ANNA UNIVERSITY, CHENNAI
AFFILIATED INSTITUTIONS
REGULATIONS - 2013
M.E. COMMUNICATION SYSTEMS
I - IV SEMESTERS (FULL TIME) CURRICULUM AND SYLLABUS

SEMESTER I

THEORY					
Course Code	**Course Title**	**L**	**T**	**P**	**C**
MA7158	Applied Mathematics for Communication Engineers	3	1	0	4
CU7101	Advanced Radiation Systems	3	0	0	3
CU7102	Advanced Digital Communication Techniques	3	0	0	3
AP7101	Advanced Digital Signal Processing	3	1	0	4
CU7103	Optical Networks	3	0	0	3
	Elective I	3	0	0	3

PRACTICAL					
Course Code	**Course Title**	**L**	**T**	**P**	**C**
CU7111	Communication Systems Laboratory	0	0	3	2
	Total	**18**	**2**	**3**	**22**

SEMESTER II

THEORY					
Course Code	**Course Title**	**L**	**T**	**P**	**C**
CU7201	Wireless Communication Networks	3	0	0	3
CU7202	MIC and RF System Design	3	0	0	3
AP7301	Electromagnetic Interference and Compatibility	3	0	0	3
	Elective II	3	0	0	3
	Elective III	3	0	0	3
	Elective IV	3	0	0	3

PRACTICAL					
Course Code	**Course Title**	**L**	**T**	**P**	**C**
CU7211	Innovative System Design Laboratory	0	0	3	2
	Total	**18**	**0**	**3**	**20**

SEMESTER III

THEORY					
Course Code	**Course Title**	**L**	**T**	**P**	**C**
CU7301	Advanced Satellite Based Systems	3	0	0	3
	Elective V	3	0	0	3
	Elective VI	3	0	0	3

PRACTICAL					
Course Code	**Course Title**	**L**	**T**	**P**	**C**
CU7311	Project Work (Phase I)	0	0	12	6
	Total	**9**	**0**	**12**	**15**

SEMESTER IV

PRACTICAL					
Course Code	**Course Title**	**L**	**T**	**P**	**C**
CU7411	Project Work (Phase II)	0	0	24	12
	Total	**0**	**0**	**24**	**12**

TOAL NO OF CREDITS 69

ELECTIVES

SEMESTER I

Course Code	Course Title	L	T	P	C
AP7103	Advanced Microprocessor and Microcontroller	3	0	0	3
VL7001	Analog and Mixed Mode VLSI Design	3	0	0	3
CU7001	Real Time Embedded Systems	3	0	0	3
CU7002	MEMS and NEMS	3	0	0	3
AP7202	ASIC and FPGA Design	3	0	0	3

SEMESTER II

ELECTIVE-II					
Course Code	**Course Title**	**L**	**T**	**P**	**C**
NC7102	Communication Networks Modelling and Simulation	3	0	0	3
CU7003	Digital Communication Receivers	3	0	0	3
CU7004	Detection and Estimation Theory	3	0	0	3
VL7013	VLSI for Wireless Communication	3	0	0	3
CU7005	Cognitive Radio	3	0	0	3

ELECTIVE-III					
Course Code	**Course Title**	**L**	**T**	**P**	**C**
DS7071	Speech and Audio Signal processing	3	0	0	3
DS7201	Advanced Digital Image Processing	3	0	0	3
DS7202	Radar Signal Processing	3	0	0	3
CP7008	Speech Processing and Synthesis	3	0	0	3

ELECTIVE-IV					
Course Code	**Course Title**	**L**	**T**	**P**	**C**
CU7006	Wavelet Transforms and Applications	3	0	0	3
DS7101	DSP Processor Architecture and Programming	3	0	0	3
NC7101	High Performance Networks	3	0	0	3
CP7023	Reconfigurable Computing	3	0	0	3

SEMESTER III

ELECTIVE-V					
Course Code	**Course Title**	**L**	**T**	**P**	**C**
NC7001	Network Routing Algorithms	3	0	0	3
NC7202	Wireless Adhoc and Sensor Networks	3	0	0	3
CU7007	Internetworking Multimedia	3	0	0	3
NC7002	Multimedia Compression Techniques	3	0	0	3
CU7008	Ultra Wide Band Communication	3	0	0	3

ELECTIVE-VI					
Course Code	**Course Title**	**L**	**T**	**P**	**C**
IF7301	Soft Computing	3	0	0	3
NC7003	Network Processor	3	0	0	3
NE7007	Network Management	3	0	0	3
NC7201	Communication Network Security	3	0	0	3
CU7009	Neural Networks and Applications	3	0	0	3

MA7158 APPLIED MATHEMATICS FOR COMMUNICATION ENGINEERS L T P C
3 1 0 4

OBJECTIVES:

- To develop the ability to use the concepts of Linear algebra and Special functions for solving problems related to Networks.
- To formulate and construct a mathematical model for a linear programming problem in real life situation;
- To expose the students to solve ordinary differential equations by various techniques.

OUTCOMES:

- To achieve an understanding of the basic concepts of algebraic equations and method of solving them.
- To familiarize the students with special functions and solve problems associated with Engineering applications.

UNIT I LINEAR ALGEBRA 12

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

UNIT II LINEAR PROGRAMMING 12

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

UNIT III ORDINARY DIFFERENTIAL EQUATIONS 12

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

UNIT IV TWO DIMENSIONAL RANDOM VARIABLES 12

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

UNIT V QUEUEING MODELS 12

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

TOTAL: 45+15:60 PERIODS

REFERENCES:

1. Richard Bronson, Gabriel B.Costa, "Linear Algebra", Academic Press, Second Edition, 2007.
2. Richard Johnson, Miller & Freund, "Probability and Statistics for Engineers", 7th Edition, Prentice – Hall of India, Private Ltd., New Delhi (2007).
3. Taha H.A., "Operations Research: An introduction", Pearson Education Asia, New Delhi, Ninth Edition, 2012.
4. Donald Gross and Carl M. Harris, "Fundamentals of Queueing Theory", 2nd edition, John Wiley and Sons, New York (1985).
5. Moon, T.K., Sterling, W.C., Mathematical methods and algorithms for signal processing, Pearson Education, 2000.

CU7101 ADVANCED RADIATION SYSTEMS L T P C
3 0 0 3

UNIT I ANTENNA FUNDAMENTALS 9

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

UNIT II RADIATION FROM APERTURES 9

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

UNIT III ARRAYS 9

Introduction-General structure of phased array, linear array theory, variation of gain as a function of pointing direction, effects of phase quantization, frequency scanned arrays, analog beam forming matrices-Active modules, digital beam forming, MEMS technology in phased arrays-Retro directive and self phased arrays.

UNIT IV MICRO STRIP ANTENNA 9

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

UNIT V EMC ANTENNA AND ANTENNA MEASUREMENTS 9

Concept of EMC measuring antenna; Receiver and Transmitter 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. Hubregt.J.Visser “Antenna Theory and Applications” 1st Edition, John Wiley & Sons Ltd, Newyork,2012.
2. Zhijun Zhang” Antenna Design for Mobile Devices” 1st Edition, John Wiley & Sons (Asia) Ltd, Newyork,2011.
3. Xavier Begaud, “Ultra Wide Band Antennas” , 1st Edition, ISTE Ltd and John Wiley & Sons Ltd, Newyork,2013.
4. Balanis.A, “Antenna Theory Analysis and Design”, John Wiley and Sons, New York, 1982.
5. Krauss.J.D, “Antennas”, II edition, John Wiley and sons, New York, 1997.
6. I.J. Bahl and P. Bhartia,” Microstrip Antennas”,Artech House,Inc.,1980
7. W.L.Stutzman and G.A.Thiele,”Antenna Theory and Design”, 2nd Edition, John Wiley& Sons Inc.,1998.
8. S.Drabowitch et.al.:, ”Modern Antennas”, 2nd Edition Springer science business Media, Inc.2005.

CU7102 ADVANCED DIGITAL COMMUNICATION TECHNIQUES L T P C
3 0 0 3

COURSE OBJECTIVES:

- To understand the basics of signal-space analysis and digital transmission.
- To understand the coherent and noncoherent receivers and its impact on different channel characteristics.
- To understand Orthogonal Frequency Division Multiplexing.
- To understand the different block coded and convolutional coded digital communication systems.
- To understand the different Equalizers.

UNIT I COHERENT AND NON-COHERENT COMMUNICATION 9

Coherent receivers – Optimum receivers in WGN – IQ modulation & demodulation – Noncoherent receivers in random phase channels; MFSK receivers – Rayleigh and Rician channels – Partially coherent receivers – DPSK; M-PSK; M-DPSK--BER Performance Analysis. Carrier Synchronization- Bit synchronization.

UNIT II 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 III BLOCK CODED DIGITAL COMMUNICATION 9

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

UNIT IV CONVOLUTIONAL CODED DIGITAL COMMUNICATION 9

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

UNIT V OFDM 9

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

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- Develop the ability to understand the concepts of signal space analysis coherent and non-coherent receivers.
- Comprehend the generation of OFDM signals and the processing of the signals.
- Possess knowledge on different block codes and convolutional codes.
- Conceptually appreciate different Equalization techniques.

REFERENCES:
1. M.K.Simon, S.M.Hinedi and W.C.Lindsey, Digital communication techniques; Signalling and detection, Prentice Hall India, New Delhi. 1995.
2. Simon Haykin, Digital communications, John Wiley and sons, 1998
3. Bernard Sklar., 'Digital Communications', second edition, Pearson Education,2001.
4. John G. Proakis., 'Digital Communication', 4 th edition, Mc Graw Hill Publication, 2001
5. Theodore S.Rappaport., 'Wireless Communications', 2nd edition, Pearson Education, 2002.
6. Stephen G. Wilson., 'Digital Modulation and Coding', First Indian Reprint ,Pearson Education, 2003.
7. Richard Van Nee & Ramjee Prasad., 'OFDM for Multimedia Communications' Artech House Publication,2001.

AP7101 ADVANCED DIGITAL SIGNAL PROCESSING L T P C
3 1 0 4

COURSE OBJECTIVES:
The purpose of this course is to provide in-depth treatment on methods and techniques in
- discrete-time signal transforms, digital filter design, optimal filtering
- power spectrum estimation, multi-rate digital signal processing
- DSP architectures which are of importance in the areas of signal processing, control and communications.

