NATIONAL ENGINEERING COLLEGE

(An Autonomous Institution Affiliated to Anna University Chennai)

K.R.NAGAR, KOVILPATTI – 628 503

REGULATIONS - 2011

Estd :1984

DEPARTMENT OF

ELECTRONICS AND COMMUNICATION ENGINEERING

CURRICULUM AND SYLLABI OF

M.E. – COMMUNICATION SYSTEMS

NATIONAL ENGINEERING COLLEGE, K.R.NAGAR, KOVILPATTI

(An Autonomous Institution Affiliated to Anna University Chennai)

M.E. (COMMUNICATION SYSTEMS)

CURRICULUM & SYLLABUS (FULL TIME)

SEMESTER I

SNO.	COURSE CODE	COURSE TITLE	L	T	P	C
1	MMA103	Applied Mathematics for Communication Engineers	3	1	0	4
2	MCE101	Advanced Radiation Systems	3	0	0	3
3	MCE102	Modern Digital Communication Techniques	3	0	0	3
4	MCE103	Advanced Digital Signal Processing	3	0	0	3
5	MCE104	Optical Communication Networks	3	0	0	3
6	E1	Elective	3	0	0	3
7	MCE131	Communication System Laboratory - I	0	0	4	2
					Total Credits	**21**

SEMESTER II

SNO.	COURSE CODE	COURSE TITLE	L	T	P	C
1	MCE201	Wireless Mobile Communication	3	0	0	3
2	MCE202	Multimedia Compression Techniques	3	0	0	3
3	MCE203	Microwave Integrated Circuits	3	0	0	3
4	E2	Elective	3	0	0	3
5	E3	Elective	3	0	0	3
6	E4	Elective	3	0	0	3
7	MCE231	Communication System Laboratory – II	0	0	4	2
					Total Credits	**20**

SEMESTER III

SNO.	COURSE CODE	COURSE TITLE	L	T	P	C
1	E5	Elective	3	0	0	3
2	E6	Elective	3	0	0	3
3	E7	Elective	3	0	0	3
4	MCE331	Project work phase – I	0	0	12	6
					Total Credits	**15**

SEMESTER IV

SNO.	COURSE CODE	COURSE TITLE	L	T	P	C
1	MCE431	Project work phase – II	0	0	24	12
					Total Credits	**12**

TOTAL CREDITS TO BE EARNED FOR THE AWARD OF THE DEGREE - 68

NATIONAL ENGINEERING COLLEGE, K.R.NAGAR, KOVILPATTI

(An Autonomous Institution Affiliated to Anna University Chennai)

M.E. (COMMUNICATION SYSTEMS)

CURRICULUM I TO VI SEMESTERS (PART TIME)

SEMESTER - I (Part time)

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
1	MMA103	Applied Mathematics for Communication Engineers	3	1	0	4
2	MCE101	Advanced Radiation Systems	3	0	0	3
3	MCE102	Modern Digital Communication Techniques	3	0	0	3
					Total Credits	**10**

SEMESTER - II (Part time)

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
1	MCE201	Wireless Mobile Communication	3	0	0	3
2	MCE202	Multimedia Compression Techniques	3	0	0	3
3	MCE203	Microwave Integrated Circuits	3	0	0	3
					Total Credits	**9**

SEMESTER - III (Part time)

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
1	MCE103	Advanced Digital Signal Processing	3	0	0	3
2	MCE104	Optical Communication Networks	3	0	0	3
3	E1	Elective	3	0	0	3
Practical						
4	MCE131	Communication System Laboratory – I	0	0	4	2
					Total Credits	**11**

SEMESTER - IV (Part time)

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
1	E2	Elective	3	0	0	3
2	E3	Elective	3	0	0	3
3	E4	Elective	3	0	0	3
Practical						
4	MCE231	Communication System Laboratory – II	0	0	4	2
					Total Credits	**11**

SEMESTER V (Part time)

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	E5	Elective	3	0	0	3
2	E6	Elective	3	0	0	3
3	E7	Elective	3	0	0	3
PRACTICAL						
4	MCE331	Project Work Phase – I	0	0	12	6
					Total Credits	**15**

SEMESTER VI (Part time)

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
PRACTICAL						
1	MCE431	Project Work Phase – II	0	0	24	12
					Total Credits	**12**

TOTAL CREDITS TO BE EARNED FOR THE AWARD OF THE DEGREE - 68

LIST OF ELECTIVES FOR
M.E. COMMUNICATION SYSTEMS

Sl.No	COURSE CODE	COURSE TITLE	L	T	P	C
1	MCE001	Communication Network Security	3	0	0	3
2	MCE002	RF System Design	3	0	0	3
3	MCE003	DSP Processor Architecture and Programming	3	0	0	3
4	MCE004	Digital Speech Signal Processing	3	0	0	3
5	MCE005	Digital Communication Receivers	3	0	0	3
6	MCE006	Electromagnetic Interference and Electromagnetic Compatibility	3	0	0	3
7	MCE007	Communication Protocol Engineering	3	0	0	3
8	MCE008	Global Positioning Systems	3	0	0	3
9	MCE009	Advanced Microprocessors and Microcontrollers	3	0	0	3
10	MCE010	Embedded Systems	3	0	0	3
11	MCE011	High Speed Switching Architectures	3	0	0	3
12	MCE012	Wavelets and Multi resolution processing	3	0	0	3
13	MCE013	Low Power VLSI Design	3	0	0	3
14	MCE014	ASIC Design	3	0	0	3
15	MCE015	Nonlinear Fiber Optics	3	0	0	3
16	MCE016	Optical Fiber Communication and Networking	3	0	0	3
17	MCE017	VLSI Signal Processing	3	0	0	3
18	MCE018	Satellite Communication	3	0	0	3
19	MCS003	Digital Image Processing	3	0	0	3
20	MCS004	Network Routing Algorithms	3	0	0	3
21	MCS005	Internetworking Multimedia	3	0	0	3
22	MCS006	Soft Computing	3	0	0	3
23	MCS007	Mobile Computing	3	0	0	3
24	MCC004	Wireless Sensor Networks	3	0	0	3
25	MCC007	Adhoc Networks	3	0	0	3
26	MCC101	High Performance Computer Networks	3	0	0	3
27	MCC202	Wireless Networks	3	0	0	3
28	MCI013	Medical Image Processing	3	0	0	3

MMA103 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.

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 for means – 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.

TUTORIAL: 15 TOTAL: 60

REFERENCES:

1. Grewal B.S., "Numerical methods in Engineering and Science", 40th edition, Khanna Publishers, 2007. [unit I]
2. Moon, T.K., Sterling, W.C., "Mathematical methods and algorithms for signal processing", Pearson Education, 2000.
3. Richard Johnson, Miller & Freund, "Probability and Statistics for Engineers", 7th Edition, Prentice – Hall of India, Private Ltd., New Delhi (2007).[unit III &IV]
4. Taha, H.A., "Operations Research, An introduction", 7th edition, Pearson education editions, Asia, New Delhi, 2002.[unit V]
5. Bronson.R, Matrix operation, Schaum's outline series, Mc Graw Hill, New York(1989) [unit II]
6. Grewal,B.S, Higher Engineering Mathematics, 37th edition, Khanna Publishers,2003. [unit I]
7. Ramana B.V, Higher Engineering Mathematics –Tata McGraw Hill, 2007 [unit I]
8. Numerical methods for scientific and engineering computation" by M.K.Jain, S.R.K. Iyengar and R.K.Jain - 5th edition New age International Publishers 2007. [Unit II].
9. Donald Gross and Carl M. Harris, "Fundamentals of Queuing theory", 2nd edition, John Wiley and Sons, New York (1985)

MCE101 ADVANCED RADIATION SYSTEMS L T P C
3 0 0 3

UNIT I ANTENNA FUNDAMENTALS 9

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

UNIT II RADIATION FROM APERTURES 9

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

UNIT III ARRAY ANTENNA 9

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

UNIT IV MICRO STRIP ANTENNA 9

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

UNIT V EMC ANTENNA AND ANTENNA MEASUREMENTS 9

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

TOTAL: 45

REFERENCES:

1. Constantine A. Balanis, “Antenna Theory: Analysis and Design”, Wiley-Inter science, 3rd Edition, 2005.
2. Krauss.J.D, “Antennas”, McGraw Hill, 2nd Edition, 2001.
3. A.R. Harish, M. Sachidananda, “Antennas and Wave Propagation”, Oxford University Press, 2008.
4. Robert S. Elliott, “Antenna Theory and Design”, John Wiley & Sons, 2007.
5. W.L. Stutzman and G.A.Thiele, “Antenna Theory and Design”, 2nd Edition, John Wiley & Sons Inc., 1998.

