PMA15104 APPLIED MATHEMATICS FORCOMMUNICATION ENGINEERS **3 2 0 4**

COURSE OBJECTIVES

To enable the students to

- Develop the ability to use the concepts of Linear algebra and Special functions for solving problems related to Networks
- Formulate and construct a mathematical model for a linear programming problem in real life situation
- Expose the students to solve ordinary differential equations by various techniques.
- Motivate and understand the axioms of probability from frequency of occurrence perspectives.
- Develop analytical capability and to important knowledge in queuing theory

UNIT I LINEAR ALGEBRA **9+6**

Vector spaces – norms – Inner Products – Eigen values using QR transformations – QR factorization -generalized eigenvectors – Canonical forms – singular value decomposition and applications – pseudo inverse– least square approximations—Toeplitz matrices and some applications.

UNIT II LINEAR PROGRAMMING **9+6**

Formulation–Graphical solution–Simplex method–Two phase method-Transportation and Assignment Models

UNIT III ORDINARY DIFFERENTIALE QUATIONS **9+6**

Runge Kutta Methods for system of IVPs, numerical stability, Adams- Bash for thmulti step method, solution of stiff ODEs, shooting method, BVP: Finite difference method, orthogonal collocation method, orthogonal collocation with finite element method, Galerkin finite element method.

UNIT IV TWO DIMENSIONAL RANDOM VARIABLES **9+6**

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

UNIT V QUEUING MODELS **9+6**

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

TOTAL PERIODS 45+30

COURSE OUTCOMES

At the end of the course, the students will be able to

- Achieve an understanding of the basic concepts of algebraic equations and method of solving them.
- Familiarize the students with special functions and solve problems associated with Engineering applications.
- Demonstrate their understanding of differential equations and their application to scientific
- Perform standard operations on vectors in two dimensional space

- Formulate concrete problems using queuing theoretical approaches.

TEXT BOOKS

1. Richard Bronson,GabrielB.Costa, "Linear Algebra", Academic Press, Second Edition,2007.
2. Richard Johnson,Miller&Freund, "Probability and Statistics for Engineers",7thEdition,Prentice– Hallof India, PrivateLtd., New Delhi, 2007.
3. TahaH.A., "Operations Research : An introduction", Pearson Education Asia, NewDelhi, Ninth Edition, 2012.
4. Donald Grossand Carl M.Harris, "Fundamentals of Queuing Theory", 2nd edition, John Wiley and Sons, New York, 1985
5. Moon,T.K.,Sterling,W.C., "Mathematical methods and algorithms for signal processing", Pearson Education,2000.

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)													
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	3	-	-	-	-	-	-	-	3	3	3
CO2	3	3	3	3	-	-	-	-	-	-	-	3	3	3
CO3	3	3	3	3	-	-	-	-	-	-	-	3	3	3
CO4	3	3	3	3	-	-	-	-	-	-	-	3	3	3
CO5	3	3	3	3	-	-	-	-	-	-	-	3	3	3

PCS15102 STATISTICAL SIGNAL PROCESSING **3 2 0 4**

COURSE OBJECTIVES

To enable the students to

- Explore the concept of discrete random signal processing
- Analysis the adaptive filters and its applications
- Understand fundamental concepts on Linear Estimation and Prediction.
- Learn fundamental concepts on signal processing in power spectrum estimation
- Explore the concepts of multirate signal processing and multirate filters

UNIT I DISCRETE RANDOM SIGNAL PROCESSING 9+6

Discrete Random Processes-Ensemble Averages, Stationary processes, Bias and Estimation, Auto covariance, Auto correlation, Parseval's theorem, Wiener Khint chine 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+6

Estimation of spectra from finite duration signals, Non parametric 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+6

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 ADAPTIVEFILTERS 9+6

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 MULTIRATEDIGITALSIGNALPROCESSING 9+6

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 sub band coding-Wavelet transform.

TOTAL PERIODS 45+30

COURSE OUTCOMES

At the end of the course, the students will be able to

- Acquire knowledge of how a multi rate system works
- Design and implement decimator and interpolator and to design multi rate filter bank
- Understand different spectral estimation techniques and linear prediction
- Design LMS and RLS adaptive filters for signal enhancement, channel equalization

TEXT BOOKS

1. MonsonH.Hayes, "Statistical Digital Signal Processing and Modeling", JohnWileyandSons,Inc, Singapore, 2002
2. John J.Proakis, Dimitris G.Manolakis, "Digital Signal Processing",PearsonEducation,2002.
3. RafaelC.Gonzalez, Richard E.Woods, "Digital Image Processing",Pearson Education Inc., Second Edition,2004(For Wavelet Transform Topic)
4. G.Dimitrisand G.Manolakis., "Statistical and Adaptive Signal Processing", McGrawHill,2002
5. Sophoncles J.Orfanidis, "Optimum Signal Processing", McGraw Hill,2007.

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	**Programme Outcomes(POs)**													
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	-	-	-	-	-	-	-	3	3	3	-	3	3
CO2	3	-	-	-	-	-	-	-	3	3	3	-	3	3
CO3	3	-	-	-	-	-	-	-	3	3	3	-	3	3
CO4	3	-	-	-	-	-	-	-	3	3	3	-	3	3
CO5	3	-	-	-	-	-	-	-	3	3	3	-	3	3

PCS15103 ADVANCED RADIATION SYSTEMS **3 2 0 4**

COURSE OBJECTIVES

To enable the students to

- Understand the relation between the fields and to be familiar with antenna arrays.
- Understand signal propagation at Radio frequencies & to study aperture and Reflector antennas
- Introduce to the students the basics of Micro strip Patch Antennas and its analysis
- Know about Antenna arrays and its parameter measurement
- Learn the special antenna arrays and their applications

UNIT I ANTENNA FUNDAMENTALS **9+6**

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+6**

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 LINEAR ESTIMATION AND PREDICTION **9+6**

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 HORN, MICROSTRIP, REFLECTOR ANTENNAS **9+6**

E and H plane sectoral Horns- Pyramidal horns- Conical and corrugated Horns-Microstrip antennas –feeding methods. Rectangular patch- Transmission line model-Parabolic Reflector antennas – Prime focus and Cassegrain reflectors - Equivalent focal Length of Cassgrain antennas- Spillover and taper Efficiencies –Optimum illumination.

UNIT V EMC ANTENNA AND ANTENNA MEASUREMENTS **9+6**

Concept of EMC measuring antenna; Tx and Rx 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 coding- Wavelet transform.

TOTAL PERIODS 45+30

COURSE OUTCOMES

At the end of the course, the students will be able to

- Understand various antenna parameters.
- Get knowledge of aperture antennas and the field associated with it

- Design of Microstrip patch antennas and their design and simulation using software
- Learn the applications of array antennas

- Perform measurement of antenna parameters and special array antennas design.

REFERENCES

1. Balanis.A,"Antenna Theory Analysis and Design",JohnWileyandSons,NewYork,1982
2. Krauss.J.D,"Antennas", IIedition, JohnWileyandsons, NewYork, 1997
3. I.J.Bahl and P.Bhartia," Microstrip Antennas",ArtechHouse,Inc.,1980.
4. W.L.StutzmanandG.A.Thiele,"Antenna Theory and Design",2nd edition, John Wiley & Sons Inc.,1998
5. Jordan,E.C., "Electromagnetic waves and Radiating systems".PHI2003

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)													
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	3	3	-	-	-	-	-	-	3	3	3
CO2	3	3	3	3	3	-	-	-	-	-	-	3	3	3
CO3	3	3	3	3	3	-	-	-	-	-	-	3	3	3
CO4	3	3	3	3	3	-	-	-	-	-	-	3	3	3
CO5	3	3	3	3	3	-	-	-	-	-	-	3	3	3

PCS15104 ADVANCED DIGITAL COMMUNICATION TECHNIQUES **3 2 0 4**

COURSE OBJECTIVES

To enable the students to

- Understand the envelope modulation techniques
- Acquire knowledge about filtering coding and scrambling
- Obtain awareness about various algorithms
- Gain the knowledge gain modulation
- Become capable of design Space time coding

UNIT I DIGITAL MODULATION SCHEMES **9+6**

Representation of Digitally Modulated signals, Memory less Modulation Methods, Signaling Schemes with Memory– CPFSK, CPM, Power Spectrum of Digitally Modulated Signals – PSD of a digitally modulated signal with memory, PSD of a linear modulated signal, PSD of a digitally modulated signal with Finite memory, PSD of a digitally modulation scheme with a Markov Structure

UNIT II OFDM **9+6**

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 TRELLIS CODED MODULATION **9+6**

Coded modulation for bandwidth-constrained channels-Trellis coded modulation; Set Partitioning, Four –state Trellis-coded modulation with 8-PSK signal constellation, Eight-state Trellis code for coded 8-PSKmodulation, Eight-state Trellis for rectangular QAM signal constellations..

UNIT IV TURBO CODING **9+6**

Introduction-Turbo Encoder, Turbo Decoder, Iterative Turbo Decoding Principles; Modifications of the MAP Algorithm- The Soft-Output Viterbi Algorithm(SOVA); Turbo Coded BPSK Performance over Gaussian channels, Turbo Coding Performance over Rayleigh Channels.

UNIT V SPACE-TIMECODING **9+6**

Maximum Ratio combining; Space-time Block codes; Space-time Trellis codes- The4-state,4-PSKSpace-timeTrellisEncoder,The4-state,4-PSKSpace-timeTrellisDecoder,MIMO-OFDMSystems.

TOTAL PERIODS **45+30**

COURSE OUTCOMES

At the end of the course, the students will be able to

- Understand the envelope modulation techniques
- Acquire knowledge about filtering coding and scrambling
- Learn about various algorithms

- Design gain modulation Capable of design Space time coding

TEXT BOOKS

1. BernardSklar.,"DigitalCommunications",secondedition,PearsonEducation,2001

2. TheodoreS.Rappaport.,"WirelessCommunications",2nd edition,PearsonEducation,2002

3.StephenG.Wilson.,"DigitalModulationandCoding",FirstIndianReprint,PearsonEducation,2003

4. RichardVanNee&RamjeePrasad.,"OFDMforMultimediaCommunications"ArtechHouse Publication,2001

5.SimonHaykins, "Communication System" , John Wiley and Sons, 2008.

Mapping of Course Outcomes with Programme Outcomes: **(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak**														
COs	**Programme Outcomes(POs)**													
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO1 1**	**PO1 2**	**PSO 1**	**PSO 2**
CO1	3	3	3	3	3	-	-	-	-	-	3	3	3	3
CO2	3	3	3	3	3	-	-	-	-	-	3	3	3	3
CO3	3	3	3	3	3	-	-	-	-	-	3	3	3	3
CO4	3	3	3	3	3	-	-	-	-	-	3	3	3	3
CO5	3	3	3	3	3	-	-	-	-	-	3	3	3	3

PCS15105 FIBEROPTIC NETWORKING **3 2 0 4**

COURSE OBJECTIVES

To enable the students to

- Explore the concepts of basic optical system components
- Understand the concepts of optical networks and its architecture
- Learn the fundamental concepts on Wavelength Routing Networks
- Introduce the concepts on Packet Switching and Access Networks
- Understand the concepts of network management and survivability

UNIT I OPTICAL SYSTEM COMPONENTS 9+6

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

UNIT II OPTICAL NETWORK ARCHITECTURE 9+6

WDM Network Elements; WDM Network Design- Cost tradeoffs - Virtual Topology Design-Routing and wavelength assignment, Statistical Dimensioning Models.