COURSE OUTCOMES:
Students should be able to:
- To design adaptive filters for a given application
- To design multirate DSP systems.

UNIT I DISCRETE RANDOM SIGNAL PROCESSING 9
Weiner Khitchine relation - Power spectral density – filtering random process, Spectral Factorization Theorem, special types of random process – Signal modeling-Least Squares method, Pade approximation, Prony's method, iterative Prefiltering, Finite Data records, Stochastic Models.

UNIT II SPECTRUM ESTIMATION 9
Non-Parametric methods - Correlation method - Co-variance estimator - Performance analysis of estimators – Unbiased consistent estimators - Periodogram estimator - Barlett spectrum estimation - Welch estimation - Model based approach - AR, MA, ARMA Signal modeling - Parameter estimation using Yule-Walker method.

UNIT III LINEAR ESTIMATION AND PREDICTION 9
Maximum likelihood criterion - Efficiency of estimator - Least mean squared error criterion - Wiener filter - Discrete Wiener Hoff equations - Recursive estimators - Kalman filter - Linear prediction, Prediction error - Whitening filter, Inverse filter - Levinson recursion, Lattice realization, Levinson recursion algorithm for solving Toeplitz system of equations.

UNIT IV ADAPTIVE FILTERS 9
FIR Adaptive filters - Newton's steepest descent method - Adaptive filters based on steepest descent method - Widrow Hoff LMS Adaptive algorithm - Adaptive channel equalization - Adaptive echo canceller - Adaptive noise cancellation - RLS Adaptive filters - Exponentially weighted RLS - Sliding window RLS - Simplified IIR LMS Adaptive filter.

UNIT V MULTIRATE DIGITAL SIGNAL PROCESSING 9

Mathematical description of change of sampling rate - Interpolation and Decimation - Continuous time model - Direct digital domain approach - Decimation by integer factor - Interpolation by an integer factor - Single and multistage realization - Poly phase realization - Applications to sub band coding - Wavelet transform and filter bank implementation of wavelet expansion of signals.

L +T= 45+15, TOTAL: 60 PERIODS

REFERENCES:

1. Monson H. Hayes, "Statistical Digital Signal Processing and Modeling", John Wiley and Sons Inc., New York, 2006.
2. Sophoncles J. Orfanidis, "Optimum Signal Processing ", McGraw-Hill, 2000.
3. John G. Proakis, Dimitris G. Manolakis, "Digital Signal Processing", Prentice Hall of India, New Delhi, 2005.
4. Simon Haykin, "Adaptive Filter Theory", Prentice Hall, Englehood Cliffs, NJ1986.
5. S. Kay," Modern spectrum Estimation theory and application", Prentice Hall, Englehood Cliffs, NJ1988.
6. P. P. Vaidyanathan, "Multirate Systems and Filter Banks", Prentice Hall, 1992.

CU7103 OPTICAL NETWORKS L T P C
3 0 0 3

UNIT I OPTICAL SYSTEM COMPONENTS 9

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

UNIT II OPTICAL NETWORK ARCHITECTURES 9

Introduction to Optical Networks; SONET / SDH standards, Metropoliton Area Networks, Layered Architecture; Broadcast and Select Networks–Topologies for Broadcast Networks, Media Access Control Protocols, Testbeds 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 [RWA], Virtual topology design, Wavelength Routing Testbeds, Architectural variations.

UNIT IV PACKET SWITCHING AND ACCESS NETWORKS 9

Photonic Packet Switching – OTDM, Multiplexing and Demultiplexing, Synchronisation, Broadcast OTDM networks, Switch-based networks; Access Networks – Network Architecture overview, OTDM networks; Optical Access Network Architectures; Future Access 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 and Kumar N. Sivarajan, "Optical Networks : A Practical Perspective", Harcourt Asia Pte Ltd., Second Edition 2004.
2. C. Siva Ram Moorthy and Mohan Gurusamy, "WDM Optical Networks : Concept, Design and Algorithms", Prentice Hall of India, Ist Edition, 2002.
3. Biswanath Mukherjee, "Optical Communication Networks", Mc-GrawHill ©1997, First Edition ISBN 0-07-044435-8.
4. P.E. Green, Jr., "Fiber Optic Networks", Prentice Hall, NJ, 1993.
5. Rajiv Ramaswami and Kumar N. Sivarajan, "Optical Networks : A Practical Perspective", Harcourt Asia Pte Ltd., First Edition 2004.

CU7111 COMMUNICATION SYSTEM LABORATORY L T P C
0 0 3 2

List of Experiments

Use Network Analyser for the following experiments:

1. Measurement of transmission line parameters.
2. S-parameter estimation of Microwave devices.
3. Design and testing of a Microstrip coupler.
4. Characteristics of λ/4 and λ/2 transmission lines.

Use appropriate simulation tools for the following experiments:

1. Channel equalizer design (LMS, RLS)
2. Antenna Radiation Pattern measurement.
3. Performance Evaluation of digital modulation schemes
4. OFDM transceiver design
5. Simulation of Microstrip Antennas
6. Performance evaluation of simulated CDMA System.

TOTAL : 45 PERIODS

CU7201 WIRELESS COMMUNICATION NETWORKS L T P C
3 0 0 3

COURSE OBJECTIVES:

- To introduce the concepts of wireless communication.
- To make the students to know about the various propagation methods, Channel models, capacity calculations multiple antennas and multiple user techniques used in the mobile communication.
- To enhance the understanding of Wi-fi, 3G systems and 4G networks.

UNIT I WIRELESS CHANNEL PROPAGATION AND MODEL 9

Propagation of EM signals in wireless channel – Reflection, diffraction and Scattering-Small scale fading- channel classification- channel models – COST -231 Hata model, Longley-Rice Model, NLOS Multipath Fading Models: Rayleigh, Rician, Nakagami, Composite Fading –shadowing Distributions, Link power budget Analysis.

UNIT II DIVERSITY 9

Capacity of flat and frequency selective fading channels-Realization of independent fading paths, Receiver Diversity: selection combining, Threshold Combining, Maximum-ratio Combining, Equal gain Combining. Transmitter Diversity: Channel known at transmitter, channel unknown at the transmitter.

UNIT III MIMO COMMUNICATIONS 9

Narrowband MIMO model, Parallel decomposition of the MIMO channel, MIMO channel capacity, MIMO Diversity Gain:Beamforming, Diversity-Multiplexing trade-offs, Space time Modulation and coding : STBC,STTC, Spacial Multiplexing and BLAST Architectures.

UNIT IV MULTI USER SYSTEMS 9

Multiple Access : FDMA,TDMA, CDMA,SDMA, Hybrid techniques, Random Access: ALOHA,SALOHA,CSMA, Scheduling, power control, uplink downlink channel capacity, multiuser diversity, MIMO-MU systems.

UNIT V WIRELESS NETWORKS 9

3G Overview, Migration path to UMTS, UMTS Basics, Air Interface, 3GPP Network Architecture, 4G features and challenges, Technology path, IMS Architecture - Introduction to wireless LANs - IEEE 802.11 WLANs - Physical Layer- MAC sublayer.

TOTAL: 45 PERIODS

REFERENCES:

1. Andrea Goldsmith, Wireless Communications, Cambridge University Press, 2007.
2. HARRY R. ANDERSON, “Fixed Broadband Wireless System Design” John Wiley – India, 2003.
3. Andreas.F. Molisch, “Wireless Communications”, John Wiley – India, 2006.
4. Simon Haykin & Michael Moher, “Modern Wireless Communications”, Pearson Education, 2007.
5. Rappaport. T.S., “Wireless communications”, Pearson Education, 2003.
6. Clint Smith. P.E., and Daniel Collins, “3G Wireless Networks”, 2nd Edition, Tata McGraw Hill, 2007.
7. Vijay. K. Garg, “Wireless Communication and Networking”, Morgan Kaufmann Publishers, http://books.elsevier.com/9780123735805:, 2007.
8. Kaveth Pahlavan,. K. Prashanth Krishnamuorthy, "Principles of Wireless Networks", Prentice Hall of India, 2006.
9. William Stallings, "Wireless Communications and networks" Pearson / Prentice Hall of India, 2nd Ed., 2007.
10. Sumit Kasera and Nishit Narang, “3G Networks – Architecture, Protocols and Procedures”, Tata McGraw Hill, 2007.

COURSE OUTCOMES:

1. The students understand the state of art techniques in wireless communication.
2. Students are enriched with the knowledge of present day technologies to enable them to face the world and contribute back as researchers.

CU7202 MIC AND RF SYSTEM DESIGN L T P C
3 0 0 3

COURSE OBJECTIVES

1. To understand the fundamentals of RF radio system design.
2. To understand the various components that constitute an RF radio system for wireless Communications.
3. To know the basic analysis techniques needed for evaluating the performance of an RF radio system for Wireless applications.

COURSE OUTCOMES

- To be able to design RF circuits
- To be able to analyse the performance of RF circuits

UNIT I CMOS PHYSICS, TRANSCEIVER ECIFICATIONSAND ARCHITECTURES 9

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

UNIT II IMPEDANCE MATCHING AND AMPLIFIERS 9

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

UNIT III FEEDBACK SYSTEMS AND POWER AMPLIFIERS 9

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

UNIT IV RF FILTER DESIGN, OSILLATOR, MIXER 9

Overview-basic resonator and filter configuration-special filter realizations-filter implementation. Basic oscillator model-high frequency oscillator configuration-basic characteristics of mixers-phase locked loops-RF directional couplers hybrid couplers-detector and demodulator circuits.

UNIT V MIC COMPONENTS, ANTENNAS AND MEASUREMENT TECHNIQUES 9

Introduction to MICs-Fabrication Technology, Advantages and applications, MIC components-Micro strip components, Coplanar circuits, Integrated antennas, photonic band gap antennas, Measurement techniques-test fixture measurements, probe station measurements, thermal and cryogenic measurements, experimental field probing techniques.

TOTAL: 45 PERIODS

REFERENCES:

1. T. Lee, ”Design of CMOS RF Integrated Circuits”, Cambridge, 2004.
2. B.Razavi, “RF Microelectronics”, Pearson Education, 1997.
3. Jan Crols, MichielSteyaert, ”CMOS Wireless Transceiver Design”, Kluwer Academic Publications, 1997.
4. B. Razavi, Design of analog CMOS Integrated Circuits”, McGraw Hill,2001.
5. I.D. Robertson &S. Lucyszyn, “RFIC and MMIC Design and Technology”, IEE Circuits, Devices and Systems series 13, London, UK, 2001.

