PRIST DEEMED UNIVERSITY

Vallam, Thanjavur

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF
ELECTRONICS & COMMUNICATION ENGINEERING

PROGRAM HANDBOOK

M.TECH – COMMUNICATION SYSTEMS
[FULL TIME]

[REGULATION 2017]

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

PEO1: To provide students with strong fundamental concepts and also advanced techniques and tools to build various communication systems.

PEO2: To enable graduates to attain successful professional careers by applying their engineering skills in communication system design to meet out the challenges in industries and academia.

PEO3: To engage graduates in lifelong learning, adapt emerging technology and pursue research for the development of innovative products.

PROGRAMME SPECIFIC OBJECTIVES (PSOs):

PSO1: To inculcate the ability in graduates to design and analyze the subsystems such as RF, Signal processing, Modern communication systems and networks.

PSO2: To enhance problem solving skills in communication systems design using the latest hardware and software tools.

PSO3: To apply communication engineering principles and practices for developing products for scientific and business applications.

PROGRAM OUTCOMES (POS):

M.Tech students will be able to:

PO1: **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: **Conduct investigations of complex problems:** Use research - based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: Life - long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

MAPPING OF PROGRAMME EDUCATIONAL OBJECTIVES (PEOs) WITH PROGRAMME OUTCOMES (POs):

The mapping between the Programme Educational Objectives (PEOs) and the Programme Outcomes (POs) is given in the following table:

PROGRAMME EDUCATIONAL OBJECTIVES	PROGRAMME OUTCOMES											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**
PEO1	3	2	1	1	2	1	-	-	2	-	-	2
PEO2	3	3	2	3	3	2	1	1	2	2	1	1
PEO3	3	3	3	3	3	1	1	1	2	2	1	3

Contribution 1: Reasonable 2: Significant 3: Strong

MAPPING OF PROGRAM SPECIFIC OBJECTIVES (PSOs) WITH PROGRAMME OUTCOMES (POs):

A broad relation between the Programme Specific Objectives (PSOs) and the Programme Outcomes(POs) is given in the following table:

PROGRAMME SPECIFIC OBJECTIVES	PROGRAMME OUTCOMES											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**
PSO1	3	2	1	1	1	1	1	-	1	-	-	1
PSO2	3	3	1	3	3	1	1	-	1	-	-	1
PSO3	3	3	2	3	2	3	2	2	2	2	2	2

Contribution 1: Reasonable 2: Significant 3: Strong

M.TECH .COMMUNICATION SYSTEMS -FULL TIME-R2017

SEMESTER I

S.N	SUB CODE	SUBJECT	L	T	P	C
Theory						
1	17248S11B	Applied mathematics for Electronics Engineering	3	1	0	4
2	17271H12	Statistical Signal Processing	4	0	0	4

3	17271H13	Modern Digital Communication Systems	4	0	0	4
4	17271S14	Communication Protocol Engineering	4	0	0	4
5	17271H15	Advanced Radiation Systems	4	0	0	4
6	17271E16_	**Elective-I**	4	0	0	4
Practical						
8	17271L17	Communication Systems Lab - I	0	0	3	3
Research Skill Development (RSD) Course						
7	17271CRS	Research Led Seminar	1	0	0	1
Total Credits			**28**			

SEMESTER II

S.N	SUB CODE	SUBJECT	L	T	P	C
Theory						
1	17271H21	Mobile Communication Networks	4	0	0	4
2	17271H22	Advanced Microwave Systems	4	0	0	4
3	17271H23	Fiber Optic Networking	4	0	0	4
4	17271E24_	**Elective-II**	**4**	**0**	**0**	**4**
5	17271E25_	**Elective-III**	**4**	**0**	**0**	**4**
Practical						
6	17271L26	Communication Systems Lab - II	0	0	3	3
7	172TECWR	Technical Writing /Seminars	0	0	3	3
Research Skill Development (RSD) Course						
8	17271CRM	Research Methodology	**3**	**0**	**0**	**3**
9	17271CBR	Participation in Bounded Research	**2**	**0**	**0**	**2**
Total Credits			**31**			

SEMESTER III

S.N	SUB CODE	SUBJECT	L	T	P	C
	Theory					
1	17271H31	Wireless Sensor Networks	4	0	0	4
2	17271E32-	**Elective – IV**	**4**	**0**	**0**	**4**
3	17271E33-	**Elective – V**	**4**	**0**	**0**	**4**
4	17271E34-	**Elective – VI**	**4**	**0**	**0**	**4**
Research Skill Development (RSD) Course						
5	17271P35	Project Phase – I	0	0	6	6
6	17271CSR	Participation in Scaffolded Research(Design/Societal Project)	**4**	**0**	**0**	**4**
Total Credits			**26**			