UNIT III WAVELENGTHROUTINGNETWORKS 9+6

WDM Network Elements; WDM Network Design- Cost tradeoffs - Virtual Topology Design-Routing and wavelength assignment, Statistical Dimensioning Models.

UNIT IV PACKETSWITCHINGANDACCESSNETWORKS 9+6

Photonic Packet Switching–OTDM, Multiplexing and Demultiplexing, Synchronization, Header Processing, Buffering, Burst Switching, Testbeds; Access Networks.

UNIT V NETWORKMANAGEMENTANDSURVIVABILITY 9+6

Control and Management – Network management functions, Configuration management, Performance management, Fault management, Optical safety, Service interface; network Survivability- Protection in SONET /SDH and IP Networks, Optical layer Protection, Interworking between layers.

TOTAL PERIODS 45+30

COURSE OUTCOMES

At the end of the course, the students will be able to

- Learn the concepts of basic optical system components
- Identifythevariousmodulesfordesignofopticalcommunicationsystems.
- Determine the performance of a given optical fiber communication link
- Trouble shoot the various stages in a optical communication link
- Learn the concepts of network management and survivability.

REFERENCES

1.RajivRamaswamiandKumarN.Sivarajan,"OpticalNetworks:APracticalPerspective",Harcourt Asia Pte Ltd., Second Edition 2006.

2.C.SivaRamMoorthyandMohanGurusamy,"WDMOpticalNetworks:Concept,Designand Algorithms",Prentice Hall of India, IstEdition, 2002.

3.GerdKeiser,"OpticalFiberCommunication"McGraw–HillInternational,Singapore,4thedition. 2011.

4. John M .Senior, "Introduction to Optical Fiber Communications", Pearson/ Prentice Hall.

5.HarryJ.RDutton,"UnderstandingOpticalCommunications",IBMCorporation,International Technical Support Organization.

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)													
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	3	3	-	3	-	-	-	3	-	3	-	3	3
CO2	3	3	3	-	3	-	-	-	3	-	3	-	3	3
CO3	3	3	3	-	3	-	-	-	3	-	3	-	3	3
CO4	3	3	3	-	3	-	-	-	3	-	3	-	3	3
CO5	3	3	3	-	3	-	-	-	3	-	3	-	3	3

PCL15107 COMMUNICATION SYSTEM DESIGN LABORATORY 0 0 4 2

COURSE OBJECTIVES

- To learn about signal transmission and reception
- To perform simulation and analysis of various systems
- To study the digital communication techniques
- To know basics of error control
- To get experience and knowledge about various communication systems.

LIST OF EXPERIMENTS

1. Design and performance analysis of error control encoder and decoder(CRC, Convolutional Codes)
2. Determination of Maximum bit rate of a digital fiber optic link.
3. Signal transmission and reception using WDM and spectral characterization.
4. Wireless Channel emulation and characterization.
5. Design and analysis of digital communication techniques on an SDR platform.
6. OFDM transceiver design using MATLAB.
7. Channel equalizer design using MATLAB (LMS, RLS)
8. Design and Analysis of Spectrum Estimators (Bartlett, Welch)
9. Simulation of MIMO systems.
10. Simulation of Turbo coding and SOVA.

COURSE OUTCOMES **TOTAL: 60 PERIODS**

At the end of this course, the students will be able to

- Analyze characteristics of wireless channel
- Understand the design and analysis of spectrum estimators.
- Understand the determination of fiber optic link.
- Comprehend the generation of OFDM signals and the processing of the signals
- Simulate various communication systems.

CO-PO Mapping:

Mapping of Course Outcomes with Programme Outcomes: **(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak**														
Programme Outcomes(POs)														
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3	3	3	3	-	-	-	-	-	-	3	3
CO2	3	3	3	3	3	3	-	-	-	-	-	-	3	3
CO3	3	3	3	3	3	3	-	-	-	-	-	-	3	3
CO4	3	3	3	3	3	3	-	-	-	-	-	-	3	3
CO5	3	3	3	3	3	3	-	-	-	-	-	-	3	3

PCS15151 ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY IN SYSTEM DESIGN **3 0 0 3**

COURSE OBJECTIVES

- To enable the students to
- learn about the basics of EMI & EMC Environment, EMI Specification Standards and Limits
- understand about EMI & EMC Coupling Principles
- study the control techniques involved in Electromagnetic Interference
- know about EMI Measurements

UNIT I EMI PRINCIPLES AND STANDARDS **9**

EMI-EMC definitions and Units of parameters; Sources and victim of EMI; Conducted and Radiated EMI Emission and Susceptibility; Transient EMI, Time domain Vs Frequency domain EMI ESD; Radiation Hazards, Units of specifications, Civilian standards - FCC, CISPR, IEC, EN, Military standards - MILSTD461D/462.

UNIT II EMI COUPLINGPRINCIPLES **10**

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-Test beds for ESD and EFT.

UNIT IV EMC DESIGN OF PCBS **8**

PCB Traces Cross Talk, Impedance Control, Power Distribution Decoupling, Zoning, Motherboard Designs and Propagation Delay Performance Models.

UNIT V EMIMEASUREMENTS **9**

EMI Test Instruments/Systems, EMI Shielded Chamber, Open Area Test Site, TEM Cell, Sensors/Injectors/ Couplers.

TOTAL PERIODS **45**

COURSE OUTCOMES

At the end of the course, the students will be able to

- Analytical concepts of EMI & EMC
- Find solution to EMI Sources
- Find solution to EMI problems in PCB level
- Measure emission immunity level from different systems to couple with different standards
- Design and implement EMI system

REFERENCES

1. V.P. Kodali, “Engineering EMC Principles, Measurement and Technologies”, IEEE Press, New York, 1996.
2. HenryW.Ott.,“NoiseReductionTechniquesinElectronicSystems”,AWileyInterSciencePublications, John Wiley and Sons, New York, 1988.
3. BemhardKeiser,“Principles of Electromagnetic Compatibility”, 3rdEd, Artech hourse, Norwood,1986
4. C.R.Paul,“Introduction to Electromagnetic Compatibility”, JohnWiley and Sons, Inc, 1992.
5. Don R.J. White Consultant In corporate, “Handbook of EMI/EMC”, VolI-V, 1988

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)												
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	3	3	-	-	-	-	-	3	3	3	3
CO2	3	3	3	3	3	-	-	-	-	-	3	3	3	3
CO3	3	3	3	3	3	-	-	-	-	-	3	3	3	3
CO4	3	3	3	3	3	-	-	-	-	-	3	3	3	3
CO5	3	3	3	3	3	-	-	-	-	-	3	3	3	3

PCS15152 HIGH SPEED SWITCHING ARCHITECTURES **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- Understand the concept of various switching
- Analysis the blocking networks
- Learn about the Quesing networks
- Understand the architecture of internet switches
- Analysis the IP

UNIT I NETWORKING **9**

Introduction- LAN, WAN, Network evolution through ISDN to B-ISDN, Transfer mode and control of B-ISDN,SDH multiplexing structure, ATM standard, ATM adaptation layers.

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, and embanyan switch.

UNIT III QUEUESIN ATM SWITCHES **9**

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

UNIT IV PACKET SWITCHING ARCHITECTURES **9**

Architecture of internet switches and routers- Buffer less and buffered crossbar switches, Multi-stage switching, Optical Packet switching; switching fabricon a chip; internally buffered Cross bars.

UNIT V IP SWITCHING & LAN SWITCHING TECHNOLOGY **9**

Addressing model, IP Switching types - flow driven and topology driven solutions, IP over ATM address and next ho pre solution, multicasting, Ip v6 over ATM. Switching Concepts, switch forwarding techniques, switch path control ,LAN Switching, cut through forwarding, store and forward, virtual LANs.

TOTAL PERIODS **45**

COURSE OUTCOMES

At the end of the course, the students will be able to

- Gain Knowledge of blocking &non blocking networks based on the switches
- Understand about ATM switches and various switching types

REFERENCES

1. AchillePattavina,“Switching Theory: Architectures and performance in Broad band ATM networks",

JohnWiley & Sons Ltd, New York. 1998.

2. ElhananyM.Hamdi,"High Performance Packet Switching architectures", Springer Publications,2007John Wiley and Sons, NewYork, 1988.
3. ChristopherYMetz,"Switching protocols & Architectures",McGraw-Hill Professional Publishing, NewYork.1998.
4. RainerHandel,Manfred NHuber,Stefan Schroder,"ATM Networks-Concepts Protocols,Applications",3rd Edition, Addison Wesley, New York. 1999
5. IrvanPepelnjk,Jim Guichard and JeffApcar,"MPLS and VPN Architecture", Cisco Press,Volume1 and 2, 2003.

Mapping of Course Outcomes with Programme Outcomes:

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	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	3	3	-	-	-	-	-	3	3	3	3
CO2	3	3	3	3	3	-	-	-	-	-	3	3	3	3
CO3	3	3	3	3	3	-	-	-	-	-	3	3	3	3
CO4	3	3	3	3	3	-	-	-	-	-	3	3	3	3
CO5	3	3	3	3	3	-	-	-	-	-	3	3	3	3

PCS15153 MICROWAVEINTEGRATEDCIRCUITS **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- Introduce the basics of microwave integrated circuits
- Study about the microwave passive components
- Understand the working principle of microwave amplifiers and its types
- Introduce the concept of microwave oscillators in various fields
- Study about the technology of IC's and propagation of signals through Micro strip Transmission lines

UNIT I UNITI FUNDAMENTAL OF MICRO WAVE INTEGRATED CIRCUITS **9**

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

UNIT II PASSIVE COMPONENTS **9**

Inductors, capacitors, resistors, micro strip components, coplanar circuits, multi layer techniques-micro machined passive components, switches &attenuators, filter design.

UNIT III AMPLIFIERS **9**

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

UNIT IV OSCILLATORS **9**

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

UNIT V INTEGRATED ANTENNAS AND MEASUREMENT TECHNIQUES **9**

Integratesantennaselection,photonicbandgapantennas,micromachinedantenna,microelectromechanicalsystemantennas,testfixturemeasurements,probestationmeasurements,thermalandcryogenicmeasurements,experimentalfieldprobingtechniques

TOTAL PERIODS **45**

COURSE OUTCOMES

At the end of the course, the students will be able to

- Learn the basics of microwave integrated circuits
- Understand the concept of microwave passive components
- Get an idea on microwave amplifiers and oscillators

REFERENCES

1. RavenderGoyal,"Monolithic MIC; Technology & Design",ArtechHouse,1989.
2. Gupta K.C.and Amarjit Singh, "Microwave Integrated Circuits",JohnWiley,NewYork,1975.

