NATIONAL ENGINEERING COLLEGE

(An Autonomous Institution – Affiliated to Anna University Chennai)

K.R.NAGAR, KOVILPATTI – 628 503

www.nec.edu.in

REGULATIONS - 2013

DEPARTMENT OF

ELECTRONICS AND COMMUNICATION ENGINEERING

CURRICULUM AND SYLLABI OF

M.E. – COMMUNICATION SYSTEMS

REGULATIONS - 2013

Curriculum and Syllabi of Full Time

M.E. - COMMUNICATION SYSTEMS

SEMESTER I

S.NO	COURSE CODE	COURSE TITLE	L	T	P	C
1	CSC11	Applied Mathematics for Communication Engineers (Common to M.E CS and M.E CC)	3	1	0	4
2	CSC12	Advanced Digital Signal Processing (Common to M.E CS, M.E CC, M.E HVE and M.E C&I)	3	0	0	3
3	CSC13	Advanced Network Security (Common to M.E CSE and M.E CS)	3	0	0	3
4	CSC14	Modern Digital Communication Techniques	3	0	0	3
5	CSC15	Optical Communication Networks	3	0	0	3
6	CSC16	High Performance Computer Networks	3	0	0	3
PRACTICAL						
7	CSC17	Communication System Laboratory – I	0	0	4	2
		TOTAL	**18**	**1**	**4**	**21**

SEMESTER II

S.NO	COURSE CODE	COURSE TITLE	L	T	P	C
1	CSC21	Advanced Wireless Communication (Common to M.E CS & M.E CC)	3	0	0	3
2	CSC22	Wireless Networks (Common to M.E CC & M.E CS)	3	1	0	4
3	CSC23	Multimedia Compression Techniques (Common to M.E CS & M.E CC)	3	0	0	3
4	E1	Elective	3	0	0	3
5	E2	Elective	3	0	0	3
6	E3	Elective	3	0	0	3
PRACTICAL						
7	CSC24	Communication System Laboratory – II	0	0	4	2
		TOTAL	**18**	**1**	**4**	**21**

SEMESTER III

S.NO	COURSE CODE	COURSE TITLE	L	T	P	C
1	E4	Elective	3	0	0	3
2	E5	Elective	3	0	0	3
3	E6	Elective	3	0	0	3
PRACTICAL						
4	CSC31	Project work phase I	0	0	12	6
		TOTAL	**9**	**0**	**12**	**15**

SEMESTER IV

S.NO	COURSE CODE	COURSE TITLE	L	T	P	C
PRACTICAL						
1	CSC41	Project work phase II	0	0	24	12
		TOTAL	**0**	**0**	**24**	**12**

TOTAL CREDITS TO BE EARNED FOR THE AWARD OF THE DEGREE - 69

CURRICULUM I TO VI SEMESTERS (PART TIME)

SEMESTER - I (Part time)

S.NO	COURSE CODE	COURSE TITLE	L	T	P	C
1	CSC11	Applied Mathematics for Communication Engineers (Common to M.E CS & M.E CC)	3	1	0	4
2	CSC13	Advanced Network Security (Common to M.E CSE & M.E CS)	3	0	0	3
3	CSC14	Modern Digital Communication Techniques	3	0	0	3
		Total	**9**	**1**	**0**	**10**

SEMESTER - II (Part time)

S.NO	COURSE CODE	COURSE TITLE	L	T	P	C
1	CSC21	Advanced Wireless Communication (Common to M.E CS & M.E CC)	3	0	0	3
2	CSC22	Wireless Networks (Common to M.E CC & M.E CS)	3	1	0	4
3	CSC23	Multimedia Compression Techniques (Common to M.E CS & M.E CC)	3	0	0	3
		Total	**9**	**1**	**0**	**10**

SEMESTER - III (Part time)

S.NO	COURSE CODE	COURSE TITLE	L	T	P	C
1	CSC12	Advanced Digital Signal Processing (Common to M.E CS, M.E CC, M.E HVE and M.E C&I)	3	0	0	3
2	CSC15	Optical Communication Networks	3	0	0	3
3	CSC16	High Performance Computer Networks	3	0	0	3
PRACTICAL						
4	CSC17	Communication System Laboratory-I	0	0	4	2
		Total	**9**	**0**	**4**	**11**

SEMESTER - IV (Part time)

S.NO	COURSE CODE	COURSE TITLE	L	T	P	C
1	E1	Elective	3	0	0	3
2	E2	Elective	3	0	0	3
3	E3	Elective	3	0	0	3
PRACTICAL						
4	CSC24	Communication System Laboratory-II	0	0	4	2
		TOTAL	**9**	**0**	**4**	**11**

SEMESTER V (Part time)

S.NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	E4	Elective	3	0	0	3
2	E5	Elective	3	0	0	3
3	E6	Elective	3	0	0	3
PRACTICAL						
4	CSC31	Project Work Phase I	0	0	12	6
		TOTAL	**9**	**0**	**12**	**15**

SEMESTER VI (Part time)

S.NO	COURSE CODE	COURSE TITLE	L	T	P	C
PRACTICAL						
1	CSC41	Project Work Phase II	0	0	24	12
		TOTAL	**0**	**0**	**24**	**12**

TOTAL CREDITS TO BE EARNED FOR THE AWARD OF THE DEGREE - 69

II SEMESTER ELECTIVE SUBJECTS

S.NO	COURSE CODE	COURSE TITLE	L	T	P	C
1	CSE2A	Advanced Radiation Systems	3	0	0	3
2	CSE2B	DSP Architecture and Programming	3	0	0	3
3	CSE2C	Optical Fiber Communication and Networking (Common to M.E CS and M.E CC)	3	0	0	3
4	CSE2D	Adhoc Networks (Common to M.E CSE, M.E CS and M.E CC)	3	0	0	3
5	CSE2E	Wavelets and Multiresolution Analysis (Common to M.E CS and M.E CSE)	3	0	0	3
6	CSE2F	Soft Computing (Common to M.E CSE, M.E CS and M.E CC)	3	0	0	3
7	CSE2G	Digital Communication Receivers	3	0	0	3
8	CSE2H	Electromagnetic Interference and Compatibility Techniques	3	0	0	3
9	CSE2J	Global Positioning Systems	3	0	0	3
10	CSE2K	Speech Signal Processing (Common to CS and CC)	3	0	0	3
11	CSE2L	Advanced Microprocessors and Microcontrollers	3	0	0	3
12	CSE2M	Low Power VLSI Design	3	0	0	3
13	CSE2N	Satellite Communication	3	0	0	3
14	CSE2P	Microwave Integrated Circuits	3	0	0	3
15	CSE2Q	Digital Image Processing	3	0	0	3

III SEMESTER ELECTIVE SUBJECTS

S. NO	COURSE CODE	COURSE TITLE	L	T	P	C
1	CSE3A	Embedded Systems (Common to M.E CS, M.E CSE and M.E CC)	3	0	0	3
2	CSE3B	Pattern Recognition (Common to M.E CSE and M.E CS)	3	0	0	3
3	CSE3C	Evolutionary Computing (Common to M.E HVE, CS, CSE and CC)	3	0	0	3
4	CSE3D	Mobile Computing (Common to M.E CSE and M.E CS)	3	0	0	3
5	CSE3E	Security in Wireless Sensor Networks (Common to M.E CSE, M.E CS and M.E CC)	3	0	0	3
6	CSE3F	High Speed Switching Architectures (Common to M.E CS and M.E CC)	3	0	0	3
7	CSE3G	Neural Networks and Its Applications (Common to M.E CC & M.E CS)	3	0	0	3
8	CSE3H	RF System Design	3	0	0	3
9	CSE3J	Communication Protocol Engineering	3	0	0	3

10	CSE3K	ASIC Design	3	0	0	3
11	CSE3L	Nonlinear Fiber Optics	3	0	0	3
12	CSE3M	VLSI Signal Processing	3	0	0	3
13	CSE3N	Medical Image Processing	3	0	0	3
14	CSE3P	Design and Deployment of Wireless Sensor Networks	3	0	0	3
15	CSE3Q	IPTV Technologies	3	0	0	3
16	CSE3R	Vehicular Adhoc Networks	3	0	0	3

CSC11 APPLIED MATHEMATICS FOR COMMUNICATION ENGINEERS L T P C
(Common to M.E CS and M.E CC) **3 1 0 4**

OBJECTIVES:

- To understand the concepts and properties of Bessel's functions and Fourier-Bessel expansion.
- To enrich the knowledge about matrix decomposition, generalized eigenvectors and Pseudo inverse.
- To acquire the knowledge about properties of moment generating functions and some theoretical distributions.
- To understand the concepts of two dimensional random variables and their joint distributions and to know the methods of correlation and regression.
- To learn the various queuing models and to apply them in practical problems.