SEMESTER IV

S.N	SUB CODE	SUBJECT	L	T	P	C
1	17271P41	Project Phase – II	0	0	12	12
Total Credits			**12**			

Elective-I (SEMESTER – I)

S.N	SUB CODE	SUBJECT	L	T	P	C
1.	17271E16A	Internetworking and Multimedia	4	0	0	4
2.	17271E16B	Digital Image Processing	4	0	0	4
3.	17271E16C	LASER Communication	4	0	0	4
4	17271E16D	MEMS and NEMS	4	0	0	4

Elective-II (SEMESTER – II)

S.N	SUB CODE	SUBJECT	L	T	P	C
1.	17271E24A	High Speed Switching Architecture	4	0	0	4
2.	17271E24B	DSP Processor Architecture and Programming	4	0	0	4
3.	17271E24C	Digital Speech Processing	4	0	0	4
4	17271E24D	ASIC and FPGA Design	4	0	0	4

Elective-III (SEMESTER – II)

S.N	SUB CODE	SUBJECT	L	T	P	C
1.	17271E25A	Digital Communication Receivers	4	0	0	4
2.	17271E25B	Soft Computing	4	0	0	4
3.	17271E25C	Communication Network Security	4	0	0	4
4.	17271E25D	Radar Signal Processing	4	0	0	4

Elective-IV (SEMESTER – III)

S.N	SUB CODE	SUBJECT	L	T	P	C
1.	17271E32A	Software Defined Radio	4	0	0	4
2.	17271E32B	Satellite Communication	4	0	0	4
3.	17271E32C	CDMA Systems	4	0	0	4
4	17271E32D	Speech Processing and Synthesis	4	0	0	4
5	17271E32E	CAD for VLSI circuit	4	0	0	4

Elective-V (SEMESTER – III)

S.N	SUB CODE	SUBJECT	L	T	P	C
1.	17271E33A	Wavelets and MultiResolution Processing	4	0	0	4
2.	17271E33B	High performance Communication Networks	4	0	0	4
3.	17271E33C	Advanced Microprocessors and Microcontrollers	4	0	0	4
4	17271E33D	Reconfigurable Computing	4	0	0	4
5	17271E33E	Fundamentals Of Operating Systems	4	0	0	4

Elective-VI (SEMESTER – III)

S.N	SUB CODE	SUBJECT	L	T	P	C
1.	17271E34A	Simulation of Communication Networks	4	0	0	4
2.	17271E34B	Medical Imaging	4	0	0	4
3.	17271E34C	Mobile ADHOC networks	4	0	0	4
4	17271E34D	Ultra Wide Band Communication	4	0	0	4
5	17271E34E	Introduction To Web Technology	4	0	0	4

M.TECH (FULL TIME) –CS – R2017

COURSE STRUCTURE AND CREDITS DISTRIBUTION

Semester	Foundation Course	Core Courses	Elective Courses	Others	

							Total
		Theory	Practical	Core Electives	Open Electives		
I	4	16	3	4	-	1	**28**
II	-	12	6	8	-	5	**31**
III	-	4	6	12	-	4	**26**
IV	-	-	12	-	-	-	**12**
TOTAL CGPA CREDITS							**97**

HOD **DEAN**

17248S11B APPLIED MATHEMATICS FOR ELECTRONICS ENGINEERING

L T P C
3 1 0 4

AIM:

The primary aim of this course is to demonstrate various analytical skills in applied mathematics and extensive experience with the tactics of problem solving and logical thinking applicable in communication engineering.

OBJECTIVES:

The primary objective of this course will help the students to identify, formulate, abstract, and solve problems using mathematical tools from a variety of mathematical areas, including fuzzy logic, matrix linear programming, probability, numerical solution of ordinary differential equations and queuing models.

UNIT I CALCULUS OF VARIATIONS 9

Functional – Euler's equation-Variational problems involving one unknown function-several unknown functions-functional dependent on higher order derivatives-several independent variables-isoperimetric problems.

UNIT II INTEGRAL TRANSFORMS AND WAVE EQUATIONS 9

Fourier transform pairs, Properties – Fourier Sine and Cosine transforms, Convolution integrals, Evaluation of integrals using Fourier Transform.Discrete Fourier Transform - properties.Application of Fourier transform to wave equation.Z-transform-properties-inverse transform- solution to difference equation.

UNIT III LINEAR PROGRAMMING 9

Simplex algorithm-two phase method-duality-transportation and assignment problems-inventory-scheduling.

UNIT IV RANDOM PROCESS AND QUEUING THEORY 9

Classification – auto correlation-cross correlation-ergodicity-power spectral density function-Poisson process.Single and multiple server Markovian queuing models- customer impatience-queuing applications.