3. UlrichL.Rohde and David P.N.,"RF/Microwave Circuit Design for Wireless Applications",JohnWiley, 2000.
4. Annapurna Das and Sisir KDas,"Microwave Engineering",Tata Mc Graw-Hill Pub.Co.Ltd.,2004
5. MathewN.O.Sadiku,"Numerical techniques in Electromagnetic",CRC Press,2001

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)													
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	3	3	3	3	-	-	-	-	-	3	3	3	3
CO2	3	3	3	3	3	-	-	-	-	-	3	3	3	3
CO3	3	3	3	3	3	-	-	-	-	-	3	3	3	3
CO4	3	3	3	3	3	-	-	-	-	-	3	3	3	3
CO5	3	3	3	3	3	-	-	-	-	-	3	3	3	3

PCS15154 COMMUNICATION NETWORK SECURITY **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- Gain knowledge on securing the data plane
- Acquire knowledge on securing the control plane
- Understand establishing of Identity and Access Control
- Learn about the network and firewall security
- Gain knowledge about there cent trends in wireless security

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

Sub situational 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 NETWORKSECURITY,FIREWALLSANDWEBSECURITY 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: Wormhole, Tunneling, DoS. WEP for Wi-Finetwork, Security for 4G networks: Secure Ad hoc Network, Secure Sensor Network.

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of the course, the students will be able to

- Gain knowledge on securing the data plane
- Know about securing the control plane
- Understand establishing of Identity and Access Control
- Learn the network and firewall security

- Gain knowledge about the recent trends in wireless security

REFERENCES

1. BehrouzA.Fourcuzan,“Cryptography and Network security”,TataMcGraw-Hill,2008
2. William Stallings, "Cryptography and Network security: principles and practice" ,2nd Edition, Prentice Hall of India, NewDelhi, 2002
3. AtulKahate, “Cryptography and Network security”, 2nd Edition,Tata McGraw-Hill, 2008
4. R.K.NicholsandP.C.Lekkas,“WirelessSecurity
5. H.Yangetal.,“Security in Mobile AdHoc Networks: Challenges and Solution”,IEEE Wireless Communications, Feb. 2004.

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

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CO3	3	3	3	3	3	-	-	-	-	-	3	3	3	3
CO4	3	3	3	3	3	-	-	-	-	-	3	3	3	3
CO5	3	3	3	3	3	-	-	-	-	-	3	3	3	3

PCS15201 WIRELESSNETWORKS **3 2 0 4**

COURSE OBJECTIVES

To enable the students to

- Understand the various concepts on wireless local area network, architectures and applications
- Study the overview of3Garchitectures
- Familiarze the various aspects of ADHOC networks
- Introduce the concept of WLANS and WWANS
- Study the concept of 4G networks

UNIT I WLAN AND WIRELESS GEO LOCATION 9+6

Introduction to wireless LANs -IEEE802 .11WLANs –Physical Layer-MAC sub layer-MAC Management Sub layer-Wireless ATM - HIPERLAN- HIPERLAN-2, WIMAX, WPAN, Home RF, Bluetooth, interface between Bluetooth and 802.11, wireless Geo location technologies for wireless Geo location, Geo location standards for E.911 service.

UNIT II 3 GOVERVIEW AND 2.5G EVOLUTION 9+6

Migration path to UMTS, UMTS Basics, Ai Interface, 3GPPNetwork Architecture, CDMA 2000 overview-Radio and Network components, Network structure, Radio network, TD-CDMA, TD-SCDMA.

UNIT III ADHOC AND SENSOR NETWORKS 9+6

Characteristics of MANETs, Table-driven and Source-initiated On Demand routing protocols, Hybrid protocols, Wireless Sensor networks-Classification, MAC and Routing protocols.

UNIT IV INTERWORKING BETWEEN WLANS AND 3G WWANS 9+6

Interworking objectives and requirements, Schemes to connect WLANs and 3GNetworks, Session Mobility, Interworking Architectures for WLAN and GPRS, System Description, Local Multipoint Distribution Service, Multichannel Multipoint Distribution system.

UNIT V 4G AND BEYOND 9+6

4G features and challenges, Technology path, IMS Architecture, Convergent Devices, 4G technologies, Advanced Broadband Wireless Access and Services, Multimedia, MVNO.

TOTAL PERIODS 45+30

COURSE OUTCOMES

At the end of the course, the students will be able to

- Learn the basics of wireless networks and its applications in enabling technologies.
- Identify the technical issues related to ADHOC sensor networks
- Understand the architecture and elements of WLANS
- Getanideaon3Gand4Gprotocolsforwirelessnetworks

REFERENCES

1. ClintSmith.P. E., and Daniel Collins, “3GWireless Networks”,2nd Edition,TataMcGrawHill,2007
2. Vijay.K.Garg,“Wireless Communication and Networking”, Morgan Kaufmann Publishers,
3. http://books.elsevier.com/9780123735805,2007.
4. William Stallings, "Wireless Communications and networks", Pearson / Prentice Hall of India, 2nd Ed.,
5. 2007.
6. Gary. S. Rogers & John Edwards, “An Introduction to Wireless Technology”, Pearson Education,2007..
7. SumitKaseraandNishitNarang,“3GNetworks–Architecture,ProtocolsandProcedures”,Tata
8. McGrawHill, 2007.

Mapping of Course Outcomes with Programme Outcomes:

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CO3	3	3	3	3	3	-	-	-	-	-	3	3	3	3
CO4	3	3	3	3	3	-	-	-	-	-	3	3	3	3
CO5	3	3	3	3	3	-	-	-	-	-	3	3	3	3

PCS15202 RFSYSTEM DESIGN **3 2 0 4**

COURSE OBJECTIVES

To enable the students to

- Learn RF design and circuit board components
- Understand various impedance transformers and biasing networks
- Study the basic RF components and the basic RF mixers and oscillators
- Acquire knowledge of RF filters and RF synthesizer

UNIT I CMOS PHYSICS, TRANSCEIVER SPECIFICATIONS AND ARCHITECTURES **9+6**

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+6**

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+6**

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+6**

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+6**

Mixer: characteristics – Non-linear based mixers: Quadratic mixers – Multiplier based mixers: Single balanced and double balanced mixers – sub sampling mixers Oscillators: Describing Functions, Colpitt's oscillators –Resonators –Tuned Oscillators – Negative resistance oscillators –Phase noise.

TOTAL PERIODS 45+30

COURSE OUTCOMES

At the end of the course, the students will be able to

- Understand of various RF issues

- Analysis of impedance transformation.
- Know about active RF component, matching and biasing networks
- Design the concepts of RF filter design and their implementation using software.
- Learn the operation of RF oscillators and mixers and their design

REFERENCES

1. T. Lee, "Design of CMOSRF Integrated Circuits", Cambridge, 2004.
2. Reinhold Ludwig and Powel Bretchko, "RF Circuit Design –Theory and Applications", Pearson
3. Education Asia, 2006.
4 Kai Chang, Inder Bahl and Vijay Nair, "RF and Microwave Circuit and Component Design for
5. Wireless Systems", John Wiley and Sons, 2002.
6. Jan Crols, MichielSteyaert, "CMOS Wireless Transceiver Design", Kluwer Academic Publishers, 1997.
7. B. Razavi, "Design of Analog CMOS Integrated Circuits", McGrawHill,2001

Mapping of Course Outcomes with Programme Outcomes:

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CO2	3	3	3	3	3	-	-	-	-	-	3	3	3	3
CO3	3	3	3	3	3	-	-	-	-	-	3	3	3	3
CO4	3	3	3	3	3	-	-	-	-	-	3	3	3	3
CO5	3	3	3	3	3	-	-	-	-	-	3	3	3	3

PCS15203 MULTIMEDIACOMMUNICATION **3 2 0 4**

COURSE OBJECTIVES

To enable the students to

- To introduces technologies for multimedia communications
- To address how to efficiently represent multimedia data, including video, image, and audio, and how to deliver the move variety of networks.
- To know about Loss less compression and VoIP technology
- To learn about Multi media Networking

UNIT I MULTI MEDIA COMPONENTS **9+6**

Introduction - Multimedia skills - Multimedia components and their characteristics Text - sound, images, graphics, animation, video, hardware.

UNIT II AUDIO AND VIDEO COMPRESSION **9+6**

Audio compression –DPCM –Adaptive PCM –adaptive predictive coding -linear Predictive coding-code excited LPC - perpetual coding, MP3; Video compression–principles-H.261-H.263-MPEG1, 2,4.

UNIT III LOSS LESS COMPRESSION **9+6**

Compression principles-source encoders and destination encoders--entropy encoding –source encoding –text compression –static Huffman coding dynamic coding– arithmetic coding–Lempel Ziv –Welch Compression.

UNIT IV VOIPTECHNOLOGY **9+6**

Basics of IP transport, VoIP challenges, H.323/ SIP –Network Architecture, Protocols, Call establishment and release, VoIP and SS7,Quality of Service-CODEC Methods-VOIP applicability.

UNIT V MULTI MEDIA NETWORKING **9+6**

Multimedia networking -Applications-streamed stored and audio-making the best Effort service-protocols for real time interactive Applications-distributing multimedia-beyond best effort service-secluding and policing Mechanisms-integrated services-differentiated Services-RSVP.

TOTAL PERIODS 45+30

COURSE OUTCOMES

At the end of the course, the students will be able to

- Understand an algorithm is to program it..
- Do projects in audio, image and video coding.

REFERENCES

1. KR .Rao, ZS Bojkovic, DA Milovanovic, “Multimedia Communication Systems: Techniques, Standards, and Networks”, Pearson Education 2007.
2. Ranjan Parekh, “Principles of Multimedia”,TMH,2006.

3. Fred Halshall,"Multimedia communication -applications, networks, protocols and standards", Pearson education, 2007.

4. Tay Vaughan, "Multimedia: Makingitwork",7/e,TMH,2007

5. Marcus Gonzalves, "Voiceover IP Networks", McGrawHill

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CO3	3	3	3	3	3	-	-	-	-	-	3	3	3	3
CO4	3	3	3	3	3	-	-	-	-	-	3	3	3	3
CO5	3	3	3	3	3	-	-	-	-	-	3	3	3	3

PCS15251 SATELLITE COMMUNICATION **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- Introduce the elements of satellite
- Introduce the concepts of various modulation schemes
- Educate about link design of satellite
- Learn about navigation of satellite
- Know about applications of satellite

UNIT I ELEMENTS OF SATELLITE COMMUNICATION 9

Satellite Systems, Orbital description and Orbital mechanics of LEO, MEO and GSO, Placement of aSatelliteinaGSO,Satellite–descriptionofdifferentCommunicationsubsystems,Bandwidthallocation.