AP7301 ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY L T P C

3 0 0 3

COURSE OBJECTIVES:

- To understand the basics of EMI
- To study EMI Sources
- To understand EMI problems
- To understand Solution methods in PCB
- To understand Measurement technique for emission
- To understand Measurement technique for immunity

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- Shielding Material-Shielding integrity at discontinuties, Filtering- Characteristics of Filters-Impedance and Lumped element filters-Telephone line filter, Power line filter design, Filter installation and Evaluation, Grounding- Measurement of Ground resistance-system grounding for EMI/EMC-Cable shielded grounding, Bonding, Isolation transformer, Transient suppressors, Cable routing, Signal control. EMI gaskets

UNIT IV EMC DESIGN OF PCBS 9

EMI Suppression Cables-Absorptive, ribbon cables-Devices-Transient protection hybrid circuits ,Component selection and mounting; PCB trace impedance; Routing; Cross talk control-Electromagnetic Pulse-Noise from relays and switches, Power distribution decoupling; Zoning; Grounding; VIAs connection; Terminations.

UNIT V EMI MEASUREMENTS AND STANDARDS 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; Civilian standards-CISPR, FCC, IEC, EN; Military standards-MIL461E/462. Frequency assignment - spectrum conversation. British VDE standards, Euro norms standards in japan - comparisons. EN Emission and Susceptibility standards and Specifications.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- To design a EMI free system
- To reduce system level crosstalk
- To design high speed Printed Circuit board with minimum interference
- To make our world free from unwanted electromagnetic environment

REFERENCES:

1. V.P.Kodali, “Engineering EMC Principles, Measurements and Technologies”, IEEE Press, Newyork, 1996.
2. Clayton R.Paul,” Introduction to Electromagnetic Compatibility”, John Wiley Publications, 2008
3. Henry W.Ott.,”Noise Reduction Techniques in Electronic Systems”, A Wiley Inter Science Publications, John Wiley and Sons, Newyork, 1988.
4. Bemhard Keiser, “Principles of Electromagnetic Compatibility”, 3rd Ed, Artech house, Norwood, 1986. .
5. Don R.J.White Consultant Incorporate, “Handbook of EMI/EMC” , Vol I-V, 1988.

CU7211 INNOVATIVE SYSTEM DESIGN LABORATORY L T P C
0 0 4 2

COURSE OBJECTIVES:

1. To encourage the students to identify socially relevant problems,
2. To enable him to think of creative solutions for the same,
3. To design and conduct suitable experiments, as well as to analyze and interpret data to produce meaningful conclusions and match with theoretical concepts,
4. To enable the student to appreciate the practical aspects of system design and understand the associated challenges.
5. To help him develop low cost proof of concept system prototype.

METHODOLOGY:

- Students could form teams not exceeding 2 members,
- Students should submit / present their ideas to the Lab-in-Charge and get it approved,
- Student should submit proposal with system/ technical details and cost implications,
- Students should periodically demonstrate the progress they have made.

EVALUATION:

- Students should be evaluated on the basis of the following:
  - Social relevance of their work
  - Utility of the system developed
  - Level of proof of concept
  - Industry support if obtained, etc.

COURSE OUTCOMES:

1. The student would be able to identify socially relevant issues and apply his knowledge to evolve feasible solutions.
2. The student would be able to comprehensively record and report the measured data, write reports, communicate research ideas and do oral presentations effectively.

TOTAL: 60 PERIODS

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

UNIT I NAVIGATION, TRACKING AND SAFETY SYSTEMS 9

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

UNIT II INERTIAL NAVIGATION AND DIFFERENTIAL GPS SYSTEMS 9

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

UNIT III REMOTE SENSING SYSTEMS AND TECHNIQUES 9

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

UNIT IV BROADCAST SYSTEMS 9

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

UNIT V SATELLITE NETWORKING SYSTEM WITH IPV6 9

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

TOTAL: 45 PERIODS

REFERENCES:

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

AP7103 ADVANCED MICROPROCESSOR AND MICROCONTROLLER L T P C

3 0 0 3

OBJECTIVES:

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

UNIT I OVERVIEW 9

Generic Architecture--Instruction Set – Data formats –Addressing modes – Memory hierarchy – register file –Cache – Virtual memory and paging – Segmentation- pipelining –the instruction pipeline – pipeline hazards – instruction level parallelism – reduced instruction set –Computer principles – RISC versus CISC.

UNIT II HIGH PERFORMANCE CISC ARCHITECTURE – PENTIUM 9

CPU Architecture- Bus Operations – Pipelining – Brach predication – floating point unit-Operating Modes –Paging – Multitasking – Exception and Interrupts – Instruction set –addressing modes – Programming the Pentium processor.

UNIT III HIGH PERFORMANCE RISC ARCHITECTURE – ARM 9

Organization of CPU – Bus architecture –Memory management unit - ARM instruction set- Thumb Instruction set- addressing modes – Programming the ARM processor.6

UNIT IV MOTOROLA 68HC11 MICROCONTROLLERS 9

Instruction set addressing modes – operating modes- Interrupt system- RTC-Serial Communication Interface – A/D Converter PWM and UART.

UNIT V PIC MICROCONTROLLER 9

CPU Architecture – Instruction set – interrupts- Timers- I2C Interfacing –UART- A/D Converter –PWM and introduction to C-Compilers.

TOTAL: 45 PERIODS

REFERENCES:
1. Daniel Tabak, ‘’Advanced Microprocessors” McGraw Hill.Inc., 1995 (recent edition)
2. James L. Antonakos , “ The Pentium Microprocessor ‘’ Pearson Education , 1997.
3. Steve Furber , ‘’ARM System –On –Chip architecture“ Addision Wesley, 2000.
4. Gene .H.Miller.” Micro Computer Engineering,” Pearson Education, 2003.
5. John .B.Peatman , “ Design with PIC Microcontroller , Prentice hall, 1997.
6. James L.Antonakos ,” An Introduction to the Intel family of Microprocessors ‘’ Pearson Education 1999.
7. Barry.B.Breg,” The Intel Microprocessors Architecture, Programming and Interfacing “ , PHI,2002.
8. Valvano "Embedded Microcomputer Systems" Thomson Asia PVT LTD first reprint 2001.

VL7001 ANALOG AND MIXED MODE VLSI DESIGN L T P C
3 0 0 3

OBJECTIVES:
- To study the concepts of MOS large signal model and small signal model
- To understand the concepts of D/A conversion methods and their architectures.
- To design filters for ADC.
- To study about the switched capacitor circuits.

UNIT I INTRODUCTION AND BASIC MOS DEVICES 9

Challenges in analog design-Mixed signal layout issues- MOS FET structures and characteristics-large signal model – small signal model- single stage Amplifier-Source follower- Common gate stage – Cascode Stage

UNIT II SIBMICRON CIRCUIT DESIGN 9

Submicron CMOS process flow, Capacitors and resistors, Current mirrors, Digital Circuit Design, Delay Elements – Adders- OP Amp parameters and Design

UNIT III DATA CONVERTERS 9

Characteristics of Sample and Hold- Digital to Analog Converters- architecture-Differential Non linearity-Integral Non linearity- Voltage Scaling-Cyclic DAC-Pipeline DAC-Analog to Digital Converters- architecture – Flash ADC-Pipeline ADC-Differential Non linearity-Integral Non linearity

UNIT IV SNR IN DATA CONVERTERS 9

Overview of SNR of Data Converters- Clock Jitters- Improving Using Averaging – Decimating Filters for ADC- Band pass and High Pass Sinc Filters- Interpolating Filters for DAC

UNIT V SWITCHED CAPACITOR CIRCUITS 9

Resistors, First order low pass Circuit, Switched capacitor Amplifier, Switched Capacitor Integrator

TOTAL: 45 PERIODS

REFERENCE BOOKS:

1. Vineetha P.Gejji Analog and Mixed Mode Design **-** Prentice Hall, 1st Edition , 2011
2. JeyaGowri Analog and Mixed Mode Design- Sapna publishing House 2011.

CU7001 REAL TIME EMBEDDED SYSTEMS L T P C
3 0 0 3

UNIT I INTRODUCTION TO EMBEDDED COMPUTING 9

Complex systems and microprocessors – Design example: Model train controller – Embedded system design process – Formalism for system design – Instruction sets Preliminaries – ARM Processor – CPU: Programming input and output – Supervisor mode, exception and traps – Coprocessor – Memory system mechanism – CPU performance – CPU power consumption.

UNIT II COMPUTING PLATFORM AND DESIGN ANALYSIS 9

CPU buses – Memory devices – I/O devices – Component interfacing – Design with microprocessors – Development and Debugging – Program design – Model of programs – Assembly and Linking – Basic compilation techniques – Analysis and optimization of execution time, power, energy, program size – Program validation and testing.

UNIT III PROCESS AND OPERATING SYSTEMS 9

Multiple tasks and multi processes – Processes – Context Switching – Operating Systems – Scheduling policies - Multiprocessor – Inter Process Communication mechanisms – Evaluating operating system performance – Power optimization strategies for processes.

UNIT IV HARDWARE ACCELERATES & NETWORKS 9

Accelerators – Accelerated system design – Distributed Embedded Architecture – Networks for Embedded Systems – Network based design – Internet enabled systems.

UNIT V CASE STUDY 9

Hardware and software co-design - Data Compressor - Software Modem – Personal Digital Assistants – Set–Top–Box. – System-on-Silicon – FOSS Tools for embedded system development.

TOTAL: 45 PERIODS

REFERENCES:

1. Wayne Wolf, “Computers as Components - Principles of Embedded Computer System Design”, Morgan Kaufmann Publisher, 2006.
2. David E-Simon, “An Embedded Software Primer”, Pearson Education, 2007.
3. K.V.K.K.Prasad, “Embedded Real-Time Systems: Concepts, Design & Programming”, dreamtech press, 2005.
4. Tim Wilmshurst, “An Introduction to the Design of Small Scale Embedded Systems”, Pal grave Publisher, 2004.
5. Sriram V Iyer, Pankaj Gupta, “Embedded Real Time Systems Programming”, Tata Mc-Graw Hill, 2004.
6. Tammy Noergaard, “Embedded Systems Architecture”, Elsevier, 2006.