UNIT V TESTING OF HYPOTHESIS 9

Sampling distributions-Testing of hypothesis of normal, t, chi square, F distributions for testing mean and variance- large sample test. Analysis of variance – one way classification.

Tutorial :15 Total:60 Periods

OUTCOMES:

After completing this course, students should demonstrate competency in the following skills:

- Concepts on vector spaces, linear transformation, inner product spaces, eigenvalues and generalized eigenvectors.
- Apply various methods in linear algebra to solve systems of linear equations.
- Could develop a fundamental understanding of linear programming models, able to develop a linear programming model from problem description, apply the simplex method for solving linear programming problems.
- Numerical solution of differential equations by single and multistep methods.

- Computation of probability, random variables and their associated distributions, correlations and regression.
- Conceptualize the principle of optimality and sub-optimization, formulation and computational procedure of dynamic programming.
- Exposing the basic characteristic features of a queuing system and acquiring skills in analyzing queuing models.
- Using discrete time Markov chains to model computer systems.

BOOKS FOR REFERENCES :

1. Grewal.B.S. "Higher Engineering Mathematics", Khanna Publications, 2005.
2. Kapoor.J.N. & Saxena.H.C., Mathematical Statistics, S.Chand & Co., New Delhi.
3. Taha.H.A. "Operation Research – An Introduction", 6th Edition, PHI, 1997.
4. M.K. Venkataraman, "Higher Mathematics for Engineering & Science", National Publishing Company, 2000.
5. Kandasamy, "Engineering Mathematics Volume II, S.Chand & Co.
6. P.K. Guptha, D.S. Hira, Operations Research, S.Chand & Co., 1999
7. T.Veerarajan, Probability, Statistics and Random Processes, TMH, 2002

17271H12 STATISTICAL SIGNAL PROCESSING L T P C
4 0 0 4

AIM:

The student comprehends mathematical description and modelling of discrete time random signals.

OBJECTIVES:

- The student is conversant with important theorems and algorithms.
- The student learns relevant figures of merit such as power, energy, bias and consistency.
- The student is familiar with estimation, prediction and filtering concepts and techniques.

UNIT I DISCRETE RANDOM SIGNAL PROCESSING 9

Discrete Random Processes-, Autocorrelation and Autocovariance matrices. Parseval's Theorem, Wiener - Khintchine Relation- Power Spectral Density-Periodogram -, Parameter estimation: Bias and consistency.

UNIT II SPECTRUM ESTIMATION 9

Non-Parametric Methods-Correlation Method, Periodogram Estimator, Performance Analysis of Estimators –Unbiased Consistent Estimators-; Bartlett, Blackman –Tukey method.
Parametric Methods - AR, MA, and ARMA model based spectral estimation.

UNIT III LINEAR ESTIMATION AND PREDICTION 9

Linear prediction- Forward and backward predictions, - Levinson-Durbin algorithms. Least mean squared error criterion -Wiener filter for filtering and prediction, FIR Wiener filter and Wiener IIR filters, Discrete Kalman filter

UNIT IV ADAPTIVE FILTERS 9

FIR adaptive filters -adaptive filter based on steepest descent method-Widrow-Hoff LMS adaptive algorithm Adaptive recursive filters (IIR). RLS adaptive filters-Exponentially weighted RLS-sliding window RLS.

UNIT V MULTIRATE DIGITAL SIGNAL PROCESSING 9

Mathematical description of change of sampling rate - Interpolation and Decimation, Decimation by an integer factor - Interpolation by an integer factor, Filter implementation for sampling rate conversion- Application to sub band coding and Filter bank implementation of wavelet expansion of signals.

Total:45 Periods

OUTCOMES:

- Formulate time domain and frequency domain description of Wide Sense Stationary process in terms of matrix algebra and relate to linear algebra concepts.
- State Parseval‟s theorem, W-K theorem, principle of orthogonality, spectral factorization theorem, Widrow-Hoff LMS algorithm and Shannon‟s sampling theorem, and define linear prediction, linear estimation, sample auto-correlation, periodogram, bias and consistency.
- Explain various noise types, Yule-Walker algorithm, parametric and non-parametric methods, Wiener and Kalman filtering, LMS and RMS algorithms, Levinson Durbin algorithm, adaptive noise cancellation and adaptive echo cancellation, speed verses convergence issues, channel equalization, sampling rate change, subband coding and wavelet transform.

- Calculate mean, variance, auto-correlation and PSD for WSS stochastic processes, and derive prediction error criterion, Wiener-Hoff equations, Parseval‟stheorem,W-K theorem and normal equations.
- Design AR, MA, ARMA models, Wiener filter, anti aliasing and anti imaging filters, and develop FIR adaptive filter and polyphase filter structures.
- Simulate spectral estimation algorithms and basic models on computing platforms.

