UNIVERSITY DEPARTMENTS

ANNA UNIVERSITY CHENNAI : : CHENNAI 600 025

REGULATIONS - 2009

CURRICULUM I TO IV SEMESTERS (FULL TIME)

M.E. OPTICAL COMMUNICATION

SEMESTER I

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	MA9108	Applied Mathematics for Communication Engineers	3	1	0	4
2	AP9114	Statistical Signal Processing	3	0	0	3
3	CU9112	Advanced Digital Communication Techniques	3	0	0	3
4	OC9111	Optical Waveguide Theory	3	0	0	3
5	OC9112	Advanced Optical Communication	3	0	0	3
6	E1	Elective I	3	0	0	3
PRACTICAL						
7	OC9117	Fiber Optics Laboratory	0	0	4	2
		TOTAL	**18**	**1**	**4**	**21**

SEMESTER II

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	OC9121	Non-linear Fiber optics and Signal Processing	3	0	0	3
2	CU9113	Fiber Optic Networking	3	0	0	3
3	E2	Elective II	3	0	0	3
4	E3	Elective III	3	0	0	3
5	E4	Elective IV	3	0	0	3
6	E5	Elective V	3	0	0	3
PRACTICAL						
7	OC9125	Optical Networking Laboratory	0	0	4	2
		TOTAL	**18**	**0**	**4**	**20**

SEMESTER III

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	E6	Elective VI	3	0	0	3
2	E7	Elective VII	3	0	0	3
3	E8	Elective VIII	3	0	0	3
PRACTICAL						
4	OC9134	Project Work – Phase I	0	0	12	6
		TOTAL	**9**	**0**	**12**	**15**

SEMESTER IV

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
PRACTICAL						
1	OC9141	Project Work – Phase II	0	0	24	12
		TOTAL	**0**	**0**	**24**	**12**

UNIVERSITY DEPARTMENTS

ANNA UNIVERSITY CHENNAI : : CHENNAI 600 025

REGULATIONS - 2009

CURRICULUM I TO VI SEMESTERS (PART TIME)

M.E. OPTICAL COMMUNICATION

SEMESTER I

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	MA9108	Applied Mathematics for Communication Engineers	3	1	0	4
2.	AP9114	Statistical Signal Processing	3	0	0	3
3.	CU9112	Advanced Digital Communication Techniques	3	0	0	3
		TOTAL	**9**	**1**	**0**	**10**

SEMESTER II

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	OC9121	Non-linear Fiber optics and Signal Processing	3	0	0	3
2.	CU9113	Fiber Optic Networking	3	0	0	3
3.	E1	Elective I	3	0	0	3
		TOTAL	**9**	**0**	**0**	**9**

SEMESTER III

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	OC9111	Optical Waveguide Theory	3	0	0	3
2.	OC9112	Advanced Optical Communication	3	0	0	3
3.	E2	Elective II	3	0	0	3
PRACTICAL						
4.	OC9117	Fiber Optics Laboratory	0	0	4	2
		TOTAL	**9**	**0**	**4**	**11**

SEMESTER IV

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	E3	Elective III	3	0	0	3
2.	E4	Elective IV	3	0	0	3
3.	E5	Elective V	3	0	0	3
PRACTICAL						
4.	OC9125	Optical Networking Laboratory	0	0	4	2
		TOTAL	**9**	**0**	**4**	**11**

SEMESTER V

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	E6	Elective VI	3	0	0	3
2.	E7	Elective VII	3	0	0	3
3.	E8	Elective VIII	3	0	0	3
PRACTICAL						
4.	OC9134	Project Work – Phase I	0	0	12	6
		TOTAL	**9**	**0**	**12**	**15**

SEMESTER VI

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
PRACTICAL						
1.	OC9141	Project Work – Phase II	0	0	24	12
		TOTAL	**0**	**0**	**24**	**12**

LIST OF ELECTIVES

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
1	OC9151	Integrated Optics	3	0	0	3
2	OC9152	Photonics Switching	3	0	0	3
3	OC9153	High Speed Photonics and Optoelectronics	3	0	0	3
4	OC9154	Quantum Electronics	3	0	0	3
5	OC9155	Laser Communication	3	0	0	3
6	OC9156	Solitons in Optical Communication	3	0	0	3
7	OC9157	MEMS Based Devices For Communication	3	0	0	3
8	OC9158	Optical Computing	3	0	0	3
9	AP9164	High Speed Switching Architectures	3	0	0	3
10	OC9159	Optical CDMA Systems	3	0	0	3
11	OC9160	Fiber Optic Sensors	3	0	0	3
12	CU9122	RF System Design	3	0	0	3
13	NE9112	High Performance Computer Networks	3	0	0	3
14	AP9122	Digital Image Processing	3	0	0	3
15	CU9153	Digital Communication Receivers	3	0	0	3
16	CU9157	Network Routing Algorithms	3	0	0	3
17	CU9158	Network Management	3	0	0	3
18	CU9159	Communication Network Security	3	0	0	3
19	CP9159	Soft Computing	3	0	0	3
20	CU9160	Telecommunication System Modeling and Stimulation	3	0	0	3

