PAAVAI ENGINEERING COLLEGE, NAMAKKAL – 637 018

(AUTONOMOUS)

M.E. COMMUNICATION SYSTEMS

REGULATIONS 2016

CURRICULUM

(CHOICE BASED CREDIT SYSTEM)

SEMESTER I

Course Code	Course Title	L	T	P	C
PMA16104	Applied Mathematics for communication Engineers	3	2	0	4
PCS16101	Statistical Signal Processing	3	2	0	4
PCS16102	Advanced Radiation Systems	3	2	0	4
PCS16103	Advanced Digital Communication Techniques	3	2	0	4
PCS16104	Fiber Optic Networks	3	2	0	4
PCS1615*	Elective I	3	0	0	3
PCL16105	Communication System Design Laboratory	0	0	4	2

SEMESTER II

Course Code	Course Title	L	T	P	C
PCS16201	Wireless Networks	3	2	0	4
PCS16202	RF System Design	3	2	0	4
PCS16203	Multimedia Communication	3	2	0	4
PCS1625*	Elective II	3	0	0	3
PCS1635*	Elective III	3	0	0	3
PCS1645*	Elective IV	3	0	0	3
PCL16207	RF and Networks Laboratory	0	0	4	2

LIST OF ELECTIVES

ELECTIVE I

Course Code	Course Title	L	T	P	C
PCS16151	Electromagnetic Interference and Compatibility in System Design	3	0	0	3
PCS16152	High Speed Switching Architectures	3	0	0	3
PCS16153	Microwave Integrated Circuit	3	0	0	3
PCS16154	Telecommunication System Modeling and Simulation	3	0	0	3

ELECTIVE II

Course Code	Course Title	L	T	P	C
PCS16251	Satellite Communication	3	0	0	3
PCS16252	Digital Communication Receivers	3	0	0	3
PCS16253	Network Routing Algorithms	3	0	0	3
PCS16254	Wireless Communications and MIMO Systems	3	0	0	3

ELECTIVE III (OPEN ELECTIVE)

Course Code	Course Title	L	T	P	C
PCS16351	Communication Network Security	3	0	0	3
PCS16352	Mobile AD-HOC Networks	3	0	0	3
PCS16353	Soft Computing	3	0	0	3
PCS16354	Network Management	3	0	0	3

ELECTIVE IV

Course Code	Course Title	L	T	P	C
PCS16451	Digital Image Processing	3	0	0	3
PCS16452	CDMA Engineering	3	0	0	3
PCS16453	Wireless Sensor Networks	3	0	0	3
PCS16454	Advanced Microwave Communication	3	0	0	3

PMA16104 APPLIED MATHEMATICS FOR COMMUNICATION ENGINEERS 3 2 0 4

COURSE OBJECTIVES

- To develop the ability to use the concepts of linear algebra and special functions for solving problems related to networks.
- To formulate and construct a mathematical model for a linear programming problem in real life situation
- Game theory is the study of strategic decision making. Specifically, it is "the study of mathematical models of conflict and cooperation between intelligent rational decision-makers.
- To expose the students to solve ordinary differential equations by various techniques.
- To understand network modeling for planning and scheduling the project activities

UNIT I LINEAR ALGEBRA 15

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 15

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

UNIT III GAME THEORY 15

Game theory – Two person zero sum games-Saddle point – Dominance rule – Convex linear combination (Averages) – Methods of matrices – Graphical and LP solutions.

UNIT IV ORDINARY DIFFERENTIAL EQUATIONS 15

Runge-Kutta Methods for system of IVPs – Numerical stability, Adam's Bashforth multistep 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 V SCHEDULING BY PERT AND CPM 15

Network construction – Critical path method – Project evaluation and review technique – Resource analysis in network scheduling.

TOTAL: 75 PERIODS

COURSE OUTCOMES

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

- Achieve an understanding of the basic concepts of algebraic equations and method of solving them.
- Understand and apply linear, integer programming to solve operational problem with constraints.
- Demonstrate their understanding of differential equations and their application to scientific.
- Game theory is the study of strategic decision making. Specifically, it is "the study of mathematical models of conflict and cooperation between intelligent rational decision-makers.

- Prepare project scheduling using PERT and CPM.