UNIT II TRANSMISSION, MULTIPLEXING, MODULATION, MULTIPLE ACCESS AND CODING 9

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 SPACE LINKS 9

The Space Link, Satellite Link Design - Satellite uplink -down link power Budget, Basic Transmission Theory, System Noise Temp, G/T Ratio, Noise Figure, Downlink Design, Design of Satellite Links for Specified C/N - Microwave Propagation on Satellite-Earth Paths. Interference between satellite circuits, Energy Dispersal, propagation characteristics offixed and mobile satellite links.

UNIT V SERVICESANDAPPLICATIONS 9

Mixed and mobile services - Multimedia satellite services - Advanced applications based on satellite platforms - INTELSAT series - INSAT, VSAT, Remote Sensing - Mobile satellite service: GSM. GPS, INMARSAT, Navigation System, Direct to Homeservice (DTH), Special services, E-mail, Video conferencing and Internet connectivity.

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of the course, the students will be able to

- Understand the Basic satellite Concepts and elements
- Understand the working principle of satellite

- Know about link design of satellite and satellite applications
- Learn about navigation and global positioning

REFERENCES

1. D.Roddy, "Satellite Communication",McGrawHill,2006.
2. TriTHa,"Digital Satellite Communication",McGrawHill,1990.
3. B.N.Agarwal, "Design of Geosynchronous Space craft",PrenticeHall,1993
4. WilburL.Pritchard,H.G.Suyderhoud,RobertA.Nelson, "Satellite Communication Systems Engineering", Prentice Hall, New Jersey, 2006
5. Timothy Prattand Charles W.Bostain, "Satellite Communications",John Wileyand Sons, 2003.

Mapping of Course Outcomes with Programme Outcomes:

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COs	Programme Outcomes(POs)													
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	3	3	-	-	-	-	-	3	3	3	3
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CO3	3	3	3	3	3	-	-	-	-	-	3	3	3	3
CO4	3	3	3	3	3	-	-	-	-	-	3	3	3	3
CO5	3	3	3	3	3	-	-	-	-	-	3	3	3	3

PCS15252 DIGITAL COMMUNICATION RECEIVERS **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- understand the basic concepts of digital communication, modulation techniques and spectralcharacteristics
- analyze the optimum characteristics of receivers used in digital communication
- understand the characteristics of fading channel
- learn various synchronization techniques
- study about the various equalization algorithms

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 AWGCHANNEL 9

Correlation demodulator, matched filter, maximum likelihood sequence detector, optimum receiver forCPM 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 OSCILLATORS 9

Carrier and signal synchronization, carrier phase estimation-PLL Decision directed loops, symbol timingestimation, 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 PERIODS 45

COURSE OUTCOMES

At the end of the course, the students will be able to

- Digital communication and spectral characteristics of digital communication
- The basic requirements of receiver design
- The various techniques to overcome the effect of fading channel
- The various synchronization techniques in digital communication
- Equalization algorithms to overcome the interference

REFERENCES

1. Heinrich Meyer, Mare Moeneclacy, Stefan .A .Fechtel, "Digital communication receivers",VolI & 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, NewDelhi, 1994
4. Annapurna Das and Si sir K Das, "Microwave Engineering", Tata McGraw-Hill Pub. Co. Ltd.,2004
5. Simon Marvin, "Digital communication over fading channel; An unified approach toperformance Analysis", John Wiley, New York, 2000

Mapping of Course Outcomes with Programme Outcomes:

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	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
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CO3	3	3	3	3	3	-	-	-	-	-	3	3	3	3
CO4	3	3	3	3	3	-	-	-	-	-	3	3	3	3
CO5	3	3	3	3	3	-	-	-	-	-	3	3	3	3

PCS15253 MOBILE AD HOC NETWORKS **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- understand the various concepts on ADHOC network, architectures and applications
- study the overview of MAC Protocols and the concepts of cross layer design.
- familiarize the various aspects of Ad-hoc networks protocols
- introduce the concept of Transport layer in ADHOC networks

UNIT I FUNDAMENTAL OF MOBILE AD HOC NETWORK **9**

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

UNIT II MEDIUM ACCESS PROTOCOLS **9**

MAC Protocols: design issues, goals and classification. Contention based protocols, reservation based protocols, scheduling algorithms, protocols using directional antennas. IEEE standards: 802.11a, 802.11b,802.11g, 802.15. HIPERLAN.

UNIT III NETWORK PROTOCOLS **9**

Addressing issues in ADHOC 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 IV END -TO - END DELIVERY AND SECURITY **9**

Transport layer: Issues in designing- Transport layer classification, ADHOC transport protocols. Security issues in ADHOC networks: issues and challenges, network security attacks, secure routing protocols.

UNIT 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.

TOTAL PERIODS **45**

COURSE OUTCOMES

At the end of the course, the students will be able to

- Identify the various challenges and vulnerabilities in MANET Identify the technical issues relatedto ADHOC sensor networks.
- Obtain an awareness on cyber attacks and threads in mobile networks.
- Understand and recognize the architectures, designing MAC,TCP,IP and security protocols

- Analyze and design security systems for wireless networks

REFERENCES

1. C .Siva Ram Murthy and B.S .Manoj, "Ad hoc Wireless Networks Architectures and protocols",2nd edition, Pearson Education. 2007.
2. Stefano Basagni, Marco Conti, Silvia Giordano and Ivanstoj menovic, "Mobile adhoc networking", Wiley-IEEE press, 2004.
3. Mohammad Ilyas, "The handbook of ad hoc wireless networks", CRC press, 2002.
4. Fekri M. Abduljalil and Shrikant K. Bodhe, "A survey of integrating IP mobility protocols andMobile Ad hoc networks", IEEE communication Survey and tutorials, v 9.no.1 2007.
5. V.T.Raisinhani and S.Iyer "Cross layer design optimization in wireless protocol stacks",Computer communication, vol 27 no. 8, 2004.

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CO4	3	3	3	3	3	-	-	-	-	-	3	3	3	3
CO5	3	3	3	3	3	-	-	-	-	-	3	3	3	3

PCS15254 WIRELESS COMMUNICATIONS AND MIMO SYSTEMS **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- introduce the Concept of Wireless System, digital modulation and detection techniques
- educate about MIMO antenna systems
- learn about Equalization and Multicarrier Modulation
- study the concepts on Spread Spectrum techniques

UNIT I WIRELESS SYSTEMS **8**

Overview of wireless systems – path loss model for wireless channels – Time and Frequency coherence – Statistical multipath 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 MULTIPLE ACCESS TECHNIQUES FOR WIRELESS COMMUNICATION **9**

Spread-Spectrum Principles, Direct-Sequence Spread Spectrum (DSSS) – DSSS System Model – Spreading Codes for ISI Rejection: Random, Pseudo random, and m-Sequence – Synchronization – RAKE Receivers, Frequency-Hopping Spread Spectrum, Multiuser DSSS Systems, Multiuser FHSS Systems

UNIT III MULTIPLE ANTENNA SYSTEMS **10**

Narrow band MIMO model, MIMO channel capacity, MIMO Diversity and beam forming – diversity, multiplexing trade off, space time modulation and coding, frequency selective fading MIMO channels, smart antennas.

UNIT IV EQUALIZATION AND MULTICARRIER MODULATION **10**

Equalizer noise enhancement and types, folded spectrum and ISI free transmission, linear equalization and MLSE, DFE and adaptive equalizers, data transmission using multiple carriers and mitigation of subcarrier fading, discrete implementation of multicarrier systems, matrix representation of OFDM, PAPR and frequency and timing offset.

UNIT V SPREAD SPECTRUM AND MULTI USER DETECTION **8**

DSSS, FHSS and multiuser versions of above, random access, power control, down link channel capacity,uplink channel capacity, multiuser diversity, MIMO diversity.

TOTAL PERIODS **45**

COURSE OUTCOMES

At the end of the course, the students will be able to

- Learn the Concept of Wireless System
- Analyze various digital modulation techniques.
- Know about MIMO antenna systems
- Compare the various multicarrier modulation schemes

- Discriminate the performance of the Multiple Access techniques

REFERENCES

1. Andrea Goldsmith, "Wireless Communication", Cambridge Univ. Press, 2006.
2. Rappaport .T.S, "Wireless Communications: Principles and Practice", Second Edition, Pearson Education / Prentice Hall of India, Third Indian Reprint, 2003.
3. Vijay K Garg, "Wireless Network Evolution 2G to 3G", Pearson Education New Delhi, 2003.
4. David T se and Pramod Viswanath, "Fundamentals of Wireless Communication", CambridgeUniversity Press, 2005.
5. A. Paulraj, R.Nabar, D.Gore, "Introduction to Space-Time Wireless Communication", Cambridge University Press, 2003.

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CO3	3	3	3	3	3	-	-	-	-	-	3	3	3	3
CO4	3	3	3	3	3	-	-	-	-	-	3	3	3	3
CO5	3	3	3	3	3	-	-	-	-	-	3	3	3	3

PCS15351 TELECOMMUNICATION SYSTEM MODELING AND SIMULATION **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- understand the various types simulation methodology and the concept of random signalgeneration & processor.
- introduce the concept on Monte Carlo simulation
- learn the various advanced models & simulation techniques
- study the different efficient simulation techniques

UNIT I SIMULATION METHODOLOGY **8**

Introduction, Aspects of methodology, Performance Estimation, Simulation sampling frequency, Low pass equivalent simulation models for band pass 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, Semi analytic techniques, Case study: Performance estimation of a wireless system.

UNIT IV ADVANCED MODELS & SIMULATION TECHNIQUES **10**

Modeling and simulation of non -linearities : Types, Memory less non -linearities, Non -linearities with memory, Modeling and simulation of Time varying systems : Random process models, Tapped delay line model, Modeling and simulation of waveform channels, Discrete memory less 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 PERIODS **45**

COURSE OUTCOMES

At the end of the course, the students will be able to

- Know about various types of simulation technologies
- Acquire knowledge on various methods of random signal generation processing.
- Realize the methods of Monte Carlo simulation
- Analyze various advanced models & simulation techniques

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", McGraw 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.

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)													
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	3	3	-	-	-	-	-	3	3	3	3
CO2	3	3	3	3	3	-	-	-	-	-	3	3	3	3
CO3	3	3	3	3	3	-	-	-	-	-	3	3	3	3
CO4	3	3	3	3	3	-	-	-	-	-	3	3	3	3
CO5	3	3	3	3	3	-	-	-	-	-	3	3	3	3

PCS15352 NETWORK ROUTING ALGORITHMS **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- understand the state-of-the-art in network protocols, routing algorithms and applications
- introduce the various internet routing algorithms
- familiarize the various aspects of routing algorithm
- gain depth knowledge about the routing protocol and congestion controls.
- study the concept of mobile ADHOC networks

UNIT I LAYER ARCHITECTURE AND ROUTING **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 staterouting, 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, 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).

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 BasedRouting (ZRP). Study of Network Simulator NS – 2.

TOTAL PERIODS **45**

COURSE OUTCOMES

At the end of the course, the students will be able to

- Learn the routing algorithm and its applications in enabling technologies.