MA9108 APPLIED MATHEMATICS FOR COMMUNICATION ENGINEERS

L T P C
3 1 0 4

UNIT I SPECIAL FUNCTIONS 9

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

UNIT II MATRIX THEORY 9

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

UNIT III ONE DIMENSIONAL RANDOM VARIABLES 9

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

UNIT IV TWO DIMENSIONAL RANDOM VARIABLES 9

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

UNIT V QUEUEING MODELS 9

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

L:45 +T: 15 TOTAL: 60 PERIODS

REFERENCES

1. Grewal, B.S., Numerical methods in Engineering and Science, 40th edition, Khanna Publishers, 2007.
2. Moon, T.K., Sterling, W.C., Mathematical methods and algorithms for signal processing, Pearson Education, 2000.
3. Richard Johnson, Miller & Freund's Probability and Statistics for Engineers, 7th Edition, Prentice – Hall of India, Private Ltd., New Delhi (2007).
4. Taha, H.A., Operations Research, An introduction, 7th edition, Pearson education editions, Asia, New Delhi, 2002.
5. Donald Gross and Carl M. Harris, Fundamentals of Queueing theory, 2nd edition, John Wiley and Sons, New York (1985)

AP9114 STATISTICAL SIGNAL PROCESSING

L	T	P	C
3	0	0	3

UNIT I DISCRETE RANDOM SIGNAL PROCESSING 9

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

UNIT II SPECTRAL ESTIMATION 9

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

UNIT III LINEAR ESTIMATION AND PREDICTION 9

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

UNIT IV ADAPTIVE FILTERS 9

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

UNIT V MULTIRATE DIGITAL SIGNAL PROCESSING 9

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

TOTAL: 45 PERIODS

REFERENCES:

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

CU9112 ADVANCED DIGITAL COMMUNICATION TECHNIQUES

L T P C
3 0 0 3

UNIT I CONSTANT ENVELOPE MODULATION 9

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

UNIT II OFDM 9

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

UNIT III TRELLIS CODED MODULATION 9

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 9

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 9

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 : 45 PERIODS

REFERENCES:

1. Bernard Sklar., 'Digital Communications', second edition, Pearson Education,2001.
2. John G. Proakis., 'Digital Communication', 4 th edition, Mc Graw Hill Publication, 2001
3. Theodore S.Rappaport., 'Wireless Communications', 2nd edition, Pearson Education, 2002.
4. Stephen G. Wilson., 'Digital Modulation and Coding', First Indian Reprint ,Pearson Education, 2003.
5. Richard Van Nee & Ramjee Prasad., 'OFDM for Multimedia Communications' Artech House Publication, 2001.

OC9111 OPTICAL WAVEGUIDE THEORY

L T P C
3 0 0 3

UNIT I UNIFORM PLANE WAVES 9

Plane wave propagation, reflection, scattering and absorption. Plane wave dispersion, Ray optics, Reflection at interfaces, Goos – Hanchen shift, Wave propagation in lossy media.

UNIT II DIELECTRIC FILMS 9

Film modes, guided modes of the symmetrical slab waveguide, filed solutions for guided modes, guided mode absorption, scattering, slabs and films with graded index.

UNIT III PLANAR WAVEGUIDES 9

Film lenses and lens guides, strip guides, strip loaded film guides, Rib guides. Modes of planar slab guides, planar guides with graded index profile, channel waveguides, periodic wave guisdes.

UNIT IV CLADDED CORE FIBERS 9

Ray picture, field solutions, guided modes for unlimited cladding, leaky modes, guided modes attenuation. Single and multimode fibers.

UNIT V GRADED INDEX FIBERS 9

Ray analysis, filed solutions for modes in parabolic profile, multimode graded index fibers, variational analysis, single mode operation, Delay difference and impulse responses.

TOTAL: 45 PERIODS

REFERENCES:

1. Snyder & Love “Optical Waveguide Theory”, Chapman and Hall, New York, 1983.
2. H.G. Unger, Planar Optical Waveguides and Fibers, Oxford University press, Oxford, 1980.
3. Tamir. T, Guided Wave Optoelectronics, Springer Verlag, Berlin, 1990.
4. G.Cancellieri, Single Mode Optical Fibers, Pergramon press, New York, 1991.
5. Kapany, N.S. and Burke T.T, Optical Wave guides, Academic press, New York, 1972.
6. D.Marcuse, Light transmission optics, Von Nostrand Publication, New York, 1972.
7. D.Marcuse, Theory of Dielectric Waveguides, Von Nostrand Publication, New York, 1975.
8. Guided – Wave photonics. A. Bruce Buckman Oxford University Press, 1992.

OC9112 ADVANCED OPTICAL COMMUNICATION

L	T	P	C
3	0	0	3

UNIT I FIBER OPTIC GUIDES 9

Light wave generation systems, system components, optical fibres, SI, GI, fibres, modes, Dispersion in fibres, limitations due to dispersion, Fiber loss, non linear effects. Dispersion shifted and Dispersion flattened fibres.

UNIT II OPTICAL TRANSMITTERS AND RECEIVERS 9

Basic concepts, LED's structure spectral distribution, semiconductor lasers, gain coefficients, modes, SLM and STM operation, Transmitter design, Receiver PIN and APD diodes design, noise sensitivity and degradation, Receiver amplifier design.