CU7002 MEMS AND NEMS L T P C
3 0 0 3

COURSE OBJECTIVES:

- To introducing the concepts of microelectromechanical devices.
- To know the fabrication process of Microsystems.
- To know the design concepts of micro sensors and micro actuators.
- To introducing concepts of quantum mechanics and nano systems.

UNIT I OVERVIEW AND INTRODUCTION 9

New trends in Engineering and Science: Micro and Nanoscale systems Introduction to Design of MEMS and NEMS, Overview of Nano and Microelectromechanical Systems, Applications of Micro and Nanoelectromechanical systems, Microelectromechanical systems, devices and structures Definitions, Materials for MEMS: Silicon, silicon compounds, polymers, metals

UNIT II MEMS FABRICATION TECHNOLOGIES 9

Microsystem fabrication processes: Photolithography, Ion Implantation, Diffusion, Oxidation.Thin film depositions: LPCVD, Sputtering, Evaporation, Electroplating; Etching techniques: Dry and wet etching, electrochemical etching; Micromachining: Bulk Micromachining, Surface Micromachining, High Aspect-Ratio (LIGA and LIGA-like) Technology; Packaging: Microsystems packaging, Essential packaging technologies, Selection of packaging materials

UNIT III MICRO SENSORS 9

MEMS Sensors: Design of Acoustic wave sensors, resonant sensor, Vibratory gyroscope, Capacitive and Piezo Resistive Pressure sensors- engineering mechanics behind these Microsensors. Case study: Piezo-resistive pressure sensor

UNIT IV MICRO ACTUATORS 9

Design of Actuators: Actuation using thermal forces, Actuation using shape memory Alloys, Actuation using piezoelectric crystals, Actuation using Electrostatic forces (Parallel plate, Torsion bar, Comb drive actuators), Micromechanical Motors and pumps. Case study: Comb drive actuators

UNIT V NANOSYSTEMS AND QUANTUM MECHANICS 9

Atomic Structures and Quantum Mechanics, Molecular and Nanostructure Dynamics: Shrodinger Equation and Wavefunction Theory, Density Functional Theory, Nanostructures and Molecular Dynamics, Electromagnetic Fields and their quantization, Molecular Wires and Molecular Circuits

TOTAL:45 PERIODS

REFERENCES:

1. Marc Madou, “Fundamentals of Microfabrication”, CRC press 1997.
2. Stephen D. Senturia,” Micro system Design”, Kluwer Academic Publishers,2001
3. Tai Ran Hsu ,”MEMS and Microsystems Design and Manufacture” ,Tata Mcraw Hill, 2002.
4. Chang Liu, “Foundations of MEMS”, Pearson education India limited, 2006,
5. Sergey Edward Lyshevski, “MEMS and NEMS: Systems, Devices, and Structures” CRC Press, 2002

AP7202 ASIC AND FPGA DESIGN L T P C
3 0 0 3

OBJECTIVES:

- To study the design flow of different types of ASIC.
- To familiarize the different types of programming technologies and logic devices.
- To learn the architecture of different types of FPGA.
- To gain knowledge about partitioning, floor planning, placement and routing including circuit extraction of ASIC
- To analyse the synthesis, Simulation and testing of systems.
- To understand the design issues of SOC.
- To know about different high performance algorithms and its applications in ASICs.

UNIT I OVERVIEW OF ASIC AND PLD 9

Types of ASICs - Design flow – CAD tools used in ASIC Design – Programming Technologies: Antifuse – static RAM – EPROM and EEPROM technology, Programmable Logic Devices : ROMs and EPROMs – PLA –PAL. Gate Arrays – CPLDs and FPGAs

UNIT II ASIC PHYSICAL DESIGN 9

System partition -partitioning - partitioning methods – interconnect delay models and measurement of delay - floor planning - placement – Routing : global routing - detailed routing - special routing - circuit extraction - DRC

UNIT III LOGIC SYNTHESIS, SIMULATION AND TESTING 9

Design systems - Logic Synthesis - Half gate ASIC -Schematic entry - Low level design language - PLA tools -EDIF- CFI design representation. Verilog and logic synthesis -VHDL and logic synthesis - types of simulation -boundary scan test - fault simulation - automatic test pattern generation.

UNIT IV FPGA 9

Field Programmable gate arrays- Logic blocks, routing architecture, Design flow technology - mapping for FPGAs, Xilinx XC4000 - ALTERA's FLEX 8000/10000, ACTEL's ACT-1,2,3 and their speed performance

Case studies: Altera MAX 5000 and 7000 - Altera MAX 9000 – Spartan II and Virtex II FPGAs - Apex and Cyclone FPGAs

UNIT V SOC DESIGN 9

Design Methodologies – Processes and Flows - Embedded software development for SOC – Techniques for SOC Testing – Configurable SOC – Hardware / Software codesign Case studies: Digital camera, Bluetooth radio / modem, SDRAM and USB

TOTAL: 45 PERIODS

REFERENCES:

1. M.J.S .Smith, "Application Specific Integrated Circuits, Addison -Wesley Longman Inc., 1997
2. S. Trimberger, Field Programmable Gate Array Technology, Edr, Kluwer Academic Publications, 1994.
3. John V.Oldfield, Richard C Dore, Field Programmable Gate Arrays, Wiley Publications 1995.
4. P.K.Chan & S. Mourad, Digital Design Using Field Programmable Gate Array, Prentice Hall, 1994.
5. Parag.K.Lala, Digital System Design using Programmable Logic Devices , BSP, 2003.
6. S. Brown, R. Francis, J. Rose, Z. Vransic, Field Programmable Gate Array, Kluwer Pubin, 1992.
7. J. Old Field, R.Dorf, Field Programmable Gate Arrays, John Wiley & Sons, Newyork, 1995.
8. Farzad Nekoogar and Faranak Nekoogar, From ASICs to SOCs: A Practical Approach, Prentice Hall PTR, 2003.
9. Wayne Wolf, FPGA-Based System Design, Prentice Hall PTR, 2004.
10. R. Rajsuman, System-on-a-Chip Design and Test. Santa Clara, CA: Artech House Publishers, 2000.
11. F. Nekoogar. Timing Verification of Application-Specific Integrated Circuits (ASICs). Prentice Hall PTR, 1999.

NC7102 COMMUNICATION NETWORK MODELING AND SIMULATION L T P C

3 0 0 3

UNIT I INTRODUCTION TO MODELING AND SIMULATION 9

Introduction, Discrete-event Simulation, Modeling for Computer Simulation, Tools and Methods for Network Simulation, The Simulation Platform, Simulation Framework, Tools and Modeling Approaches for Simulating Hardware.

UNIT II MONTE CARLO SIMULATION 9

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

UNIT III LOWER LAYER & LINK LAYER WIRELESS MODELING 9

Physical Layer Modeling, Description of the Main Components of the PHY Layer, Accurate Simulation of Physical Layers, Physical Layer Modeling for Network Simulations, Link Layer Modeling, Medium Access Control (MAC) Protocols, Logical Link Control, Forward Error Detection and Correction, Backward Error Detection and Correction, Queueing and Processing Delay.

UNIT IV CHANNEL MODELING & MOBILITY MODELING 9

Channel Modeling :The Physics of Radiation, The Nature of Electromagnetic Radiation, Classification of Propagation Models, Deterministic Approaches by Classical Field Theory, Deterministic Geometric Optical Approaches, Empirical Path Loss Approaches, Stochastic Shadowing Models, Stochastic Fading Models, MIMO Channel Models.

Mobility modeling :Categorization of Mobility Models, Mobility Models, Random Walk Model, Random Waypoint Model, Random Direction Model, Gauss-Markov Model, Manhattan Model, Column Model , Pursue Model, Nomadic Community Model, Selection of Appropriate Mobility Models.

UNIT V HIGHER LAYER MODELING & MODELING THE NETWORK TOPOLOGY 9

Higher Layer Modeling :Modeling the Network Layer and Routing Protocols, Components of a Routing Protocol, Metrics, Virtual Routing on Overlays, Modeling Transport Layer Protocols, Modeling Application Traffic.

Modeling the Network Topology : Abstraction of Network Topologies by Graphs, Characterizing Graphs, Common Topology Models, Geometric Random Graphs – The Waxman Model, Hierarchical Topologies, Preferential Linking – The Barabási-Albert Model , Modeling the Internet.

TOTAL: 45 PERIODS

REFERENCES:

1. K.Wehrie. Gunes, J.Gross, “Modeling and Tools for Network simulation”, Springer, 2010.
2. Irene Karzela, “Modeling and Simulating Communications Networks”, Prentice Hall India, 1998,
3. William.H.Tranter, K. Sam Shanmugam, Theodore. S. Rappaport, Kurt L. Kosbar, “Principles of Communication Systems Simulation”, Pearson Education (Singapore) Pvt. Ltd, 2004.
4. M.C. Jeruchim, P.Balaban and K. Sam Shanmugam, “Simulation of Communication Systems: Modeling, Methodology and Techniques”, Plenum Press, New York, 2001.
5. Nejat; Bragg, Arnold, “Recent Advances in Modeling and Simulation Tools for Communication Networks and Services”, Springer, 2007

CU7003 DIGITAL COMMUNICATION RECEIVERS L T P C
3 0 0 3

UNIT I REVIEW OF DIGITAL COMMUNICATION TECHNIQUES 9

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

UNIT II OPTIMUM RECEIVERS FOR AWGN CHANNEL 9

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

UNIT III RECEIVERS FOR FADING CHANNELS 9

Characterization of fading multiple channels, statistical models, flat and frequency selective fading, diversity technique, Optimal receivers for data detection and synchronization parameter estimation, coded waveform for fading channel.