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 ADVANCED MATRIX THEORY 9

Eigen-values using QR transformations - Generalized eigen vectors - Canonical forms - Singular value decomposition and applications - Pseudo inverse - Least square approximations.

UNIT III ONE DIMENSIONAL RANDOM VARIABLES 9

Random variables - Probability function – moments – moment generating functions and their properties – Binomial, Poisson, Uniform, Exponential, Gamma and Normal distributions**.**

UNIT IV TWO DIMENSIONAL RANDOM VARIABLES 9

Joint distributions – Marginal and Conditional distributions – Correlation and Regression, Regression Curve for means.

UNIT V QUEUEING MODELS 9

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

TUTORIAL: 15 PERIODS TOTAL: 60 PERIODS

REFERENCES:

1. Taha, H.A., "Operations Research, An introduction", 7th Edition, Pearson Education Editions, Asia, New Delhi, 2002.
2. Bronson.R, "Matrix operation, Schaum's outline series", Mc Graw Hill, New York, 1989.
3. Grewal B.S, "Higher Engineering Mathematics", 37th Edition, Khanna Publishers, 2003.
4. Ramana B.V, Higher Engineering Mathematics –Tata McGraw Hill, 2007.
5. Donald Gross and Carl M. Harris, "Fundamentals of Queuing theory", 2nd Edition, John Wiley and Sons, New York, 1985.

CSC12 ADVANCED DIGITAL SIGNAL PROCESSING L T P C
(Common to M.E CS, M.E CC, M.E HVE and M.E C&I) **3 0 0 3**

OBJECTIVES:

- Understand the basic concepts and to apply in discrete random signal processing.
- Estimate the spectrum using parametric methods and non parametric methods.
- Estimation and prediction using wiener FIR & IIR filters
- Study adaptive filtering techniques using LMS algorithm and to study the applications of adaptive filtering.
- Apply multirate signal processing fundamentals.

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.

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, Yule-Walker equations, Solution using Levinson-Durbin algorithm.

UNIT III LINEAR ESTIMATION AND PREDICTION 9

Linear prediction, Forward and Backward prediction, Signal modeling, 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

Up sampling and down sampling, Interpolation and Decimation, Sampling rate conversion by a rational factor, Polyphase filter structures, Multistage implementation of multirate system, Application to subband coding.

TOTAL: 45 PERIODS

REFERENCES:

1. Monson H. Hayes, "Statistical Digital Signal Processing and Modeling", John Wiley and Sons, Inc, Singapore, 1st Edition, 2008.
2. John G. Proakis and Dimitris K Manolakis, "Digital Signal Processing", Pearson Education, 4th Edition, 2009.
3. Alan V. Oppenheim and Ronald W. Schafer, "Discrete-Time Signal Processing" 3rd Edition, Prentice Hall, 2009.
4. Emmanuel C. Ifeachor and Barrie W. Jervis, "Digital signal processing: A practical approach" 2nd Edition, Prentice Hall, 2002.

CSC13 ADVANCED NETWORK SECURITY L T P C
(Common to CSE and CS) **3 0 0 3**

OBJECTIVES

- To know about various network attacks and challenges.
- To study the security algorithms.
- To learn web security and wireless security.

UNIT I INTRODUCTION ON SECURITY 9

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

UNIT II SYMMETRIC AND ASYMMETRIC KEY ALGORITHMS 9

Substitutional and Transposition Ciphers – Stream and Block Ciphers – Data Encryption Standards (DES) – Advanced Encryption Standard (AES) – RC4 – principle of asymmetric key algorithms – RSA Cryptosystem – Diffie Hellmen Key Exchanging algorithm.

UNIT III INTEGRITY, AUTHENTICATION AND KEY MANAGEMENT 9

Message Integrity – Hash functions – SHA – Digital signatures – Digital signature standards Authentication – Kerberos – 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

Attacks – Routing, Integrity, confidentiality and availability related attacks – Wired Equivalent Privacy, Wi-Fi Protected Access and WPA-2 for Wi-Fi network – Secure Adhoc Network – Secure Sensor Network.

TOTAL: 45

REFERENCES

1. Behrouz A. Fourcuzan, “Cryptography and Network security”, 2nd Edition, Tata McGraw Hill, 2008.
2. William Stallings, “Cryptography and Network Security”, 3rd Edition, Pearson Education, 2003.
3. Mark D. Ciampa, “Security+ Guide to Network Security Fundamentals”, 3rd Edition, Cengage Learning, 2009.
4. Stuart McClure, Joel Scambray and George Kurtz, “Hacking Exposed: Network Security Secrets and Solutions”, 6th Edition, McGraw Hill Publications, 2009.
5. Chris McNab, “Network Security Assessment: Know Your Network”, 2nd Edition, O'Reilly Media, 2007.
6. Fahim Hussain Yusuf Bhaiji, “Network Security Technologies and Solutions (CCIE Professional Development Series)”, 1st Edition, Cisco Press, 2008.

CSC14 MODERN DIGITAL COMMUNICATION TECHNIQUES L T P C
3 0 0 3

OBJECTIVES:

- To explore Representation of Signal.
- To study about Coding theory and Modulation.
- To learn about M-ary signaling.

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 – Probability of Error.

UNIT II BLOCK CODED DIGITAL COMMUNICATION 9

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

UNIT III 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 IV PULSE SHAPING AND 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.

UNIT V 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.

TOTAL: 45 PERIODS

REFERENCES:

1. M.K.Simon, S.M.Hinedi and W.C.Lindsey, "Digital communication techniques; Signalling and detection", Prentice Hall India, US Edition, 1995.
2. John G. Proakis and Masoud Salehi, "Digital Communications", 5th Edition, McGraw-Hill International Editions, 2008.
3. Haykins, "Communication Systems", 5th Edition, John Wiley, 2008.
4. Richard Van Nee & Ramjee Prasad., "OFDM for Multimedia Communications", Artech House Publication, 2001.

CSC15 OPTICAL COMMUNICATION NETWORKS L T P C
3 0 0 3

OBJECTIVES:

- To study the Optical network components for Optical Network communication.
- To study various Network architecture and topologies for optical networks.
- To study the issues in the network design and operation for wavelength routing in optical networks.

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 PERIODS

REFERENCES:

1. Rajiv Ramaswami, Kumar Sivarajan and Galen Sasaki, “Optical Networks: A Practical Perspective”, 3rd Edition, Morgan Kaufmann, 2009.
2. John M. Senior, “Optical Fiber Communications: Principles and Practice”, 3rd Edition, Prentice Hall, 2008.
3. Gerd Keiser, “Optical Fiber Communications”, 4th Edition, McGraw Hill, 2010.
4. C. Siva Ram Moorthy and Mohan Gurusamy, “WDM Optical Networks: Concept, Design and Algorithms”, 1st Edition, Prentice Hall of India, 2002.

CSC16 HIGH PERFORMANCE COMPUTER NETWORKS L T P C
3 0 0 3

OBJECTIVES:

- To study the OSI and IP models for packet switched networks.
- To study the ISDN and broadband ISDN architecture and protocols.
- To study the ATM backbone and advanced network architecture for high performance communication networks.

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 PERIODS

REFERENCES:

1. J.F. Kurose & K.W. Ross, "Computer Networking - A top down approach featuring the internet", 6th Edition, Pearson education, 2012.
2. Nader F.Mir, "Computer and Communication Networks", 1st Edition, Prentice Hall, 2010.
3. Walrand. J. Varatya, "High performance communication network", 2nd Edition, Morgan Kaufmann, Harcourt Asia Pvt. Ltd., 2000.
4. Leom-Garcia, Widjaja, "Communication networks", 7th reprint, TMH, 2002.

CSC17	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. Design of Adaptive filters
4. Implementation of Polyphase filter structures
5. Performance Evaluation of digital modulation schemes using MATLAB and Lab view
6. Implementation of Linear and Cyclic Codes
7. OFDM transceiver design using MATLAB
8. Performance evaluation of Digital Data Transmission through Fiber Optic Link
9. Fiber optic characterization using OTDR

CSC21 ADVANCED WIRELESS COMMUNICATION L T P C
(Common to M.E CS & M.E CC) **3 0 0 3**

OBJECTIVES:

- To learn the basics of Wireless voice and data communications technologies.
- To build working knowledge on various telephone and satellite networks.
- To study the working principles of wireless LAN and its standards.
- To build knowledge on various Mobile Computing algorithms.
- To build skills in working with Wireless application Protocols to develop mobile content applications.