REFERENCES

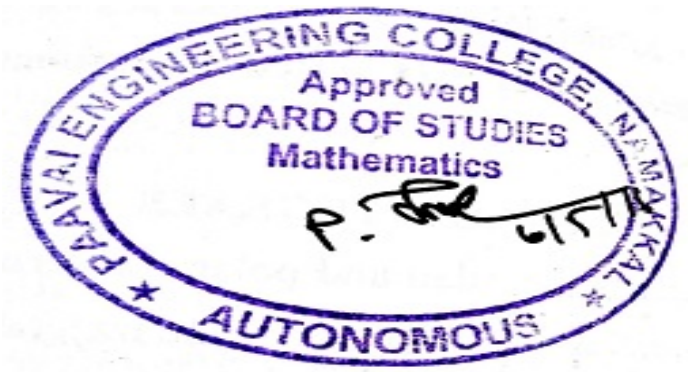
1. Richard Bronson, Gabriel B.Costa, “Linear Algebra”, Academic Press, Second Edition, 2007.
2. Taha H.A., “Operations Research: An introduction”, Pearson Education Asia, New Delhi, Ninth Edition, 2012.
3. R.K. Jain, S.R.K. Iyengar ., “Advanced Engineering Mathematics”, Taylor & Francis, 2002.

WEB LINKS

- https://www.youtube.com/watch?v=KvQkRX1nIqQ
- https://www.youtube.com/watch?v=M8POtpPtQZc
- https://www.youtube.com/watch?v=Fb3UakRTBMU

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
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



PCS16101 STATISTICAL SIGNAL PROCESSING 3 2 0 4

COURSE OBJECTIVES

- To explore the concepts of discrete random signal processing
- To analyze the adaptive filters and its applications
- To understand the fundamental concepts on linear estimation and prediction
- To learn fundamental concepts of signal processing in power spectrum estimation.
- To explore the concepts of multi rate signal processing and multi rate filters

UNIT I DISCRETE RANDOM SIGNAL PROCESSING 15

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

UNIT II SPECTRAL ESTIMATION 15

Estimation of spectra from finite duration signals, Nonparametric methods – Periodogram, Modified periodogram, Bartlett, Welch and Blackman-Tukey methods, Parametric methods – ARMA, AR and MA model based spectral estimation, Solution using Levinson-Durbin algorithm.

UNIT III LINEAR ESTIMATION AND PREDICTION 15

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

UNIT IV ADAPTIVE FILTERS 15

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

UNIT V MULTIRATE DIGITAL SIGNAL PROCESSING 15

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, Poly phase filter structures, Multistage implementation of multirate system, Application to sub band coding – Wavelet transform

TOTAL: 75 PERIODS

COURSE OUTCOMES

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

- Acquire knowledge of how a multi rate system works
- Design and implement the decimator, the 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 and channel equalization.

REFERENCES

1. Monson H. Hayes, "Statistical Digital Signal Processing and Modeling", John Wiley and Sons, Inc, Singapore, 2002.
2. John J. Proakis, Dimitris G. Manolakis, "Digital Signal Processing", Pearson Education, 2002.
3. Rafael C. Gonzalez, Richard E. Woods, " Digital Image Processing", Pearson Education Inc., Second Edition, 2004 (For Wavelet Transform Topic)
4. G.Dimitris and G.Manolakis., "Statistical and Adaptive Signal Processing", McGraw Hill, 2002.
5. Sophoncles J. Orfanidis, "Optimum Signal Processing", McGraw Hill, 2007.

WEB LINKS

1. www.ee.stanford.edu/~gray/sp.html
2. www.shahidshah.weebly.com/statistical-signal-processing.html
3. T-eBooks. website/book-0521897726.html

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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

PCS16102 ADVANCED RADIATION SYSTEMS 3 2 0 4

COURSE OBJECTIVES

- To understand the relation between the fields and be familiar with antenna arrays.
- To understand signal propagation at radio frequencies and study aperture and reflector antennas.
- To introduce the basics of microstrip patch antennas and its analysis
- To know about antenna arrays and its parameter measurement
- To learn the special antenna arrays and their applications

UNIT I ANTENNA FUNDAMENTALS 15

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 15

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

UNIT III ARRAY ANTENNA 15

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 15

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 15

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.