BOOKS FOR REFERENCES :

1. Monson H.Hayes, Statistical Digital Signal Processing and Modeling, John Wiley and Sons, Inc., Singapore, 2002.
2. John G. Proakis, Dimitris G.Manolakis, Digital Signal Processing Pearson Education, 2002.
3. John G. Proakis et.al.,'Algorithms for Statistical Signal Processing', Pearson Education, 2002.
4. Dimitris G.Manolakis et.al.,'Statistical and adaptive signal Processing', McGraw Hill, Newyork,2000.

17271H13 MODERN DIGITAL COMMUNICATION SYSTEMS L T P C
4 0 0 4

AIM:

To understand the basics of signal-space analysis and digital transmission.

OBJECTIVES:

- To understand the coherent and noncoherent receivers and its impact on different channel characteristics.
- To understand the different Equalizers
- To understand the different block coded and convolutional coded digital communication systems.
- To understand the basics of Multicarrier and Multiuser Communications.

UNIT I COHERENT AND NON-COHERENT COMMUNICATION: 9

Coherent receivers – Optimum receivers in WGN – IQ modulation & demodulation – Noncoherent Receivers in random phase channels; M-FSK receivers – Rayleigh and Rician channels – Partially Coherent receives – DPSK; M-PSK; M-DPSK,-BER Performance Analysis.

UNIT II BANDLIMITED CHANNELS AND DIGITAL MODULATIONS: 9

Eye pattern; demodulation in the presence of ISI and AWGN; Equalization techniques – IQ modulations;QPSK; QAM; QBOM; -BER Performance Analysis. – Continuous phase modulation; CPFM; CPFSK;MSK,OFDM.

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.

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 SPREAD SPECTRUM SIGNALS FOR DIGITAL COMMUNICATION 9

Model of spread Spectrum Digital Communication System-Direct Sequence Spread Spectrum Signals, Error rate performance of the coder, Generation of PN Sequences- Frequency-Hopped Spread Spectrum Signals, Performance of FH Spread Spectrum Signals in an AWGN Channel-Synchronization of Spread Spectrum Systems.

Total:45 Periods

OUTCOMES:

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

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

BOOKS FOR REFERENCES :

1. M.K.Simon, S.M.Hinedi and W.C.Lindsey, Digital communication techniques; Signalling and detection, Prentice HallIndia, New Delhi. 1995.
2. Simon Haykin, Digital communications, John Wiley and sons, 1998
3. Wayne Tomasi, Advanced electronic communication systems, 4th Edition Pearson EducationAsia, 1998
4. B.P.Lathi Modern digital and analog communication systems, 3rd Edition, Oxford Universitypress 1998.
5. John G. Proakis, Digital Communications, 4th Edition, McGraw-Hill, New york , 2001

17271S14 COMMUNICATION PROTOCOL ENGINEERING L T P C
4 0 0 4

AIM:

To expose the students to the layered architecture for communication networks and the specific functionality of the network layer.

OBJECTIVES:

- 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 NETWORK REFERENCE MODEL 9

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

UNIT II PROTOCOL SPECIFICATIONS 9

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

UNIT III PROTOCOL VERIFICATION/VALIDATION 9

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

UNIT IV PROTOCOL CONFORMANCE/PERFORMANCE TESTING 9

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

UNIT V PROTOCOL SYNTHESIS AND IMPLEMENTATION 9

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

Total:45 Periods

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.

BOOKS FOR REFERENCES :

1. Pallapa Venkataram and Sunilkumar S.Manvi, "Communication protocol Engineering", EasternEconomy edition, 2004
2. Richard Lai and Jirachiefpattana, "Communication Protocol Specification and Verification", KluwerPublishers, Boston, 1998.
3. Tarnay, K., "Protocol Specification and Testing", Plenum, New York, 1991.
4. Mohamed G. Gouda, "Elements of Network Protocol Design", John Wiley & Sons, Inc. New York,USA, 1998
5. V.Ahuja, "Design and Analysis of Computer Communication networks", McGraw-Hill, London,1982.
6. G.J.Holtzmann, "Design and validation of Computer protocols", Prentice Hall, New York, 1991.

17271H15 ADVANCED RADIATION SYSTEMS **L T P C**
4 0 0 4

AIM:

To enhance the student's knowledge in the area of various antenna design.

OBJECTIVES:

- To understand antenna radiation and its parameters.
- To enhance the student's knowledge in the area of various antenna design.
- To design monopole, dipole and patch antenna and to impart the knowledge about modern antennas.