UNIT I THE WIRELESS CHANNEL 9

Overview of wireless systems, Physical modeling for wireless channels, Time and Frequency coherence, Statistical channel models, Fading, 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.

UNIT II PERFORMANCE OF DIGITAL MODULATION OVER WIRELESS CHANNELS 8

Capacity with Receiver diversity, Capacity comparisons, Capacity of Frequency Selective Fading channels, 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, Space-time Multiplexing, 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 PERIODS

REFERENCES:

1. Andrea Goldsmith, “Wireless Communications”, Cambridge University Press, 2005.
2. T.S. Rappaport, “Wireless Communications: Principles and Practices”, 2nd Edition, Pearson Education, 2010.
3. David Tse and Pramod Viswanath, “Fundamentals of Wireless Communication”, 1st Edition, Cambridge University Press, 2005.
4. Andreas F. Molisch, “Wireless Communications”, 2nd Edition, Wiley - IEEE, 2011.

CSC22	WIRELESS NETWORKS (Common to CC & CS)	L T P C 3 1 0 4

OBJECTIVES:

- To Study about Wireless transmission basics and Protocols.
- To know about Wireless LAN and ATM.
- To understand the Mobile Application Architecture, Messaging and Security.
- To understand the concepts of 4G technologies.

UNIT I WIRELESS LOCAL AREA NETWORKS 12

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 AND 2.5G EVOLUTION 12

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

UNIT III ADHOC AND SENSOR NETWORKS 12

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 12

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

UNIT V 4G AND BEYOND 12

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

L:45 T:15 TOTAL: 60 PERIODS

REFERENCES:

1. Vijay. K. Garg, “Wireless Communication and Networking”, Morgan Kaufmann Publishers, http://books.elsevier.com/9780123735805. 2007.
2. Kaveth Pahlavan, K.Prashanth Krishnamoorthy, "Principles of Wireless networks", Prentice Hall of India, 2006.
3. Clint Smith. P.E., and Daniel Collins, “3G Wireless Networks”, 2nd Edition, Tata McGraw Hill, 2007.

CSC23 MULTIMEDIA COMPRESSION TECHNIQUES L T P C
(Common to M.E CS & M.E CC) **3 0 0 3**

OBJECTIVES:

- To study the image fundamentals and mathematical transforms necessary for image processing.
- To study the image enhancement techniques
- To study image restoration procedures.
- To study the image compression procedures.

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 PERIODS

REFERENCES:

1. Khalid Sayood, “Introduction to Data Compression”, Morgan Kauffman Harcourt India, 2nd Edition, 2000.
2. David Salomon, “Data Compression – The Complete Reference”, Springer Verlag New York Inc., 2nd Edition, 2007.
3. Mark S.Drew, Ze-Nian Li, “Fundamentals of Multimedia”, PHI, 1st Edition, 2003.
4. John F. Buford, “Multimedia Systems”, 6th Edition, Pearson Education, 2009.

CSC24	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
9. Antenna Radiation Pattern measurement
10. Design of Digital Receiver in AWGN and Fading channels

CSE2A ADVANCED RADIATION SYSTEMS **L T P C**
3 0 0 3

OBJECTIVES:

- To study the concepts of radiation from a current element.
- To study Antenna arrays.
- To study various antenna synthesis methods.
- To study horn , microstrip , reflector antennas and various types of antennas.

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 EMI/EMC AND ANTENNA MEASUREMENTS **9**

Concept of EMI/EMC; 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 PERIODS

REFERENCES:

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

CSE2B DSP ARCHITECTURE AND PROGRAMMING L T P C
3 0 0 3

OBJECTIVES:

- To study DSP system design & CMOS technologies, DFT & FFT computation.
- To study the digital filters and finite word length.
- To introduce the architecture of synthesis of DSP.

UNIT I FUNDAMENTALS OF PROGRAMMABLE DSP 9

Basic Architectural features-DSP computation building blocks-Bus architecture-Data Addressing Capabilities-Address generation unit-Speed issues-Features for external interfacing-Basic DSP algorithms-Q Notation-FIR filters-Interpolation Filters-Decimation Filters-Adaptive filters-2D Signal Processing.

UNIT II TMS 320C6474 MULTICORE DIGITAL SIGNAL PROCESSOR 9

Functional Block Diagram-Device overview-Device configuration-System interconnect-C64x$^+$ mega module-Peripherals-Mapping an Application to a Multicore Processor-Interprocess Communication-Data transfer Engines-DSP code and Data images-Memory Management-Simple Programs using TMS 320C6474.

UNIT III OMAP FAMILY DSP PROCESSORS 9

OMAP 35x Family Introduction-Memory mapping-MPU subsystem-Power and clock management - Interprocessor communication-DMA-Interrupt Controller-Memory subsystem-Timers-Display subsystem—Serial interfaces like UART, USB, Multichannel buffered serial port-MMC/SD Card interface-Simple programs using OMAP 3530.

UNIT IV SHARC PROCESSOR 9

ADSP 21363 Family core architecture: Independent parallel computation unit, Data register file, Instruction cache, Data address generators-Memory and I/O interface features: On chip memory, DMA controller, serial ports, Digital audio interface, Parallel port, PWM, Timers, Development tools.

UNIT V BLACKFIN PROCESSOR 9

ADSP - BF534 Processor block diagram - Memory architecture - DMA support - System interrupts - External bus interface - Ethernet MAC-CAN module - SPORT controller – Timers - RTC Simple programs.

TOTAL: 45 PERIODS

REFERENCES:

1. "Multicore Programming Guide-Application Report", Texas Instruments, 2012.
2. "TMS320C6474 Multicore Digital Signal Processor-Technical Reference", Revised Edition, Texas Instruments, 2011.
3. "OMAP35x Applications Processor-Technical Reference", Revised Edition, Texas Instruments, 2012.
4. "ADSP-21363 SHARC Processor-Hardware Reference", 2004.
5. "ADSP-BF534 Blackfin Processor-Hardware Reference", Revision 2.0, 2005.
6. Avtar Singh and S. Srinivasan, "Digital Signal Processing Implementations", 1st Edition, Thomson Publications, 2004.

CSE2C OPTICAL FIBER COMMUNICATION AND NETWORKING L T P C
(Common to M.E CS and M.E CC) **3 0 0 3**

OBJECTIVES:

- To study the Optical network components for Optical Network communication.
- To study various Network architecture and topologies for optical networks.
- To study the issues in the network design and operation for wavelength routing in optical networks.

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 TRANSCEIVER 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 PERIODS

REFERENCES:

1. G.P. Agarwal, " Fiber optic communication systems", 2nd Edition, John Wiley & Sons, New York, 2008.
2. G. Keiser, " Optical fiber communications", 4th Edition, Tata McGraw-Hill, New Delhi, 2008.
3. Rajiv Ramaswami, Kumar Sivarajan and Galen Sasaki, "Optical Networks: A Practical Perspective", 3rd Edition, Morgan Kaufmann, 2009.
4. Harold Kolimbiris, "Fiber Optic Communication", 1st Edition (Reprint), Pearson Education, 2004.

CSE2D	ADHOC NETWORKS	L T P C
	(Common to CSE, CS and CC)	3 0 0 3

OBJECTIVES

- To learn the MAC address spoofing concepts and basics of networks.
- To learn the routing principles and Adhoc network types.
- To learn the IEEE standards, MESH networks and its heterogeneous models.

UNIT I ADHOC MAC 9

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

UNIT II ADHOC NETWORK ROUTING AND 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, Adhoc TCP, and Split TCP.

UNIT III WSN - MAC 9

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

UNIT IV WSN ROUTING, LOCALIZATION AND QoS 9

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

UNIT V MESH NETWORKS 9

Necessity for Mesh Networks – MAC enhancements – IEEE 802.11's 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, B.S. Manoj, "Adhoc Wireless Networks: Architectures and Protocols", 1st Edition, Pearson Education, 2004.
2. Feng Zhao, Leonidas Guibas, "Wireless Sensor Networks", 1st Edition, Morgan Kaufman Publishers, 2004.
3. C.K.Toh, "Adhoc Mobile Wireless Networks", 1st Edition, Pearson Education, 2002.
4. Thomas Krag and Sebastin Buettrich, "Wireless Mesh Networking", 2nd Edition, O'Reilly Publishers, 2007.
5. C K Toh, "Adhoc mobile wireless networks, Protocols and Systems", 2nd Edition, Pearson Education, 2009.
6. Azzedine Boukerche, "Handbook of algorithms for wireless Networking and Mobile computing", 2nd Edition, CRC Press, 2006.