MCE102 MODERN 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: PAPR reduction schemes, Clipping, Filtering, Coding and Scrambling.

UNIT III BLOCK CODED DIGITAL COMMUNICATION 9

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

UNIT IV CONVOLUTIONAL CODED DIGITAL COMMUNICATION 9

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

UNIT V EQUALIZATION TECHNIQUES 9

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

Total: 45

REFERENCES:

1. M.K.Simon, S.M.Hinedi and W.C.Lindsey, "Digital communication techniques; Signalling and detection", Prentice Hall India, New Delhi. 1995. [Unit-III, IV]
2. John G. Proakis and Masoud Salehi, "Digital Communications", 5th ed., McGraw-Hill International Editions, 2008. [Unit- V]
3. Haykins, "Communication Systems", 5th ed., John Wiley, 2008. [Unit-I, III, IV].
4. M. K. Simon and M. S. Alouini," Digital Communication over Fading Channels", Wiley-Interscience, 2nd Edition 2005.
5. R. G. Gallager, "Principles of Digital Communication", Cambridge University Press, 2008.
6. A. Lapidoth, "A Foundation in Digital Communication",Cambridge, 2009. [Unit-I, III, IV].
7. Stephen G. Wilson., "Digital Modulation and Coding", First Indian Reprint Pearson Education, 2003. [Unit-I, III, IV].
8. Richard Van Nee & Ramjee Prasad., "OFDM for Multimedia Communications" Artech House Publication, 2001. [Unit-II].

MCE103 ADVANCED DIGITAL 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, 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 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-Hoff 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

REFERENCES:

1. Monson H. Hayes, "Statistical Digital Signal Processing and Modeling", John Wiley and Sons, Inc, Singapore, 2002 (First to Fourth Units)
2. Saeed V. Vaseghi, "Advanced Digital Signal Processing and Noise Reduction", 4th Edition, Wiley, 2009
3. John G. Proakis and Dimitris K Manolakis "Digital Signal Processing", Pearson Education, 4th Edition, 2009 (V-unit)
4. Richard G. Lyons "Understanding Digital Signal Processing" , Prentice Hall, 3rd Edition, 2010
5. Alan V. Oppenheim and Ronald W. Schafer "Discrete-Time Signal Processing" 3rd Edition, Prentice Hall, 2009.
6. Emmanuel C. Ifeachor, Barrie W. Jervis "Digital signal processing: A practical approach" 2nd Edition, Prentice Hall, 2002
7. Mallat.S., "Wavelet Signal Processing", Academic Press, Third Edition, 2008. (Wavelet Transform)

MCE104 OPTICAL COMMUNICATION NETWORKS L T P C
3 0 0 3

UNIT I OPTICAL SYSTEM COMPONENTS 9

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

UNIT II OPTICAL NETWORK ARCHITECTURES 9

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

UNIT III WAVELENGTH ROUTING NETWORKS 9

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

UNIT IV PACKET SWITCHING AND ACCESS NETWORKS 9

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

UNIT V NETWORK DESIGN AND MANAGEMENT 9

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

TOTAL: 45

REFERENCES:

1. John M. Senior, “Optical Fiber Communications: Principles and Practice”, Prentice Hall, 3rd Edition 2008
2. Rajiv Ramaswami, Kumar Sivarajan and Galen Sasaki “Optical Networks: A Practical Perspective”, Morgan Kaufmann, 3rd Edition, 2009.
3. William Shieh and Ivan Djordjevic, “OFDM for Optical Communications”, Academic Press, 2009
4. Gerd Keiser, “Optical Fiber Communications”, McGraw Hill, 4th Edition, 2010
5. Leonid G. Kazovsky, Ning Cheng, Wei-Tao Shaw and David Gutierrez, “Broadband Optical Access Networks” , Wiley Interscience, 2011
6. C. Siva Ram Moorthy and Mohan Gurusamy, “WDM Optical Networks: Concept, Design and Algorithms”, Prentice Hall of India, 1st Edition, 2002.

MCE131 COMMUNICATION SYSTEM LABORATORY - I

L	T	P	C
0	0	4	2

1. Channel equalizer design using MATLAB (LMS, RLS)
2. Transform based compression techniques.
3. Antenna Radiation Pattern measurement.
4. Performance Evaluation of digital modulation schemes
5. Implementation of Linear and Cyclic Codes
6. OFDM transceiver design using MATLAB
7. Performance evaluation of Digital Data Transmission through Fiber Optic Link
8. Fiber optic characterization using OTDR

TOTAL: 60

MCE201 WIRELESS MOBILE COMMUNICATION L T P C
3 0 0 3

UNIT I THE WIRELESS CHANNEL 9

Overview of wireless systems, Physical modeling for wireless channels, Time and Frequency coherence, Statistical channel models, Capacity of wireless Channel, Capacity of Flat Fading Channel, Channel Distribution Information known, Channel Side Information at Receiver, Channel Side Information at Transmitter and Receiver, Capacity with Receiver diversity, Capacity comparisons, Capacity of Frequency Selective Fading channels.

UNIT II PERFORMANCE OF DIGITAL MODULATION OVER WIRELESS CHANNELS 8

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

UNIT III DIVERSITY 9

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

UNIT IV MULTICARRIER MODULATION 10

Data Transmission using Multiple Carriers, Multicarrier Modulation with Overlapping Sub channels, Mitigation of Subcarrier Fading, Discrete Implementation of Multicarrier Modulation, Peak to Average Power Ratio- Frequency and Timing offset, Case study IEEE 802.11a.

UNIT V SPREAD SPECTRUM 9

Spread Spectrum Principles, Direct Sequence Spread Spectrum, Spreading Codes, Synchronization, RAKE receivers, Frequency Hopping Spread Spectrum, Multiuser DSSS Systems, Multi user FHSS Systems.

TOTAL: 45

REFERENCES:

1. Andrea Goldsmith, “Wireless Communications”, Cambridge University Press, 2005.
2. T.S. Rappaport, “Wireless Communications”, Pearson Education, 2003.
3. David Tse and Pramod Viswanath, “Fundamentals of Wireless Communication”, Cambridge University Press, 2005.
4. Andreas F. Molisch , “Wireless Communications”, Wiley - IEEE, 2011.
5. Noureddine Boudriga, “Security of Mobile Communications”, CRC Press, 2009.
6. William Stallings, "Wireless Communications & Networks”, 2nd edition, Prentice Hall, 2004.

MCE202 MULTIMEDIA COMPRESSION TECHNIQUES L T P C
3 0 0 3

UNIT I INTRODUCTION 9

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

UNIT II TEXT COMPRESSION 9

Compression techniques, Huffman coding, Adaptive Huffman Coding, Arithmetic coding, Shannon-Fano coding, Dictionary techniques, LZW family algorithms.

UNIT III AUDIO COMPRESSION 9

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

UNIT IV IMAGE COMPRESSION 9

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

UNIT V VIDEO COMPRESSION 9

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

TOTAL: 45

REFERENCES:

1. Khalid Sayood : “Introduction to Data Compression”, Morgan Kauffman Harcourt India, Second Edition, 2000. [Unit- I, II]
2. David Salomon: “Data Compression – The Complete Reference”, Springer Verlag New York Inc., Second Edition, 2007. [Unit- III, IV]
3. Yun Q.Shi, Huifang Sun: “Image and Video Compression for Multimedia Engineering -Fundamentals, Algorithms & Standards”, CRC press, 2003. [Unit- V]
4. Peter Symes : “Digital Video Compression”, McGraw Hill Pub., 2004. [Unit- V]
5. Mark Nelson: “Data compression”, BPB Publishers, New Delhi, 1998. [Unit- I, II]
6. Mark S.Drew, Ze-Nian Li : “Fundamentals of Multimedia”, PHI, First Edition, 2003 [Unit- I, IV]
7. Borivoje Furht, Stephen W. Smoliar, Hong Jiang Zhang: **“**Video and Image Processing in Multimedia Systems", The Springer International Series in Engineering and Computer Science- Springer; First Edition (October 31, 1995) [Unit- V]
8. Fred Halsal, “Multimedia Communications”, Pearson, 2009.
9. Andy Beach, “Real World Video Compression”, Pearson Education, 2010.
10. Irina Bocharova , “Compression for Multimedia”, Cambridge University Press, 2010.
11. Jenq-Neng Hwang, “Multimedia Networking: From Theory to Practice”, Cambridge University Press, 2009.