- Understand the architecture and elements of WLANS
- Get an idea on routing protocols on networking field.
- Identify the technical issues related to Ad hoc sensor networks

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

3. S. Keshav, "An engineering approach to computer networking", Addison Wesley 1999

4. C.E Perkins, "Ad Hoc Networking", Addison – Wesley, 2001

5. A.T Campbell et al., "Comparison of IP Micro mobility Protocols, "IEEEWireless Communications Feb.2002, pp 72-82.

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)													
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	3	3	-	-	-	-	-	3	3	3	3
CO2	3	3	3	3	3	-	-	-	-	-	3	3	3	3
CO3	3	3	3	3	3	-	-	-	-	-	3	3	3	3
CO4	3	3	3	3	3	-	-	-	-	-	3	3	3	3
CO5	3	3	3	3	3	-	-	-	-	-	3	3	3	3

PCS15353 SOFT COMPUTING **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- introduce the various types of classical sets, Fuzzy sets and its properties
- understand about the Operation of the Fuzzy logic control systems.
- introduce the various methods of Fuzzy rules and the concepts classical and fuzzy relation

UNIT I ARTIFICIAL NEURAL NETWORKS **9**

Basic-concepts-single layer perception-Multi layer perception-Supervised and unsupervised learning,back propagation networks, Application.

UNIT II FUZZY LOGIC **9**

Fuzzy sets and Fuzzy reasoning- Fuzzy matrices-Fuzzy functions-decomposition-Fuzzy automata andlanguages-Fuzzy control methods-Fuzzy decision making, Applications.

UNIT III NEURO-FUZZY MODELING **9**

Networks based Fuzzy interfaces-Classification and Representation trees Adaptive -Data dustemp algorithm – Rule based structure identification-Neuro-Fuzzy controls.

UNIT IV GENETIC ALGORITHM **9**

Survival of the fittest-Fitness computations-crossover- mutation-reproduction-rank method-rank spacemethod, Applications.

UNIT V SOFT COMPUTING AND CONVENTIONAL AI **9**

AI Search algorithm-Predicate calculus - rules of interface - Semantic networks-frames-objects-Hybridmodels applications.

TOTAL PERIODS **45**

COURSE OUTCOMES

At the end of the course, the students will be able to

- Understand the various types of classical sets, Fuzzy sets and its properties.
- Design Fuzzy logic control systems.
- Perform Neuro-Fuzzy Modeling
- Know about Genetic Algorithm, Soft computing and Conventional AI

REFERENCES

1. Jang J.S .R., Sun C.T and Mizutami E –“Neuro Fuzzy and Soft computing”, Prentice hall New Jersey,1998

2. Timothy J .Ross “Fuzzy Logic Engineering Applications”, McGraw Hill,NewYork,1997.
3. Laurene Fauseett: Fundamentals of Neural Networks”, Prentice Hall India, New Delhi,1994.
4. George J .Klir and Bo Yuan, “Fuzzy Sets and Fuzzy Logic”, Prentice Hall Inc., New Jersey,1995
5. Nih .J. N dssen “Artificial Intelligence”, Harcourt Asia Ltd., Singapore,1998.

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	**Programme Outcomes(POs)**													
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	3	3	3	3	-	-	-	-	-	3	3	3	3
CO2	3	3	3	3	3	-	-	-	-	-	3	3	3	3
CO3	3	3	3	3	3	-	-	-	-	-	3	3	3	3
CO4	3	3	3	3	3	-	-	-	-	-	3	3	3	3
CO5	3	3	3	3	3	-	-	-	-	-	3	3	3	3

PCS15354 CDMA ENGINEERING **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- understand basic concepts of CDMA
- learn the IS-95 CDMA Techniques, WCDMA and CDMA 2000
- understand the multicarrier CDMA Systems
- study about the Optical CDMA

UNIT I BASIC CONCEPTS OF CDMA **9**

Spread spectrum communication techniques (DS-CDMA, FH-CDMA) - Synchronization in CDMA system, Detection and False alarm probabilities, Early-Late gate measurement statistics, Information capacity of Spread Spectrum Systems.

UNIT II IS-95 CDMA TECHNIQUES **9**

Spreading Codes, Power control, Handover techniques, Physical and logical channels and processing (Forward and reverse links).

UNIT III WCDMA / CDMA 2000 **9**

Introduction to IMT 2000 - CDMA 2000 - Physical layer characteristics - modulation & demodulation process - Handoff and power control in 3G systems.

UNIT IV MULTICARRIER CDMA SYSTEMS **9**

Multicarrier CDMA, System design - Performance parameters – BER lower bound, Multiuser detection, UTRA, FDD and TDD systems.

UNIT V Optical CDMA **9**

Prime Codes and it's properties - Generalized and Extended Prime Codes - Experimental demonstration of Optical CDMA, Synchronization of Optical CDMA networks, Multi wavelength Optical CDMA networks.

TOTAL PERIODS **45**

COURSE OUTCOMES

At the end of the course, the students will be able to

- Demonstrate the various concepts of CDMA.
- Identify the technical issues related to networking of communication
- Design and build a wireless sensor network CDMA technology.

REFERENCES

1. John G. Proakis, "Digital Communications", McGraw Hill International Ltd,4th ed., Singapore,2000.
2. Kaveth Pahlavan, K. Prashanth Krishnamuorthy, "Principles of Wireless Networks", PrenticeHall of India, 2006.

3. Andreas F. Molisch, “Wireless Communication”, Wiley India, 2006

4. Raymond Steele, Chin-Chun Lee, Peter Gould, “GSM CDMA One and 3GSystems”, WileyIndia, 2004
5. Guu -Chang Yang, “Prime Codes with Application to Optical and Wireless Networks”, Artech House, Inc., 2002

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	**Programme Outcomes(POs)**													
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	3	3	3	3	-	-	-	-	-	3	3	3	3
CO2	3	3	3	3	3	-	-	-	-	-	3	3	3	3
CO3	3	3	3	3	3	-	-	-	-	-	3	3	3	3
CO4	3	3	3	3	3	-	-	-	-	-	3	3	3	3
CO5	3	3	3	3	3	-	-	-	-	-	3	3	3	3

PCS15451 DIGITAL IMAGE PROCESSING **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- be familiar with digital image fundamentals
- understand the concept of image enhancement and restoration.
- acquire the knowledge about segmentation restoration.
- import the concept of various compression techniques

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, match band effect, Color imagefundamentals - RGB, HSI models, Image sampling, Quantization, dither, Two-dimensional mathematical preliminaries, 2D transforms - DFT, DCT, KLT, SVD.

UNIT II IMAGE ENHANCEMENT **9**

Histogram equalization and specification techniques, Noise distributions, Spatial averaging, Directional Smoothing, Median, Geometric mean, Harmonic mean, Contra harmonic mean filters, Homomorphic filtering, Color image enhancement.

UNIT III IMAGE RESTORATION **9**

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

UNIT IV IMAGE SEGMENTATION **9**

Edge detection, Edge linking via Hough transform – Thresholding - Region based segmentation – Region growing – Region splitting and merging – Segmentation by morphological watersheds – basic concepts – Dam construction – Watershed segmentation algorithm.

UNIT V IMAGE COMPRESSION **9**

Need for data compression – Huffman, Run Length Encoding - Shift codes - Arithmetic coding - Vector Quantization - Transform coding - JPEG standard –MPEG.

TOTAL PERIODS **45**

COURSE OUTCOMES

At the end of the course, the students will be able to

- Understand the Basic Concepts of digital image fundamentals.
- Understand the need of enhancement and restoration.
- Understand the concept of segmentation in various image problems
- Acquire knowledge on the compression techniques in lossy and lossless coding

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”, Pearson Education, Inc., 2002
3. Kenneth R. Castleman, “Digital Image Processing", Pearson, 2006..
4. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins, “Digital Image Processing using MATLAB”, Pearson Education, Inc., 2004.
5. William K. Pratt, “Digital Image Processing”, John Wiley, New York, 2002

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)													
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	3	3	3	3	-	-	-	-	-	3	3	3	3
CO2	3	3	3	3	3	-	-	-	-	-	3	3	3	3
CO3	3	3	3	3	3	-	-	-	-	-	3	3	3	3
CO4	3	3	3	3	3	-	-	-	-	-	3	3	3	3
CO5	3	3	3	3	3	-	-	-	-	-	3	3	3	3

PCS15452 NETWORK MANAGEMENT **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- understand the state-of-the-art in network protocols, architectures and applications
- study the functions of different layers
- familiarize the various aspects of SNMP networks
- introduce the concept of ATM networks
- study the Various Network Management Applications

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 -Functionalmodel, SNMP proxy server, Management information, protocol remote monitoring Addressing Model, IP switching types, Flow driven and topology driven solutions, IP over ATM, Address and next hopresolution, Multicasting, IP v6 over ATM.

UNIT IV BROADBAND NETWORK MANAGEMENT **9**

Broadband network s and services, ATM Technology-VP,VC,ATM Packet, Integrated service, ATM LAN 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 PERIODS **45**

COURSE OUTCOMES

At the end of the course, the students will be able to

- Demonstrate the networking strategies.
- Identify the technical issues related to networking technologies.

- Design and build a network using routers.

REFERENCES

1. Mani Subramanian, “Network Management Principles and Practice”, Addison Wesley New York,2000.
2. James F .Kurose& Keith W .Ross, “Computer Networking A Top-down Approach Featuring the Internet”, PHI, 2007.
3. William Stallings, “Data and Computer Communication”, PHI 2000.
4. Salah Aiidarous, Thomas Plevayk, “Telecommunications Network Management Technologiesand Implementations ", Eastern Economy Edition IEEE press, New Delhi, 1998.
5. Lakshmi G. Raman, “Fundamentals of Telecommunication Network Management”, EasternEconomy Edition IEEE Press, New Delhi, 1999.

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)													
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	3	3	3	3	-	-	-	-	-	3	3	3	3
CO2	3	3	3	3	3	-	-	-	-	-	3	3	3	3
CO3	3	3	3	3	3	-	-	-	-	-	3	3	3	3
CO4	3	3	3	3	3	-	-	-	-	-	3	3	3	3
CO5	3	3	3	3	3	-	-	-	-	-	3	3	3	3

PCS15453 WIRELESS SENSOR NETWORKS **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- To understand the state-of-the-art in wireless sensor network, architectures and applications
- To study the functions of different wireless architectures
- To familiarize the various aspects of MAC protocols
- To introduce the concept of Infrastructure Establishment
- To study the various sensor network tools

UNIT I OVERVIEW OF WIRELESS SENSOR NETWORKS **8**

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 **10**

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 PERIODS **45+30**

COURSE OUTCOMES

At the end of the course, the students will be able to

- Demonstrate the various wireless sensor networking strategies.
- Identify the technical issues related to networking of sensors.
- Design and build a wireless sensor network using simulators.