TOTAL: 75 PERIODS

COURSE OUTCOMES

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

- Understand various antenna parameters
- Get knowledge of aperture antennas and the field associated with it
- Design microstrip patch antennas and its simulation using software

- Apply the applications of array antennas
- Perform measurement of antenna parameters and design special array antennas

REFERENCES

1. Balanis.A, "Antenna Theory Analysis and Design", John Wiley and Sons, New York, 1982.
2. Krauss.J.D, "Antennas", II edition, John Wiley and sons, New York, 1997.
3. I.J. Bahl and P. Bhartia," Microstrip Antennas", Artech House, Inc., 1980.
4. W.L.Stutzman and G.A.Thiele, "Antenna Theory and Design", 2nd edition, John Wiley& Sons Inc., 1998.
5. Jordan, E.C., " Electromagnetic waves and Radiating systems". PHI 2003

WEB LINKS

1. https://books.google.co.in/books?isbn=1402034504
2. www.slogix.in/cu7101-advanced-radiation-systems-reference.../index.html
3. www.ncbi.nlm.nih.gov/pubmed/8685406

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

PCS16103 ADVANCED DIGITAL COMMUNICATION TECHNIQUES 3 2 0 4

COURSE OBJECTIVES

- To understand the envelope modulation techniques
- To acquire knowledge about filtering coding and scrambling
- To know the various algorithms
- To gain knowledge in gain modulation
- To design space time coding

UNIT I DIGITAL MODULATION SCHEMES 15

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 15

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 15

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-PSK modulation, Eight-state Trellis for rectangular QAM signal constellations

UNIT IV TURBO CODING 15

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-TIME CODING 15

Maximum Ratio combining; Space-time Block codes; Space-time Trellis codes- The 4-state, 4-PSK Space- time Trellis Encoder, The 4-state,4-PSK Space-time Trellis Decoder, MIMO-OFDM Systems

TOTAL: 75 PERIODS

COURSE OUTCOMES

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

- Understand the envelope modulation techniques
- Gain knowledge about filtering coding and scrambling
- Apply various algorithms
- Design gain modulation and space time coding

REFERENCES

1. Bernard Sklar., "Digital Communications", second edition, Pearson Education, 2001.
2. Theodore S.Rappaport., "Wireless Communications", 2nd edition, Pearson Education, 2002.
3. Stephen G. Wilson., "Digital Modulation and Coding", First Indian Reprint, Pearson Education, 2003.
4. Richard Van Nee &Ramjee Prasad., "OFDM for Multimedia Communications" Artech House Publication, 2001.
5. Simon Haykins, "Communication System", John Wiley and Sons, 2008.

WEB LINKS

1. www.sciencedirect.com/science/book/9780340731253
2. www.radio-electronics.com/.../courses_item.php?...digital-communication
3. www.researchgate.net/.../245489205_Book_review_Advanced_Digital_Communication

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

PCS16104 FIBER OPTIC NETWORKS 3 2 0 4

COURSE OBJECTIVES

- To learn the concepts of basic optical system components
- To understand the concepts of optical networks and its architecture
- To know the fundamental concepts on wavelength routing networks
- To introduce the concepts on packet switching and access networks
- To understand the concepts of network management and survivability

UNIT I OPTICAL SYSTEM COMPONENTS 15

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 15

Introduction to Optical Networks; SONET / SDH, Metropolitan-Area Networks, Layered Architecture; Broadcast and Select Networks – Topologies, Media-Access Control Protocols and Test beds; Wavelength Routing Architecture, Performance of WDM + EDFA System, Solitons.

UNIT III WAVELENGTH ROUTING NETWORKS 15

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

UNIT IV PACKET SWITCHING AND ACCESS NETWORKS 15

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

UNIT V NETWORK MANAGEMENT AND SURVIVABILITY 15

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: 75 PERIODS

COURSE OUTCOMES

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

- Understand the concepts of basic optical system components
- Identify the various modules for design of optical communication systems
- Determine the performance of a given optical fiber communication link
- Understand the concepts of packet switching and access networks
- Learn the concepts of network management and survivability

REFERENCES

1. Rajiv Ramaswami and Kumar N. Sivarajan, “Optical Networks: A Practical Perspective”, Harcourt Asia Pte Ltd., Second Edition 2006.
2. C. Siva Ram Moorthy and Mohan Gurusamy, “WDM Optical Networks: Concept, Design and Algorithms”, Prentice Hall of India, Ist Edition, 2002.
3. Gerd Keiser, “Optical Fiber Communication” McGraw –Hill International, Singapore, 4th edition. 2011.
4. John M. Senior, “Introduction to Optical Fiber Communications”, Pearson / Prentice Hall.
5. Harry J.R Dutton, “Understanding Optical Communications”, IBM Corporation, International Technical Support Organization.