MCE203 MICROWAVE INTEGRATED CIRCUITS L T P C
3 0 0 3

UNIT I INTRODUCTION TO MICROWAVE INTEGRATED CIRCUITS 7
MMIC- technology, advantages and applications, Active device technologies, design approaches, multichip module technology, substrates.

UNIT II PASSIVE COMPONENTS 10
Inductors, capacitors, resistors, microstrip components, coplanar circuits, multilayer techniques, micro machined passive components, switches & attenuators, filter design.

UNIT III AMPLIFIERS 10
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
Integrated 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

REFERENCES:

1. Ravender Goyal, “Monolithic MIC; Technology and Design”, Artech House, 1989.
2. Allen A. Sweet, “Designing Bipolar Transistor Radio Frequency Integrated Circuits”, (Artech House Microwave Library) , 2008.
3. Arjuna Marzuki, Ahmad Ismat Bin Abdul Rahim and Mourad Loulou, “Advances in Monolithic Microwave Integrated Circuits: Modeling and Design Technologies”, (Premier Reference source), 2011.
4. David M. Pozar, “Microwave Engineering”, Wiley, 2004.
5. Annapurna Das and Sisir K. Das, “Microwave Engineering”, Tata McGraw-Hill Pub.Co.Ltd., 2004.

MCE231 COMMUNICATION SYSTEM LABORATORY – II

L	T	P	C
0	0	4	2

1. Simulation of Audio and speech compression algorithms
2. Simulation of EZW / SPIHT Image coding algorithm.
3. Simulation of Microstrip Antennas
4. S-parameter estimation of Microwave devices.
5. Study of Global Positioning System.
6. Performance evaluation of simulated CDMA System.
7. Design and testing of a Microstrip coupler.
8. Characteristics of $\lambda/4$ and $\lambda/2$ transmission lines.

TOTAL: 60

MCE001 COMMUNICATION NETWORK SECURITY L T P C
3 0 0 3

UNIT I INTRODUCTION ON SECURITY 9

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

UNIT II SYMMETRIC & ASYMMETRIC KEY ALGORITHMS 9

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

UNIT III INTEGRITY, AUTHENTICATION AND KEY MANAGEMENT 9

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

UNIT IV NETWORK SECURITY, FIREWALLS AND WEB SECURITY 9

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

UNIT V WIRELESS NETWORK SECURITY 9

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

TOTAL: 45

REFERENCES:

1. Behrouz A. Fourcuzan, “Cryptography and Network security” Tata McGraw- Hill, 2008. [UNIT – I, II, III]
2. William Stallings, "Cryptography and Network Security", 3rd Edition, Pearson Education, New Delhi, 2003 [UNIT – IV]
3. Tom Karygiannis, Les Owens,"Wireless Network Security 802.11, Bluetooth and Handheld Devices", National Institute of Standards and Technology, US Dept. of Commerce Special Publication 800-48, 2002 [UNIT – V]
4. B.A. Forouzan, "Cryptography & Network Security", TaTa McGrawHill, 2007
5. Eric Cole “Network Security Bible” , 2009
6. Mark D. Ciampa,“Security+ Guide to Network Security Fundamentals”,2008.
7. William Stallings “Network Security Essentials: Applications and Standards” 4th Edition, 2010
8. Stuart McClure, Joel Scambray and George Kurtz “Hacking Exposed: Network Security Secrets and Solutions”, Sixth Edition 2009
9. Chris McNab”Network Security Assessment: Know Your Network”, 2007
10. Fahim Hussain Yusuf Bhaiji “Network Security Technologies and Solutions” CCIE Professional Development Series, 2008

MCE002 RF SYSTEM DESIGN L T P C
3 0 0 3

UNIT I CMOS PHYSICS, TRANSCEIVER SPECIFICATIONS AND ARCHITECTURES 9

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

UNIT II IMPEDANCE MATCHING AND AMPLIFIERS 9

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

UNIT III FEEDBACK SYSTEMS AND POWER AMPLIFIERS 9

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

UNIT IV PLL AND FREQUENCY SYNTHESIZERS 9

PLL: Linearized Model, Noise properties, Phase detectors, Loop filters and Charge Pumps Frequency Synthesizers: Integer-N frequency synthesizers, Direct Digital Frequency synthesizers

UNIT V MIXERS AND OSCILLATORS 9

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

TOTAL: 45

REFERENCES:

1. Jaime Aguilera and Roc Berenguer, “Design and Test of Integrated Inductors for RF Applications”, Kluwer Academic Publishers, 2010.
2. Qizheng Gu, “RF System Design of Transceivers for Wireless Communications”, Springer, 2010.
3. Michael B. Steer , “Microwave and RF Design: A Systems Approach”, SciTech Publishing, 2009.
4. Ken Kuang, Franklin Kim and Sean S. Cahill, “RF and Microwave Microelectronics Packaging”, Springer, 2009.
5. R. Jacob Baker, “CMOS Circuit Design, Layout, and Simulation”, 3rd Edition (IEEE Press Series on Microelectronic Systems) , 2010.
6. J. Craninckx and Michiel Steyaert, “Wireless CMOS Frequency Synthesizer Design”, Springer International Series in Engineering and Computer Science, 2010.

MCE003 DSP PROCESSOR ARCHITECTURE AND PROGRAMMING L T P C
3 0 0 3

UNIT I FUNDAMENTALS OF PROGRAMMABLE DSP 9

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

UNIT II TMS320C5XXX PROCESSOR 9

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

UNIT III TMS320C6XXX PROCESSOR 9

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

UNIT IV ADSP PROCESSOR 9

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

UNIT V ADVANCED PROCESSORS 9

Architecture of TMS320C6472 (Multicore DSP): Pipe line operation, Code Composer studio – Architecture of Motorola DSP563XX – Comparison of the features of DSP family processors.

TOTAL: 45

REFERENCES:

1. U. Meyer-Baese, “Digital Signal Processing with Field Programmable Gate Arrays”, Signals and Communication Technology, Springer, 2007.
2. Mahesh Mehendale and Sunil D. Sherlekar, “VLSI Synthesis of DSP Kernels: Algorithmic and Architectural Transformations”, Kluwer Academic Publishers, 2010.
3. Manish Verma and Peter Marwedel, “ Advanced Memory Optimization Techniques for Low-Power Embedded Processors”, Springer, 2010.
4. Muhammad Shafique and Jörg Henkel, “ Hardware/Software Architectures for Low-Power Embedded Multimedia Systems”, Springer, 2011.
5. Woon-Seng Gan and Sen M. Kuo, “ Embedded Signal Processing with the Micro Signal Architecture”, John Wiley & sons,Inc., 2007
6. User guides Texas Instrumentation, Analog Devices, and Motorola.

MCE004 DIGITAL SPEECH SIGNAL PROCESSING L T P C
3 0 0 3

UNIT I MECHANICS OF SPEECH 8

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

UNIT II TIME DOMAIN METHODS FOR SPEECH PROCESSING 8

Time domain parameters of Speech signal , Methods for extracting the parameters Energy, Average Magnitude , Zero crossing Rate , Silence Discrimination using ZCR and energy , Short Time Auto Correlation Function , Pitch period estimation using Auto Correlation Function

UNIT III FREQUENCY DOMAIN METHOD FOR SPEECH PROCESSING 9

Short Time Fourier analysis, Filter bank analysis, Formant extraction, Pitch Extraction Analysis by Synthesis, Analysis synthesis systems, Phase vocoder, Channel Vocoder. Homomorphic Speech Analysis: Cepstral analysis of Speech, Formant and Pitch Estimation, Homomorphic Vocoders.

UNIT IV LINEAR PREDICTIVE ANALYSIS OF SPEECH 10

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

UNIT V APPLICATION OF SPEECH SIGNAL PROCESSING 10

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

TOTAL: 45

REFERENCES:

1. Ben Gold and Nelson Morgan, "Speech and Audio Signal Processing", 2nd Edition, John Wiley and Sons Inc., Singapore, 2004.
2. Quatieri, "Discrete-time Speech Signal Processing", Pearson Education, 2008
3. Lawrence Rabiner and Ronald Schafer, "Theory and Applications of Digital Speech Processing" Pearson Education, 2010.
4. A.Nejat Ince, "Digital Speech Processing-Speech Coding, Synthesis and Recognition", The Springer International Series in Engineering and Computer Science, 2010.