REFERENCES

1. Holger Karl & Andreas Willig, “Protocols and Architectures for Wireless Sensor Networks”, JohnWiley, 2005.
2. BhaskarKrishnamachari, ”Networking Wireless Sensors”, Cambridge Press,2005
3. Feng Zhao & Leonidas J. Guibas, “Wireless Sensor Networks- An Information ProcessingApproach", Elsevier, 2007.
4. KazemSohraby, Daniel Minoli, & TaiebZnati, “Wireless Sensor Networks-Technology, Protocols,and Applications”, John Wiley, 2007
5. Mohammad Ilyas and ImadMahgaob, “Handbook of Sensor Networks: Compact Wireless AndWired Sensing Systems”, CRC Press,2005.

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)													
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	3	3	-	-	-	-	-	3	3	3	3
CO2	3	3	3	3	3	-	-	-	-	-	3	3	3	3
CO3	3	3	3	3	3	-	-	-	-	-	3	3	3	3
CO4	3	3	3	3	3	-	-	-	-	-	3	3	3	3
CO5	3	3	3	3	3	-	-	-	-	-	3	3	3	3

PCS15454 ADVANCED MICROWAVE COMMUNICATION **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- learn various microwave devices and the microwave passive components
- learn the microwave resonators and filters and the characteristics of microwave antennas
- study about the microwave radio system

UNIT I MICROWAVE AMPLIFIERS AND OSCILLATORS **10**

Klystron Amplifier – Reflex Klystron Amplifier –Travelling wave tube Amplifier – Magnetron Oscillator and Modulator-Varactor diode – Parametric amplifier and applications – diode detector and mixer – GUNN, Tunnel IMPATT diode oscillators – Masers and lasers.

UNIT II MICROWAVE PASSIVE COMPONENTS **6**

Scattering parameters-S-Matrix – Attenuator –Phase shifters – T Junctions – Hybrid T Junctions – Directional couplers – Isolator, Properties of ferrite devices – Faraday rotation – Gyrator – Circulator – Scattering parameter measurement.

UNIT III MICROWAVE RESONATORS AND FILTERS **7**

Review of resonant circuits – principle of Microwave resonators – field analysis of cavity resonators – Characteristics of filters – Narrow and wide band filters – Filter and resonant applications – Frequency multiplier and frequency Discrimination.

UNIT IV MICROWAVE ANTENNAS **6**

Characteristics of Microwave Antennas – Half Wave Dipole –Array – Horn –Paraboloidal Reflector – feeds – Lens and slot Antennas – Leaky and surface wave Antennas – Broad band Antennas – Micro strip Antennas – Antenna measurements.

UNIT V MICROWAVE RADIO SYSTEM **9**

Types of propagation – Line of sight transmission – Radio horizon – Microwave links-Repeaters – Diversity – frequency and space diversity systems – Fading – System gain and path losses - Noise and Absorption in Microwave links.

TOTAL PERIODS **45**

COURSE OUTCOMES

At the end of the course, the students will be able to

- Understand functions of microwave amplifiers and oscillators
- Understand functions of microwave passive components, microwave resonators and filters, thevarious characteristics of microwave antennas.
- Analyze the problems in microwave communication

REFERENCES

1. Roddy. D., “Microwave Technology”, Reston Publications.1986.
2. Chatterjee R. “Microwave Engineering”, East West Press. 1988
3. Clock. P.N. “Microwave Principles and Systems”, Prentice Hall.1986
4. Combes, Graffewil and Sauterean “Microwave Components, Devices and Active Circuits”, Johnwiley, 1987
5. Annapurana Das, Sisir. K. Das ,“Microwave Engineering”, Tata McGraw Hill, 2000.

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)													
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	3	3	-	-	-	-	-	3	3	3	3
CO2	3	3	3	3	3	-	-	-	-	-	3	3	3	3
CO3	3	3	3	3	3	-	-	-	-	-	3	3	3	3
CO4	3	3	3	3	3	-	-	-	-	-	3	3	3	3
CO5	3	3	3	3	3	-	-	-	-	-	3	3	3	3

PCL15207 **RF AND NETWORKS LABORATORY** **0 0 4 2**

COURSE OBJECTIVES

- To provide experience in simulation and implementation of the mobility models and various protocols
- To provide the comprehensive analysis of communication signals
- To learn about the antennas and VCO design and RF link
- To understand the concept of ZIGBEE/BLUETOOTH
- To focus on various systems for performance evaluation using GLOMOSIM/NS2

LIST OF EXPERIMENTS

1. Transmission line parameters – Measurement using Network Analyzer.
2. Design and characterization of Antennas using ADS/IE3D/HFSS.
3. Spectral Characterization of communication signals (using Spectrum Analyzer).
4. LNA / Mixer / VCO design and characterization using ADS/IE3D/HFSS.
5. Design and budget analysis of communication links using ADS/IE3D/HFSS.
6. Study of a RF link.
7. Simulation and performance evaluation of entity mobility models using GLOMOSIM / NS2 (Random walk, random way point)
8. Simulation and performance evaluation of Ad-hoc routing protocols using GLOMOSIM / NS2 (DSR, AODV, ZRP)
9. Simulation and performance evaluation of Wireless MAC protocols using NS2.
10. Mini Projects using Simulation Tools

TOTAL: 60 PERIODS

COURSE OUTCOMES

At the end of this course, the students will be able to

- Understand the basic concepts of communication and RF link
- Analyze the characteristics of communication signals and simulation and performance evaluation ofvarious protocols
- Design a network aimed ZIGBEE/Bluetooth
- Know the performances of various protocols using GLOMOSIM/NS2

CO-PO Mapping:

Mapping of Course Outcomes with Programme Outcomes: **(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak**														
	Programme Outcomes(POs)													
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3	3	3	3	-	-	3	-	-	-	3	3
CO2	3	3	3	3	3	3	-	-	3	-	-	-	3	3
CO3	3	3	3	3	3	3	-	-	3	-	-	-	3	3
CO4	3	3	3	3	3	3	-	-	3	-	-	-	3	3

CU7301 ADVANCED SATELLITE BASED SYSTEMS L T P C
3 0 0 3

UNIT I NAVIGATION, TRACKING AND SAFETY SYSTEMS 9

Global Navigation Satellite Systems - Basic concepts of GPS. Space segment, Control segment, user segment, GPS constellation, GPS measurement characteristics, selective availability (AS), Anti spoofing (AS). Applications of Satelite and GPS for 3D position,Velocity,determination as function of time,Interdisciplinary applications. Regional Navigation Systems- Distress and Safety- Cospas-Sarsat- Inmarsat Distress System- Location-Based service.

UNIT II INERTIAL NAVIGATION AND DIFFERENTIAL GPS SYSTEMS 9

Introduction to Inertial Navigation- Inertial Sensors - Navigation Coordinates-System Implementations- System-Level Error Models- Introduction to Differential GPS- LADGPS-WADGPS-WAAS - GEO Uplink Subsystem (GUS) - GEO Uplink Subsystem (GUS) Clock Steering Algorithms - GEO Orbit Determination - Problems

UNIT III REMOTE SENSING SYSTEMS AND TECHNIQUES 9

Introduction - Commercial Imaging - DigitalGlobe – GeoEye - Meteorology – Meteosat - Land Observation – Landsat- Remote Sensing Data- Sensors- Overview - Optical Sensors: Cameras- Non-Optical Sensors- Image Processing - Image Interpretation- System Characteristics.

UNIT IV BROADCAST SYSTEMS 9

Introduction - Satellite Radio Systems - XM Satellite Radio Inc. - Sirius Satellite Radio –world space - Direct Multimedia Broadcast- MBCO and TU Multimedia - European Initiatives - Direct-to-Home Television - Implementation Issues - DTH Services- Representative DTH Systems - Military Multimedia Broadcasts - US Global Broadcast Service (GBS)- Business TV(BTV), GRAMSAT, Specialized services – E –mail, Video conferencing, Internet.

UNIT V SATELLITE NETWORKING SYSTEM WITH IPV6 9

Overview of IPv6 and its benefits- Migration and Coexistence- IPv6 Addressing Mechanisms- Addresses for Hosts and Routers- IPv6 Infrastructure - Routing and Route Management- Configuration Methods- Dynamic Host Configuration Protocol for IPv6 - IPv6 and Related Protocols- IPv6 Header Format- Traffic Classes.

TOTAL: 45 PERIODS

REFERENCES:

1. Global Positioning Systems, Inertial Navigation, and Integration. MOHINDER S. GREWAL California State University at Fullerton, A John Wiley & Sons, Inc. Publication.
2. Satellite Systems Engineering in an IPv6 Environment, Daniel Minoli, CRC Press.
3. Satellite systems for personal Applications, Madhavendra Richharia, A John Wiley and Sons, Ltd., Publication.
4. Dennis Roddy, ‘Satellite Communication’, McGraw Hill International, 4th Edition, 2006.
5. Wilbur L. Pritchard, Hendri G. Suyderhoud, Robert A. Nelson, ‘Satellite Communication Systems Engineering’, Prentice Hall/Pearson, 2007 (Books to be added)

AP7103 ADVANCED MICROPROCESSOR AND MICROCONTROLLER L T P C
3 0 0 3

OBJECTIVES:

- To familiarize the fundamental concepts of microprocessor architecture.
- To gain knowledge about high performance CISC and RISC architectures.
- To study about 8 bit Microcontrollers viz. 68HC11 and PIC.

UNIT II RECONFIGURABLE COMPUTING ARCHITECTURES AND SYSTEMS **9**

Reconfigurable Processing Fabric Architectures – RPF Integration into Traditional Computing Systems – Reconfigurable Computing Systems – Case Studies – Reconfiguration Management.

UNIT III PROGRAMMING RECONFIGURABLE SYSTEMS **9**

Compute Models - Programming FPGA Applications in HDL – Compiling C for Spatial Computing – Operating System Support for Reconfigurable Computing.

UNIT IV MAPPING DESIGNS TO RECONFIGURABLE PLATFORMS **9**

The Design Flow - Technology Mapping – FPGA Placement and Routing – Configuration Bitstream Generation – Case Studies with Appropriate Tools.

UNIT V APPLICATION DEVELOPMENT WITH FPGAS **9**

Case Studies of FPGA Applications – System on a Programmable Chip (SoPC) Designs.

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of the course, the students will be able to

1. Identify the need for reconfigurable architectures
2. Discuss the architecture of FPGAs
3. Point out the salient features of different reconfigurable architectures
4. Build basic modules using any HDL
5. Develop applications using any HDL and appropriate tools
6. Design and build an SoPC for a particular application

REFERENCES:

1. Maya B. Gokhale and Paul S. Graham, “Reconfigurable Computing: Accelerating Computation with Field-Programmable Gate Arrays”, Springer, 2005.
2. Scott Hauck and Andre Dehon (Eds.), “Reconfigurable Computing – The Theory and Practice of FPGA-Based Computation”, Elsevier / Morgan Kaufmann, 2008.
3. Christophe Bobda, “Introduction to Reconfigurable Computing – Architectures, Algorithms and Applications”, Springer, 2010.