UNIT IV SYNCHRONIZATION TECHNIQUES 9

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

UNIT V ADAPTIVE EQUALIZATION 9

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

TOTAL : 45 PERIODS

REFERENCES:

1. Heinrich Meyer, Mare Moeneclacy, Stefan.A.Fechtel, " Digital communication receivers ", Vol I & Vol II, John Wiley, New York, 1997.
2. U.Mengali & A.N.D'Andrea, Synchronization Techniques for Digital Receivers, Kluwer, 1997.
3. John.G.Proakis, "Digital communication "4th Edition, McGraw-Hill, New York, 2001.
4. E.A.Lee and D.G. Messerschmitt, "Digital communication ", 2nd Edition, Allied Publishers, New Delhi, 1994.
5. Simon Marvin, "Digital communication over fading channel; An unified approach to performance Analysis ", John Wiley, New York, 2000.
6. H.Meyr & G.Ascheid, Synchronization in Digital Communications, John Wiley, 1990.
7. R. G. Gallager, Principles of Digital Communication, Cambridge University Press, 2008.

CU7004 DETECTION AND ESTIMATION THEORY L T P C

3 0 0 3

COURSE OBJECTIVES:

- To enable the student to understand the basic principles of random signal processing , spectral estimation methods and their applications.
- To enable the student to understand the different signal detection and estimation methods used in communication system design and the implications of proper synchronization methods for proper functioning of the system.

UNIT I DISCRETE RANDOM SIGNAL PROCESSING 9

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

UNIT II SPECTRAL ESTIMATION 9

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

UNIT III DETECTION AND ESTIMATION CRITERIA 9

Detection criteria : Bayes detection techniques, MAP, ML,– detection of M-ary signals, Neyman Peason, minimax decision criteria. Estimation: linear estimators, non-linear estimators, Bayes, MAP,ML, properties of estimators, phase and amplitude estimation.

UNIT IV SYNCHRONIZATION 9

Signal parameter estimation, carrier phase estimation, symbol timing estimator, joint estimation of carrier phase and symbol timing.

UNIT V RECEIVERS FOR AWGN AND FADING CHANNELS 9

Optimum receivers for AWGN channel -Correlation demodulator, matched filter, maximum likelihood sequence detector, envelope detectors for M-ary signals; Characterization of fading multipath channels, RAKE demodulator, Multiuser detection techniques.

TOTAL: 45 PERIODS

REFERENCES:

1. Monson H. Hayes, 'Statistical Digital Signal Processing and Modeling", John Wiley and Sons, Inc, Singapore, 2002
2. John J. Proakis, Dimitris G. Manolakis, : Digital Signal Processing', Pearson Education, 2002.
3. John G. Proakis., 'Digital Communication', 4 th edition, Mc Graw Hill Publication, 2001.
4. Bernard Sklar and Pabitra Kumar Roy, Digital Communications: Fundamentals & Applications, 2/E, Pearson Education India, 2009
5. John G. Proakis, Masoud Salehi, "Communication Systems Engineering", Prentice Hall, 1994.

COURSE OUTCOMES:

- The student would be able to demonstrate an understanding of the basic principles of random signal processing, spectral estimation methods and their applications.
- The student would be able to demonstrate an understanding of the different signal detection and estimation methods used in communication system design and the implications of proper synchronization methods for proper functioning of the system.
- The student would be in a position to apply his knowledge for designing a baseband system addressing the channel impairments.
- Heinrich Meyer, Mare Moeneclacy, Stefan.A.Fechtel, " Digital communication receivers ", Vol I & Vol II, John Wiley, New York, 1997.
- Sergio Verdu, "Multiuser Detection", Cambridge University Press, 1998.

VL7013 VLSI FOR WIRELESS COMMUNICATION L T P C
3 0 0 3

OBJECTIVES:

- To study the design concepts of low noise amplifiers.
- To study the various types of mixers designed for wireless communication.
- To study and design PLL and VCO.
- To understand the concepts of CDMA in wireless communication.

UNIT I COMPONENTS AND DEVICES 9

Integrated inductors, resistors, MOSFET and BJT AMPLIFIER DESIGN: Low Noise Amplifier Design - Wideband LNA - Design Narrowband LNA - Impedance Matching - Automatic Gain Control Amplifiers – Power Amplifiers

UNIT II MIXERS 9

Balancing Mixer - Qualitative Description of the Gilbert Mixer - Conversion Gain – Distortion - Low Frequency Case: Analysis of Gilbert Mixer – Distortion - High-Frequency Case – Noise - A Complete Active Mixer. Switching Mixer - Distortion in Unbalanced Switching Mixer - Conversion Gain in Unbalanced Switching Mixer - Noise in Unbalanced Switching Mixer - A Practical Unbalanced Switching Mixer. Sampling Mixer - Conversion Gain in Single Ended Sampling Mixer - Distortion in Single Ended Sampling Mixer - Intrinsic Noise in Single Ended Sampling Mixer - Extrinsic Noise in Single Ended Sampling Mixer.

UNIT III FREQUENCY SYNTHESIZERS 9

Phase Locked Loops - Voltage Controlled Oscillators - Phase Detector – Analog Phase Detectors – Digital Phase Detectors - Frequency Dividers - LC Oscillators - Ring Oscillators - Phase Noise - A Complete Synthesizer Design Example (DECT Application).

UNIT IV SUB SYSTEMS 9

Data converters in communications, adaptive Filters, equalizers and transceivers

UNIT V IMPLEMENTATIONS 9

VLSI architecture for Multitier Wireless System - Hardware Design Issues for a Next generation CDMA System .

TOTAL : 45 PERIODS

REFERENCES:

1. B.Razavi ,"RF Microelectronics" , Prentice-Hall ,1998.
2. Bosco H Leung "VLSI for Wireless Communication", Pearson Education, 2002.
3. Thomas H.Lee, "The Design of CMOS Radio –Frequency Integrated Circuits', Cambridge University Press ,2003.
4. Emad N Farag and Mohamed I Elmasry, "Mixed Signal VLSI Wireless Design - Circuits and Systems", Kluwer Academic Publishers, 2000.
5. Behzad Razavi, "Design of Analog CMOS Integrated Circuits" McGraw-Hill, 1999.
6. J. Crols and M. Steyaert, "CMOS Wireless Transceiver Design," Boston, Kluwer Academic Pub., 1997.

CU7005 COGNITIVE RADIO L T P C
3 0 0 3

COURSE OBJECTIVES:

1. To enable the student to understand the evolving paradigm of cognitive radio communication and the enabling technologies for its implementation.
2. To enable the student to understand the essential functionalities and requirements in designing software defined radios and their usage for cognitive communication.
3. To expose the student to the evolving next generation wireless networks and their associated challenges.

UNIT I INTRODUCTION TO SDR 9

Definitions and potential benefits, software radio architecture evolution – foundations, technology tradeoffs and architecture implications, Antenna for Cognitive Radio.

UNIT II SDR ARCHITECTURE 9

Essential functions of the software radio, architecture goals, quantifying degrees of programmability, top level component topology, computational properties of functional components, interface topologies among plug and play modules, architecture partitions.

UNITIII INTRODUCTION TO COGNITIVE RADIOS 9

Marking radio self-aware, the cognition cycle, organization of congnition tasks, structuring knowledge for cognition tasks, Enabling location and environment awareness in cognitive radios – concepts, architecture, design considerations.

UNIT IV COGNITIVE RADIO ARCHITECTURE 9

Primary Cognitive Radio functions, Behaviors, Components, A–Priori Knowledge taxonomy, observe – phase data structures, Radio procedure knowledge encapsulation, components of orient, plan, decide phases, act phase knowledge representation, design rules.

UNIT V NEXT GENERATION WIRELESS NETWORKS 9

The XG Network architecture, spectrum sensing, spectrum management, spectrum mobility, spectrum sharing, upper layer issues, cross – layer design.

TOTAL: 45 PERIODS

REFERENCES:

1. Alexander M. Wyglinski, Maziar Nekovee, And Y. Thomas Hou, " Cognitive Radio Communications And Networks - Principles And Practice", Elsevier Inc. , 2010.
2. "E. Biglieri, A.J. Goldsmith., L.J. Greenstein, N.B. Mandayam, H.V. Poor, Principles of Cognitive Radio", Cambridge University Press, 2013.

3. Kwang-Cheng Chen and Ramjee Prasad, " Cognitive Radio Networks" , John Wiley & Sons, Ltd, 2009.
4. Khattab, Ahmed, Perkins, Dmitri, Bayoumi, Magdy, "Cognitive Radio Networks - From Theory to Practice", Springer Series: Analog Circuits and Signal Processing, 2009.
5. J. Mitola, " Cognitive Radio: An Integrated Agent Architecture for software defined radio", Doctor of Technology thesis, Royal Inst. Technology, Sweden 2000.
6. Simon Haykin, "Cognitive Radio: Brain –empowered wireless communications", IEEE Journal on selected areas in communications, Feb 2005.
7. Ian F. Akyildiz, Won – Yeol Lee, Mehmet C. Vuran, Shantidev Mohanty, " NeXt generation /dynamic spectrum access / cognitive radio wireless networks: A Survey Elsevier Computer Networks, May 2006.

COURSE OUTCOMES:

1. The student would be able to appreciate the motivation and the necessity for cognitive radio communication strategies.
2. The student would be able to evolve new techniques and demonstrate their feasibility using mathematical validations and simulation tools.
3. The student would be able to demonstrate the impact of the evolved solutions in future wireless network design.

DS7071 SPEECH AND AUDIO SIGNAL PROCESSING L T P C
3 0 0 3

COURSE OBJECTIVES:

1. To study the basic concepts of speech and audio.
2. To study the analysis of various M-band filter banks for audio coding
3. To learn various transform coders for audio coding.
4. To study the speech processing methods in time and frequency domain

UNIT I MECHANICS OF SPEECH AND AUDIO 9

Introduction - Review Of Signal Processing Theory-Speech production mechanism – Nature of Speech signal – Discrete time modelling of Speech production – Classification of Speech sounds – Phones – Phonemes – Phonetic and Phonemic alphabets – Articulatory features.

Absolute Threshold of Hearing - Critical Bands- Simultaneous Masking, Masking-Asymmetry, and the Spread of Masking- Nonsimultaneous Masking - Perceptual Entropy - Basic measuring philosophy -Subjective versus objective perceptual testing - The perceptual audio quality measure (PAQM) - Cognitive effects in judging audio quality.