MCE005 DIGITAL COMMUNICATION RECEIVERS L T P C
3 0 0 3

UNIT I REVIEW OF DIGITAL COMMUNICATION TECHNIQUES 9

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

UNIT II OPTIMUM RECEIVERS FOR AWGN CHANNEL 9

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

UNIT III RECEIVERS FOR FADING CHANNELS 9

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

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 EQUALIZATION TECHNIQUES 9

Linear equalizer, Decision feedback equalization, Adaptive Equalization algorithms: 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

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 and Masoud Salehi, "Digital Communications", 5th Edition, McGraw-Hill International Editions, 2008.
3. Simon Marvin, "Digital communication over fading channel- An unified approach to performance Analysis", John Wiley, New York, 2000.
4. James B. Y. Tsui, "Special Design Topics in Digital Wideband Receivers", Artech House Radar Library, 2009.

MCE006 ELECTROMAGNETIC INTERFERENCE AND ELECTROMAGNETIC COMPATIBILITY

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UNIT I EMI/EMC CONCEPTS **9**

EMI-EMC definitions and Units of parameters, Sources and victim of EMI, Conducted and Radiated EMI Emission and Susceptibility, Transient EMI, ESD, Radiation Hazards.

UNIT II EMI COUPLING PRINCIPLES **9**

Conducted, radiated and transient coupling, Common ground impedance coupling, Common mode and ground loop coupling, Differential mode coupling, near field cable to cable coupling, cross talk, Field to cable coupling, Power mains and Power supply coupling.

UNIT III EMI CONTROL TECHNIQUES **9**

Shielding, Filtering, Grounding, Bonding, Isolation transformer, Transient suppressors, Cable routing, Signal control.

UNIT IV EMC DESIGN OF PCBS **9**

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

UNIT V EMI MEASUREMENTS **9**

Open area test site, TEM cell, EMI test shielded chamber and shielded ferrite lined anechoic chamber, Tx /Rx Antennas, Sensors, Injectors / Couplers, and coupling factors, EMI Rx and spectrum analyzer.

TOTAL: 45

REFERENCES:

1. V.P.Kodali, “Engineering EMC Principles, Measurements and Technologies”, IEEE Press, Newyork, 1996.
2. Clayton R. Paul, "Introduction to Electromagnetic Compatibility” Wiley Series in Microwave and Optical Engineering, 2006.
3. Ralph Morrison, "Grounding and Shielding: Circuits and Interference”, John Wiley & Sons, 2007.
4. Christos Christopoulos, “Principles and Techniques of Electromagnetic Compatibility”, Electronic Engineering Systems, CRC Press, Second Edition, 2007.
5. Xingcun Colin Tong, "Advanced Materials and Design for Electromagnetic Interference Shielding”, CRC Press, 2008.

MCE007 COMMUNICATION PROTOCOL ENGINEERING L T P C
3 0 0 3

UNIT I NETWORK REFERENCE MODEL 9

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

UNIT II PROTOCOL SPECIFICATIONS 9

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

UNIT III PROTOCOL VERIFICATION/VALIDATION 9

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

UNIT IV PROTOCOL CONFORMANCE/PERFORMANCE TESTING 9

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

UNIT V PROTOCOL SYNTHESIS AND IMPLEMENTATION 9

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

TOTAL: 45

REFERENCES:

1. Pallapa Venkataram and Sunilkumar S.Manvi, “Communication protocol Engineering”, Eastern Economy edition, 2004
2. Richard Lai and Jirachiefpattana, “Communication Protocol Specification and Verification”, Kluwer Publishers, Boston, 1998.
3. Tarnay, K., “Protocol Specification and Testing”, Plenum, New York, 1991.
4. Mohamed G. Gouda, “Elements of Network Protocol Design”, John Wiley & Sons, Inc. New York, USA, 1998
5. V.Ahuja, “Design and Analysis of Computer Communication networks”, McGraw- Hill, London, 1990.
6. G.J.Holtzmann, “Design and validation of Computer protocols”, Prentice Hall, New York, 1991.

MCE008 GLOBAL POSITIONING SYSTEMS L T P C
3 0 0 3

UNIT I HISTORY OF GPS 9

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

UNIT II COORDINATE SYSTEMS 9

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

UNIT III C/A CODE 9

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

UNIT IV PROPAGATION MEDIA 9

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

UNIT V INTER DISCIPLINARY APPLICATIONS 9

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

TOTAL: 45

REFERENCES:

1. B.Hoffman - Wellenhof, H.Lichtenegger and J.Collins, “GPS: Theory and Practice”, 4th revised edition, Springer, Wein, New york, 1997
2. A.Leick, “GPS Satellites Surveying”, 3rd edition, John Wiley & Sons, NewYork, 2003
3. James Ba – Yen Tsui, “Fundamentals of GPS receivers – A software approach”, John Wiley & Son, 2001.
4. L.Adams, “The GPS - A Shared National Asset”, Chair, National Academy Press, Washington, DC, 1995
5. http://www.auslig.gov.au.
6. http://igscb.jpl.nasa.gov.
7. http://gibs.leipzig.ifag.de.
8. http://www.navcen.uscg.mil.

MCE009 ADVANCED MICROPROCESSORS AND MICROCONTROLLERS

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UNIT I MICROPROCESSOR ARCHITECTURE 9

ISA Architecture –Application specific ISA Models: Finite State machine Models, Datapath Models, Java Virtual machine Models-`General purpose ISA Models: CISC Model, RISC Model-Instruction level parallelism ISA Models: Single instruction Multiple data model (SIMD),Superscalar machine Models, Very long instruction word model – Processor Internals: CPU, ALU, Registers, Memory, I/O mechanism diagram – RISC versus CISC Characteristics of Embedded Processor.

UNIT II ADVANCED PROCESSORS 9

OMAP 3530: Architecture ,Block diagram, ARM part Registers, Architecture of TMS320C64X, Pipeline operation, DSP part Registers, Code Composer studio, Programming steps, significance of OS bridge – Comparison of the features of DSP family processors.

UNIT III HIGH PERFORMANCE RISC ARCHITECTURE – ARM 9

Organization of CPU – Bus architecture –Memory management unit: virtual memory to physical memory address translation, TLB, Domains and memory access permission ,cache and write buffer ,single stage and two stage cache accessing ,significance of coprocessor 15 Fast Context Switch Extension - ARM instruction set-addressing modes – Programming.

UNIT IV MOTOROLA 68HC11 MICROCONTROLLERS 9

Organization of CPU- Architecture -Block diagram -Instruction set -addressing modes operating modes-I/O Ports-Registers structures- Interrupt system- RTC-Serial Communication Interface – A/D Converter- PWM and UART.

UNIT V: **MSP430 MICRO CONTROLLERS 9**

MSP430 RISC CPU architecture, Compiler-friendly features, Instruction set, Clock system, Memory subsystem. Key differentiating factors between different MSP430 families. Digital I/O - I/O ports programming using C and assembly, Understanding the muxing scheme of the MSP430 pins. On-chip peripherals. Watchdog Timer, Comparator, Op-Amp, Basic Timer, Real Time Clock (RTC), ADC, DAC, SD16, LCD, DMA. Using the Low-power features of MSP430. Clock system; low-power modes, Clock request feature, Low-power programming and Interrupt. Interfacing LED, LCD, External memory. Seven segment LED modules interfacing. Example - Real-time clock.

TOTAL: 45

REFERENCES:

1. Tammy Noergaard , "Embedded Systems Architecture" , ELSEVIER, 2005
2. Steve Furber , " ARM System –On –Chip architecture", Addision Wesley , 2000.
3. Gene .H.Miller, " Micro Computer Engineering " , Pearson Education , 2003.
4. Valvano, "Embedded Microcomputer Systems", Thomson Asia Pvt. Ltd, first reprint, 2001.
5. Tim Wilmshurst ,"Designing Embedded Systems with PIC Microcontrollers: Principles and Applications", Elsevier, Second Edition, 2009
6. John Catsoulis, "Designing Embedded Hardware", O'Reilly Media Inc, Second Edition, 2005
7. "MSP430 Microcontroller Basics", John Davies, Elsevier, 2008

MCE010 EMBEDDED SYSTEMS L T P C
3 0 0 3

UNIT I EMBEDDED SYSTEM BASICS 9

Embedded Computers, Characteristics of Embedded Computing Applications, Challenges in Embedded Computing system design, Embedded system design process, Overview of embedded system development-embedded system IDE- ARM Family-Core Types,-Memory Mapping-and ARM Based embedded development system.