NC7001 NETWORK ROUTING ALGORITHMS **L T P C**
3 0 0 3

OBJECTIVES:

- To expose the students to the layered architecture for communication networks and the specific functionality of the network layer.
- To enable the student to understand the basic principles of routing and the manner this is implemented in conventional networks and the evolving routing algorithms based on Internetworking requirements, optical backbone and the wireless access part of the network.
- To enable the student to understand the different routing algorithms existing and their performance characteristics.

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.

OUTCOMES:

- Given the network and user requirements and the type of channel over which the network has to operate, the student would be in a position to apply his knowledge for identifying a suitable routing algorithm , implementing it and analyzing its performance.
- The student would also be able to design a new algorithm or modify an existing algorithm to satisfy the evolving demands in the network and by the user applications.

NC7202 WIRELESS ADHOC AND SENSOR NETWORKS L T P C
3 0 0 3

UNIT I ADHOC NETWORKS AND ROUTING PROTOCOLS 9

Ad hoc Wireless Networks – What is an Ad Hoc Network? Heterogeneity in Mobile Devices – Wireless Sensor Networks – Traffic Profiles – Types of Ad hoc Mobile Communications – Types of Mobile Host Movements – Challenges Facing Ad hoc Mobile Networks – Ad hoc wireless Internet . Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks – Classifications of Routing Protocols – Table–Driven Routing Protocols – Destination Sequenced Distance Vector (DSDV) – Wireless Routing Protocol (WRP) – Cluster Switch Gateway Routing (CSGR) – Source–Initiated On–Demand Approaches – Ad hoc On–Demand Distance Vector Routing (AODV) – Dynamic Source Routing (DSR) –Temporally Ordered Routing Algorithm (TORA) – Signal Stability Routing (SSR) –Location–Aided Routing (LAR) – Power–Aware Routing (PAR) – Zone Routing Protocol (ZRP).

UNIT II MULTICAST ROUTING AND SECURITY 9

Issues in Designing a Multicast Routing Protocol – Operation of Multicast Routing Protocols – An Architecture Reference Model for Multicast Routing Protocols –Classifications of Multicast Routing Protocols – Tree–Based Multicast Routing Protocols– Mesh–Based Multicast Routing Protocols – Summary of Tree and Mesh based Protocols – Energy–Efficient Multicasting – Multicasting with Quality of Service Guarantees – Application – Dependent Multicast Routing –
Comparisons of Multicast Routing Protocols - Design Goals of a Transport Layer Protocol for Ad hoc Wireless Networks –Classification of Transport Layer Solutions – TCP over 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.

UNIT III QoS AND ENERGY MANAGEMENT 9

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 Schemes.

UNIT IV SENSOR NETWORKS – ARCHITECTUREAND MACPROTOCOLS 9

Single node architecture – Hardware components, energy consumption of sensor nodes, Network architecture – Sensor network scenarios, types of sources and sinks, single hop versus multi-hop networks, multiple sinks and sources, design principles, Development of wireless sensor networks. , physical layer and transceiver design consideration in wireless sensor networks, Energy usage profile, choice of modulation, Power Management - MAC protocols – fundamentals of wireless MAC protocols, low duty cycle protocols and wakeup concepts, contention-based protocols, Schedule-based protocols - SMAC, BMAC, Traffic-adaptive medium access protocol (TRAMA), Link Layer protocols – fundamentals task and requirements, error control, framing, link management.

UNIT V SENSOR NETWORKS – ROUTING PROTOCOLS AND OPERATING SYSTEMS 9

Gossiping and agent-based uni-cast forwarding, Energy-efficient unicast, Broadcast and multicast, geographic routing, mobile nodes, Data-centric routing – SPIN, Directed Diffusion, Energy aware routing, Gradient-based routing – COUGAR, ACQUIRE, Hierarchical Routing – LEACH, PEGASIS, Location Based Routing – GAF, GEAR, Data aggregation – Various aggregation techniques. Introduction to TinyOS – NesC, Interfaces, modules, configuration, Programming in TinyOS using NesC, Emulator TOSSIM.

TOTAL: 45 PERIODS

REFERENCES

1. C. Siva Ram Murthy and B. S. Manoj, “Ad Hoc Wireless Networks Architectures and Protocols”, Prentice Hall, PTR, 2004.
2. C. K. Toh, “Ad Hoc Mobile Wireless Networks Protocols and Systems”, Prentice Hall, PTR, 2001.
3. Charles E. Perkins, “Ad Hoc Networking”, Addison Wesley, 2000.
4. Kazem Sohraby, Daniel Minoli and Taieb Znati, “ Wireless Sensor Networks Technology-Protocols and Applications”, John Wiley & Sons, 2007.
5. Feng Zhao, Leonidas Guibas, “Wireless Sensor Networks: an information processing approach”, Else vier publication, 2004.
6. C.S.Raghavendra Krishna, M.Sivalingam and Tarib znati, “Wireless Sensor Networks”, Springer publication, 2004.
7. Holger Karl , Andreas willig, “Protocol and Architecture for Wireless Sensor Networks”, John wiley publication, Jan 2006.
8. K.Akkaya and M.Younis, “ A Survey of routing protocols in wireless sensor networks”, Elsevier Adhoc Network Journal, Vol.3, no.3,pp. 325-349, 2005.
9. Philip Levis, “ TinyOS Programming”, 2006 – www.tinyos.net.
10. I.F. Akyildiz, W. Su, Sankarasubramaniam, E. Cayirci, “Wireless sensor networks: a survey”, computer networks, Elsevier, 2002, 394 - 422.
11. Jamal N. Al-karaki, Ahmed E. Kamal, “Routing Techniques in Wireless sensor networks: A survey”, IEEE wireless communication, December 2004, 6 – 28.

CU7007 INTERNETWORKING MULTIMEDIA L T P C
3 0 0 3

UNIT I MULTIMEDIA NETWORKING 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.

UNIT II BROADBAND NETWORK 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 – Storage and Media Services – Voice and Video Over IP – MPEG–2 over ATM/IP – Indexing Synchronization of Requests – Recording and Remote Control .

UNIT III RELIABLE TRANSPORT PROTOCOL AND APPLICATIONS 9

Multicast over Shared Media Network – Multicast Routing and Addressing – Scaling Multicast and NBMA Networks – Reliable Transport Protocols – TCP Adaptation Algorithm – RTP, RTCP – MIME – Peer–to–Peer Computing – Shared Application – Video Conferencing, Centralized and Distributed Conference Control – Distributed Virtual Reality – Light Weight Session Philosophy .

UNIT IV MULTIMEDIA COMMUNICATION STANDARDS 9

Objective of MPEG – 7 Standard – Functionalities and Systems of MPEG–7 MPEG–21 Multimedia Framework Architecture – Content Representation – Content Management and Usage – Intellectual Property Management – Audio Visual System – H322: Guaranteed QOS LAN Systems – MPEG_4 Video Transport Across Internet.

UNIT V MULTIMEDIA COMMUNICATION ACROSS NETWORKS 9

Packet Audio/Video in The Network Environment –Video Transport across Generic Networks – Layered Video Coding– Error Resilient Video Coding Techniques – Scalable Rate Control – Streaming Video Across Internet – Multimedia Transport Across ATM Networks and IP Network – Multimedia Across Wireless Networks .

TOTAL: 45 PERIODS

REFERENCES:

1. B O Szuprowicz, “Multimedia Networking”, McGraw Hill, Newyork, 1995.
2. K R Rao, Zoran S, Bojkovic and Dragorad A, Milovanovic “Multimedia communication systems”, PHI, 2003.
3. Jon Crowcroft, Mark Handley, Ian Wakeman “Internetworking Multimedia” Harcourt, Singapore, 1998.
4. Tay Vaughan,“Multimedia Making it to work”, 4th edition Tata McGraw Hill, NewDelhi, 2000.

NC7002 MULTIMEDIA COMPRESSION TECHNIQUES L T P C
3 0 0 3

OBJECTIVES:

To provide in-depth knowledge about

- Data Compression
- Text Compression and Audio Compression
- Image and Video Compression

OUTCOMES:

Students will be able to

- Explain Scalar quantization theory and Rate distribution Theory
- Understand different coding techniques
- Describe Contour based compression and Motion estimation techniques

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 qua ntization 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. Speech compression- waveform codecs-source codecs- hybrid codecs-Shorten compressor, 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, NewYork, 1995

CU7008 ULTRAWIDE BAND COMMUNICATION **L T P C**
3 0 0 3

UNIT I INTRODUCTION TO UWB **9**

History, Definition, FCC Mask, UWB features, UWB Interference: IEEE 802.11.a Interference, Signal to Interference ratio calculation, Interference with other wireless services.

UNIT II UWB TECHNOLOGIES AND CHANNEL MODELS **9**

Impulse Radio , Pulsed Multiband, Multiband OFDM, features : Complexity, Power Consumption, Security and achievable data rate. MIMO Multiband OFDM, Differential multiband ofdm, Performacne characterization Ultra Wide Band Wireless Channels

Channel model: Impulse Response Modeling of UWB Wireless Channels, IEEE UWB channel model, Path loss, Delay profiles, Time and frequency modeling.

UNIT III UWB SIGNAL PROCESSING **9**

Data Modulation schemes, UWB Multiple Access Modulation, BER, Rake Receiver, Transmit-Reference (T-R) Technique, UWB Range- Data Rate Performance, UWB Channel Capacity UWB Wireless Locationing: Position Locationing Methods, Time of Arrival Estimation, NLOS Location Error , Locationing with OFDM

UNIT IV UWB ANTENNAS **9**

Antenna Requirements, Radiation Mechanism of the UWB Antennas, Types of Broad band antennas, Parameters, Analysis of UWB Antennas, Link Budget for UWB System. Design examples of broad band UWB antennas.

UNIT V UWB APPLICATIONS AND REGULATIONS **9**

Wireless Ad hoc Networking, UWB Wireless Sensor, RFID , Consumer Electronics and Personal ,Asset Location, Medical applications UWB Regulation and standards in various countries , UWB Regulation in ITU, IEEE Standardization

REFERENCES:

1. Homayoun Nikookar and Ramjee Prasad, “Introduction to Ultra Wideband for Wireless Communications”1st Edition, Springer Science & Business Media B.V. 2009.
2. Thomas Kaiser, Feng Zheng “Ultra Wideband Systems with MIMO”, 1st Edition, John Wiley & Sons Ltd, Newyork, 2010.
3. W. Pam Siriwongpairat and K. J. Ray Liu, “Ultra-Wideband Communications Systems: Multiband OFDM approach” John Wiley and IEEE press, Newyork 2008.

IF7301	SOFT COMPUTING	L T P C 3 0 0 3

OBJECTIVES

- To learn the key aspects of Soft computing and Neural networks.
- To know about the components and building block hypothesis of Genetic algorithm.
- To understand the features of neural network and its applications
- To study the fuzzy logic components
- To gain insight onto Neuro Fuzzy modeling and control.
- To gain knowledge in machine learning through Support vector machines.