UNIT III LIGHT WAVE SYSTEM 9

Coherent, homodyne and heterodyne keying formats, BER in synchronous – and asynchronous – receivers, sensitivity degradation, system performance, Multichannel, WDM, multiple access networks, WDM components, TDM, Subcarrier and Code division multiplexing.

UNIT IV AMPLIFIERS 9

Basic concepts, Semiconductor laser amplifiers, Raman – and Brillouin – fiber amplifiers, Erbium doped – fiber amplifiers, pumping phenomenon, LAN and cascaded in-line amplifiers.

UNIT V DISPERSION COMPENSATION 9

Limitations, Post- and Pre- compensation techniques, Equalizing filters, fiber based gratings, Broad band compensation, soliton communication system, fiber soliton, Soliton based communication system design, High capacity and WDM soliton system.

TOTAL: 45 PERIODS

REFERENCES:

1. G.P. Agarwal, Fiber optic communication systems, 2nd Ed, John Wiley & Sons, New York, 1997.
2. Franz & Jain, Optical Communication Systems, Narosa Publications, New Delhi, 1 995.
3. G. Keiser, Optical fiber communication systems, McGraw-Hill, New York, 2000.
4. Franz & Jain, Optical communication, Systems and components, Narosa Publications, New Delhi, 2000.

OC9117 FIBER OPTICS LABORATORY

L	T	P	C
0	0	4	2

LIST OF EXPERIMENTS

1. Characteristics of LED and PIN Photo diode
2. Characteristics of Laser diode
3. Characteristics of avalanche Photo diode
4. Measurements of Fiber parameters: Numerical aperture, Attenuation.
5. System bandwidth determination by analog modulation
6. BER measurements in fiber optic digital link
7. Time division multiplexing
8. Study of He-Ne Laser and Optical components.

OC9121 NON LINEAR FIBER OPTICS AND SIGNAL PROCESSING

L	T	P	C
3	0	0	3

UNIT I NONLINEAR PHENOMENA IN OPTICAL MATERIALS 9

Optical power, wave length dependent nonlinearity, First, Second and Third order effects, Refractive index dependence on optical power, Chirping, Pulse compression, Solitons, Photon mixing, Faraday and Kerr effects, Optical phase conjugation.

UNIT II SCATTERING 9

Raman and Brillonin scattering, Four photon mixing, Parametric process, Stokes line generation.

UNIT III SPATIAL FILTERING AND FILTERING SYSTEM 9

Types of spatial filters, optical signal processing and filter generation, read out module, orientation and sequential search, applications of optical spatial filter.

UNIT IV ACOUSTO-OPTIC DEVICES AND POWER SPECTRUM ANALYSIS 9

Acousto-optic cells, spatial light modulators, Raman – Nath and Bragg mode, basic spectrum analyzer, aperture weighting, dynamic range and SNR, photo detector, geometric considerations, radiometer.

UNIT V HOMODYNE AND HETERODYNE SPECTRUM ANALYSERS 9

Overlapping of waves, photo detector size, optimum photo detector size for 1D and 2D structure, Optical radio, spatial and temporal frequencies. Distributed and local oscillator. Dynamic range comparison of heterodyne and power spectrum analysers.

TOTAL: 45 PERIODS

REFERENCES:

1. Govind P.Agarwal, Nonlinear Fiber Optics, AT&T – Academic Press, 1989.
2. Vanderlught, Optical Signal Processing, John Wiley & Sons, New York, 1992.
3. P.K. Das, Optical Signal Processing Fundamentals, Narosa Publishing New Delhi,1991.
4. Signal Processing wing optics Bradley G. Boone, Oxford University Press, 1998.

CU9113 FIBER OPTIC NETWORKING

L T P C
3 0 0 3

UNIT I OPTICAL SYSTEM COMPONENTS AND NETWORK DESIGN 9

Optical System Components – Couplers, Isolators & Circulators, Multiplexers & Filters, Optical Amplifiers, Switches, Wavelength Converters; Transmission System Engineering – System model, Power penalty - transmitter, receiver, Optical amplifiers, crosstalk, dispersion; Wavelength stabilization ; Overall design considerations.

UNIT II OPTICAL NETWORK ARCHITECTURES 9

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

UNIT III WAVELENGTH ROUTING NETWORKS 9

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 9

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

UNIT V NETWORK MANAGEMENT AND SURVIVABILITY 9

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: 45 PERIODS

REFERENCES:

1. Rajiv Ramaswami and Kumar N. Sivarajan, “Optical Networks : A Practical
2. Perspective”, Harcourt Asia Pte Ltd., Second Edition 2006.
3. C. Siva Ram Moorthy and Mohan Gurusamy, “WDM Optical Networks : Concept, Design and Algorithms”, Prentice Hall of India, Ist Edition, 2002.
4. P.E. Green, Jr., “Fiber Optic Networks”, Prentice Hall, NJ, 1993.
5. Biswanath Mukherjee, “Optical WDM Networks”, Springer, 2006.