UNIT II ARM ARCHITECTURE 9

Organization of CPU – Bus architecture –Memory management unit: virtual memory to physical memory address translation, TLB, Domains and memory access permission ,cache and write buffer ,single stage and two stage cache accessing ,significance of co-processor 15 Fast Context Switch Extension.

UNIT III EMBEDDED PROGRAMMING AND COMPUTING PLATFORM 9

Basic Embedded system Development Tools-Embest embedded IDE for ARM, Study of S3C3V40 based University Teaching Kit and Unet ICE JTAG emulator.-**E**mbedded software development based on ARM including: ARM basic instruction set, Thumb instruction set-assembly programming- ARM processor mode switching-embedded C programming- C and assembly language mixed programming.

UNIT IV ARM BASIC PERIPHERAL INTERFACING 9

I/O interface concepts-interrupts-types of interrupts-ARM interrupts-serial communication real-time clock and simple digital LED interface - LCD display interfacing- GLCD display interfacing – TFT display interfacing -the keyboard interfacing-the touch screen interfacing.

UNIT V ARM COMMUNICATION INTERFACING 9

Synchronous and asynchronous data transfer- UART based communication-I2C Protocol basics -serial communication using I2C bus: RTC Interfacing, EEPROM data transfer Ethernet communication – I2S voice bus interface communication.

TOTAL: 45

REFERENCES:

1. "ARM Architecture Reference Manual", 2011, ARM Ltd.
2. "The ARM-Thumb Procedure Call Standard", 2011 ARM Ltd.
3. Steve Furber, "ARM System-on-Chip Architecture", Second Edition, Addison - Wesley, 2000.
4. Todd D. Morton, "Embedded Microcontrollers", Prentice Hall, 2001.
5. "Embest ARM Teaching System User Manual", Embest Info & Tech, Ltd, Version2.01.
6. Embedded System Development and Labs for ARM, (Edited, revised and updated by Radu Muresan).

MCE011 HIGH SPEED SWITCHING ARCHITECTURES L T P C
3 0 0 3

UNIT I LAN SWITCHING TECHNOLOGY 9

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

UNIT II ATM SWITCHING ARCHITECTURE 9

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

UNIT III QUEUES IN ATM SWITCHES ` 9

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

UNIT IV PACKET SWITCHING ARCHITECTURES 9

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

UNIT V IP SWITCHING 9

Addressing model, IP Switching types, flow driven and topology driven solutions, IP over ATM address and next hop resolution, multicasting, IPV6 over ATM.

TOTAL: 45

REFERENCES:

1. Achille Pattavina, “Switching Theory: Architectures and performance in Broadband ATM networks”, John Wiley & Sons Ltd, New York. 1998
2. Itamar Elhanany and Mounir Hamdi, “High-performance Packet Switching Architectures”, Springer Publications, 2011.
3. Rich Seifert and James Edwards,” The All-New Switch Book: The Complete Guide to LAN Switching Technology”, John Wiley & Sons, 2008
4. Chris Hellberg, Dylan Greene and Truman Boyes, “Broadband Network Architectures: Designing and Deploying Triple-Play Services”, Prentice Hall, 2007
5. Christopher Y.Metz , “IP Switching: Protocols and architectures”, McGraw Hill, 1999.

MCE012 WAVELETS AND MULTIRESOLUTION PROCESSING L T P C
3 0 0 3

UNIT I INTRODUCTION 9

Vector Spaces , properties , dot product , basis , dimension, orthogonality and orthonormality , relationship between vectors and signals , Signal spaces , concept of Convergence , Hilbert spaces for energy signals , Generalized Fourier Expansion.

UNIT II MULTI RESOLUTION ANALYSIS 9

Definition of Multi Resolution Analysis (MRA) , Haar basis , Construction of general orthonormal MRA, Wavelet basis for MRA , Continuous time MRA interpretation for the DTWT , Discrete time MRA, Basis functions for the DTWT , PRQMF filter banks

UNIT III CONTINUOUS WAVELET TRANSFORMS 9

Wavelet Transform , definition and properties , concept of scale and its relation with frequency , Continuous Wavelet Transform (CWT) , Scaling function and wavelet functions (Daubechies, Coiflet, Mexican Hat, Sinc, Gaussian, Bi-Orthogonal) , Tiling of time scale plane for CWT.

UNIT IV DISCRETE WAVELET TRANSFORM 9

Filter Bank and sub band coding principles, Wavelet Filters, Inverse DWT computation by Filter banks, Basic Properties of Filter coefficients, Choice of wavelet function coefficients , Derivations of Daubechies Wavelets, Mallat's algorithm for DWT, Multiband Wavelet transforms.

Lifting Scheme: Wavelet Transform using Polyphase matrix Factorization, Geometrical foundations of lifting scheme, Lifting scheme in Z -domain

UNIT V APPLICATIONS 9

Signal Compression, Image Compression techniques: EZW-SPHIT Coding, Image denoising techniques: Noise estimation, Shrinkage rules, Shrinkage Functions, Edge detection and object Isolation, Image Fusion, and Object Detection. Curve and Surface Editing, Variational modeling and finite element method using wavelets.

TOTAL: 45

REFERENCES

1. Rao .R.M and A.S.Bopardikar, “Wavelet Transforms: Introduction to theory and Applications”, Pearson Education Asia Pvt. Ltd., 2000.
2. K.P.Soman and K.I.Ramachandran, “Insight into Wavelets – From Theory to practice”, Prentice- Hall, 2004.
3. Strang G, Nguyen T, “Wavelets and Filter Banks”, Wellesley Cambridge Press, 1996
4. Mallat.S, “A wavelet tour of Signal Processing” , Elsevier publications, 2nd edition 1999
5. Goswami (Jaideva.C),Chan (Andrew.K) , “Fundamentals of Wavelets theory, algorithms and applications”, John Wiley &Sons,2006
6. Weeks Michael, “Digital Signal Processing Using MATLAB and Wavelets”, Firewall Media, 2011.

MCE013 LOW POWER VLSI DESIGN L T P C
3 0 0 3

UNIT I POWER DISSIPATION IN CMOS 9

Hierarchy of limits of power, Sources of power consumption, Physics of power dissipation in CMOS FET devices, Basic principle of low power design.

UNIT II POWER OPTIMIZATION 9

Logic level power optimization, Circuit level low power design, circuit techniques for reducing power consumption in adders and multipliers.

UNIT III DESIGN OF LOW POWER CMOS CIRCUITS 9

Computer arithmetic techniques for low power system, reducing power consumption in memories, low power clock, Inter connect and layout design, advanced techniques, Special techniques.

UNIT IV POWER ESTIMATION 9

Power Estimation technique, logic power estimation, Simulation power analysis, Probabilistic power analysis.

UNIT V SYNTHESIS AND SOFTWARE DESIGN FOR LOW POWER 9

Synthesis for low power, Behavioral level transform, software design for low power.

TOTAL: 45

REFERENCES:

1. Dimitrios Soudris, Chirstian Pignet, Costas Goutis, “Designing CMOS Circuits for Low Power”, Kluwer, 2002.
2. J.B.Kulo and J.H Lou, “Low voltage CMOS VLSI Circuits”, Wiley, 1999.
3. A.P.Chandrasekaran and R.W.Broadersen, “Low power digital CMOS design”, Kluwer, 1995.
4. James B.Kulo, Shih-Chia Lin, “Low voltage SOI CMOS VLSI devices and Circuits”, John Wiley and sons, inc., 2001.
5. Kaushik Roy, Sharat Prasad, Jean Claude Ed Roy, “Low- power CMOS VLSI Circuit Design, Wiley- Interscience, 2000.
6. Alice Wang, Benton Highsmith Calhoun and Anantha P. Chandrakasan, “Sub-threshold Design for Ultra Low-Power Systems (Integrated Circuits and Systems)”, Springer, 2010.

MCE014 ASIC DESIGN L T P C
3 0 0 3

UNIT I INTRODUCTION TO ASICS, CMOS LOGIC AND ASIC LIBRARY DESIGN 9

Types of ASICs , Design flow , CMOS transistors CMOS Design rules , Combinational Logic Cell , Sequential logic cell , Data path logic cell , Transistors as Resistors , Transistor Parasitic Capacitance, Logical effort ,Library cell design , Library architecture .