UNIT I INTRODUCTION TO SOFT COMPUTING 9

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

UNIT II GENETIC ALGORITHMS 9

Introduction, Building block hypothesis, working principle, Basic operators and Terminologies like individual, gene, encoding, fitness function and reproduction, Genetic modeling: Significance of Genetic operators, Inheritance operator, cross over, inversion & deletion, mutation operator, Bitwise operator, GA optimization problems, JSPP (Job Shop Scheduling Problem), TSP (Travelling Salesman Problem),Differences & similarities between GA & other traditional methods, Applications of GA.

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 – Rule base Structure Identification – Neuro-Fuzzy Control – Case Studies.

TOTAL: 45 PERIODS

OUTCOMES:

- Implement machine learning through Neural networks.
- Develop a Fuzzy expert system.
- Model Neuro Fuzzy system for clustering and classification.
- Write Genetic Algorithm to solve the optimization problem
- Use Support Vector Machine for enabling the machine learning

REFERENCES:

1. Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, “Neuro-Fuzzy and Soft Computing”, Prentice-Hall of India, 2003.
2. Kwang H.Lee, “First course on Fuzzy Theory and Applications”, Springer–Verlag Berlin Heidelberg, 2005.
3. George J. Klir and Bo Yuan, “Fuzzy Sets and Fuzzy Logic-Theory and Applications”, Prentice Hall, 1995.
4. James A. Freeman and David M. Skapura, “Neural Networks Algorithms, Applications, and Programming Techniques”, Pearson Edn., 2003.
5. David E. Goldberg, “Genetic Algorithms in Search, Optimization and Machine Learning”, Addison Wesley, 2007.
6. Mitsuo Gen and Runwei Cheng,”Genetic Algorithms and Engineering Optimization”, Wiley Publishers 2000.
7. Mitchell Melanie, “An Introduction to Genetic Algorithm”, Prentice Hall, 1998.
8. S.N.Sivanandam, S.N.Deepa, “Introduction to Genetic Algorithms”, Springer, 2007.
9. Eiben and Smith “Introduction to Evolutionary Computing” Springer
10. E. Sanchez, T. Shibata, and L. A. Zadeh, Eds., "Genetic Algorithms and Fuzzy Logic Systems: Soft Computing Perspectives, Advances in Fuzzy Systems - Applications and Theory", Vol. 7, River Edge, World Scientific, 1997.

NC7003 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 – Connectilvity and scalability – high availability – IP routing – IP services – IPV6 – Mobile IP – MPLS – IP Multicast 0 Manageability – QoS – Security – Switching – Layer VPN2.

TOTAL: 45PERIODS

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

NE7007 NETWORK MANAGEMENT L T P C
3 0 0 3

OBJECTIVES

The objective of this course is to

- To understand the need for interoperable network management
- To learn to the concepts and architecture behind standards based network management
- To understand the concepts and terminology associated with SNMP and TMN
- To understand network management as a typical distributed application
- To study the current trends in network management technologies

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. Network Management: Goals, Organization, and Functions, Network and System Management, Network Management System Platform, Current Status and future of Network

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(V1 and V2)-Organizational model-System Overview, The information model, communication model-Functional model, SNMP proxy server, Management information, protocol remote monitoring- , RMON SMI and MIB, RMON1,RMON2 - A Case Study of Internet Traffic Using RMON.

UNIT IV BROADBAND NETWORK MANAGEMENT 9

Broadband networks 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- , TMN conceptual Model- TMN Architecture, TMN Management Service Architecture

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- Network Management Tools, Network Statistics Measurement Systems – Web Based Management, XML Based Network Management - : Future Directions.

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of this course, the students will be able to

- Analyze the issues and challenges pertaining to management of emerging network technologies such as wired/wireless networks and high-speed internets.
- Apply network management standards to manage practical networks.
- Formulate possible approaches for managing OSI network model.
- Use on SNMP for managing the network
- Use RMON for monitoring the behavior of the network
- Explore the possibilities of improving the speed of the network and managing them
- Identify the various components of network and formulate the scheme for the managing them

REFERENCES:

1. Mani Subramanian, “Network Management Principles and practice ", Pearson Education, New Delhi, 2010.
2. STALLINGS, WILLIAM, “SNMP, SNMPv2, SNMPv3, and RMON 1 and 2,” Pearson Education, 2012
3. Salah Aiidarous, Thomas Plevayk, “Telecommunications Network Management Technologies and Implementations ", eastern Economy Edition IEEE press, New Delhi, 1998.
4. Lakshmi G. Raman, “Fundamentals of Telecommunication Network Management ", Eastern Economy Edition IEEE Press, New Delhi, 1999.

NC7201 COMMUNICATION NETWORK SECURITY **L T P C**
3 0 0 3

UNIT I DATA ENCRYPTION STANDARD **9**

Services – Mechanisms and Attacks – OSI security Architecture – Model for Network Security – Classical Encryption Techniques – Symmetric Cipher Model – Substitution Techniques – Transposition Techniques – Rotor Machines– Stenography – Block Ciphers and Data Encryption Standard – Simplified DES – Block Cipher Principles, Data Encryption Standard – Strength of DES – Differential and Linear Crypt Analysis, Block Cipher Design Principles – Block Cipher Modes of Operation.

UNIT II ADVANCED ENCRYPTION STANDARD **9**

Advanced Encryption Standard – Evaluation Criteria for AES, AES Cipher– Contemporary Symmetric Ciphers – Triple DES, Blowfish, RC5 – Characteristics of Advanced Symmetric Block Ciphers – RC4 Stream Cipher – Confidentiality using Symmetric Encryption – Placement of Encryption Function – Traffic Confidentiality – Key Distribution and Random Number Generation.

UNIT III PUBLIC KEY ENCRYPTION AND HASH FUNCTIONS **9**

Public Key Cryptography and RSA – Principles of Public Key Cryptosystems – RSA Algorithm – Key Management and other public key cryptosystems – Key Management– Diffie–Hellman Key Exchange – Elliptic Curve Arithmetic – Elliptic Curve Cryptography – Message Authentication and Hash Functions – Authentication Requirements – Authentication Functions – Message Authentication Codes – Hash Functions and MACs; Hash Algorithms – MD5 Message Digest Algorithm, Secure Hash Algorithm RIPEMD 160, HMAC– Digital Signatures and Authentication Protocols – Digital Signature Standards .

UNIT IV NETWORK SECURITY PRACTICE 9

Authentication Applications – Kerberos – X.509 Authentication Service– Electronic Mail Security – Pretty Good Privacy – S/MIME– IP Security – IP Security Overview– IP Security Architecture – Authentication Header – Encapsulating Security Payload – Combining Security Associations – Web Security – Web Security Considerations – Secure Sockets Layer and Transport Layer Security – Secure Electronic Transaction .

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

TEXT BOOKS:

1. William Stallings, "Network Security Essentials", 2nd edition, Prentice Hall of India New Delhi, 2004.
2. Charlie Kaufman, "Network Security Private Communication in Public World" 2nd edition, Prentice Hall of India New Delhi, 2004.

REFERENCES:

1. William Stallings, "Cryptography and Network Security", 3rd edition, Prentice Hall of India, New Delhi, 2004.
2. R.K.Nichols and P.C. Lekkas ," Wireless Security" Mc Graw Hill 2002

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UNIT I BASIC LEARNING ALGORITHMS 9

Biological Neuron – Artificial Neural Model - Types of activation functions – Architecture: Feedforward and Feedback – Learning Process: Error Correction Learning –Memory Based Learning – Hebbian Learning – Competitive Learning - Boltzman Learning – Supervised and Unsupervised Learning – Learning Tasks: Pattern Space – Weight Space – Pattern Association – Pattern Recognition – Function Approximation – Control – Filtering - Beamforming – Memory – Adaptation - Statistical Learning Theory – Single Layer Perceptron – Perceptron Learning Algorithm – Perceptron Convergence Theorem – Least Mean Square Learning Algorithm – Multilayer Perceptron – Back Propagation Algorithm – XOR problem – Limitations of Back Propagation Algorithm.

UNIT II RADIAL-BASIS FUNCTION NETWORKS AND SUPPORT VECTOR MACHINES RADIAL BASIS FUNCTION NETWORKS 9

Cover's Theorem on the Separability of Patterns - Exact Interpolator – Regularization Theory – Generalized Radial Basis Function Networks - Learning in Radial Basis Function Networks Applications: XOR Problem – Image Classification.

SUPPORT VECTOR MACHINES

Optimal Hyperplane for Linearly Separable Patterns and Nonseparable Patterns – Support Vector Machine for Pattern Recognition – XOR Problem - -insensitive Loss Function – Support Vector Machines for Nonlinear Regression

UNIT III COMMITTEE MACHINES 9

Ensemble Averaging - Boosting – Associative Gaussian Mixture Model – Hierarchical Mixture of Experts Model(HME) – Model Selection using a Standard Decision Tree – A Priori and Postpriori Probabilities – Maximum Likelihood Estimation – Learning Strategies for the HME Model - EMAlgorithm – Applications of EM Algorithm to HME Model

NEURODYNAMICS SYSTEMS

Dynamical Systems – Attractors and Stability – Non-linear Dynamical Systems- Lyapunov Stability – Neurodynamical Systems – The Cohen-Grossberg Theorem.

UNIT IV ATTRACTOR NEURAL NETWORKS: 9

Associative Learning – Attractor Neural Network Associative Memory – Linear Associative Memory – Hopfield Network – Content Addressable Memory – Strange Attractors and Chaos- Error Performance of Hopfield Networks - Applications of Hopfield Networks – Simulated Annealing – Boltzmann Machine – Bidirectional Associative Memory – BAM Stability Analysis – Error Correction in BAMs - Memory Annihilation of Structured Maps in BAMS – Continuous BAMs – Adaptive BAMs – Applications

ADAPTIVE RESONANCE THEORY:

Noise-Saturation Dilemma - Solving Noise-Saturation Dilemma – Recurrent On-center –Off surround Networks – Building Blocks of Adaptive Resonance – Substrate of Resonance Structural Details of Resonance Model – Adaptive Resonance Theory – Applications

UNIT V SELF ORGANISING MAPS: 9

Self-organizing Map – Maximal Eigenvector Filtering – Sanger's Rule – Generalized Learning Law – Competitive Learning - Vector Quantization – Mexican Hat Networks - Self-organizing Feature Maps – Applications

PULSED NEURON MODELS:

Spiking Neuron Model – Integrate-and-Fire Neurons – Conductance Based Models – Computing with Spiking Neurons.

TOTAL: 45 PERIODS

REFERENCES:

1. Satish Kumar, "Neural Networks: A Classroom Approach", Tata McGraw-Hill Publishing Company Limited, New Delhi, 2004.
2. Simon Haykin, "Neural Networks: A Comprehensive Foundation", 2ed., Addison Wesley Longman (Singapore) Private Limited, Delhi, 2001.
3. Martin T.Hagan, Howard B. Demuth, and Mark Beale, "Neural Network Design", Thomson Learning, New Delhi, 2003.
4. James A. Freeman and David M. Skapura, "Neural Networks Algorithms, Applications, and Programming Techniques, Pearson Education (Singapore) Private Limited, Delhi, 2003.