OC9125 OPTICAL NETWORKING LABORATORY

L	T	P	C
0	0	4	2

SIMULATION PACKAGES REQUIRED:

MEMS Intellisuite, Optiwave, Optisim, Matlab Simulink

LIST OF EXPERIMENTS

1. Optical Source Spectral Characterisation (1550 nm range)
2. Wavelength Division Multiplexing And Demultiplexing
3. Characterisation Of Fibre Bragg Grating Filters
4. Design Of MEMS Based Optical Sources, Filters And Switches
5. Characterisation Of Optical Crossconnects By Simulation
6. Study Of Routing And Wavelength Assignment Algorithms
7. Fibre Non-Linearity Characterisation By Simulation
8. Erbium Doped Fibre Amplifier Characterisation

OC9151 INTEGRATED OPTICS

L	T	P	C
3	0	0	3

UNIT I OPTICAL WAVE GUIDES 9

Coupled mode theory in guided wave systems, Theory of gratings in wave guide structure-Guided wave control – Fabrication of optical waveguides in glass, lithium niobate substrate.

UNIT II WAVEGUIDE COUPLERS 9

Coupling of beams to planar guides-prism, grating couplers. Theory of beam couplers and design. Waveguide couplers and mode converters, Filters.

UNIT III OPTICAL INTEGRATED CIRCUIT 9

Microfabrication techniques in optical integrated circuits – Guide evaluation and measurement. Pattern fabrication. Passive waveguide devices-Functional devices.

UNIT IV SEMICONDUCTOR INTEGRATED OPTIC DEVICES 9

Integrated semiconductors laser:- Gas heterostructure lasers, DFB lasers, modulators, Epitaxial detectors and electro absorption detectors, active switches, Optolectronic integrated circuits. Development trends.

UNIT V APPLICATIONS OF OPTICAL INTEGRATED CIRCUITS 9

Optical switches, A/D converters, RF spectrum analysers, convolvers and correlators. Integrated optic sensors. Optical inter connectors.

TOTAL: 45 PERIODS

REFERENCES:

1. Hiroshi Nishihara, Masamitsu Haruna, Toshiaki Suhara, Optical Integrated Circuits, McGraw-Hill, New York, 1992.
2. B.Saleh, Fundamental of Photonics, John Wiley, New York, 1991.
3. Tamir.T. (ed) Integrated optics, Vol. 7, Topics in applied Physics, Springer Verlag, New York, 1975.
4. Tamir.T. (ed) Guided wave Optoelectronics, Springer Verlag, Berlin, 1990.
5. Buckman. AB, Guided Wave Photonics, Saunders College publishing, New York, 1992.
6. Photonic Switching, Technology & Sensors, Vol. 13, OSA publishing, 1987.

OC9152 PHOTONIC SWITCHING

L T P C
3 0 0 3

UNIT I INTRODUCTION 9

Function semiconductor laser, Basic concepts of semi conductor laser, Semi conductor quantum wells, Vertical cavity surface emitting lasers, Non linear effects in semiconductor lasers.

UNIT II BISTABLE LASER DIODES 9

Optical Bistability, bistable switches, Inhomogeneous current injections – absorptive scheme. Dispersive bistable laser diodes. Injection locking. Bistability in laser diode amplifiers, wavelength, power and polarisation bistability.

UNIT III SELF PULSATION & ULTRA SHORT PULSE GENERATORS 9

Self pulsation-theory of self pulsation in laser diodes, Period doubling in modulated laser diodes. Optical chaos, Mode locking in laser diodes, Monolithic mode locked laser diodes.

UNIT IV WAVELENGTH SELECTION AND WAVELENGTH SELECTIVE PHOTODETECTION 9

Wavelength selection-Laser diode amplifier filters - DFB laser diode amplifier. Signal selection, Noise properties, Wavelength selection photo detectors.

UNIT V APPLICATIONS OF PHOTONIC SWITCHING 9

High speed data transmission systems, Clock distribution, All optical fibre communication systems: Clock extraction & dispersion compensation, WDM systems, optical exchange systems: Time division & wavelength division switching, Power mixing & Frequency division switching, Space switches.

TOTAL: 45 PERIODS

REFERENCES:

1. H. Kawaguchi, Bistabilities and Non-linearities in Laser Diodes, Artech house Inc, Norwood, 1994.
2. Sueta and Okoshi, Fundamental of Ultra fast & Ultra Parallel Opto Electronics, John Wiley & Sons, New York, 1996.
3. K. Tada and Hinton. H.S, Photonic Switching II, Springer Verlag, Berlin, 1990.

OC9153 HIGH SPEED PHOTONICS AND OPTOELECTRONICS

L T P C
3 0 0 3

UNIT I ELECTRONICS PROPERTIES OF SEMICONDUCTORS 9

Semiconductor materials, Band structure, Band structure modification by alloying, Heterostructure, Intrinsic carrier concentration, Defect levels, excess carriers, recombination process, charge injection and non radiative effects.

UNIT II HIGH SPEED PHENOMENA 12

Picosecond process in carrier transport theory, carrier-carrier interaction, excitonexcition interaction in super lattices, exciton life time reduction, reduction of electrons – photon scattering rates, hot electron diffusion.

UNIT III HIGH SPEED OPTOELECTRONIC DEVICES 12

Mode locked lasers, Fast multiple quantum well absorbers, suppressing of timing and energy fluctuation in lasers, Parametric oscillation in lasers, Ultra fast detectors – metal semiconductor photo diodes, Photo conductors, Switches.