CSE2E WAVELETS AND MULTIRESOLUTION ANALYSIS L T P C
(Common to M.E CS and M.E CSE) **3 0 0 3**

OBJECTIVES:

- To study the mathematical background for the wavelets.
- To study the Multiresolution Analysis.
- To study the Continuous and Discrete wavelet transforms.

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 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 III MULTI RESOLUTION ANALYSIS 9

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

UNIT IV DISCRETE WAVELET TRANSFORMS 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 PERIODS

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", 3rd Edition, Prentice- Hall, 2004.
3. Mallat.S, "A wavelet tour of Signal Processing", Elsevier publications, 3rd edition, Academic Press, 2008.
4. Jaideva.C.Goswami, Andrew.K.Chan, "Fundamentals of Wavelets theory, algorithms and applications", 2nd Edition, John Wiley &Sons, 2011.
5. Weeks Michael, "Digital Signal Processing Using MATLAB and Wavelets", Firewall Media, 2011.

CSE2F	SOFT COMPUTING	L T P C
	(Common to CSE, CS and CC)	3 0 0 3

OBJECTIVES

- To understand the concept of soft computing.
- To learn fuzzy logic concepts.
- To learn the different classifications of neural networks.
- To study the concepts of Genetic algorithm and its applications.

UNIT I SOFTCOMPUTING AND CONVENTIONAL AI 9

Evolution of Computing – Soft Computing Constituents – From Conventional AI to Computational Intelligence – Derivative based optimization: Descent Methods, Newton's method – Step size determination – Derivative free optimization.

UNIT II FUZZY SYSTEMS 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 III ARTIFICIAL 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.

UNIT IV NEURO - FUZZY MODELING 9

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

UNIT V GENETIC ALGORITHMS 9

Evolutionary Computation – Genetic Algorithms – Terminologies and Operators of GA – Classification of GA: Simple GA, Parallel and Distributed GA, Adaptive GA – Ant Colony Optimization – Particle Swarm Optimization – Application of GA: Machine Learning, Image Processing, Data Mining and Wireless networks.

TOTAL: 45

REFERENCES

1. Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, "Neuro-Fuzzy and Soft Computing", 1st Edition, Prentice Hall of India, 2003.
2. S.N.Sivanandam, S.N.Deepa, "Introduction to Genetic Algorithms", 1st Edition, Springer, 2007.
3. S.N.Sivanandam, S.N.Deepa, "Principles of Soft Computing", Wiley & Sons, 2nd Edition, 2007.
4. Agoston E.Eiben, J.E.Smith, "Introduction to Evolutionary Computing", 1st Edition, Springer, 2008.
5. S.N.Sivanandam, S.Sumathi and S.N.Deepa, "Introduction to Fuzzy Logic using MATLAB", 1st Edition, Springer, 2007.
6. James A.Freeman and David M.Skapura, "Neural Networks Algorithms, Applications, and Programming Techniques", 1st Edition, Pearson Education, 2003.

CSE2G DIGITAL COMMUNICATION RECEIVERS L T P C
3 0 0 3

OBJECTIVES:

- To review the digital communication techniques for the optimum receiver design for AWGN channels and Fading channels.
- To study the synchronization techniques and adaptive equalization techniques in the receiver design.

UNIT I DEMODULATION 9

Gaussian basics, Hypothesis testing basics, Signal space concepts - Geometrical representation of signals, Receiver structure and sufficient statistics, Decision region, Optimal reception in AWGN, Performance analysis of ML reception, Link budget analysis.

UNIT II SYNCHRONIZATION 9

Receiver design requirements, Parameter estimation basics, Parameter estimation for synchronization, Carrier phase estimation, Symbol timing estimation, Joint carrier phase and symbol timing estimation.

UNIT III PARAMETER SYNCHRONIZATION FOR FADING CHANNELS 9

Data aided and non data aided flat fading channel estimation and detection, Data aided and non data aided selective fading channel estimation and detection

UNIT IV RECEIVER STRUCTURE FOR FADING CHANNELS 9

Outer and inner receiver for fading channels, Inner receiver for frequency selective and flat fading channels, Rake receivers, Non-coherent communication – Hypothesis testing, Optimal demodulation, Differential modulation and demodulation, Performance.

UNIT V CHANNEL EQUALIZATION 9

The channel model, Receiver front end, Eye Diagrams, Maximum likelihood sequence estimation, Geometrical model for suboptimal equalizer design, Linear equalization, Decision feedback equalization, Performance analysis of MLSE, Adaptive equalization.

TOTAL: 45 PERIODS

REFERENCES:

1. Upamanyu Madhow, “Fundamentals of Digital Communication”, Cambridge University press, 2008.
2. Heinrich Meyer, Mare Moeneclacy, Stefan.A.Fechtel, “Digital communication Receivers”, Vol I & Vol II, John Wiley, New York, 1997.
3. John G. Proakis and Masoud Salehi, “Digital Communications”, 4th Edition, McGraw-Hill International Editions, 2008.
4. Andrea Goldsmith, “Wireless Communications”, Cambridge university press, 2005.
5. Theodore S Rappaport, “Wireless Communications – Principles and practice”, 2nd Edition, Pearson Education, 2012.

CSE2H ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY TECHNIQUES

L T P C
3 0 0 3

OBJECTIVES:

- To study the EMI Environment and its coupling principles.
- To study the EMI / EMC standards and measurements for the test procedures.
- To design the PCBs with EMC compliance.

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 PERIODS

REFERENCES:

1. V.P.Kodali, “Engineering EMC Principles, Measurements and Technologies”, IEEE Press, New york, 1996.
2. Clayton R. Paul, “Introduction to Electromagnetic Compatibility”, 2nd Edition, Wiley Series in Microwave and Optical Engineering, 2006.
3. Ralph Morrison, “Grounding and Shielding: Circuits and Interference”, 5th Edition, John Wiley & Sons, 2007.
4. Christos Christopoulos, “Principles and Techniques of Electromagnetic Compatibility”, Electronic Engineering Systems, Second Edition, CRC Press, 2010.
5. Xingcun Colin Tong, “Advanced Materials and Design for Electromagnetic Interference Shielding”, 1st Edition, CRC Press, 2008.

CSE2J GLOBAL POSITIONING SYSTEMS L T P C
3 0 0 3

OBJECTIVES:

- To study the History of GPS and its various segments.
- To Study the co-ordinate system for the GPS systems.
- To study the navigational aids and signal processing for GPS systems.
- To Study the propagation media for the GPS.
- To learn the Inter disciplinary applications for GPS.

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 Observables, Multipath Effect, Antenna Phase Centre Problems and Correction.

UNIT V INTER DISCIPLINARY APPLICATIONS 9

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

TOTAL: 45 PERIODS

REFERENCES:

1. B.Hoffman - Wellenhof, H.Lichtenegger and J.Collins, "GPS: Theory and Practice", 5th revised Edition, Springer, Wein, New york, 2001.
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", 2nd Edition, John Wiley & Son, 2005.
4. http://www.auslig.gov.au.
5. http://igscb.jpl.nasa.gov

CSE2K SPEECH SIGNAL PROCESSING L T P C
(Common to M.E CS and M.E CC) **3 0 0 3**

OBJECTIVES:

- To study the fundamental mechanics of speech production and the nature of the speech signals.
- To study the time domain and frequency domain methods for speech processing.
- To study the Predictive analysis of speech and the algorithm for estimation and detection.

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 PERIODS

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. Nejat Ince, "Digital Speech Processing-Speech Coding, Synthesis and Recognition", The Springer International Series in Engineering and Computer Science, 2010.

CSE2L ADVANCED MICROPROCESSORS AND MICROCONTROLLERS L T P C
3 0 0 3

OBJECTIVES:

- To introduce the architecture and programming of various 16 bit microprocessors and microcontrollers.
- To introduce the concepts and architecture of RISC processor and ARM processors.
- To study Motorola 68HC11 Microcontrollers and PIC Micro Controller architecture and programming

UNIT I MICROPROCESSOR ARCHITECTURE 9

ISA Architecture –Application specific ISA Models: Finite State machine Models, Data path 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 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 III 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 IV 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 multiplexing scheme of the MSP430 pins.