WEB LINKS

1. www.muninetworks.org/content/fiber-optic-network
2. www.lanshack.com/fiber-optic-tutorial-network.aspx
3. www.lightwaveonline.com/network-design.html

CO-PO Mapping:

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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

PCL1610 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:

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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

SEMESTER II

PCS16201 WIRELESS NETWORKS 3 2 0 4

COURSE OBJECTIVES

- To understand the various concepts on wireless local area network, architectures and applications
- To study the overview of 3G architectures
- To familiarize the various aspects of ADHOC networks
- To introduce the concept of WLANS and WWANS
- To study the concept of 4G networks

UNIT I WLAN AND WIRELESS GEOLOCATION 15

Introduction to wireless LANs - IEEE 802.11 WLANs - 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 Geolocation technologies for wireless Geolocation, Geolocation standards for E.911 service.

UNIT II 3G OVERVIEW AND 2.5G EVOLUTION 15

Migration path to UMTS, UMTS Basics, Air Interface, 3GPP Network Architecture, CDMA2000 overview-Radio and Network components, Network structure, Radio network, TD-CDMA, TD-SCDMA.

UNIT III ADHOC AND SENSOR NETWORKS 15

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 15

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

UNIT V 4G AND BEYOND 15

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

TOTAL: 75 PERIODS

COURSE OUTCOMES

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

- Understand the basics of wireless networks and its applications in enabling technologies.
- Identify the technical issues related to Ad-hoc sensor networks
- Understand the architecture and elements of WLANS
- Get an idea on 3G and 4G protocols for wireless networks.

REFERENCES

1. Clint Smith. P.E., and Daniel Collins, "3G Wireless Networks", 2nd Edition, Tata McGraw Hill, 2007.
2. Vijay. K. Garg, "Wireless Communication and Networking", Morgan Kaufmann Publishers, http://books.elsevier.com/9780123735805, 2007.
3. William Stallings, "Wireless Communications and networks", Pearson / Prentice Hall of India, 2nd Ed., 2007.
4. Gary. S. Rogers & John Edwards, "An Introduction to Wireless Technology", Pearson Education, 2007.
5. Sumit Kasera and Nishit Narang, "3G Networks – Architecture, Protocols and Procedures", Tata McGraw Hill, 2007.

WEB LINKS

1. www.vicomsoft.com/learning-center/wireless-networking
2. https://www.freebsd.org/doc/handbook/network-wireless.html
3. www.computer.howstuffworks.com/wireless-network.html

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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

PCS16202 RF SYSTEM DESIGN 3 2 0 4

COURSE OBJECTIVES

- To learn RF design and circuit board components
- To understand various impedance transformers and biasing networks
- To study the basic RF components and the basic RF mixers and oscillators
- To acquire knowledge of RF filters and RF synthesizer

UNIT I CMOSPHYSICS TRANSCEIVER SPECIFICATIONS AND ARCHITECTURES 15

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 MPEDANCE MATCHING AND AMPLIFIERS 15

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 15

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 15

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 15

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: 75 PERIODS

COURSE OUTCOMES

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

- Understand of various RF issues.
- Know the analysis of the impedance transformation
- Know about active RF component, matching and biasing networks
- Design the concepts of RF filter design and their implementation using software
- Gain knowledge in operation of RF oscillators and mixers and their design

REFERENCES

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

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2. https://books.google.co.in/books?isbn=0387241612
3. www.awrcorp.com/solutions/technology-overview/rf-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

PCS16203 MULTIMEDIA COMMUNICATION 3 2 0 4

COURSE OBJECTIVES

- To introduces technologies for multimedia communications.
- To address how to efficiently represent multimedia data, including video, image, and audio, and how to deliver them over a variety of networks.
- To know about lossless compression and VOIP technology
- To learn about multimedia networking

UNIT I MULTIMEDIA COMPONENTS 15

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

UNIT II AUDIO AND VIDEO COMPRESSION 15

Audio compression–DPCM-Adaptive PCM –adaptive predictive coding-linear Predictive coding-code excited LPC-perpetual coding, MP3; Video compression – principles-H.261-H.263-MPEG 1, 2, 4.