UNIT IV SHORT PULSE GENERATION AND APPLICATIONS 12

Gain switching in semiconductor lasers, Self-pulsation in semiconductor laser, bistable laser, Short pulse generation using fiber non-linearity. Application to long distance and high speed communication, High speed optical signal processing, Picosecond electro optic sampling, logic gates, parallel processing and inter connectors.

TOTAL: 45 PERIODS

REFERENCES:

1. M.L.Riaziat, “Introduction to high speed electronics and Opto electronics”, John Wiley, New York, 1995.
2. Sueta. T, Okoshi. T, “Fundamental of Ultra fast and Ultra parallel opto electronics”, John Wiley, New York, 1996.
3. Mourou.G.A., Bloom O.M and Lee.C.H., “Principle electronics and Opto Electronics”, Springer Vering, Berlin, 1995.

OC9154 QUANTUM ELECTRONICS

L T P C
3 0 0 3

UNIT I BASIC THEOREMS AND POSTULATES OF QUANTUM MECHANICS 10

The Schrodinger wave equation, some solutions of time independent Schrodinger equation, Matrix formulation of quantum mechanics, Lattice vibration and their quantization, Electromagnetic fields and their quantization.

UNIT II LASER 10

Gaussian beam in a homogenous medium, Gaussian beam in a lens waveguide, Elliptic Gaussian beams, Optical resonators, Spontaneous and induced transitions, gain coefficient, homogenous and inhomogeneous broadening, Laser oscillations, Semiconductor laser, quantum well laser, modulation of optical radiation, Q switching and Mole locking of laser, Quantum wires and dots, Laser arrays, Concept of super modes, Phase amplitude in laser, Free electron lasers.

UNIT III NONLINEAR OPTICS 10

The nonlinear optical susceptibility tensor, Second harmonic generation, parametric oscillations, parametric amplifiers, Applications.

UNIT IV STIMULATED RAMAN AND BRILLOUIN SCATTERING 10

Stimulated Raman scattering, Antisokes scattering, stimulated Brillouin scattering, self focusing of optical beams.

UNIT V NOISE 5

Noise in laser amplifier and oscillator, Laser spectra, Measurements.

TOTAL: 45 PERIODS

REFERENCES:

1. Schubert Max, Wilhelmi Bernd, Non liner Optics and Quantum Electronics, John Wiley, New York, 1998.
2. D.Marcuse, Principle of Quantum Electronics, Academic Press, New York, 1980.
3. J.T. Verdeyen, Laser Electronics, Prentice Hall of India, New Delhi, 1981.
4. A.Yariv, Optical Electronics, Holt Reinhart and Winston, Cambridge, 1983.
5. G.P.Agarwal and N.K.Dutta, Long Wavelength Semiconductor lasers, Von Nostrand Reinholt, New York, 1985.
6. Harisson Paul, Quantum Wells, Wires and Dots, John Wiley, New York, 2000.
7. A.Yariv, Quantum Electronics, 3rd ed, John Wiley, New York, 1989.

OC9155 LASER COMMUNICATION

L T P C
3 0 0 3

UNIT I INTRODUCTION TO LASER COMMUNICATIONS 9

Atmospheric low loss windows, optical sources and detectors for these windows, Characteristics of source and detectors. Optical transmitting and receiving antennas.

UNIT II SYSTEM DESIGN 9

Link equation, Transmitter terminal, Antenna design, Antenna gain, Beam width, C/N, Optical detectors, Optical modulation formats, Deriving error statistics, Signal requirements for acquisition and tracking, Fundamentals of system design.

UNIT III SEMICONDUCTOR AND METAL LASER SOURCES FOR SATELLITE COMMUNICATIONS 9

Performance and Geometries, output wavelength control, Semiconductor laser lifetime, Direct and indirect modulation techniques and radiation effects.

UNIT IV OPTICAL RECEIVERS AND SYSTEM DESIGN 9

Direct detection, coherent detection and demodulation. Gimbals in transceiver design, Receiver options and optics; Lasers; antennas / Telescope, Internal optical systems, Transmitter analysis.

UNIT V LASER BEAM POINTING CONTROL 9

Acquisition and Tracking systems, System description, Acquisition methodology, racking and pointing control system, RF cross link system design, link equation.

TOTAL: 45 PERIODS

REFERENCES:

1. Morris Katzman, “Laser Satellite Communications”, Prentice Hall Inc, New York, 1991.
2. J. Franz and V.K.Jain, “Optical Communication Systems”, Narosa Publication, New Delhi, 1994.

OC9156 SOLITONS IN OPTICAL COMMUNICATION

L T P C
3 0 0 3

UNIT I INTRODUCTION 9

Elastic properties of dielectric fiber, Loss dispersion, birefringence, Non-Linear properties – Kerr, Raman and Brillouin effects, Non Linear SchrÖdinger equation and a solitary wave solution. Parameters for Soliton transmission.

UNIT II INVERSE SCATTERING TRANSFORM AND PERTURBATION METHODS 9

Lax theory – Inverse Scattering transforms – Soliton solutions – Perturbation methods – Conservation Laws – Stability.