UNIT II PROGRAMMABLE ASICS, PROGRAMMABLE ASIC LOGIC CELLS AND PROGRAMMABLE ASIC I/O CELLS 9

Anti fuse, static RAM, EPROM and EEPROM technology, PREP benchmarks, Actel, Xilinx LCA, Altera FLEX, Altera MAX DC & AC inputs and outputs, Clock & Power inputs, Xilinx I/O blocks.

UNIT III PROGRAMMABLE ASIC INTERCONNECT, PROGRAMMABLE ASIC DESIGN SOFTWARE AND LOW LEVEL DESIGN ENTRY 9

Actel ACT ,Xilinx LCA , Xilinx EPLD , Altera MAX 5000 and 7000 , Altera MAX 9000 , Altera FLEX Design systems , Logic Synthesis , Half gate ASIC ,Schematic entry , Low level design language , PLA tools ,EDIF, CFI design representation.

UNIT IV LOGIC SYNTHESIS, SIMULATION AND TESTING 9

Verilog and logic synthesis, VHDL and logic synthesis, types of simulation, boundary scan test, fault simulation, automatic test pattern generation.

UNIT V ASIC CONSTRUCTION, FLOOR PLANNING, PLACEMENT AND ROUTING 9

System partition, FPGA partitioning, partitioning methods, floor planning, placement, physical design flow, global routing, detailed routing, special routing, circuit extraction, DRC.

TOTAL: 45

REFERENCES

1. M.J.S .Smith, “Application Specific Integrated Circuits”, Addison -Wesley Longman Inc., 1997.
2. Farzad Nekoogar and Faranak Nekoogar, “From ASICs to SOCs: A Practical Approach”, Prentice Hall PTR, 2003.
3. Wayne Wolf, “FPGA-Based System Design”, Prentice Hall PTR, 2004.
4. R. Rajsuman, “System-on-a-Chip Design and Test”, Artech House Publishers, 2000.
5. F. Nekoogar, “Timing Verification of Application-Specific Integrated Circuits (ASICs)”, Prentice Hall PTR, 1999.
6. Elaine Rhodes, “ASIC basics: An introduction to developing Application Specific Integrated Circuits”, Lulu Publications, 2008.
7. Khosrow Golshan, “Physical Design Essentials: An ASIC Design Implementation Perspective”, Springer, 2010.

MCE015 NONLINEAR FIBER OPTICS L T P C
3 0 0 3

UNIT I FIBER NONLINEARITIES 9

Introduction , Nonlinear Refraction , Maxwell's Equations , Fiber Modes , Eigen value Equations Single Mode Condition , Nonlinear pulse Propagation , Higher Order Nonlinear Effects.

UNIT II GROUP VELOCITY DISPERSION AND PHASE MODULATION 10

Gaussian Pulse , Chirped Gaussian Pulse , Higher Order Dispersions , Changes in Pulse Shape , Self Phase Modulation (SPM) induced Spectral Broadening , Non-linear Phase Shift , Effect of Group Velocity Dispersion , Self Steepening , Application of SPM, Cross Phase Modulation (XPM) , Coupling between Waves of Different Frequencies , Non-linear Birefringence , Optical Kerr Effect , Pulse Shaping.

UNIT III OPTICAL SOLITONS AND DISPERSION MANAGEMENT 9

Soliton Characteristics, Soliton Stability , Dark Solitons , Other kinds of Solitons, Effect of Birefringence in Solitons, Solitons based Fiber Optic Communication System (Qualitative treatment) , Demerits , Dispersion Managed Solitons (DMS).

UNIT IV SOLITON LASERS 8

Non-linear Fiber Loop Mirrors , Soliton Lasers , Fiber Raman Lasers , Fiber Raman Amplifiers , Fiber Raman Solitons , Erbium doped fiber amplifiers.

UNIT V APPLICATIONS OF SOLITONS 9

DMS for single channel transmission, WDM transmission, Fiber Gratings, Fiber Couplers, Fiber Interferometers, Pulse Compression, Soliton Switching, Soliton light wave systems.

TOTAL: 45

REFERENCES

1. Govind P. Agrawal, 'Nonlinear Fiber Optics', Academic Press, New York (1995).
2. A. Hasegawa and M. Matsumoto, ‘Optical Solitons in Fibers’, Springer, Berlin (2003).
3. Govind P. Agrawal, 'Applications of Nonlinear Fiber Optics', Academic Press, 2nd Edition New York (2008).
4. M. Lakshmanan and S. Rajasekar, ‘Nonlinear Dynamics: Integrability, Chaos and Patterns’, Springer, Berlin (2003).
5. Y. S. Kivshar and Govind Agrawal, ‘Optical Solitons: From Fibers to Photonic Crystals’, Academic Press, New York (2003).
6. Agrawal G.P, “Non-linear fiber optics”, Elsevier India,4th Edition,2008.
7. http://www.optics.rochester.edu/workgroups/agrawal/grouphomepage

MCE016 OPTICAL FIBER COMMUNICATION AND NETWORKING L T P C
3 0 0 3

UNIT I FIBER OPTIC WAVE GUIDES 9

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

UNIT II OPTICAL TRANSMITTERS, RECEIVERS AND AMPLIFIERS 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, Basic concepts of Semiconductor Optical amplifiers and EDFA operation.

UNIT III LIGHT WAVE SYSTEM 9

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

UNIT IV DISPERSION COMPENSATION 9

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

UNIT V PRINCIPLES OF OPTICAL NETWORKS 9

First and second generation optical networks: system network evaluation. SONET / SDH, MAN layered architecture broadcast and select networks MAC protocols, test beds, wavelength routing networks.

TOTAL = 45

REFERENCES:

1. G.P. Agarwal, "Fiber optic communication systems", 2nd Ed, John Wiley & Sons, New York, 2008 [Unit I to IV]
2. G. Keiser, Optical fiber communications. 4th Ed Tata McGraw-Hill, New Delhi, 2008.[Unit V]
3. Franz & Jain, "Optical communication, Systems and components", Narosa Publications, New Delhi, 2000.
4. Rajiv Ramaswami, Kumar Sivarajan and Galen Sasaki "Optical Networks: A Practical Perspective", Morgan Kaufmann, 3rd Edition, 2009.
5. Harold Kolimbiris, "Fiber Optic Communication", Education Asia, Delhi, ,2004
6. Biswanath Mukherjee, "Optical WDM Networks", Springer publications, 2006.
7. Ulysees Black, "Optical Networks", Pearson Education, 2007

MCE017 VLSI SIGNAL PROCESSING L T P C
3 0 0 3

UNIT I INTRODUCTION TO DSP SYSTEMS, PIPELINING AND PARALLEL PROCESSING OF FIR FILTERS 9

Introduction to DSP systems, Typical DSP algorithms, Data flow and Dependence graphs, critical path, Loop bound, iteration bound, longest path matrix algorithm, Pipelining and Parallel processing of FIR filters, Pipelining and Parallel processing for low power.

UNIT II RETIMING, ALGORITHMIC STRENGTH REDUCTION 9

Retiming – definitions and properties, Unfolding – an algorithm for unfolding, properties of unfolding, sample period reduction and parallel processing application, Algorithmic strength reduction in filters and transforms , 2-parallel FIR filter, 2-parallel fast FIR filter, DCT architecture, rank-order filters, Odd-Even merge-sort architecture, parallel rank order filters.

UNIT III FAST CONVOLUTION, PIPELINING AND PARALLEL PROCESSING OF IIR FILTERS 9

Fast convolution , Cook-Toom algorithm, modified Cook-Toom algorithm, Pipelined and parallel recursive filters , Look-Ahead pipelining in first-order IIR filters, Look-Ahead pipelining with power-of-2 decomposition, Clustered look-ahead pipelining, Parallel processing of IIR filters, combined pipelining and parallel processing of IIR filters.

UNIT IV SCALING, ROUND-OFF NOISE, BIT-LEVEL ARITHMETIC ARCHITECTURES 9

Scaling and round-off noise , scaling operation, round-off noise, state variable description of digital filters, scaling and round-off noise computation, round-off noise in pipelined IIR filters, Bit-level arithmetic architectures , parallel multipliers with sign extension, parallel carry-ripple and carry-save multipliers, Design of Lyon's bit-serial multipliers using Horner's rule, bit-serial FIR filter, CSD representation, CSD multiplication using Horner's rule for precision improvement, Distributed Arithmetic fundamentals and FIR filters

UNIT V NUMERICAL STRENGTH REDUCTION, SYNCHRONOUS, WAVE AND ASYNCHRONOUS PIPELINING 9

Numerical strength reduction , sub expression elimination, multiple constant multiplication, iterative matching, synchronous pipelining and clocking styles, clock skew in edge-triggered single phase clocking, two-phase clocking, wave pipelining, Asynchronous pipelining bundled data versus dual rail protocol.