UNIT V MSP430 ON CHIP PERIPHERALS AND INTERFACING 9

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 PERIODS

REFERENCES:

1. Tammy Noergaard, “Embedded Systems Architecture”, 2nd Edition, Newnes, 2012.
2. Steve Furber, “ARM System –On –Chip architecture”, 2nd Edition, Addision Wesley, 2000.
3. Gene. H. Miller, “Micro Computer Engineering”, 3rd Edition, Pearson Education, 2003.
4. Tim Wilmshurst, “Designing Embedded Systems with PIC Microcontrollers: Principles and Applications”, 2nd Edition, Elsevier, 2009.
5. John Davies, “MSP430 Microcontroller Basics”, 1st Edition, Elsevier, 2008.

CSE2M	LOW POWER VLSI DESIGN	L T P C
		3 0 0 3

OBJECTIVES:

- To learn principles of design, analysis, modeling and optimization of Low Power VLSI.
- To study the approaches for power consumption estimation and different methods to reduce the power consumption, low power architectures and algorithmic level analysis for low power optimization.

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 transforms, software design for low power.

TOTAL: 45 PERIODS

REFERENCES:

1. Dimitrios Soudris, Chirstian Pignet, Costas Goutis, "Designing CMOS Circuits for Low Power", 1st Edition (Reprint) Springer, 2010.
2. J.B.Kuo and J.H Lou, "Low voltage CMOS VLSI Circuits", 1st Edition, Wiley, 1999.
3. A.P.Chandrasekaran and R.W.Broadersen, "Low power digital CMOS design", 1st Edition, Wiley, 1998.
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)", 1st Edition (Reprint), Springer, 2010.

CSE2N SATELLITE COMMUNICATION L T P C
3 0 0 3

OBJECTIVES:

- To study the orbital mechanics and space craft sub systems and earth station.
- To study space links for the satellite link design.
- To study the various multiple access techniques and network aspects for Space services and applications.

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, coding and Multiplexing Schemes, Multiple Access Techniques – FDMA, TDMA, CDMA, and DAMA.

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 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, INMARSAT, Satellite and Cable Television, DBS (DTH), VSAT, Satellite Phones.

TOTAL: 45 PERIODS

REFERENCES:

1. Wilbur L. Pritchard, H.G. Suyderhoud ,Robert A.Nelson, "Satellite Communication Systems Engineering", 2nd Edition (Reprint), Prentice Hall, New Jersey, 2008.
2. D.Roddy, "Satellite Communication", 4th Edition (Reprint), McGraw Hill, 2009.
3. Tri T Ha, "Digital Satellite Communication", 2nd Edition, McGrawHill, 2009.
4. Timothy Pratt and Charles W.Bostain, "Satellite Communications", 2nd Edition, John Wiley and Sons, 2003.

CSE2P MICROWAVE INTEGRATED CIRCUITS L T P C
3 0 0 3

OBJECTIVES:

- To study the Microstrip lines and its field analysis.
- To study the waveguide systems using the equivalent circuit theory concepts.
- To study the design and analysis of microwave solid state amplifiers
- To learn integrated antennas and measurement techniques

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 PERIODS

REFERENCES:

1. Ravender Goyal, “Monolithic MIC; Technology and Design”, Artech House, 1989.
2. Arjuna Marzuki, Ahmad Ismat Bin Abdul Rahim and Mourad Loulou, “Advances in Monolithic Microwave Integrated Circuits: Modeling and Design Technologies”, 1st Edition, IGI Global, 2011.
3. David M. Pozar, “Microwave Engineering”, 4th Edition, Wiley, 2011.
4. Annapurna Das and Sisir K. Das, “Microwave Engineering”, Tata McGraw-Hill Pub.Co.Ltd., 2010.

CSE2Q DIGITAL IMAGE PROCESSING L T P C
3 0 0 3

OBJECTIVES:

- To study the image fundamentals and mathematical transforms necessary for image processing.
- To study the image enhancement and restoration techniques.
- To study the image segmentation and recognition techniques.
- To study the image compression procedures.

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 PERIODS

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. A.Ardeshir Goshtasby, “2-D and 3-D Image Registration for Medical- Remote Sensing-and Industrial Applications”, Wiley Interscience Publication, 2005.

CSE3A EMBEDDED SYSTEMS L T P C
(Common to M.E CS, M.E CSE and M.E CC) **3 0 0 3**

OBJECTIVES:

- To study the Embedded processor and its architecture.
- To study the Real- time characteristics and its system design techniques.

UNIT I EMBEDDED SYSTEM BASICS 9

Embedded Computers, Characteristics of Embedded Computing Applications, and 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

Embedded 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 mix 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 AND DEVELOPMENT TOOLS 9

Synchronous and asynchronous data transfer- UART based communication-I^2C Protocol basics -serial communication using I^2C bus: RTC Interfacing, EEPROM data transfer Ethernet communication – I^2S voice bus interface communication. Basic Embedded system Development Tools-Embest embedded IDE for ARM, Study of S3C3V40 based University Teaching Kit – Keil C and Unet ICE JTAG emulator

TOTAL: 45 PERIODS

REFERENCES:

1. "ARM Architecture Reference Manual", ARM Ltd, 2011.
2. "The ARM-Thumb Procedure Call Standard", ARM Ltd, 2011.
3. Steve Furber, "ARM System-on-Chip Architecture", 2nd 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).

CSE3B PATTERN RECOGNITION L T P C
(Common to CSE and CS) **3 0 0 3**

OBJECTIVES

- To learn the different approaches for pattern recognition.
- To study various mathematical models in pattern recognition.
- To study the non parametric and clustering techniques.

UNIT I INTRODUCTION 8

Introduction: Basics of pattern recognition – Design principles of pattern recognition system – Learning and adaptation – Pattern recognition approaches. Mathematical foundations: Linear algebra – Probability theory – Expectation – Mean and Covariance – Normal distribution – Multivariate normal densities – Chi square test of hypothesis.

UNIT II STATISTICAL PATTERN RECOGNITION 7

Statistical Patten Recognition: Bayesian Decision Theory – Classifiers – Normal density and discriminant functions.

UNIT III MODELS 10

Parameter estimation methods: Maximum-Likelihood estimation – Bayesian Parameter estimation – Dimension reduction methods – Principal Component Analysis (PCA) – Fisher Linear discriminant analysis – Expectation – maximization (EM) – Hidden Markov Models (HMM) – Gaussian mixture models.

UNIT IV NON PARAMETRIC TECHNIQUES 10

Nonparametric Techniques: Density Estimation – Parzen Windows – K-Nearest Neighbor Estimation – Nearest Neighbor Rule – Fuzzy classification.

UNIT V CLUSTERING TECHNIQUES 10

Unsupervised Learning and Clustering: Criterion functions for clustering – Clustering Techniques: Iterative square – Error partitional clustering – K-Means – agglomerative hierarchical clustering – Cluster validation.

TOTAL: 45

REFERENCES

1. Richard O. Duda, Peter E. Hart and David G. Stork, “Pattern Classification”, 2nd Edition, John Wiley, 2006.
2. Bishop, Christopher M., “Pattern Recognition and Machine Learning”, 1st Edition, Springer, 2009.
3. S. Theodoridis, K. Koutroumbas, “Pattern Recognition”, 4th Edition, Academic Press, 2009.
4. Keinosuke Fukunaga, “Introduction to Statistical Pattern Recognition”, 2nd Edition, Academic Press, 2003.
5. Sergios Thedoridis, Konstantinos Koutroumbas, “Pattern Recognition”, 4th Edition, Academic Press, 2009.

CSE3C	EVOLUTIONARY COMPUTING	L	T	P	C
	(Common to HVE, CSE, CS and CC)	3	0	0	3

OBJECTIVES:

- To know the fundamentals of evolutionary computations.
- To understand the Genetic Algorithms.
- To study the various hybrid systems.
- To study various Applications on Evolutionary Computations.

UNIT I INTRODUCTION TO EVOLUTIONARY COMPUTATION 9

Introduction – Possible applications of evolutionary computations – History of evolutionary computation – Genetic algorithms – Evolution strategic – Evolutionary programming – Derivative methods – Stochastic processes – Modes of stochastic convergence – Schema processing – Transform methods – Fitness landscape – Probably Approximately Correct(PAC) learning analysis – Limitation of evolutionary computation methods – Local performance measures.

UNIT II REPRESENTATION, SELECTION AND SEARCH OPERATORS 9

Representation – Binary strings – Real-valued vectors – Permutations – finite-state representation – Parse trees – Guidelines for a suitable encoding – Other representations Selection – Proportional selection and sampling algorithms – Tournament selection – Rank based selection – Boltz Mann selection – Other selection methods – Hybrids Generation gap methods –A comparison of selection mechanisms – Interactive evolution – Search Operators – Mutation – recombination – Other operators.