UNIT ICONCEPTS OF RADIATION **9**

Retarded vector potentials – Heuristic approach and Maxwell's equation approach. Electric vector potential F for a magnetic current source M. Duality theorem. The Lorentz gauge condition. Vector potential in Phasor form. Fields radiated by an alternating current element and half wave dipole. Total power radiated and radiation resistance of alternating current element and half wave dipole. Power radiated in the far field. Linear, Elliptical and circular polarization. Development of the Poincare sphere.

UNIT II ANTENNA ARRAYS **9**

N element linear arrays – uniform amplitude and spacing- Phased arrays- Directivity of Broadside and End fire arrays. Three dimensional characteristics - Pattern multiplication- Binomial arrays and Dolph-Tchebycheff arrays. Circular array. Mutual coupling in arrays, multidimensional arrays- phased arrays and array feeding techniques.

UNIT III ANTENNA SYNTHESIS **9**

Synthesis problem-Line source based beam synthesis methods (Fourier transform and Woodward-Lawson sampling method – Linear array shaped beam synthesis method – Low side lobe, narrow main beam synthesis methods - discretization of continuous sources. Schelkunoff polynomial method

UNIT IV APERTURE ANTENNAS **9**

Radiation from apertures - Huygens Principle. Rectangular apertures- techniques for evaluating gain,Circular apertures and their design considerations- Babinet's principle Fraunhofer and Fresnel diffraction.Complimentary screens and slot antennas. Slot and dipoles as dual antennas. Fourier transform in aperture antenna theory.

UNIT V HORN, MICROSTRIP, REFLECTOR ANTENNAS. **9**

E and H plane sectoral Horns. Pyramidal horns. Conical and corrugated Horns. Multimode horns. Phase center.Microstrip antennas – feeding methods. Rectangular patch- Transmission line model – Circular patch Parabolic Reflector antennas – Prime focus and cassegrain reflectors. Equivalent focal length of Cassegrain antennas. Spillover and taper efficiencies. Optimum illumination.

Total:45 Periods

OUTCOMES:

- Ability to understand antenna concepts
- Ability to design antenna for various applications
- Knowledge of modern antenna design

BOOKS FOR REFERENCES :

1. Balanis, C.A., “Antenna Theory” Wiley,2003
2. Warren L. Stutzman and Gary A. Thiele,“ Antenna theory and design”John Wiley and sons 1998
3. Jordan, E.C., “ Electromagnetic waves and Radiating systems”. PHI 2003
4. Krauss, J.D., “ Radio Astronomy” McGraw-Hill 1966, for the last unit (reprints available)
5. Krauss, J.D.,, Fleisch,D.A., “Electromagnetics” McGraw-Hill,1999

17271L17 COMMUNICATION SYSTEM LABORATORY - I **L T P C**
0 0 3 3

OBJECTIVES:

- To acquire knowledge on Transmission line and S- parameter estimation of microwave devices.
- To introduce the basics of Microstrip Patch Antenna and its analysis .
- To study & measure the performance of digital communication systems.
- To provide a comprehensive knowledge of Wireless Communication.
- To learn about the design of digital filters and its adaptive filtering algorithms.

LIST OF EXPERIMENTS:

1. Antenna Radiation Pattern measurement.
2. Simulation of Modulation and Coding in a AWGN Communication Channel using Simulation Packages.
3. Implementation of Adaptive Filters, period gram and multistage multirate system in DSP Processor
4. Performance evaluation of Digital Data Transmission through Fiber Optic Link.
5. Study of Spread Spectrum Techniques.
6. Simulation of QMF using Simulation Packages.
7. Implementation of Video Link using Optical Fiber.
8. Implementation of Linear and Cyclic Codes.

TOTAL :45 PERIODS

OUTCOMES:

Upon the completion of course, students are able to

- Measure and analyze various transmission line parameters.
- Design Microstrip patch antennas.
- Implement the adaptive filtering algorithms
- To generate and detect digital communication signals of various modulation techniques using MATLAB.

SEMESTER I
ELECTIVE -I

17271E16A INTERNETWORKING AND MULTIMEDIA L T P C
4 0 0 4

AIM:

The aim of this module is to address the technical issues and the solutions for the implementation of multimedia services on the Internet.

OBJECTIVES:

- Recent advances in multimedia and networking technologies have made possible the evolution of the Internet from a text-based environment to a multimedia global communication network.
- The objective of this module is to address the technical issues and the solutions for the implementation of multimedia services on the Internet.
- After studying this module, students are expected to be able to appreciate the state-of-the-art in Internet technologies for multimedia services.

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, lightweight 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

OUTCOMES:

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

- Understand the state-of-art developments in Internet technologies and applications
- Understand the development of next generation Internet
- Appreciate the principles used in designing Internet protocols for multimedia applications, and so understand why standard protocols are designed the way that they are
- Be able to solve problems for the design of multimedia applications on the Internet.