TOTAL: 45

REFERENCES:

1. Keshab K. Parhi, "VLSI Digital Signal Processing Systems, Design and implementation ", Wiley, Interscience, 2007.
2. U. Meyer – Baese, "Digital Signal Processing with Field Programmable Gate Arrays", Springer, Second Edition, 2004
3. Rogger Woods, John MCallister, Richard Turner and Ying Yi, "FPGA – based Implementation of Signal Processing Systems, John Wiley & Sons, 2008.

MCE018 SATELLITE COMMUNICATION L T P C
3 0 0 3

UNIT I ELEMENTS OF SATELLITE COMMUNICATION 8

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

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

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

UNIT III SATELLITE LINK DESIGN 9

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

UNIT IV SATELLITE NAVIGATION AND GLOBAL POSITIONING SYSTEM 8

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

UNIT V APPLICATIONS 8

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

TOTAL= 45

REFERENCES:

1. Wilbur L. Pritchard, H.G. Suyderhoud ,Robert A.Nelson, “Satellite Communication Systems Engineering”, Prentice Hall, New Jersey, 2006.
2. D.Roddy, “Satellite Communication”, McGraw Hill, 2006.
3. B.N.Agarwal, “Design of Geosynchronous Spacecraft”, Prentice Hall, 1993.
4. Gerard Maral, Michel Bousquet and Zhili ,“Satellite Communications Systems: Systems,Techniques and Technology”, Wiley, 2010.
5. Anil K. Maini and Varsha Agrawal “Satellite Technology: Principles and Applications”, Wiley, 2010.
6. Bruce R. Elbert "Introduction to Satellite Communication (Artech House Space Applications)”, 2008.

MCS003 DIGITAL IMAGE PROCESSING L T P C
3 0 0 3

UNIT I DIGITAL IMAGE FUNDAMENTALS 9

Elements of digital image processing systems, Elements of visual perception, brightness, contrast, hue, saturation, Mach Band effect, Image sampling, Quantization, Dither, Two dimensional mathematical preliminaries, Basic Principles of Tomography, Tomography, Projection, Image Reconstruction, Radon Transform, Central Slice Theorem.

UNIT II IMAGE TRANSFORMS 9

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

UNIT III IMAGE ENHANCEMENT AND RESTORATION 9

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

UNIT IV IMAGE SEGMENTATION AND RECOGNITION 9

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

UNIT V IMAGE REGISTRATION AND VISUALIZATION 9

Notation and terminology in Image Registration, Classification of Image Registration techniques, Types of Transformation, Non Rigid Registration - Registration Using Basis Functions -Registration Using Splines -Thin-Plate Splines – B-Splines -Elastic Registration - Fluid Registration - Role of Registration in Clinical Applications and Remote Sensing - Image Registration in Nuclear Medicine . Image visualization - Rigid body visualization - 2D display methods, 3D display methods, Virtual Reality based interactive visualization.

TOTAL: 45

REFERENCES:

1. Rafael C. Gonzalez and Richard E. Woods, “Digital Image Processing”, Addison Wesley, (3rd Edition), 2007.
2. Anil K. Jain, “Fundamentals of Digital Image Processing”, Prentice Hall of India, 2002.
3. William K. Pratt, “Digital Image Processing”, John Wiley, New York, 2007.
4. Mark A. Haidekker, “Advanced Biomedical Image Analysis”, Wiley Publications, 2010
5. A. Ardeshir Goshtasby “2-D and 3-D Image Registration for Medical- Remote Sensing- and Industrial Applications” Wiley Interscience Publication, 2005.
6. Atam P.Dhawan , “Medical Image Analysis” Wiley Interscience Publication, NJ, US 2003.

MCS004 NETWORK ROUTING ALGORITHMS L T P C
3 0 0 3

UNIT I INTRODUCTION 7

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

UNIT II INTERNET ROUTING 10

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

UNIT III ROUTING IN OPTICAL WDM NETWORKS 10

Classification of RWA algorithms, RWA algorithms, Fairness and Admission Control, Distributed Control Protocols, Permanent Routing and Wavelength Requirements, Wavelength Rerouting- Benefits and Issues, 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).

TOTAL: 45

REFERENCES:

1. William Stallings, “High speed networks and Internets Performance and Quality of Service”, Second Edition, Pearson Education Asia. Reprint India 2002
2. M. Steen Strub, “Routing in Communication network”, Prentice –Hall International, Newyork, 1995.
3. C.E Perkins, “Ad Hoc Networking”, Addison – Wesley, 2001
4. 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.
5. A.T Campbell et al., “Comparison of IP Micro mobility Protocols,” IEEE Wireless Communications Feb.2002, pp 72-82.
6. Canhui (Sam) Ou and Biswanath Mukherjee, “Survivable Optical WDM Networks”, Optical Networks series, Springer, 2011.

MCS005	INTERNETWORKING MULTIMEDIA	L	T	P	C
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UNIT I INTRODUCTION 9

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

UNIT II SUBNETWORK TECHNOLOGY 9

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

UNIT III MULTICAST AND TRANSPORT PROTOCOL 9

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

UNIT IV MEDIA - ON – DEMAND 9

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

UNIT V APPLICATIONS 9

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

TOTAL: 45

REFERENCES:

1. Jon Crowcroft, Mark Handley, Ian Wakeman. “Internetworking Multimedia”, Harcourt Asia Pvt. Ltd. Singapore, 1998.
2. B.O. Szuprowicz, “Multimedia Networking”, McGraw Hill, NewYork. 1995
3. Tay Vaughan,Multimedia making it to work, 4ed,Tata McGrawHill, NewDelhi,2000.
4. Ellen kayata wesel, Ellen Khayata, “Wireless Multimedia Communication: Networking Video, Voice and Data”, Addison Wesley Longman Publication, USA, 1998.
5. Parag Havaldar and Gerard Medioni “Multimedia Systems: Algorithms, Standards, and Industry Practices” , Course Technology - Cengage learning, 2009
6. Lawrence Harte “Introduction to Data Multicasting, IP Multicast Streaming for Audio and Video Media Distribution”, Althos, 2008

MCS006 SOFT COMPUTING L T P C
3 0 0 3

UNIT I INTRODUCTION TO SOFT COMPUTING AND NEURAL NETWORKS 9

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

UNIT II GENETIC ALGORITHMS 9

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

UNIT III NEURAL NETWORKS 9

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

UNIT IV FUZZY LOGIC 9

Fuzzy Sets – Operations on Fuzzy Sets – Fuzzy Relations – Membership Functions- Fuzzy Rules and Fuzzy Reasoning – Fuzzy Inference Systems – Fuzzy Expert Systems – Fuzzy Decision Making.

UNIT V NEURO-FUZZY MODELING 9

Adaptive Neuro-Fuzzy Inference Systems – Coactive Neuro-Fuzzy Modeling – Classification and Regression Trees – Data Clustering Algorithms – Rulebase Structure Identification – Neuro-Fuzzy Control – Case studies.

TOTAL: 45

TEXT BOOKS:

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

REFERENCES:

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

MCS007	MOBILE COMPUTING	L	T	P	C
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UNIT I WIRELESS COMMUNICATION FUNDAMENTALS 9

Introduction – Wireless transmission – Frequencies for radio transmission – Signals – Antennas – Signal Propagation – Multiplexing – Modulations – Spread spectrum – MAC – SDMA – FDMA – TDMA – CDMA – Cellular Wireless Networks.

UNIT II TELECOMMUNICATION SYSTEMS 11

GSM – System Architecture – Protocols – Connection Establishment – Frequency Allocation – Routing – Handover – Security – GPRS.

UNIT III WIRELESS NETWORKS 9

Wireless LAN – IEEE 802.11 Standards – Architecture – Services – HIPERLAN – Adhoc Network – Blue Tooth.

UNIT IV NETWORK LAYER 9

Mobile IP – Dynamic Host Configuration Protocol – Routing – DSDV – DSR – AODV – ZRP –ODMR.

UNIT V TRANSPORT AND APPLICATION LAYERS 7

TCP over Wireless Networks – Indirect TCP – Snooping TCP – Mobile TCP – Fast Retransmit / Fast Recovery – Transmission/Timeout Freezing – Selective Retransmission – Transaction Oriented TCP – WAP – WAP Architecture – WDP – WTLS – WTP – WSP – WML –WML Script – WAE – WTA.