UNIT III LOSSLESS COMPRESSION 15

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 VOIP TECHNOLOGY 15

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 MULTIMEDIA NETWORKING 15

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: 75 PERIODS

COURSE OUTCOMES

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

- Acquire knowledge multimedia components and their characteristics
- Do projects using audio, image and video coding
- Analyze the lossless compression coding techniques
- Gain knowledge in multimedia networking

REFERENCES

1. KR. Rao,Z S Bojkovic, D A 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: Making it work”, 7/e, TMH, 2007.
5. Marcus Gonzalves, “Voice over IP Networks”, McGraw Hill,

WEB LINKS

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2. www.eurecom.fr › Home › Research
3. www.sciencedirect.com/science/book/9780122821608

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

PCL16207 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:

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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

ELECTIVE I

PCS16151 ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY IN SYSTEM DESIGN 3 0 0 3

COURSE OBJECTIVES

- To learn the basics of EMI and EMC Environment, EMI specification standards and limits
- To understand the EMI and EMC coupling principles
- To study the control techniques involved in electromagnetic interference
- To 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 - MIL STD 461D/462

UNIT II EMI COUPLING PRINCIPLES 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 EMI MEASUREMENTS 9

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

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

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

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2. https://www.cst.com/Applications/EMC_EMI
3. https://books.google.co.in/books?isbn=1420073591

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

PCS16152 HIGH SPEED SWITCHING ARCHITECTURES 3 0 0 3

COURSE OBJECTIVES

- To understand the concept of various switching
- To analyze the blocking networks
- To learn about the queuing networks
- To understand the architecture of internet switches
- To analyze 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, tandem banyan switch.

UNIT III QUEUES IN 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 fabric on a chip; internally buffered Crossbars.

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 hop resolution, multicasting, Ipv6 over ATM. Switching Concepts, switch forwarding techniques, switch path control, LAN Switching, cut through forwarding, store and forward, virtual LANs.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

- Know the concepts of networking
- Gain knowledge about blocking and non-blocking networks based on the switches
- Understand about atm switches and various switching types
- Obtain knowledge about LAN switching concepts

REFERENCES

1. Achille Pattavina, “Switching Theory: Architectures and performance in Broadband ATM networks ", John Wiley & Sons Ltd, New York. 1998.
2. Elhanany M. Hamdi, “High Performance Packet Switching architectures”, Springer Publications, 2007.
3. Christopher Y Metz, “Switching protocols & Architectures”, McGraw - Hill Professional Publishing, NewYork.1998.
4. Rainer Handel, Manfred N Huber, Stefan Schroder, “ATM Networks - Concepts Protocols, Applications”, 3rd Edition, Addison Wesley, New York. 1999.
5. IrvanPepelnjk, Jim Guichard and Jeff Apcar, “MPLS and VPN Architecture”, Cisco Press, Volume 1 and 2, 2003.

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3. www.prnewswire.co.uk/.../kabira-supports-high-speed-volume-switching.

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

PCS16153 MICROWAVE INTEGRATED CIRCUITS 3 0 0 3

COURSE OBJECTIVES

- To introduce the basics of microwave integrated circuits
- To study about the microwave passive components
- To understand the working principle of microwave amplifiers and its types
- To introduce the concept of microwave oscillators in various fields
- To study about the technology of IC's and propagation of signals through Microstrip Transmission lines

UNIT I FUNDAMENTAL OF MICROWAVE INTEGRATED CIRCUITS 9

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

UNIT II PASSIVE COMPONENTS 9

Inductors, capacitors, resistors, microstrip components, coplanar circuits, multilayer 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

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

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

- Know the basics of microwave integrated circuits
- Understand the concept of microwave passive components
- Get an idea on microwave amplifiers and oscillators
- Acquire knowledge about integrated antennas and measurement techniques

REFERENCES

1. Ravender Goyal, "Monolithic MIC; Technology & Design", Artech House, 1989.
2. Gupta K.C. and Amarjit Singh, "Microwave Integrated Circuits", John Wiley, New York, 1975.
3. Ulrich L. Rohde and David P.N., "RF / Microwave Circuit Design for Wireless Applications", John Wiley, 2000.

4. Annapurna Das and Sisir K Das, “Microwave Engineering”, Tata McGraw-Hill Pub. Co. Ltd., 2004.
5. Mathew N.O. Sadiku, “Numerical techniques in Electromagnetic”, CRC Press, 2001.