BOOKS FOR REFERENCES :

1. Jon Crowcroft, Mark Handley, Ian Wakeman, Internetworking Multimedia, Harcourt Asia Pvt. Ltd.Singapore, 1998.
2. B.O. Szuprowicz, Multimedia Networking, McGraw Hill, New York. 1995.
3. Tay Vaughan, Multimedia - Making it to work, 4ed, Tata McGraw Hill , NewDelhi, 2000.
4. K.R.Rao, Zoran S. Bojkovic and Dragorad A. Milovanovic, Multimedia Communication systems, PHI ,

SEMESTER I
ELECTIVE - I

17271E16B DIGITAL IMAGE PROCESSING **L T P C**
4 0 0 4

AIM:

The aim of this course is to explain the fundamentals of digital image processing.

OBJECTIVES:

- To understand the image fundamentals.
- To understand the various image segmentation techniques.
- To extract features for image analysis.
- To introduce the concepts of image registration and image fusion.

UNIT I DIGITAL IMAGE FUNDAMENTALS **9**

Elements of digital image processing systems - Elements of visual perception - Psycho visual model- Brightness - Contrast - Hue - Saturation - Mach band effect - Color image fundamentals – RGBHSI models - Image sampling - Quantization - Dither - Two-dimensional mathematical preliminaries.

UNIT II IMAGE TRANSFORMS **9**

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

UNIT III ENHANCEMENT AND RESTORATION **9**

Histogram modification and specification techniques - Noise distributions - Spatial averaging - Directional Smoothing – Median - Geometric mean - Harmonic mean – Contra harmonic and Yp mean filters - Homomorphic filtering - Color image enhancement - Image Restoration – Degradation model - Unconstrained and Constrained restoration - Inverse filtering - Removal of blur caused by uniform linear motion - Wiener filtering - Geometric transformations - Spatial transformations -Gray Level interpolation.

UNIT IV IMAGE SEGMENTATION AND RECOGNITION **9**

Edge detection - Image segmentation by region growing - Region splitting and merging – Edge linking - Image Recognition - Patterns and pattern classes - Matching by minimum distance classifier - Matching by correlation - Back Propagation Neural Network - Neural Network applications in Image Processing.

UNIT V IMAGE COMPRESSION **9**

Need for data compression - Huffman - Run Length Encoding - Shift codes - Arithmetic coding - Vector Quantization - Block Truncation Coding - Transform Coding - DCT and Wavelet - JPEG -MPEG – Standards - Concepts of Context based Compression.

Total:45 Periods

OUTCOMES:

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

- Explain the fundamentals of digital image processing.
- Describe image various segmentation and feature extraction techniques for image analysis.
- Discuss the concepts of image registration and fusion.

BOOKS FOR REFERENCES :

1. Rafael C. Gonzalez, Richard E. Woods, 'Digital Image Processing', Second Edition, Pearson Education Inc., 2004.
2. Anil K. Jain, 'Fundamentals of Digital Image Processing', Prentice Hall of India, 2002.
3. David Salomon , "Data Compression The Complete Reference", 2nd Edition, Springer Verlag , New York Inc., 2001.
4. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins, "Digital Image Processing using MATLAB", Pearson Education, Inc., 2004.
5. William K. Pratt, "Digital Image Processing", John Wiley, NewYork, 2002.
6. Milman Sonka, Vaclav Hlavac, Roger Boyle, "Image Processing Analysis and MachineVision", 2nd edition, Brooks/Cole, Vikas Publishing House, 1999.

17271E16C LASER COMMUNICATION L T P C
4 0 0 4

AIM:

The aim of this course is to gain knowledge about light and its propagation

OBJECTIVES:

- To study the nonlinear optic devices.
- To learn about holography.
- To study the different types of laser and its effects.

UNIT I INTRODUCTION TO LASER COMMUNICATIONS 9

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

UNIT II SYSTEM DESIGN 9

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

UNIT III SEMICONDUCTOR AND METAL LASER SOURCES FOR SATELLITE COMMUNICATIONS 9

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

UNIT IV OPTICAL RECEIVERS AND SYSTEM DESIGN 9

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

UNIT V LASER BEAM POINTING CONTROL 9

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

TOTAL:45 PERIODS

OUTCOMES:

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

- Understand the fundamentals of light and its propagation.
- Design nonlinear optic devices.
- Gain knowledge about holography and laser and its effects.

BOOKS FOR REFERENCES :

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

17271E16D MEMS AND NEMS L T P C
4 0 0 4

AIM:

The aim of this course is to explain the basics of micro/nano electromechanical systems including their applications and advantages .