UNIT III FITNESS EVALUATION AND CONSTRAINT HANDLING 9

Fitness Evaluation – Encoding and decoding functions – Competitive fitness evaluation – Complexity based fitness evaluation – Multi objective optimization – Constraint handling techniques – Penalty functions – Decoders – Repair algorithms – Constraint preserving operators – Other constraint handling methods – Constraint satisfaction problems – Population structures – Niching Methods – Specification methods – Island(migration)models.

UNIT IV HYBRID SYSTEM 9

Self-adaptation – Meta evolutionary approaches – Neural – Evolutionary systems – New areas for evolutionary computation research in evolutionary systems – fuzzy-Evolutionary Systems – Combination with Other Optimization Methods – Combination with local search – Combination with dynamic programming – Simulated annealing and tabu search – Comparison with existing optimization.

UNIT V PARAMETER SETTING AND APPLICATIONS 9

Heuristics for Parameter setting Issues – Population size – Mutation parameters – Recombination parameters – Implementation of Evolutionary Algorithms – Efficient implementation of algorithms – Computation time of evolutionary operators – Applications – Classical optimization problems – Control Identification – Scheduling – Pattern recognition – Simulation models

Total = 45 Periods

REFERENCES:

1. Thomas Backetal., “Handbook on evolutionary computation”, Institute of Physics, Publishing, 2000.
2. Xin Yao, “Evolutionary Computations: Theory and Applications”, World Scientific 39 Publishing, 1999.
3. Goldberg, “Genetic algorithm in search, optimization and machine learning”, Addison Wesley, 1998.
4. Davis, “Hand book on Genetic Algorithms”, NewYork, 1991.
5. Kenneth A. De Jong, “Evolutionary Computation: A Unified Approach”, MIT Press, 2006.

CSE3D	MOBILE COMPUTING	L T P C
	(Common to CSE and CS)	3 0 0 3

OBJECTIVES

- To know the fundamentals of wireless communication.
- To understand the telecommunication systems.
- To study the different network layers.
- To study various protocols and their uses.

UNIT I WIRELESS COMMUNICATION FUNDAMENTALS 9

Introduction – Wireless transmission – Frequencies for radio transmission – Signals – Antennas– Signal Propagation – Multiplexing – Modulations – Spread spectrum – Medium Access Control – Space Division Multiple Access – Frequency Division Multiple Access – Time Division Multiple Access – Code Division Multiple Access – Cellular Wireless Networks.

UNIT II TELECOMMUNICATION SYSTEMS 9

GSM – System Architecture – Protocols – Connection Establishment – Frequency Allocation – Routing – Handover – Security – General packet radio service.

UNIT III WIRELESS NETWORKS 9

Wireless LAN – IEEE 802.11 Standards – Architecture – Services – High Performance Radio LAN – Adhoc Network – Blue Tooth.

UNIT IV NETWORK LAYER 9

Mobile IP – Dynamic Host Configuration Protocol – Routing – Destination Sequential Distance Vector – Dynamic Source Routing – Adhoc On-demand Distance Vector – Zone Routing Protocol – On-Demand Multicast Routing Protocol

UNIT V TRANSPORT AND APPLICATION LAYERS 9

TCP over Wireless Networks – Indirect TCP – Snooping TCP – Mobile TCP – Fast Retransmit / Fast Recovery – Transmission/Timeout Freezing – Selective Retransmission – Transaction Oriented TCP – Wireless Application Protocol – Wireless Application Protocol Architecture – Wireless Datagram Protocol – Wireless Transport Layer Security – Wireless Transaction Protocol – Wireless Session Protocol – Wireless Markup Language – WML Script – Wireless application environment – Wireless Transaction Application.

TOTAL: 45

REFERENCES

1. Jochen Schiller, "Mobile Communications", 3rd Edition, Pearson Education, 2005.
2. William Stallings, "Wireless Communications and Networks", 2nd Edition, Pearson Education, 2004.
3. Asoke k Talukder, Hasan Ahmed, Roopa R Yavagal, "Mobile computing", 2nd Edition, Tata McGraw Hill, 2010.
4. Kaveh Pahlavan, Prasanth Krishnamoorthy, "Principles of Wireless Networks", 1st Edition, Pearson Education, 2003.
5. Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, "Principles of Mobile Computing", 2nd Edition, Springer, 2003.
6. Burkhardt, "Pervasive Computing", 1st Edition, Pearson Education, 2003.

CSE3E SECURITY IN WIRELESS SENSOR NETWORKS L T P C
(Common to CSE, CS and CC) **3 0 0 3**

OBJECTIVES

- To know about the threats and vulnerabilities of communication architecture in WSN.
- To discuss about the various key management and authentication techniques in WSN.
- To study about the operations of existing well known secure routing protocols in WSN.
- To have an idea about the different secured data aggregation mechanisms in WSN.

UNIT I INTRODUCTION 9

Communication architecture of WSN – Constraints – security requirements – Threats – evaluation – attacks; Vulnerabilities of physical layer – jamming, tampering; Vulnerabilities of data link layer – collisions, exhaustion, unfairness; Vulnerabilities of network layer - Spoofed, Altered, or Replayed Routing Information, Selective Forwarding, Sinkhole, Sybil, Wormholes, Hello Flood Attacks, Acknowledgment Spoofing; Vulnerabilities of transport layer – Flooding, Desynchronization.

UNIT II KEY MANAGEMENT PROTOCOLS AND BROADCAST AUTHENTICATION 9

Key distribution – classifications: deterministic and probabilistic; protocols: LEAP, BROSK, IOS/DMBS, PIKE, SKEW; Broadcast authentication: μTesla, Certificate-Based Authentication Scheme, Basic Merkle Hash Tree Based Authentication Scheme, Enhanced Merkle Hash Tree Based Authentication Scheme, ID-Based Authentication Scheme.

UNIT III SECURE ROUTING PROTOCOLS 9

EAR, PRSA, R-LEACH, S-SPIN, Secure-SPIN, Segment transmission secure routing protocol, SONS, SS-LEACH, INSENS

UNIT IV DATA AGGREGATION, INTRUSION DETECTION AND AUTOCONFIGURATION 9

Data Aggregation – plain text based secure data aggregation – SIA, SINP, ESPDA, SSDA, WDA; cipher based secure data aggregation – CDA, HSC, Secure hierarchical data aggregation; Intrusion Detection: IHOP, SEF, DIDS, Decentralized intrusion detection; Auto Configuration – LEADS, PDAA, Dynamic address allocation.

UNIT V TRUST MANAGEMENT 9

Trust model - Certificate based - Behavior based, Combinational approach; Trust based routing protocols-secure routing based on multiple criteria decision, LEACH -TM, TRANS; Trust based node selection algorithm- cross layer trust model, reliable sensor selection algorithm, novel sensor node selection algorithm.

TOTAL: 45

REFERENCES

1. Yang Xiao, "Security in distributed, grid, mobile and pervasive computing", Auerbach publications, 3rd Edition, 2006.
2. Yong Wang, Garhan Attebury and Byrav Ramamurthy, "A Survey of security issues in wireless sensor networks" IEEE Communication Surveys & Tutorials, 2nd Quarter 2006.
3. Mohsen Sharifi, Saeid Peurroostaei Ardakani, Saeed Sedighian Kashi, "SKEW: An Efficient Self Key Establishment Protocol for Wireless Sensor Networks", IEEE 2009.
4. Kui Ren, Kai Zeng, Wenjing Lou and Patrick J.Moran, "On Broadcast Authentication in Wireless Sensor Networks", Proc. First International Conference on Wireless Algorithms, Systems, and Applications, WASA 2006, Springer Publication.
5. Hani Alzaid, Ernest Foo and Juan Genzalez Nieto, "Secure Data Aggregation in Wireless Sensor Network: a survey", Australasian Information Security Conference (ACSC2008), Wollongong, Australia, January 2008. Australian Computer Society Inc.

CSE3F HIGH SPEED SWITCHING ARCHITECTURES L T P C
(Common to M.E CS and M.E CC) **3 0 0 3**

OBJECTIVES:

- Introduction to Various high speed networks and its standards.
- To study the LAN and ATM switching architecture.
- To study the packet switching architectures and IP switching.

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 PERIODS

REFERENCES:

1. Achille Pattavina, "Switching Theory: Architectures and performance in Broadband ATM networks", 1st Edition, 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", 2nd Edition (Reprint), John Wiley & Sons, 2008.
4. Christopher Y.Metz , "IP Switching: Protocols and architectures", McGraw Hill, 1999.