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1. www.macom.com/technologies/HMIC
2. www.meslmicrowave.com/microwave-integrated-circuits/overview
3. https://www.tno.nl/.../mmic-s-monolithic-microwave-integrated-circuits

CO-PO Mapping:

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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

PCS16154 TELECOMMUNICATION SYSTEM MODELING AND SIMULATION 3 0 0 3

COURSE OBJECTIVES

- To understand the various types of simulation methodology and the concept of random signal generation and processor
- To introduce the concepts on monte carlo simulation
- To learn the various advanced models and simulation techniques
- To 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: 45 PERIODS

COURSE OUTCOMES

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

- Know about the 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 and 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.

WEB LINKS

1. www.ftn.uns.ac.rs/.../modelling-and-simulation-of-communication-system
2. https://books.google.co.in/books?isbn=1118423143
3. www.informatics.indiana.edu/rocha/complex/csm.html

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)													
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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

ELECTIVE II

PCS16251 SATELLITE COMMUNICATION 3 0 0 3

COURSE OBJECTIVES

- To introduce the elements of satellite
- To introduce the concepts of various modulation schemes
- To educate about link design of satellite
- To learn about navigation of satellite
- To know about applications of satellite

UNIT I ELEMENTS OF SATELLITE COMMUNICATION 8

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

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

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

UNIT III SATELLITE LINK DESIGN 9

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

UNIT IV SPACE LINKS 8

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 of fixed and mobile satellite links.

UNIT V SERVICES AND APPLICATIONS 8

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 Home service (DTH), Special services, E-mail, Video conferencing and Internet connectivity

TOTAL: 45 PERIODS

COURSE OUTCOMES

At the end of this 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
- Gain knowledge about navigation and global positioning

REFERENCES

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

WEB LINKS

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2. www.fao.org/docrep/003/w9633e/w9633e09.html
3. www.williamcraigcook.com/satellite/work.html

CO-PO Mapping:

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Programme Outcomes(POs)														
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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

PCS16252 DIGITAL COMMUNICATION RECEIVERS 3 0 0 3

COURSE OBJECTIVES

- To understand the basic concepts of digital communication, modulation techniques and spectral characteristics
- To analyze the optimum characteristics of receivers used in digital communication
- To understand the characteristics of fading channel
- To learn various synchronization techniques
- To 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 AWGN CHANNEL 9

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

UNIT III RECEIVERS FOR FADING CHANNELS 9

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

UNIT IV SYNCHRONIZATION TECHNIQUES 9

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

UNIT V ADAPTIVE EQUALIZATION 9

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

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

- Know the digital communication and spectral characteristics of digital communication
- Design the basic requirements of receiver
- Understand the various techniques to overcome the effect of fading channel
- Synchronize various synchronization techniques in digital communication
- Analyze the equalization algorithms to overcome the interference

REFERENCES

1. Heinrich Meyer, Mare Moeneclacy, Stefan. A. Fechtel, "Digital communication receivers", Vol I &Vol II, John Wiley, New York, 1997.

2. John.G.Proakis, “Digital communication”, 4th Edition, McGraw-Hill, New York, 2001.
3. E.A.Lee and D.G. Messerschmitt, “Digital communication", 2nd Edition, Allied Publishers, New Delhi, 1994.
4. Simon Marvin, “Digital communication over fading channel; An unified approach to performance Analysis", John Wiley, New York, 2000.

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2. www.researchgate.net/.../3450771_Noise_figure_of_digital_communication
3. www.scannermaster.com/Communication_Receivers_s/508.html

CO-PO Mapping:

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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

PCS16253 NETWORK ROUTING ALGORITHMS 3 0 0 3

COURSE OBJECTIVES

- To understand the state-of-the-art in network protocols, routing algorithms and its applications
- To introduce the various internet routing algorithms
- To familiarize the various aspects of routing algorithm
- To gain in-depth knowledge about the routing protocol and congestion controls
- To 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 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 VectorMulticast 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 Based Routing (ZRP). Study of Network Simulator NS - 2

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

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

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

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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 Micromobility Protocols," IEEE Wireless Communications Feb.2002, pp 72-82.