OBJECTIVES:

- To introduce the concepts of micro electro mechanical devices.
- To know the fabrication process of Microsystems.
- To know the design concepts of micro sensors and micro actuators.
- To introduce 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 Piezoresistive Pressure sensors- engineering mechanics behind these Micro sensors. 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: Schrodinger Equation and Wave function Theory, Density Functional Theory, Nanostructures and Molecular Dynamics, Electromagnetic Fields and their quantization, Molecular Wires and Molecular Circuits.

TOTAL:45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- Interpret the basics of micro/nano electromechanical systems including their applications and advantages
- Recognize the use of materials in micro fabrication and describe the fabrication processes including surface micromachining, bulk micromachining and LIGA.

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

SEMESTER II

17271H21 MOBILE COMMUNICATION NETWORKS **L T P C**
4 0 0 4

AIM:

The aim of this course is to provide the basic cellular system concepts.

OBJECTIVES:

- To understand the basic cellular system concepts.
- To have an insight into the various propagation models and the speech coders used in mobile communication.
- To understand the multiple access techniques and interference education techniques in mobile communication

UNIT I OPERATION OF MOBILE COMMUNICATION NETWORKS 9

Operation of first, second, and third generation wireless networks: cellular systems, medium access techniques, Mobile networks Elementary Principles of cellular Telephony Channel Division Techniques(TDMA, FDMA, CDMA) Cellular Coverage Methods Network Planning and Resource Allocation,Network Dimensioning ,Mobility Management Procedures

UNIT II PROPAGATION MODELS AND AIR PROTOCOLS 9

Radio propagation models, error control techniques, handoff, power control, Soft handover, Forward link,Reverse link , common air protocols (AMPS, IS-95, IS-176, GSM, GPRS, EDGE, WCDMA, cdma2000,etc)

UNIT III MOBILE NETWORK ARCHITECTURE 9

General Architecture definition, Mobile Terminals (MT, SIM) Radio Section (BTS, BSC) Core Network (MSC, G-MSC, VLR, HLR, AuC) User and Control Plane Protocol Stack, MAP & SS#7, the Key Role of Signaling Interfaces and Network Entities Relation The Physical Channel, The Logical Channels Terminal, Call and Network Management Procedures, Network Planning.

UNIT IV WIRELESS LOCAL AREA NETWORKS 9

Wireless Local Area Networks , General Characteristics of the Hiperlan System, 802.11 Standard, Basic DCF access scheme DCF Access Scheme with Handshaking, PCF Access Scheme, The 802.11a Standard, Mobile Ad Hoc Networks, Wireless Sensor Networks, Routing Energy Efficiency, Localization, Clustering.

UNIT V SECURITY ISSUES IN WIRELESS NETWORKS 9

Security in Wireless Networks, Secure routing, Key Pre-distribution and Management, Encryption and Authentication, Security in Group Communication, Trust Establishment and Management, Denial of Service Attacks, Energy-aware security mechanisms, Location verification, Security on Data fusion.

Total:45 Periods

OUTCOMES:

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

- Discuss cellular radio concepts.
- Identify various propagation effects.
- To have knowledge of the mobile system specifications.
- Classify multiple access techniques in mobile communication.
- Outline cellular mobile communication standards.
- Analyze various methodologies to improve the cellular capacity

BOOKS FOR REFERENCES :

1. W. Stallings, "Wireless Communications and Networks",Second Edition Prentice Hall, 2007.
2. V.K. Garg, "IS-95 CDMA and CDMA 2000", Prentice Hall PTR, 2000.
3. T.S. Rappaport, "Wireless Communications: Principles & Practice", Second Edition, Prentice Hall,2002.
4. Leon-Garcia and I. Widjaja, "Communication Networks, Fundamental Concepts and KeyArchitectures", McGraw-Hill, 2000.
5. J.Schiller,"Mobile Communications", Addison Wesley, 2000.

6. Fred Halsall, "Multimedia Communications, Applications, Networks, Protocols and Standards",Addison Wesley, 2001.
7. Uyless Black ,"Mobile and Wireless Networks" , Prentice Hall PTR, 1996.

17271H22 ADVANCED MICROWAVE SYSTEMS **L T P C**
4 0 0 4

AIM:

The aim of this course is to explain fundamentals of microwave integrated circuits.

OBJECTIVES:

- To understand the fundamentals of Microwave integrated circuits.
- To understand the various components for Wireless Communications.
- To know the basic techniques needed for analysis of Microwave systems.

UNIT I TECHNOLOGY OF HYBRID MICS **9**

Dielectric substrates - thick film technology and materials - thin film technology and materials – methods of testing – encapsulation of devices for MICs – mounting of active devices.