UNIT III SOLITON RESHAPING AND TRANSMISSION CONTROL 9

Reshaping schemes – Lie transformation – guiding centre soliton – Soliton transmission control: The Gordon Haus limit, Guiding filter, Soliton control in frequency and time domains, Synchronization techniques.

UNIT IV INTERACTION BETWEEN SOLITONS 9

Two soliton interaction in the same element, suppression, Soliton interaction in different channels: Wavelength division multiplexing, Briefringence effects and polarization division multiplexing.

UNIT V SOLITON TRANSMISSION EXPERIMENTS AND APPLICATIONS 9

Reshaping of solitons in Erbium doped fiber amplifiers and Raman amplifiers, long distance soliton transmission. Soliton laser, Optical soliton switching. Spatial soliton application.

TOTAL: 45 PERIODS

REFERENCES:

1. Akira Hazegawa and Yuji Kodama, Solitons in Optical Communication, Oxford University Press Inc, Oxford, 1995.
2. Iannone Engenio, Matera Francesco, Mecozzi Antonio & Settembre Marina, Non Linear Optical Communication Networks, John Wiley and Sons, New York, 1998.
3. Govind P.Agarwal, Non Linear fiber Optics, Academic Press, New York, 1995.

OC9157 MEMS BASED DEVICES FOR COMMUNICATION

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UNIT I INTRODUCTION TO MEMS 9

Principles of Microsystems, Nano and Microscale systems, devices, and structures, Microstructures, Axial stress and strain, Shear stress and strain, Static bending of beams and thin plates, Mechanical vibration, Stiction issue, Scaling laws in miniaturization & Materials ;

MEMS Materials: Substrates and Wafers, Active substrate materials, Silicon, Silicon compounds, Silicon Piezoresistors, Gallium Arsenide, Quartz, Polymers, Packaging materials.

UNIT II ACTUATION MECHANISMS IN MEMS AND FABRICATION 9

Electrostatic Actuators : charge control, voltage control, spring suspended C, pull-in voltage, linearization methods, comb drive actuators, levitation, equivalent circuits, Piezoelectric, Thermal, Magnetic actuators, gap closers, rotary finger pull up, Electronics Interface, Feedback systems, Noise,circuit and system issues.

MEMS Fabrication: Bulk micromachining, Surface micromachining, Thin-film depositions (LPCVD, Sputtering, Evaporation), LIGA, Electroplating, Wet and dry etching,

Packaging: Microsystems packaging, Interfaces in microsystem packaging, Essential packaging technologies, 3D packaging, Assembly of Microsystems, Selection of packaging materials, Current and future trends for NEMS

UNIT III RF MEMS 9

Introduction to RF MEMS, general concepts in high frequency effects , RF MEMS Switches- Intro, basic design guidelines, RF switch design case studies, RF filters with MEMS- Tunable Capacitors and Inductors, RF MEMS resonators and their applications, Comparison of electrostatic and piezoelectric resonators, Case Study: Micromachined Antennas, Microstrip antenna ,Micromachining for antennas fabrication, Reconfigurable antennas, Example of RF MEMS switches and applications, design approaches.

UNIT IV MOEMS 9

Digital Micro mirror Device, Grating Light Valve, Optical switches, optical filters, arrayed waveguide grating,, Electrostatic reflective light modulator, Torsion mirror (TI DMD) Micromachined optical structures ,Fiber-optic couplers, Refractive lenses, Diffractive lenses, Waveguide optical systems, MEMS deformable mirrors Case study: Grating Light Valve

UNIT V MODELLING OF MEMS SYSTEMS 9

Circuit Modeling of MEMS: resonator equivalent circuits, thermal circuits, fluidic circuits, general filter topologies, insertion loss , shape factor, resonator and couplers, circuit modeling of coupled resonators, systematic micromechanical filter design procedure, Electrostatically actuated micro-mirror, design of optical filters, case studies.

REFERENCES:

1. Gregory T.A. Kovacs, Micromachined Transducers Sourecbook, The McGraw-Hill, Inc.1998
2. Stephen D. Senturia, Microsystem Design, Kluar Publishers, 2001
3. Nadim Maluf, An Introduction to Microelectromechanical Systems Engineering, Artech House, 2000.
4. Vijay Varadan, K. J. Vinoy, K. A. Jose, .RF MEMS and Their applications,Wiley,2002.

5. N.P.Mahalik,MEMS,TataMcGraw hill,2007.
6. Tai Ran Hsu ,MEMS and Microsystems Design and Manufacture, TataMcGraw hill,2002.

OC9158 OPTICAL COMPUTING

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UNIT I OPTICAL COMPUTING PRINCIPLES 9

Non Von-Neuman architecture, various forms of parallel processing, SLM, LEDs, Lasers and Photo detectors arrays, Holographic techniques, Optical storage devices.

UNIT II DIGITAL LOGIC 9

Symbolic substitution, Image computing, Cellular logic, Boolean logic, Cellular arrays, Cellular hyper cubes, conventional hyper cube, Binary stack coded arithmetic, Binary Row coded, Binary symbol, Coded arithmetic multilevel logic processing.

UNIT III OPTICAL COMPUTING ELEMENTS 9

ß switches, Machzender interferometeric logic elements for Boolean functions, Acousto optic; optical matrix multipliers, Non linear optical switches as memories.

