Wireless communication and Networking”, Prentice Hall India 2003.