CSE3G NEURAL NETWORKS AND ITS APPLICATIONS L T P C
(Common to CC & CS) 3 0 0 3

OBJECTIVES:

- To learn about basic neural models and learning algorithms.
- To impart knowledge about vector machines and basic function networks.
- To learn about EM ALGORITHMS & non linear dynamical systems.
- To learn about various neuron models.

UNIT I BASIC LEARNING ALGORITHMS 9

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

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

Radial Basis Function Networks:

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

Support Vector Machine:

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

UNIT III COMMITTEE MACHINES: 9

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

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

UNIT IV ATTRACTOR NEURAL NETWORKS 10

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

ADAPTIVE RESONANCE THEORY:

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

UNIT V SELF ORGANISING MAPS: 8

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

PULSED NEURON MODELS:

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

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Satish Kumar, "Neural Networks: A Classroom Approach", Tata McGraw-Hill Publishing Company Limited, New Delhi, Reprint 2007.
2. Simon Haykin, "Neural Networks: A Comprehensive Foundation", 2nd Edition, Addison Wesley Longman (Singapore) Private Limited, Delhi, 2001.

REFERENCES:

1. Martin T.Hagan, Howard B. Demuth, and Mark Beale, "Neural Network Design", Thomson Learning, New Delhi, 2003.
2. James A. Freeman and David M. Skapura, "Neural Networks Algorithms, Applications, and Programming Techniques", Pearson Education (Singapore) Private Limited, Delhi, 2003.
3. Simon Haykin, "Neural Networks and Learning Machines", Third Edition, Prentice Hall, 2009.

CSE3H RF SYSTEM DESIGN L T P C
3 0 0 3

OBJECTIVES:

- To learn the fundamentals of RF design and its parameters.
- To study the RF filter design and implementations.
- To analyze and design active RF components.

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 RF POWER AMPLIFIERS AND FEEDBACK SYSTEMS 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 D, E, F and S 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 PERIODS

REFERENCES:

1. Thomas.H.Lee, “The Design of CMOS Radio-Frequency Integrated Circuits”, 2nd Edition, Cambridge University Press, 2004.
2. Jaime Aguilera and Roc Berenguer, “Design and Test of Integrated Inductors for RF Applications”, Kluwer Academic Publishers, 2010.
3. Qizheng Gu, “RF System Design of Transceivers for Wireless Communications”, Springer, 2010.
4. Michael B. Steer , “Microwave and RF Design: A Systems Approach”, SciTech Publishing, 2009.

CSE3J COMMUNICATION PROTOCOL ENGINEERING L T P C
3 0 0 3

OBJECTIVES:

- To study the network reference model for the communication Protocol engineering process.
- To study the Protocol specifications, verification and Validation process.
- To study the performance testing, synthesis and implementation of the Protocols.

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 PERIODS

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.

CSE3K ASIC DESIGN L T P C
3 0 0 3

OBJECTIVES:

- To understand capabilities and limitations of CMOS logic and adjust designs to best use CMOS ASIC technologies.
- To demonstrate an understanding of verilog and logic synthesis.
- To perform an ASIC design from requirements to timing verification.

UNIT I INTRODUCTION TO ASIC 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 ASIC 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 9

Actel ACT, Xilinx EPLD, 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 9

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

TOTAL: 45 PERIODS

REFERENCES

1. M.J.S .Smith, “Application Specific Integrated Circuits”,Prentice Hall, 2008.
2. Farzad Nekoogar and Faranak Nekoogar, “From ASICs to SOCs: A Practical Approach”, 3rd Edition, Prentice Hall PTR, 2003.
3. Wayne Wolf, “FPGA-Based System Design”, 1st Edition, Prentice Hall PTR, 2004.
4. R. Rajsuman, “System-on-a-Chip Design and Test”, Artech House Publishers, 2000.

CSE3L NONLINEAR FIBER OPTICS L T P C
3 0 0 3

OBJECTIVES:

- To learn about the basics of fiber Nonlinearities, Gaussian Pulse.
- To impart knowledge about Soliton Lasers.
- To study various applications of Soliton Lasers.

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, 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 PERIODS

REFERENCES

1. Govind P. Agrawal, “Nonlinear Fiber Optics”, 4th Edition, Academic Press, New York, 2007.
2. A.Hasegawa and M. Matsumoto, “Optical Solitons in Fibers”, 3rd revised Edition, Springer, Berlin, 2003.
3. Govind P. Agrawal, “Applications of Nonlinear Fiber Optics”, 2nd Edition, Academic Press, 2008.
4. M. Lakshmanan and S. Rajasekar, “Nonlinear Dynamics: Integrability, Chaos and Patterns”, Springer, Berlin, 2003.

CSE3M VLSI SIGNAL PROCESSING L T P C
3 0 0 3

OBJECTIVES:

- To introduce the basic approaches and methodologies for VLSI design of signal processing and communication systems.
- To design high-speed, low-area, and low-power VLSI systems for a broad range of DSP applications.
- To present real-life case studies of architectures at the implementation level, and presents several approaches to analysis, estimation, and reduction of power consumption.

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 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.

UNIT V 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

TOTAL: 45 PERIODS

REFERENCES:

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

CSE3N MEDICAL IMAGE PROCESSING L T P C
3 0 0 3

OBJECTIVES:

- To learn about the computational and mathematical methods in medical image processing.
- To impart knowledge about main sources of medical imaging data (CT, MRI, PET, and ultrasound).
- To study various methods used to enhance and extract useful information from medical images.

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 PERIODS

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.

CSE3P	DESIGN AND DEPLOYMENT OF WIRELESS SENSOR NETWORKS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To provide an overview about sensor deployment and clustering in networks.
- To study the coverage control concept in Wireless sensor Networks.
- To understand the concept of existing solution in Wireless sensor Networks.

UNIT I DEPLOYMENT MECHANISMS AND CLUSTERING TECHNIQUES 9

Learning from Deployment Experience - Designing for Deployment**:** The Design for Deployment Process, Key Design Parameters, Iterative Deployment, Lessons from the Field.

Topology Discovery and Clusters in Sensor Networks - Adaptive Clustering with Deterministic Cluster -Head Selection - Sensor Clusters' Performance – Power Aware Functions in Wireless Sensor Networks - Efficient Flooding With Passive Clustering.

UNIT II COVERAGE CONTROL AND TARGET COVERAGE PROBLEMS 9

Sensor coverage Models: Boolean Sector Coverage Models, Boolean Disk Coverage Models, Attenuated Disk Coverage Models, Truncated Attenuated Disk Models, Detection Coverage Models, Estimation Coverage Models – Coverage control in protocol architecture Design issues of Network coverage control.

Node Placement Optimization: Node Placement as the set-Covering Problem – Optimal Sensor Placement Problem. Coverage Lifetime Maximization: Maximization Target Coverage Lifetime – Maximizing connected Target Coverage Lifetime.

UNIT III AREA COVERAGE PROBLEMS 9

Critical Sensor Density: Deterministic Node Placement – Random Node Placement. Sensor Activity and Scheduling: Preserving Complete Coverage - Preserving Partial Coverage – Preserving area coverage and Network Connectivity. Node Movement Strategy: Healing Coverage Hole – Optimizing Area Coverage – Improving Event Coverage.

UNIT IV BARRIER COVERAGE PROBLEMS AND ENERGY EFFICIENCY 9

Barrier Coverage Problems: Build in Intrusion Barriers – Find the Penetration Paths.

Energy Harvesting in WSN: Energy harvesting, Harvesting techniques, Energy harvesting storage devices, Power management for EH-WSN.

UNIT V CASE STUDIES 9

Volcano Monitoring: Addressing Data Quality through Iterative Deployment - VoxNet: Reducing Latency in High Data Rate Applications - Failure Is Inevitable: The Trade-off between Missing Data and Maintenance, Glacier Monitoring: Deploying Custom Hardware in Harsh Environments.

Energy-efficient border intrusion detection - Multiobjective Optimization for Topology and Coverage Control - Sensor Node Deployment Based on Electromagnetism – Energy Hole Detection and Healing

TOTAL: 45 PERIODS

REFERENCES

1. Elena Gaura, Lewis Girod, "Wireless Sensor Network - Deployments and Design Frameworks" - Springer Science Business Media, LLC 2010.
2. Bang Wang, "Coverage Control in Sensor Networks", Springer Science & Business Media, 2010.
3. Oswald Jumira, Sherali Zeadally "Energy Efficiency in Wireless Networks", John Wiley Publication, Jan 2013.
4. Anna Ha´c, "Wireless Sensor Network Designs", John Wiley & Sons Ltd, 2003.