UNIT IV ANALOG OPTICAL COMPUTING 9

Linear optic processing, Analog optical arithmatics. Recognition by analog optical system.

UNIT V DIGITAL OPTICAL COMPUTING 9

Devices, Shadow casting, Symbolic substitution, Optical matrix processing, Optical linear neural network. Nonlinear network.

TOTAL: 45 PERIODS

REFERENCES:

1. A.Karim Mohammed and A.S.Abdul Awwall, Optical computing-An introduction, John Wiley, New York, 1992.
2. Mc. Aulay Alastair.D, Optical Computer Architecture: The Application of optical concepts to next generation computers, John Wiley, New York, 1991.
3. Dror Feitelsen, Optical Computing, MIT press, Cambridge, 1988.

AP9164 HIGH SPEED SWITCHING ARCHITECTURES

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UNIT I LAN SWITCHING TECHNOLOGY 9

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

UNIT II ATM SWITCHING ARCHITECTURE 9

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

UNIT III QUEUES IN ATM SWITCHES 9

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

UNIT IV HIGH PERFORMANCE PACKET SWITCHING ARCHITECTURES 9

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

UNIT V IP SWITCHING 9

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

TOTAL: 45 PERIODS

REFERENCES:

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

OC9159 OPTICAL CDMA SYSTEMS

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UNIT I OPTICAL CDMA 9

Introduction; Optical CDMA codes - Construction of Coherent and Incoherent Codes , Performance Analysis and Comparison of Coherent and Incoherent Codes, Advanced Incoherent Codes, Information Capacity of Fiber-Optical CDMA Systems, Advanced Coding Techniques for Performance Improvement.

UNIT II COHERENT OPTICAL CDMA SYSTEMS 9

Introduction, Coherent OCDMA Approaches, Subsystem Technologies, Code Selection for SPC-OCDMA, OCDMA Network Architectures for SPC-OCDMA.

UNIT III INCOHERENT OPTICAL CDMA SYSTEMS 9

Introduction, WHTS System Architecture, Technologies for WHTS OCDMA, Experimental Demonstration of WHTS OCDMA.

UNIT IV ENABLING TECHNOLOGIES 9

Introduction, Fiber Bragg Grating Technology, FBGs for FOCDMA, Encoding/Decoding for OCDMA Systems.

UNIT V OPTICAL CDMA ARCHITECTURES 9

Hybrid Multiplexing Transmission System, Photonic Gateway: Multiplexing Format Conversion, OCDMA/WDM Virtual Optical Path Cross Connect, Optical CDMA network architectures and applications-Local Area Networks, Applications Demonstrations.

REFERENCES:

1. Paul R. Prucnal, “Optical Code Division Multiple Access- Fundamentals and Applications”, Taylor & Francis Ltd; Har/Cdr edition, 2005.
2. Guu-Chang Yang & Wing C. Kwong, “Prime Codes with Applications to CDMA Optical and Wireless Networks”, Artech House, 2002.

OC9160 FIBER OPTIC SENSORS

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UNIT I FIBERS AND MODULATED SENSORS 9

Principles of glass and plastic fibers for sensing applications. Electro- optic modulation, Bulk and integrated optic types. All fiber modulators, Interferometric Sensors, Fabry perot, Mach Zender, Michelson and Sagnac interferometric sensors.

UNIT II MULTIMEDIA GRATING AND POLARISATION SENSORS 9

Introduction to sensors based on relative movements of opposite gratings, sensors based on grating period modulation, Photo elastic effects, retardation plates.

UNIT III DISTRIBUTED AND MULTIPLEXED FIBER OPTIC SENSORS 9

Introduction, Distributed sensing, Principles of sensor multiplexing, Topology, Detection schemes, Interferometer sensor multiplexing.

UNIT IV FIBER OTPIC MAGENTIC SENSORS 9

Introduction, Faraday effect sensors, Magneto strictive and Lorentz force sensors.

UNIT V INDUSTRIAL APPLICATIONS AND SMART STRUCTURES 9

Temperature, Pressure, fluid level, flow, position, vibration and rotation measurements. Chemical analysis, Current and voltage measurement. Introduction to smart structures, Application of fiber optic smart structures and skins, Examples.

TOTAL: 45 PERIODS

REFERENCES:

1. Eric Udd, Fiber Optic Sensors, John Wiley, New York, 1991.
2. Eric Udd, Fiber Optic Smart structures, John Wiley, New York, 1995.
3. B.P.Pal, Fiber Optics in Telecommunication and Sensor, Wiley Eastern, New Delhi, 1995.
4. B.Culshaw and J.Daykin, Optic fiber Sensors Systems and Applications, Vol. I & II Artech House, Norwood, 1989.
5. F.Allard, Fiber Optics Hand book, McGraw-Hill, New York, 1990.