UNIT II TIME-FREQUENCY ANALYSIS: FILTER BANKS AND TRANSFORMS 9

Introduction -Analysis-Synthesis Framework for M-band Filter Banks- Filter Banks for Audio Coding: Design Considerations - Quadrature Mirror and Conjugate Quadrature Filters- Tree-Structured QMF and CQF M-band Banks - Cosine Modulated "Pseudo QMF" M-band Banks - Cosine Modulated Perfect Reconstruction (PR) M-band Banksand the Modified Discrete Cosine Transform (MDCT) - Discrete Fourier and Discrete Cosine Transform - Pre-echo Distortion- Pre-echo Control Strategies.

UNIT III AUDIO CODING AND TRANSFORM CODERS 9

Lossless Audio Coding-Lossy Audio Coding- ISO-MPEG-1A,2A,2A Advaned , 4AudioCoding - Optimum Coding in the Frequency Domain - Perceptual Transform Coder -Brandenburg-Johnston Hybrid Coder - CNET Coders - Adaptive Spectral Entropy Coding -Differential Perceptual Audio Coder - DFT Noise Substitution -DCT with Vector Quantization -MDCT with Vector Quantization.

UNIT IV TIME AND FREQUENCY DOMAIN METHODS FOR SPEECH PROCESSING **9**

Time domain parameters of Speech signal – Methods for extracting the parameters :Energy, Average Magnitude – Zero crossing Rate – Silence Discrimination using ZCRand energy

Short Time Fourier analysis – Formant extraction – Pitch Extraction using time and frequency domain methods

HOMOMORPHIC SPEECH ANALYSIS:

Cepstral analysis of Speech – Formant and Pitch Estimation – Homomorphic Vocoders.

UNIT V LINEAR PREDICTIVE ANALYSIS OF SPEECH **9**

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.

TOTAL: 45 PERIODS

REFERENCES

1. Digital Audio Signal Processing, Second Edition, Udo Zölzer**,** A John Wiley& sons Ltd Publicatioons
2. Applications of Digital Signal Processing to Audio And Acoustics Mark Kahrs, Karlheinz Brandenburg, KLUWER ACADEMIC PUBLISHERS NEW YORK, BOSTON, DORDRECHT, L ONDON , MOSCOW
3. Digital Processing of Speech signals – L.R.Rabiner and R.W.Schaffer - Prentice Hall --1978

DS7201 ADVANCED DIGITAL IMAGE PROCESSING **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To understand the image fundamentals and mathematical transforms necessary for image processing and to study the image enhancement techniques.
- To understand the image segmentation and representation techniques.
- To understand how image are analyzed to extract features of interest.
- To introduce the concepts of image registration and image fusion.
- To analyze the constraints in image processing when dealing with 3D data sets.

UNIT I FUNDAMENTALS OF DIGITAL IMAGE PROCESSING **9**

Elements of visual perception, brightness, contrast, hue, saturation, mach band effect, 2D image transforms-DFT, DCT, KLT, and SVD. Image enhancement in spatial and frequency domain, Review of morphological image processing

UNIT II SEGMENTATION **9**

Edge detection, Thresholding, Region growing, Fuzzy clustering, Watershed algorithm, Active contour methods, Texture feature based segmentation, Model based segmentation, Atlas based segmentation, Wavelet based Segmentation methods

UNIT III FEATURE EXTRACTION **9**

First and second order edge detection operators, Phase congruency, Localized feature extraction-detecting image curvature, shape features Hough transform, shape skeletonization, Boundary descriptors, Moments, Texture descriptors- Autocorrelation, Co-occurrence features, Runlength features, Fractal model based features, Gabor filter, wavelet features.

UNIT IV REGISTRATION AND IMAGE FUSION 9

Registration- Preprocessing, Feature selection-points, lines, regions and templates Feature correspondence-Point pattern matching, Line matching, region matching Template matching. Transformation functions-Similarity transformationand Affine Transformation. Resampling- Nearest Neighbour and Cubic Splines

Image Fusion-Overview of image fusion, pixel fusion, Multiresolution based fusiondiscrete wavelet transform, Curvelet transform. Region based fusion.

UNIT V 3D IMAGE VISUALIZATION 9

Sources of 3D Data sets, Slicing the Data set, Arbitrary section planes, The use of color, Volumetric display, Stereo Viewing, Ray tracing, Reflection, Surfaces, Multiply connected surfaces, Image processing in 3D, Measurements on 3D images.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- To understand image formation and the role human visual system plays in perception of gray and color image data.
- To apply image processing techniques in both the spatial and frequency (Fourier) domains.
- To design image analysis techniques in the form of image segmentation and to evaluate the methodologies for segmentation.
- To conduct independent study and analysis of feature extraction techniques.
- To understand the concepts of image registration and image fusion.
- To analyze the constraints in image processing when dealing with 3D data sets and to apply image processing algorithms in practical applications.

TEXT BOOKS:

1. John C.Russ, “The Image Processing Handbook”, CRC Press,2007.
2. Mark Nixon, Alberto Aguado, “Feature Extraction and Image Processing”, Academic Press, 2008.
3. Ardeshir Goshtasby, “ 2D and 3D Image registration for Medical, Remote Sensing and Industrial Applications”,John Wiley and Sons,2005.

REFERENCE BOOKS:

1. Rafael C. Gonzalez, Richard E. Woods, , Digital Image Processing', Pearson,Education, Inc., Second Edition, 2004.
2. Anil K. Jain, , Fundamentals of Digital Image Processing', Pearson Education,Inc., 2002.
3. Rick S.Blum, Zheng Liu,“ Multisensor image fusion and its Applications“,Taylor& Francis,2006.

DS7202 RADAR SIGNAL PROCESSING L T P C
3 0 0 3

COURSE OBJECTIVES:

- To understand the Radar Signal acquisition and sampling in multiple domains
- To provide clear instruction in radar DSP basics
- To equip the skills needed in both design and analysis of common radar algorithms
- To understand the basics of synthetic aperture imaging and adaptive array processing
- To illustrate how theoretical results are derived and applied in practice

UNIT I INTRODUCTION TO RADAR SYSTEMS 9

History and application of radar, basic radar function, elements of pulsed radar, review of signal processing concepts and operations, A preview of basic radar signal processing, radar system components, advanced radar signal processing

UNIT II SIGNAL MODELS 9

Components of a radar signal, amplitude models, types of clutters, noise model and signal-to-noise ratio, jamming, frequency models: the doppler shift, spatial models, spectral model

UNIT III SAMPLING AND QUANTIZATION OF PULSED RADAR SIGNALS 9

Domains and criteria for sampling radar signals, Sampling in the fast time dimension,Sampling in slow time: selecting the pulse repetition interval, sampling the doppler spectrum,Sampling in the spatial and angle dimension, Quantization, I/Q Imbalance and Digital I/Q

UNIT IV RADAR WAVEFORMS 9

Introduction, The waveform matched filter, Matched filtering of moving targets, The ambiguity function, The pulse burst waveform, frequency-modulated pulse compression waveforms, Range sidelobe control for FM waveforms, the stepped frequency waveform, Phase-modulated pulse compression waveforms, COSTAS Frequency Codes.

UNIT V DOPPLER PROCESSING 9

Alternate forms of the Doppler spectrum, Moving target indication (MTI), Pulse Doppler processing, dwell-to-dwell stagger, Pulse pair processing, additional Doppler processing issues, clutter mapping and the moving target detector, MTI for moving platforms: adaptive displaced phase center antenna processing

TOTAL : 45 PERIODS

REFERENCE BOOKS:

1. Fundamentals of Radar Signal Processing, Mark A. Richards McGraw-Hill, New York, 2005
2. Principles of Radar and Sonar Signal Processing, Francois Le Chevalier, Artech House
3. Radar systems, Peak Detection and Tracking, Michael O Kolawole ,2010,Elseveir
4. Introduction To Radar Systems 3/E, Skolnik, McGraw Hill.
5. Radar Principles, Peyton Z. Peebles, 2009 Wiley India
6. Radar Design Principles-Signal Processing and the environment, Fred E. Nathanson, PHI

CP7008 SPEECH PROCESSING AND SYNTHESIS L T P C
3 0 0 3

COURSE OBJECTIVES:

- To understand the mathematical foundations needed for speech processing
- To understand the basic concepts and algorithms of speech processing and synthesis
- To familiarize the students with the various speech signal representation, coding and recognition techniques
- To appreciate the use of speech processing in current technologies and to expose the students to real– world applications of speech processing

UNIT I FUNDAMENTALS OF SPEECH PROCESSING 9

Introduction – Spoken Language Structure – Phonetics and Phonology – Syllables and Words – Syntax and Semantics – Probability, Statistics and Information Theory – Probability Theory – Estimation Theory – Significance Testing – Information Theory.

UNIT II SPEECH SIGNAL REPRESENTATIONS AND CODING 9

Overview of Digital Signal Processing – Speech Signal Representations – Short time Fourier Analysis – Acoustic Model of Speech Production – Linear Predictive Coding – Cepstral Processing – Formant Frequencies – The Role of Pitch – Speech Coding – LPC Coder.

UNITIII SPEECH RECOGNITION 9

Hidden Markov Models – Definition – Continuous and Discontinuous HMMs – Practical Issues – Limitations. Acoustic Modeling – Variability in the Speech Signal – Extracting Features – Phonetic Modeling – Adaptive Techniques – Confidence Measures – Other Techniques.

UNITIV TEXT ANALYSIS **9**

Lexicon – Document Structure Detection – Text Normalization – Linguistic Analysis – Homograph Disambiguation – Morphological Analysis – Letter-to-sound Conversion – Prosody – Generation schematic – Speaking Style – Symbolic Prosody – Duration Assignment – Pitch Generation

UNIT V SPEECH SYNTHESIS **9**

Attributes – Formant Speech Synthesis – Concatenative Speech Synthesis – Prosodic Modification of Speech – Source-filter Models for Prosody Modification – Evaluation of TTS Systems.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- Identify the various temporal, spectral and cepstral features required for identifying speech units – phoneme, syllable and word
- Determine and apply Mel-frequency cepstral coefficients for processing all types of signals
- Justify the use of formant and concatenative approaches to speech synthesis
- Identify the apt approach of speech synthesis depending on the language to be processed
- Determine the various encoding techniques for representing speech.