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1. https://en.wikibooks.org/wiki/Communication_Networks/Routing
2. www.computer.howstuffworks.com/routing-algorithm.html
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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

PCS16254 WIRELESS COMMUNICATIONS AND MIMO SYSTEMS 3 0 0 3

COURSE OBJECTIVES

- To introduce the concept of wireless system, digital modulation and detection techniques
- To educate about MIMO antenna systems
- To learn about equalization and multicarrier modulation
- To 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 WIRLESS COMMUNICATION 9

Spread-Spectrum Principles, Direct-Sequence Spread Spectrum (DSSS) – DSSS System Model – Spreading Codes for ISI Rejection: Random, Pseudorandom, 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 tradeoff, 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, downlink channel capacity, uplink channel capacity, multiuser diversity, MIMO diversity.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

- Know 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

REFERENCE

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 Tse and Pramod Viswanath, “Fundamentals of Wireless Communication”, Cambridge University Press, 2005.
5. A.Paulraj, R.Nabar, D.Gore, “Introduction to Space-Time Wireless Communication”, Cambridge University Press, 2003.

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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

ELECTIVE III

PCS16351 COMMUNICATION NETWORK SECURITY 3 0 0 3

COURSE OBJECTIVES

- To gain knowledge about securing the data plane
- To acquire knowledge in securing the control plane
- To understand establishing of identity and access control
- To learn about the network and firewall security
- To gain knowledge about the recent 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

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

UNIT III INTEGRITY, AUTHENTICATION AND KEY MANAGEMENT 9

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

UNIT IV NETWORKSECURITY, FIREWALL SAND WEB SECURITY 9

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

UNIT V WIRELESS NETWORK SECURITY 9

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

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

- Gain knowledge about securing the data plane
- Know about securing the control plane
- Understand establishing of identity and access control
- Understand the network and firewall security
- Gain knowledge about the recent trends in wireless security

REFERENCES

1. Behrouz A. Fourcuzan , "Cryptography and Network security", Tata McGraw- Hill, 2008
2. WilliamStallings, "Cryptography and Network security: principles and practice", 2nd Edition, Prentice Hall of India, New Delhi,2002
3. AtulKahate, "Cryptography and Network security", 2nd Edition, Tata McGraw- Hill, 2008
4. R.K.Nichols and P.C. Lekkas , "Wireless Security"
5. H. Yang et al., "Security in Mobile Ad Hoc Networks: Challenges and Solution", IEEE Wireless Communications, Feb. 2004.

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1. www.springer.com/us/book/9781402072512
2. https://books.google.co.in/books?isbn=144716654X
3. www.williamstallings.com/

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
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

PCS16352 MOBILE AD HOC NETWORKS 3 0 0 3

COURSE OBJECTIVES

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

UNIT I FUNDAMENTAL OF MOBILE AD HOC NETWORK 9

Introduction to AD HOC networks – definition, characteristics features, applications. Characteristics of Wireless channel, AD HOC 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, AD HOC transport protocols. Security issues in AD HOC 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: 45 PERIODS

COURSE OUTCOMES

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

- Identify the various challenges and vulnerabilities in MANET identify the technical issues related to AD-HOC 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 Ivan stojmenovic, “Mobile adhoc networking”, Wiley-IEEE press, 2004.
3. Mohammad Ilyas, “The handbook of adhoc wireless networks”, CRC press, 2002.
4. Fekri M. Abduljalil and Shrikant K. Bodhe, “A survey of integrating IP mobility protocols and Mobile Ad hoc networks”, IEEE communication Survey and tutorials, v 9.no.1 2007.
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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2. www.techopedia.com/definition/5532/mobile-ad-hoc-network-manet
3. www.sciencedirect.com/science/article/pii/S157087051200217

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

PCS16353 SOFT COMPUTING 3 0 0 3

COURSE OBJECTIVES

- To introduce the various types of classical sets, fuzzy sets and its properties.
- To understand about the operation of the fuzzy logic control systems.
- To learn the concepts of neuro-fuzzy modeling.
- To introduce the various methods of genetic algorithm and the concepts soft computing.

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 and languages- 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 space method, Applications

UNIT V SOFT COMPUTING AND CONVENTIONAL AI 9

AI Search algorithm-Predicate calculus - rules of interface - Semantic networks-frames-objects-Hybrid models applications

TOTAL: 45 PERIODS

COURSE OUTCOMES

At the end of this 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. LaureneFauseett: 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. Ndssen "Artificial Intelligence", Harcourt Asia Ltd., Singapore, 1998.