TOTAL: 45

TEXT BOOKS:

1. Jochen Schiller, “Mobile Communications”, Second Edition, Pearson Education, 2003.
2. William Stallings, “Wireless Communications and Networks”, Pearson Education, 2002.

REFERENCES:

1. Kaveh Pahlavan, Prasanth Krishnamoorthy, “Principles of Wireless Networks”, First Edition, Pearson Education, 2003.
2. Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, “Principles of Mobile Computing”, Springer, 2003.
3. C.K.Toh, “AdHoc Mobile Wireless Networks”, First Edition, Pearson Education, 2002.
4. Burkhardt, “Pervasive Computing”, First Edition, Pearson Education, 2003.

MCC004 WIRELESS SENSOR NETWORKS L T P C
3 0 0 3

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

REFERENCES:

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

MCC007 ADHOC NETWORKS L T P C
3 0 0 3

UNIT I ADHOC MAC 9

Introduction – Issues in Adhoc Wireless Networks. MAC Protocols – Issues, Classifications of MAC protocols, Multi channel MAC & Power control MAC protocol.

UNIT II ADHOC NETWORK ROUTING & TCP 9

Issues – Classifications of routing protocols – Hierarchical and Power aware. Multicast routing – Classifications, Tree based, Mesh based. Adhoc Transport Layer Issues. TCP Over Adhoc – Feedback based, TCP with explicit link, TCP-BuS, Ad Hoc TCP, and Split TCP.

UNIT III WSN –MAC 9

Introduction – Sensor Network Architecture, Data dissemination, Gathering. MAC Protocols – self-organizing, Hybrid TDMA/FDMA and CSMA based MAC.

UNIT IV WSN ROUTING, LOCALIZATION & QOS 9

Issues in WSN routing – OLSR, AODV. Localization – Indoor and Sensor Network Localization. QoS in WSN.

UNIT V MESH NETWORKS 9

Necessity for Mesh Networks – MAC enhancements – IEEE 802.11s Architecture Opportunistic routing – Self configuration and Auto configuration – Capacity Models Fairness – Heterogeneous Mesh Networks – Vehicular Mesh Networks.

TOTAL: 45

REFERENCES:

1. C.Siva Ram Murthy and B.Smanoj, " Adhoc Wireless Networks – Architectures and Protocols", Pearson Education, 2004.[Units I to IV]
2. Feng Zhao and Leonidas Guibas, "Wireless Sensor Networks", Morgan Kaufman Publishers, 2004.[Units V]
3. C.K.Toh, "Adhoc Mobile Wireless Networks", Pearson Education, 2002.
4. Thomas Krag and Sebastin Buettrich, "Wireless Mesh Networking", O'Reilly Publishers, 2007.

MCC101 HIGH PERFORMANCE COMPUTER NETWORKS L T P C
3 0 0 3

UNIT I INTRODUCTION 9

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

UNIT II MULTIMEDIA NETWORKING APPLICATIONS 9

Streaming stored Audio and Video – Best effort service – protocols for real time interactive applications – Providing Multiple Classes of Service – Providing Quality of Service Guarantees.

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, Birth-and-Death Process – Queuing Disciplines – Markovian FIFO Queuing Systems – Non-Markovian and Self-Similar Models – Networks of Queues.

UNIT V NETWORK SECURITY AND MANAGEMENT 10

Principles of cryptography – Message Integrity and End-Point Authentication – Securing Email – Securing TCP connections – Network Layer Security – Securing Wireless LANs Operational Security - Infrastructure for network management – The internet standard management framework – SMI, MIB, SNMP, Security and administration – ASN.1

TOTAL: 45

REFERENCES:

1. J.F. Kurose & K.W. Ross,"Computer Networking - A top down approach featuring the internet", Pearson education, fifth edition.
2. Nader F.Mir ,Computer and Communication Networks, first edition, 2006.
3. Behrouz A. Fourouzan," Data Communication and Networking ",Tata McGraw-Hill, 2004.
4. Walrand .J. Varatya, High performance communication network, Margan Kanffman Harcourt Asia Pvt. Ltd. 2nd Edition, 2000.
5. LEOM-GarCIA, WIDJAJA, "Communication networks", TMH seventh reprint 2002.
6. Aunurag kumar, D. MAnjunath, Joy kuri, "Communication Networking", Morgan Kaufmann Publishers, 1ed 2004.
7. Hersent Gurle & petit, "IP Telephony, packet Pored Multimedia communication Systems", Pearson education 2003.
8. Fred Halsall and Lingana Gouda Kulkarni,Computer Networking and the Internet,fifth edition, pearson education.
9. Larry l.Peterson & Bruce S.David, "Computer Networks: A System Approach"-1996.

MCC202 WIRELESS NETWORKS

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UNIT I WIRELESS LOCAL AREA NETWORKS 9

Introduction to wireless LANs - IEEE 802.11 WLANs - Physical Layer- MAC sublayer- MAC Management Sublayer- Wireless ATM - HIPERLAN- HIPERLAN-2, WiMax

UNIT II 3G OVERVIEW & 2.5G EVOLUTION 9

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 & SENSOR NETWORKS 9

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

UNIT IV INTERWORKING BETWEEN WLANS AND 3G WWANS 9

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 & BEYOND 9

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

TOTAL: 45

REFERENCES:

1. Vijay. K. Garg, “Wireless Communication and Networking”, Morgan Kaufmann Publishers, http://books.elsevier.com/9780123735805:, 2007.(unit I-V)
2. Kaveth Pahlavan,. K. Prashanth Krishnamuorthy, "Principles of Wireless Networks", Prentice Hall of India, 2006. unit-1.
3. Clint Smith. P.E., and Daniel Collins, “3G Wireless Networks”, 2nd Edition, Tata McGraw Hill, 2007. unit-2
4. William Stallings, “Wireless Communications and networks” Pearson / Prentice Hall of India, 2nd Ed., 2007.
5. Dharma Prakash Agrawal & Qing-An Zeng, “Introduction to Wireless and Mobile Systems”, Thomson India Edition, 2nd Ed., 2007. unit-3
6. Gary. S. Rogers & John Edwards, “An Introduction to Wireless Technology”, Pearson Education, 2007.
7. Sumit Kasera and Nishit Narang, “3G Networks – Architecture, Protocols and Procedures”, Tata McGraw Hill, 2007.

MCI013 MEDICAL IMAGE PROCESSING L T P C
3 0 0 3

UNIT I IMAGE FUNDAMENTALS 9

Image Perception, MTF of the visual system, Image Fidelity criteria, Image model, Image sampling and quantization – two dimensional sampling theory, Image quantization, Optimum mean square quantizer, Image transforms – 2D- DFT and other transforms

UNIT II IMAGE PREPROCESSING 9

Image enhancement – point operation, Histogram modeling, spatial operations, Transform operations, Image restoration- Image degradation model, Inverse and Weiner filtering, Image Compression- Spatial and Transform methods

UNIT III IMAGE RECONSTRUCTION IN MEDICAL IMAGING MODALITIES 9

Mathematical preliminaries and basic reconstruction methods, Image reconstruction in CT scanners, MRI, Nuclear Medicine Imaging Modalities, Ultra sound imaging, 3D Ultra sound imaging

UNIT IV IMAGE ANALYSIS AND CLASSIFICATION 9

Image segmentation- pixel based, edge based, region based segmentation, Image representation and analysis, Feature extraction and representation, Statistical Shape, Texture, feature and Image classification- Statistical, Rule based, Neural Network approaches

UNIT V IMAGE REGISTRATIONS AND VISUALIZATION 9

Rigid body visualization, Principal axis registration, Interactive principal axis registration, Feature based registration, Elastic deformation based registration, Image visualization- 2D display methods, 3D display methods, virtual reality based interactive visualization

TOTAL: 45

REFERENCES

1. Atam P.Dhawan , “Medical Image Analysis” Wiley Interscience Publication, NJ, US 2003
2. R.C. Gonzalez and R.E woods , “Digital Image Processing” , Second Edition, Pearson Education, 2002
3. Anil. K. Jain, “ Fundamentals of Digital Image Processing” Pearson education, Indian Reprint, 2002
4. Eric Krestel, “Image System for Medical diagnosis” Siemens Aktiengesell Schaft, Germany, 1990
5. Alfred Horowitz, “MRI Physics for Radiologists” – A Visual Approach’ , Second edition Springer Vertag New York, 1991