REFERENCES:

1. Xuedong Huang, Alex Acero, Hsiao-Wuen Hon, “Spoken Language Processing – A guide to Theory, Algorithm and System Development”, Prentice Hall PTR, 2001.
2. Thomas F.Quatieri, “Discrete-Time Speech Signal Processing”, Pearson Education, 2002.
3. Lawrence Rabiner and Biing-Hwang Juang, “Fundamentals of Speech Recognition”, Prentice Hall Signal Processing Series, 1993.
4. Sadaoki Furui, “Digital Speech Processing: Synthesis, and Recognition, Second Edition, (Signal Processing and Communications)”, Marcel Dekker, 2000.
5. Joseph Mariani, “Language and Speech Processing”, Wiley, 2009.

CU7006 WAVELET TRANSFORMS AND APPLICATIONS **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To study the basics of signal representation and Fourier theory
- To understand Multi Resolution Analysis and Wavelet concepts
- To study the wavelet transform in both continuous and discrete domain
- To understand the design of wavelets using Lifting scheme
- To understand the applications of Wavelet transform

UNIT I FUNDAMENTALS **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- Fourier Theory: Fourier series expansion, Fourier transform, Short time Fourier transform, Time-frequency analysis.

UNIT II MULTI RESOLUTION ANALYSIS **9**

Definition of Multi Resolution Analysis (MRA) – Haar Basis – Construction of General Orthonormal MRA – Wavelet Basis for MRA – Continuous Time MRA Interpretation for the DTWT – Discrete Time MRA – Basis Functions for the DTWT – PRQMF Filter Banks.

UNIT III CONTINUOUS WAVELET TRANSFORMS 9

Wavelet Transform – Definition and Properties – Concept of Scale and its Relation with Frequency – Continuous Wavelet Transform (CWT) – Scaling Function and Wavelet Functions (Daubechies Coiflet, Mexican Hat, Sinc, Gaussian, Bi Orthogonal)– Tiling of Time – Scale Plane for CWT.

UNIT IV DISCRETE WAVELET TRANSFORM 9

Filter Bank and Sub Band Coding Principles – Wavelet Filters – Inverse DWT Computation by Filter Banks – Basic Properties of Filter Coefficients – Choice of Wavelet Function Coefficients – Derivations of Daubechies Wavelets – Mallat's Algorithm for DWT – Multi Band Wavelet Transforms Lifting Scheme- Wavelet Transform Using Polyphase Matrix Factorization – Geometrical Foundations of Lifting Scheme – Lifting Scheme in Z –Domain.

UNIT V APPLICATIONS 9

Wavelet methods for signal processing- 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.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

- Use Fourier tools to analyse signals
- Gain knowledge about MRA and representation using wavelet bases
- Acquire knowledge about various wavelet transforms and design wavelet transform
- Apply wavelet transform for various signal & image processing applications

TEXT BOOKS:

1. Rao R M and A S Bopardikar, —Wavelet Transforms Introduction to theory and Applications, Pearson Education, Asia, 2000.
2. L.Prasad & S.S.Iyengar, Wavelet Analysis with Applications to Image Processing, CRC Press, 1997.

REFERENCE BOOKS:

1. J. C. Goswami and A. K. Chan, “Fundamentals of wavelets: Theory, Algorithms and Applications" WileyInterscience Publication,John Wiley & Sons Inc., 1999.
2. M. Vetterli, J. Kovacevic, “Wavelets and subband coding" Prentice Hall Inc, 1995.
3. Stephen G. Mallat, “A wavelet tour of signal processing" 2 nd Edition Academic Press, 2000.
4. Soman K P and Ramachandran K I, —Insight into Wavelets From Theory to practice□, Prentice Hall, 2004.

DS7101 DSP PROCESSOR ARCHITECTURE AND PROGRAMMING L T P C
3 0 0 3

COURSE OBJECTIVES:

The objective of this course is to provide in-depth knowledge on

- Digital Signal Processor basics
- Third generation DSP Architecture and programming skills
- Advanced DSP architectures and some applications.

COURSE OUTCOMES:

Students should be able to:

- Become Digital Signal Processor specialized engineer
- DSP based System Developer

UNIT I FUNDAMENTALS OF PROGRAMMABLE DSPs 9

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

UNIT II TMS320C5X PROCESSOR 9

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

UNIT III TMS320C6X PROCESSOR 9

Architecture of the C6x Processor - Instruction Set - DSP Development System: Introduction – DSP Starter Kit Support Tools- Code Composer Studio - Support Files - Programming Examples to Test the DSK Tools – Application Programs for processing real time signals.

UNIT IV ADSP PROCESSORS 9

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

UNIT V ADVANCED PROCESSORS 9

Architecture of TMS320C54X: Pipe line operation, Code Composer studio – Architecture of TMS320C6X - Architecture of Motorola DSP563XX – Comparison of the features of DSP family processors.

TOTAL: 45 PERIODS

REFERENCES:

1. B.Venkataramani and M.Bhaskar, “Digital Signal Processors – Architecture, Programming and Applications” – Tata McGraw – Hill Publishing Company Limited. New Delhi, 2003.
2. Avtar Singh and S. Srinivasan, Digital Signal Processing – Implementations using DSP Microprocessors with Examples from TMS320C54xx, cengage Learning India Private Limited, Delhi 2012
3. User guides Texas Instrumentation, Analog Devices, Motorola.
4. Rulph Chassaing, Digital Signal Processing and Applications with the C6713 and C6416 DSK, A JOHN WILEY & SONS, INC., PUBLICATION, 2005

NC7101 HIGH PERFORMANCE NETWORKS L T P C
3 0 0 3

COURSE OBJECTIVES:

- To develop a comprehensive understanding of multimedia networking.
- To study the types of VPN and tunneling protocols for security.
- To learn about network security in many layers and network management.

UNIT I INTRODUCTION 9

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

UNIT II MULTIMEDIA NETWORKING APPLICATIONS 9

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

UNIT III ADVANCED NETWORKS CONCEPTS 9

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 8

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

UNIT V NETWORK SECURITY AND MANAGEMENT 10

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

TOTAL: 45 PERIODS

REFERENCES:

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

CP7023 RECONFIGURABLE COMPUTING L T P C

3 0 0 3

COURSE OBJECTIVES

- To understand the need for reconfigurable computing
- To expose the students to various device architectures
- To examine the various reconfigurable computing systems
- To understand the different types of compute models for programming reconfigurable architectures
- To expose the students to HDL programming and familiarize with the development environment
- To expose the students to the various placement and routing protocols
- To develop applications with FPGAs

UNIT I DEVICE ARCHITECTURE 9

General Purpose Computing Vs Reconfigurable Computing – Simple Programmable Logic Devices – Complex Programmable Logic Devices – FPGAs – Device Architecture - Case Studies.

UNIT II RECONFIGURABLE COMPUTING ARCHITECTURES AND SYSTEMS 9

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

UNIT III PROGRAMMING RECONFIGURABLE SYSTEMS 9

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

UNIT IV MAPPING DESIGNS TO RECONFIGURABLE PLATFORMS 9

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

UNIT V APPLICATION DEVELOPMENT WITH FPGAS 9

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

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

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

REFERENCES:

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

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

COURSE OBJECTIVES:

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

UNIT I INTRODUCTION 7

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

UNIT II INTERNET ROUTING 10

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

UNIT III ROUTING IN OPTICAL WDM NETWORKS 10

Classification of RWA algorithms, RWA algorithms, Fairness and Admission Control, Distributed Control Protocols, Permanent Routing and Wavelength Requirements, Wavelength Rerouting-Benefits and Issues, Lightpath Migration, Rerouting Schemes, Algorithms- AG, MWPG.

UNIT IV MOBILE - IP NETWORKS 9

Macro-mobility Protocols, Micro-mobility protocol: Tunnel based : Hierarchical Mobile IP, Intra domain Mobility Management, Routing based: Cellular IP, Handoff Wireless Access Internet Infrastructure (HAWAII).

UNIT V MOBILE AD –HOC NETWORKS 9

Internet-based mobile ad-hoc networking communication strategies, Routing algorithms – Proactive routing: destination sequenced Distance Vector Routing (DSDV), Reactive routing: Dynamic Source Routing (DSR), Ad hoc On-Demand Distance Vector Routing (AODV), Hybrid Routing: Zone Based Routing (ZRP).

TOTAL: 45 PERIODS

REFERENCES:

1. William Stallings, ' High speed networks and Internets Performance and Quality of Service', IInd Edition, Pearson Education Asia. Reprint India 2002
2. M. Steen Strub, ' Routing in Communication network, Prentice –Hall International, Newyork,1995.
3. S. Keshav, 'An engineering approach to computer networking' Addison Wesley 1999.
4. William Stallings, 'High speed Networks TCP/IP and ATM Design Principles, Prentice- Hall, New York, 1995
5. C.E Perkins, 'Ad Hoc Networking', Addison – Wesley, 2001
6. Ian F. Akyildiz, Jiang Xie and Shantidev Mohanty, " A Survey of mobility Management in Next generation All IP- Based Wireless Systems", IEEE Wireless Communications Aug.2004, pp 16-27.
7. A.T Campbell et al., " Comparison of IP Micromobility Protocols," IEEE Wireless Communications Feb.2002, pp 72-82.
8. C.Siva Rama Murthy and Mohan Gurusamy, " WDM Optical Networks – Concepts, Design and Algorithms", Prentice Hall of India Pvt. Ltd, New Delhi –2002.

COURSE OUTCOMES:

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

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

UNIT I ADHOC NETWORKS AND ROUTING PROTOCOLS 9

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

UNIT II MULTICAST ROUTING AND SECURITY 9

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

UNIT III QoS AND ENERGY MANAGEMENT 9

Issues and Challenges in Providing QoS in Ad hoc Wireless Networks – Classifications of QoS Solutions – MAC Layer Solutions – Network Layer Solutions – QoS Frameworks for Ad hoc Wireless Networks Energy Management in Ad hoc Wireless Networks – Introduction – Need for Energy Management in Ad hoc Wireless Networks – Classification of Energy Management Schemes – Battery Management Schemes – Transmission Power Management Schemes – System Power Management Schemes.