CSE3Q	IPTV TECHNOLOGIES	L	T	P	C
		3	0	0	3

OBJECTIVES

- To know the fundamentals of IPTV.
- To understand the Digital Rights Management and IPTV Encoding Techniques.
- To study IPTV on different networks.
- To study various Security Threats on IPTV.

UNIT I NEXT GENERATION TV NETWORK 9

Introduction - IPTV Architecture: High-level Architecture , Functional Architecture for the IPTV Service, Head End (IPTV Service Provider), Transport and Aggregation Network, IPTV Standards and Solutions: The Open ITPV Forum Architecture, The ETSI IPTV Standard - Interactive, Personal IPTV: Home Connectivity, The Set-top Box for IPTV, Channel Switching, Dynamic Creation of Interactive Television, Profiles to Adapt, Design of Interaction Objects, Generic Interaction Models, Designing Menus and Text - Monetizing IPTV: Advertising and Interaction, IPTV Toolbox for Advertisers, IPTV Advertising Design Project, Splicing Advertising, Inserting Advertising

UNIT II DIGITAL RIGHTS MANAGEMENT 9

Digital Rights Management: Exceptions to Copyright, Attaching Strings to Copyright Gifts, Legal Constraints for users, Simple Philosophy, Complicated Mechanism, Standards for DRM – Identities: Managing and Federating User Profiles XDMS, PGM, Data Format, Lists and Profiles, Advertising and Presence - Beyond the EPG : Social Software, Presence and Personalized EPG, Metadata Types and Models, Metadata and the EPG: TV-Anytime - Protocols for Interaction: HTTP,VoD,SIP,SDP - IPTV Encoding: MPEG-2, MPEG-4, Transporting the MPEG Stream - IPTV Networking and Streaming : IMS, Registering in IMS, IMS works with SIP, IMS Communications Services, Handling Quality of Service.

UNIT III SERVICES AND TECHNOLOGIES 9

Network Distribution Technologies : Broadband Distribution Network Types, IPTV over a Fiber Access Network, IPTV over an ADSL Network, IPTV over Cable TV Networks, IPTV over Wireless Networks, IPTV over the Internet, IPTV Backbone Technologies, Network Factors Associated with Deploying IPTV - Real-Time Encoding and Transportation: Compression Methods, Packetizing and Encapsulating Video Content - Broadcasting over IPTV: Video Components of an End-to-End IPTV System, Streaming IPTV Content, Multicasting across an IPTV Network - IPTV Multicasting Networking Architecture: Multicasting IPTV over IPV6 Networks - IPTV Devices: Residential Gateways.

UNIT IV IPTV SECURITY 9

General Mechanisms for Content Protection : CPS , CAS , VCPS , CPRM/CPPM (CPSA) - Open DRM: SDMI, OMA, DRM DMP - Interoperability Proposals : Watermarking and Fingerprinting - Threats to IPTV Implementations: IPTV Service Provider Head End - IPTV Network Provider: Protocol Vulnerabilities, Content Distribution Service, Multicast Content Propagation, QoS Signaling, Connection Management Service - Countering the Threats : Hardening Operating Systems, Intrusion Detection/Intrusion Prevention, Network Firewalls, Fraud Prevention, Head End (IPTV Service Provider), Aggregation and Transport Network , Home End .

UNIT V CASE STUDY 9

IPTV - Household Structures - P2P - VoD - Cloud computing Environment - Channel Navigation- Channel Switching - Zapping Delay - Resource Allocation for wireless environment- SAMP – EPON.

TOTAL: 45 PERIODS

REFERENCES

1. Johan Hjelm , “Why IPTV? Interactivity, Technologies and Services”, John Wiley and Sons, Ltd, Publication 2008
2. Gerard O’driscoll, “Next Generation IPTV Services and Technologies”, John Wiley & Sons, Inc., Publication, 2008
3. David Ramirez, “IPTV Security Protecting High-Value Digital Contents”, John Wiley & Sons, Inc., Publication, 2008
4. Dixin Luo, Hongteng Xu, "You Are What You Watch and When You Watch: Inferring Household Structures From IPTV Viewing Data " IEEE Transactions on Broadcasting, VOL. 60, NO. 1, pp 61 - 72 MARCH 2014
5. Yunyoung Nam, Hyung Ju Park, "An Interactive IPTV System With Community Participation in Cloud Computing Environments" IEEE Systems Journal, Vol. 8, No. 1, pp 174 - 183 MARCH 2014
6. Fernando M. V. Ramos, "Mitigating IPTV Zapping Delay", IEEE Communications Magazine, pp128 - 133, August 2013.
7. Wen-Hsing Kuo, Wanjiun Liao, "Adaptive Resource Allocation for Layer-Encoded IPTV Multicasting in IEEE 802.16 WiMAX Wireless Networks", IEEE Transactions on Multimedia, VOL. 13, NO. 1 pp 116 - 124, February 2011.

CSE3R VEHICULAR ADHOC NETWORKS L T P C
3 0 0 3

OBJECTIVES

- To brief about the basic principles and challenges of VANET.
- To study and discuss about link layer protocols and wireless access technologies.
- To build working knowledge on various routing protocols and connectivity techniques.
- To learn about emerging security issues, Description of modeling issues and mathematical analysis using various encryption schemes techniques in VANET.
- To study various mobility models and simulation techniques of VANET in wireless Environment.

UNIT I INTRODUCTION TO VANET 9

Introduction - VANET architecture - communication domains: Vehicle to Vehicle Communication, Vehicle to Infrastructure - characteristics - Applications: Cooperative Vehicular Safety Applications: Enabling Technologies, Cooperative System Architecture and VANET- enabled Active Safety Applications - VANET Convenience and Efficiency Applications: Communication Paradigms - Probabilistic, Area-based Aggregation - Travel Time Aggregation and limitation.

UNIT II VANET LINK LAYER PROTOCOLS 9

MAC Layer and Scalability Aspects of Vehicular Communication Networks - Survey on Proposed MAC Approaches for VANETs - Communication Based on IEEE 802.11p - Performance Evaluation and Modeling - Aspects of Congestion Control. Wireless Access Technologies - WLAN/Wi-Fi – WiMAX - WAVE.

UNIT III RESEARCH CHALLENGES IN VANET 9

Information Dissemination: Introduction, Information Transport & Geographical Data Aggregation Local and summarizing the measurements - VANET Routing protocols - Topology based routing - proactive - CGSR and reactive protocols - DYMO - Broadcast routing protocol - Connectivity in VANET - performance modeling - Node connectivity -Road side connectivity - connectivity in urban area and highways.

UNIT IV DATA SECURITY IN VANET 9

Data Security: Introduction - security threats - Classification of attacks: Sybil Attack - Impersonation Attack and Masquerade - Timing Attack - Spoofing, Hidden vehicle and Tunnel Attack - Illusion Attack - Denial of Service (DoS) - Challenges of Data Security in Vehicular Networks, Security Infrastructure, Cryptographic Protocols.

UNIT V MOBILITY MODELS AND SIMULATION TECHNIQUES IN VANET 9

Mobility Models: Random Models, Flow Models, Traffic Models, Trace or survey - based Models and Behavioral Model - Overview of Simulators for VANETs - General Features of VANET Simulators - Simulator Architecture - Types of Simulators: Mobility Simulator, Network Simulator, VANET Simulator.

TOTAL: 45 PERIODS

REFERENCES

1. Hannes Hartenstein and Kenneth P.Laberteaux, "VANET:Vehicular Applications and Inter-Networking Technologies", 1st Edition, Wiley publications, 2010.
2. Stephan Olariu,Michele C. Weigle, "Vehicular Network from theory to practice", 1st Edition, CRC Press, 2009.
3. Marco Picone, Stefano Busanelli, Michele Amoretti, Francesco Zanichelli, Gianluigi Ferrari, "Advanced Technologies for Intelligent Transportation Systems", Springer Cham Heidelberg, New york, 1st Edition, 2014.
4. Watfa, Mohamed, "Advances in Vehicular Ad-Hoc Networks: Developments and Challenges", published in USA, Information Science Rreference, 2010.

5. Vinh Hoa LA, Ana Cavalli, "Security attacks and solutions in Vehicular Adhoc Networks:A Survey", International Journal on Adhoc Networking Systems (IJANS) Vol. 4, No. 2, April 2014.