CU9122 **RF SYSTEM DESIGN**

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UNIT I CMOS PHYSICS, TRANSCEIVER SPECIFICATIONS AND ARCHITECTURES

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

UNIT II IMPEDANCE MATCHING AND AMPLIFIERS

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

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

UNIT IV PLL AND FREQUENCY SYNTHESIZERS

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

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

TOTAL: 45 PERIODS

TEXT BOOKS:

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

NE9112 HIGH PERFORMANCE COMPUTER NETWORKS

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UNIT I INTRODUCTION 9

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

UNIT II MULTIMEDIA NETWORKING APPLICATIONS 9

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

UNIT III ADVANCED NETWORKS CONCEPTS 10

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

UNIT IV TRAFFIC MODELLING 7

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

UNIT V NETWORK SECURITY AND MANAGEMENT 10

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

L=45

REFERENCES:

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

AP9122 DIGITAL IMAGE PROCESSING

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UNIT I DIGITAL IMAGE FUNDAMENTALS 9

Elements of digital image processing systems, Vidicon and Digital Camera working principles, Elements of visual perception, brightness, contrast, hue, saturation, mach band effect, Image sampling, Quantization, dither, Two-dimensional mathematical preliminaries.

UNIT II IMAGE TRANSFORMS: 9

1D DFT, 2D transforms – DFT, DCT, Discrete Sine, Walsh, Hadamard, Slant, Haar, KLT, SVD, Wavelet transform.

UNIT III IMAGE ENHANCEMENT AND RESTORATION 7

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

UNIT IV IMAGE SEGMENTATION AND RECOGNITION 11

Image segmentation – Edge detection, Edge linking and boundary detection, Region growing, Region splitting and Merging, Image Recognition **–** Patterns and pattern classes, Matching by minimum distance classifier, Matching by correlation., Neural networks-Backpropagation network and training, Neural network to recognize shapes.

UNIT V IMAGE COMPRESSION 9

Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, Vector Quantization, Block Truncation Coding, Transform coding, JPEG standard, JPEG 2000, SPIHT, MPEG.

TOTAL: 45 PERIODS

REFERENCES:

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

CU9153 DIGITAL COMMUNICATION RECEIVERS

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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 RECIEVERS 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 RECIEVERS FOR FADING CHANNELS 9

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

UNIT IV SYNCHRONIZATION TECHNIQUES 9

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

UNIT V ADAPTIVE EQUALIZATION 9

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

TOTAL: 45 PERIODS

REFERENCES:

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

CU9157 NETWORK ROUTING ALGORITHMS

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UNIT I INTRODUCTION 5

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 10

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 10

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 all., " 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.

CU9158 NETWORK MANAGEMENT

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UNIT I FUNDAMENTALS OF COMPUTER NETWORK TEHNOLOGY 9

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

UNIT II OSI NETWORK MANAGEMENT 9

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

UNIT III INTERNET MANAGEMENT(SNMP) 9

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

UNIT IV BROADBAND NETWORK MANAGEMENT 9

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

UNIT V NETWORK MANAGEMENT APPLICATIONS 9

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

TOTAL: 45 PERIODS

REFERENCES:

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

CU9159 COMMUNICATION NETWORK SECURITY

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UNIT I INTRODUCTION ON SECURITY 9

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

UNIT II SYMMETRIC & ASYMMETRIC KEY ALGORITHMS 9

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

UNIT III INTEGRITY, AUTHENTICATION AND KEY MANAGEMENT 9

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

UNIT IV NETWORK SECURITY , FIREWALLS AND WEB SECURITY 9

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

UNIT V WIRELESS NETWORK SECURITY 9

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

TOTAL: 45 PERIODS

REFERENCES:

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

CP9159 SOFT COMPUTING

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UNIT I ARTIFICIAL NEURALS 9

Basic-concepts-single layer perception-Multi layer perception-Supervised and un supervised 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 MODELLING 9

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

UNIT IV GENETIC ALGORITHM 9

Survival of the fittest-pictures computations-cross over mutation-reproduction-rank method-rank space method, Application

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

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. Ndssen Artificial Intelligence, Harcourt Asia Ltd.,Singapore,1998.

CU9160 TELECOMMUNICATION SYSTEM MODELING AND SIMULATION

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UNIT I SIMULATION METHODOLOGY 8

Introduction, Aspects of methodology, Performance Estimation, Simulation sampling frequency, Low pass equivalent simulation models for bandpass signals, Multicarrier signals, Non-linear and time-varying systems, Post processing – Basic graphical techniques and estimations.

UNIT II RANDOM SIGNAL GENERATION & PROCESSING 8

Uniform random number generation, Mapping uniform random variables to an arbitrary pdf, Correlated and Uncorrelated Gaussian random number generation, PN sequence generation, Random signal processing, Testing of random number generators.

UNIT III MONTE CARLO SIMULATION 9

Fundamental concepts, Application to communication systems, Monte Carlo integration, Semianalytic techniques, Case study: Performance estimation of a wireless system.

UNIT IV ADVANCED MODELS & SIMULATION TECHNIQUES 10

Modeling and simulation of non-linearities: Types, Memoryless non-linearities, Non-linearities with memory, Modeling and simulation of Time varying systems : Random process models, Tapped delay line model, Modelling aand simulation of waveform channels, Discrete memoryless channel models, Markov model for discrete channels with memory.

UNIT V EFFICIENT SIMULATION TECHNIQUES 10

Tail extrapolation, pdf estimators, Importance sampling methods, Case study: Simulation of a Cellular Radio System.

TOTAL: 45 PERIODS

REFERENCES:

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