UNIT IV SENSOR NETWORKS – ARCHITECTUREAND MACPROTOCOLS 9

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

UNIT V SENSOR NETWORKS – ROUTING PROTOCOLS AND OPERATING SYSTEMS 9

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

TOTAL: 45 PERIODS

REFERENCES

1. C. Siva Ram Murthy and B. S. Manoj, “Ad Hoc Wireless Networks Architectures and Protocols”, Prentice Hall, PTR, 2004.
2. C. K. Toh, “Ad Hoc Mobile Wireless Networks Protocols and Systems”, Prentice Hall, PTR, 2001.
3. Charles E. Perkins, “Ad Hoc Networking”, Addison Wesley, 2000.
4. Kazem Sohraby, Daniel Minoli and Taieb Znati, “ Wireless Sensor Networks Technology-Protocols and Applications”, John Wiley & Sons, 2007.
5. Feng Zhao, Leonidas Guibas, “Wireless Sensor Networks: an information processing approach”, Else vier publication, 2004.
6. C.S.Raghavendra Krishna, M.Sivalingam and Tarib znati, “Wireless Sensor Networks”, Springer publication, 2004.

7. Holger Karl , Andreas willig, “Protocol and Architecture for Wireless Sensor Networks”, John wiley publication, Jan 2006.
8. K.Akkaya and M.Younis, “ A Survey of routing protocols in wireless sensor networks”, Elsevier Adhoc Network Journal, Vol.3, no.3,pp. 325-349, 2005.
9. Philip Levis, “ TinyOS Programming”, 2006 – www.tinyos.net.
10. I.F. Akyildiz, W. Su, Sankarasubramaniam, E. Cayirci, “Wireless sensor networks: a survey”, computer networks, Elsevier, 2002, 394 - 422.
11. Jamal N. Al-karaki, Ahmed E. Kamal, “Routing Techniques in Wireless sensor networks: A survey”, IEEE wireless communication, December 2004, 6 – 28.

CU7007 INTERNETWORKING MULTIMEDIA L T P C
3 0 0 3

UNIT I MULTIMEDIA NETWORKING 9

Digital Sound, Video and Graphics – Basic Multimedia Networking – Multimedia Characteristics – Evolution of Internet Services Model – Network Requirements for Audio/ Video Transform – Multimedia Coding and Compression for Text, Image Audio And Video.

UNIT II BROADBAND NETWORK TECHNOLOGY 9

Broadband Services – ATM and IP, IPV6, High Speed Switching – Resource Reservation, Buffer Management – Traffic Shaping – Caching – Scheduling and Policing, Throughput, Delay and Jitter Performance – Storage and Media Services – Voice and Video Over IP – MPEG–2 over ATM/IP – Indexing Synchronization of Requests – Recording and Remote Control .

UNIT III RELIABLE TRANSPORT PROTOCOL AND APPLICATIONS 9

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

UNIT IV MULTIMEDIA COMMUNICATION STANDARDS 9

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

UNIT V MULTIMEDIA COMMUNICATION ACROSS NETWORKS 9

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

TOTAL: 45 PERIODS

REFERENCES:

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

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

COURSE OBJECTIVES:

To provide in-depth knowledge about

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

COURSE OUTCOMES:

Students will be able to

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

UNIT I INTRODUCTION 9

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

UNIT II TEXT COMPRESSION 9

Compaction techniques – Huffmann coding – Adaptive Huffmann Coding – Arithmatic coding – Shannon-Fano coding – Dictionary techniques – LZW family algorithms.

UNIT III AUDIO COMPRESSION 9

Audio compression techniques - μ- Law and A- Law companding. Speech compression- waveform codecs-source codecs- hybrid codecs-Shorten compressor, Frequency domain and filtering – Basic sub-band coding – Application to speech coding – G.722 –Application to audio coding – MPEG audio, progressive encoding for audio – Silencecompression, speech compression techniques – Formant and CELP Vocoders.

UNIT IV IMAGE COMPRESSION 9

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

UNIT V VIDEO COMPRESSION 9

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

TOTAL: 45 PERIODS

REFERENCES:

1. Khalid Sayood : Introduction to Data Compression, Morgan Kauffman Harcourt India, 2nd Edition, 2000.
2. David Salomon : Data Compression – The Complete Reference, Springer Verlag New York Inc., 2nd Edition, 2001.
3. Yun Q.Shi, Huifang Sun : Image and Video Compression for Multimedia Engineering - Fundamentals, Algorithms & Standards, CRC press, 2003.
4. Peter Symes : Digital Video Compression, McGraw Hill Pub., 2004.
5. Mark Nelson : Data compression, BPB Publishers, New Delhi,1998.
6. Mark S.Drew, Ze-Nian Li : Fundamentals of Multimedia, PHI, 1st Edition, 2003.
7. Watkinson,J : Compression in Video and Audio, Focal press,London.1995.
8. Jan Vozer : Video Compression for Multimedia, AP Profes, NewYork, 1995

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

UNIT I INTRODUCTION TO UWB 9

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

UNIT II UWB TECHNOLOGIES AND CHANNEL MODELS 9

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

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

UNIT III UWB SIGNAL PROCESSING 9

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

UNIT IV UWB ANTENNAS 9

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

UNIT V UWB APPLICATIONS AND REGULATIONS 9

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

REFERENCES:

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

IF7301 SOFT COMPUTING L T P C
3 0 0 3

COURSE OBJECTIVES

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

UNIT I INTRODUCTION TO SOFT COMPUTING 9

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

UNIT II GENETIC ALGORITHMS 9

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

UNIT III NEURAL NETWORKS 9

Machine Learning using Neural Network, Adaptive Networks – Feed Forward Networks – Supervised Learning Neural Networks – Radial Basis Function Networks - Reinforcement Learning – Unsupervised Learning Neural Networks – Adaptive Resonance Architectures – Advances in Neural Networks.

UNIT IV FUZZY LOGIC 9

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

UNIT V NEURO-FUZZY MODELING 9

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

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

REFERENCES:

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

NC7003 **NETWORK PROCESSOR** **L T P C**
3 0 0 3

UNIT I INTRODUCTION **9**

Traditional protocol processing Systems – Network processing Hardware – Basic Packet Processing Algorithms and data Structures - Packet processing functions – Protocol Software – Hardware Architectures for Protocol processing – Classification and Forwarding – Switching Fabrics.

UNIT II NETWORK PROCESSOR TECHNOLOGY **9**

Network Processors: Motivation and purpose - Complexity of Network Processor Design – Network Processor Architectures architectural variety, architectural characteristics Peripheral Chips supporting Network Processors: Storage processors, Classification Processors, Search Engines, Switch Fabrics, Traffic Managers.

UNIT III COMMERCIAL NETWORK PROCESSORS **9**

Multi-Chip Pipeline, Augmented RISC processor, Embedded Processor plus Coprocessors, Pipelilne of Flomogeneous processors. Configurable Instruction set processors – Pipeline of Electrogeneous processors – Extensive and Diverse processors – Flexible RISC plus Coprocessors – Scalability issues – Design Tradeuffs and consequences.

UNIT IV NETWORK PROCESSOR: ARCHITECTURE AND PROGRAMMING **9**

Architecture: Intel Network Processor: Multiheaded Architecture Overview – Features- Embedded EISC processor - Packet Processor Hardware – Memory interfaces – System and Control Interface Components – Bus Interface. Programming Software Development Kit-IXP Instruction set – register formats – Micro Engine Programming – Intra thread and Inter-thread communication – thread synchronization – developing sample applications – control plane – ARM programming.

UNIT V IOS TECHNOLOGIES **9**

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

TOTAL: 45PERIODS

REFERENCES:

1. Douglas E.Comer “Networks Systems Design using Network Processors” Prentice Hall JaN. 2003.
2. Panas C. Lekkas, “Network Processors: Architectgures, Protocols and Paradigms Telecom Engineering)”, McGraw Hill, Professional, 2003.
3. Patrick Crowley, M a Eranklin, H. Hadminglu, PZ Onfryk, “Network Processor Design, Issues and Practices Vol-1” Morgan Kaufman, 2002.
4. Patrick Crowley, M a Frankliln, H. Hadimioglyum PZ Onufryk, Network Processor Design, Issues and Prentices vol.II, Morgan Kaufman, 2003.
5. Erik, J.Johnson and Aaron R.Kunze, “IXP2400/2806 Programming: The Microengine Coding Grade” Intel Press.
6. Hill Carlson, “Intel Internet Exchange Architecture & Applications a Practical Guide to Intel’s network Processors” Intel press. www.cisco.com

NE7007 **NETWORK MANAGEMENT** **L T P C**
3 0 0 3

COURSE OBJECTIVES

The objective of this course is to

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

UNIT I FUNDAMENTALS OF COMPUTER NETWORK TECHNOLOGY 9

Network Topology, LAN, Network node components- Hubs, Bridges, Routers, Gateways, Switches, WAN, ISDN Transmission Technology, Communications protocols and standards. Network Management: Goals, Organization, and Functions, Network and System Management, Network Management System Platform, Current Status and future of Network

UNIT II OSI NETWORK MANAGEMENT 9

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

UNIT III INTERNET MANAGEMENT(SNMP) 9

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

UNIT IV BROADBAND NETWORK MANAGEMENT 9

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

UNIT V NETWORK MANAGEMENT APPLICATIONS 9

Configuration management, Fault management, performance management, Event Correlation Techniques security Management, Accounting management, Report Management, Policy Based Management Service Level Management- Network Management Tools, Network Statistics Measurement Systems – Web Based Management, XML Based Network Management - : Future Directions.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

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

REFERENCES:

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

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

UNIT I DATA ENCRYPTION STANDARD 9

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

UNIT II ADVANCED ENCRYPTION STANDARD 9

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

UNIT III PUBLIC KEY ENCRYPTION AND HASH FUNCTIONS 9

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

UNIT IV NETWORK SECURITY PRACTICE 9

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

UNIT V WIRELESS NETWORK SECURITY 9

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

TOTAL: 45 PERIODS

TEXT BOOKS:

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

REFERENCES:

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

CU7009 NEURAL NETWORK AND APPLICATIONS L T P C
3 0 0 3

UNIT I BASIC LEARNING ALGORITHMS 9

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

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

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

SUPPORT VECTOR MACHINES

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

UNIT III COMMITTEE MACHINES 9

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

NEURODYNAMICS SYSTEMS

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

UNIT IV ATTRACTOR NEURAL NETWORKS: 9

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

ADAPTIVE RESONANCE THEORY:

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

UNIT V SELF ORGANISING MAPS: 9

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

PULSED NEURON MODELS:

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

TOTAL: 45 PERIODS

REFERENCES:

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