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2. www.soft-computing.de/def.html
3. www.scrs.in

CO-PO Mapping:

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

PCS16354 NETWORK MANAGEMENT 3 0 0 3

COURSE OBJECTIVES

- To understand the state-of-the-art in network protocols, architectures and applications
- To study the functions of different layers
- To familiarize the various aspects of SNMP networks
- To introduce the concepts of ATM networks
- To 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 -Functional model, 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 hop resolution, 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: 45 PERIODS

COURSE OUTCOMES

At the end of this 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
- Acquire knowledge about broad band network management
- Understand the different management techniques and its applications

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 Technologies and Implementations ", Eastern Economy Edition IEEE press, New Delhi, 1998.
5. Lakshmi G. Raman, “Fundamentals of Telecommunication Network Management”, Eastern Economy Edition IEEE Press, New Delhi, 1999.

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3. www.networkworld.com/category/network-management

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
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

ELECTIVE IV

PCS16451 DIGITAL IMAGE PROCESSING 3 0 0 3

COURSE OBJECTIVES

- To be familiar with digital image fundamentals
- To understand the concepts of image enhancement and restoration
- To acquire the knowledge about segmentation restoration
- To impart 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, mach band effect, Color image fundamentals - 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, Contraharmonic 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: 45 PERIODS

COURSE OUTCOMES

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

- Understand the basic concepts of digital image fundamentals
- Understand the need of enhancement and restoration
- Know the concept of segmentation in various image problems
- Acquire knowledge about 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.
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2. www.nptel.ac.in/courses/106105032
3. www.bookboon.com/en/digital-image-processing-part-one-ebook

CO-PO Mapping:

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Programme Outcomes(POs)														
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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

PCS16452 **CDMA ENGINEERING** **3 0 0 3**

COURSE OBJECTIVES

- To understand basic concepts of CDMA
- To learn the IS-95 CDMA Techniques, WCDMA and CDMA 2000
- To understand the multicarrier CDMA Systems
- To 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, Multiwavelength Optical CDMA networks.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

- Demonstrate the various concepts of CDMA and IS-95 CDMA techniques.
- Identify the technical issues in WCDMA / CDMA 2000.
- Design and build a wireless sensor network using multicarrier CDMA systems.
- Synchronize the various synchronization concepts of optical CDMA networks.

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", Prentice Hall 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”, Wiley India, 2004.
5. Guu-Chang Yang, “Prime Codes with Application to Optical and Wireless Networks”, Artech House, Inc., 2002.

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

PCS16453 WIRELESS SENSOR NETWORKS 3 0 0 3

COURSE OBJECTIVES

- 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: 45 PERIODS

COURSE OUTCOMES

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

- Demonstrate the various strategies of wireless sensor networking
- Know the concepts of networks architecture
- 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”, John Wiley, 2005.
2. Bhaskar Krishnamachari, ”Networking Wireless Sensors”, Cambridge Press,2005
3. Feng Zhao & Leonidas J. Guibas, “Wireless Sensor Networks- An Information Processing Approach", Elsevier, 2007.
4. Kazem Sohraby, Daniel Minoli, &Taieb Znati, “Wireless Sensor Networks-Technology, Protocols, and Applications”, John Wiley, 2007.
5. Mohammad Ilyas and Imad Mahgaob, “Handbook of Sensor Networks: Compact Wireless And Wired Sensing Systems”, CRC Press, 2005.

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1. www.sciencedirect.com/science/article/pii/S1389128608001254
2. www.ni.com › Products and Services › White Papers
3. www.techopedia.com/definition/25651/wireless-sensor-network-wsn

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

PCS16454 ADVANCED MICROWAVE COMMUNICATION 3 0 0 3

COURSE OBJECTIVES

- To learn various microwave devices and the microwave passive components
- To understand the microwave resonators and filters and the characteristics of microwave antennas
- To study about the microwave radio system
- To know the various links in satellite

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

UNIT VI SATELLITE LINKS 7

Frequency ranges – Orbits – Earth station – Up links – Transponders- Down links – Satellite system parameters – Multiple access

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

- Understand the functions of microwave amplifiers and oscillators
- Understand the functions of microwave passive components, microwave resonators and filters, thevarious characteristics of microwave antennas

- Analyze the problems in microwave communication
- Acquire knowledge in microwave radio system and satellite links

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”, John wiley, 1987.
5. Annapurana Das, Sisir.K.Das, “Microwave Engineering”, Tata McGraw Hill, 2000.

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2. https://books.google.co.in/books?isbn=0080560504
3. www.work-microwave.de/139.html

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