UNIT II TECHNOLOGY OF MONOLITHIC MICS **9**

Processes involved in fabrication – epitaxial growth of semiconductor layer – growth of dielectric layer –diffusion-ion implantation – electron beam technology.

UNIT III ANALYSIS OF MICROSTRIP LINE **9**

Methods of conformal transformation – numerical method for analysis – hybrid mode analysis – coupled mode analysis- method of images – losses in miscrostrips.

UNIT IV COUPLED MICROSTRIPS, SLOT LINE AND COPLANAR VEGUIDES 9

Coupled microstrips – even and odd mode analysis – microstrip directional couplers – branch line couplers– periodic branch line couplers – synchronous branch line couplers.

UNIT V LUMPED ELEMENTS AND NON-RECIPROCAL COMPONENTS 9

Design and fabrication using microstrips – flat resistors – flat inductors – interdigital capacitors – sandwich capacitors – ferromagnetic substrates for non-reciprocal devices – microstrip circulators – latching circulators – isolators – phase shifters.

Total:45 Periods

OUTCOMES:

- Capability to design Microwave circuits.
- To be able to analyze microwave integrated circuits.

REFERENCES:

1. Gupta,K.C, and Amarjit singh "Microwave Integrated Circuits" John Wiley and sons Wiley Eastern Reprint, 1978.
2. Hoffmann, R.K "Handbook of Microwave Integrated Circuits" Artech House, 1987.

17271H23 FIBER OPTIC NETWORKING L T P C
4 0 0 4

AIM:

The aim of the course is to design and analyze network components.

OBJECTIVES:

The students should be made to understand:

- Optical system components like optical amplifiers, wavelength converters.
- Up-to-date survey of development in Optical Network Architectures.
- Packet switching.
- Network design perspectives.
- Different Optical Network management techniques and functions.

UNIT I OPTICAL NETWORKING COMPONENTS: 9

First- and second-generation optical networks, Components: couplers, isolators, circulators, multiplexers,filters, amplifiers, switches, and wavelength converters.

UNIT II SONET AND SDH NETWORKS: 9

Integration of TDM signals, Layers, Framing, Transport overhead, Alarms, Multiplexing, Network Elements, Topologies, Protection architectures, Ring architectures, Network Management.

UNIT III BROADCAST – AND- SELECT NETWORKS: 9

Topologies, Single-hop, Multi hop, and Shuffle net multi hop networks, Media-Access control protocols,Test beds.

UNIT IV WAVELENGTH-ROUTING NETWORKS: 9

Node designs, Issues in Network design and operation, Optical layer cost Tradeoffs, Routing and Wavelength assignment, Wavelength routing testbeds.

UNIT V HIGH CAPACITY NETWORKS: 9

SDM, TDM, and WDM approaches, Application areas, Optical TDM Networks: Multiplexing and demultiplexing, Synchronization, Broadcast networks, Switch-based networks, OTDM test beds.

Total:45 Periods

OUTCOMES:

At the end of the course, the student should be able to:

- Design and Analyze Network Components
- Assess and Evaluate optical networks

BOOKS FOR REFERENCES :

1. Rajiv Ramaswami and Kumar Sivarajan, Optical Networks: A practical perspective, MorganKaufmann, 2nd edition, 2001.
2. Vivek Alwayn, Optical Network Design and Implementation, Pearson Education, 2004.
3. Hussein T.Mouftab and Pin-Han Ho, Optical Networks: Architecture and Survivability, KluwerAcademic Publishers, 2002.
4. Biswanath Mukherjee, Optical Communication Networks, McGraw Hill, 1997

ELECTIVE - II

17271E24A HIGH SPEED SWITCHING ARCHITECTURE L T P C
4 0 0 4

AIM:

To expose the student to the advances in packet switching architectures and IP addressing and switching solutions and approaches to exploit and integrate the best features of different architectures for high speed switching.

OBJECTIVES:

- To enable the student to understand the basics of switching technologies and their implementation LANs, ATM networks and IP networks.
- To enable the student to understand the different switching architectures and queuing strategies and their impact on the blocking performances.

UNIT I HIGH SPEED NETWORK 9

LAN and WAN network evolution through ISDN to BISDN - Transfer mode and control of BISDN -SDH multiplexing structure - ATM standard; ATM adaptation layers.

UNIT II LAN SWITCHING TECHNOLOGY 9

Switching concepts; Switch forwarding techniques; switch path control - LAN switching; cut through forwarding; store and forward - virtual LANs.

UNIT III ATM SWITCHING ARCHITECTURE 9

Switch models - Blocking networks – basic and enhanced banyan networks - sorting networks – merge sorting - rearrangeable networks - full and partial connection networks - nonblocking networks –recursive network – construction and comparison of non-blocking network - switches with deflection routing – shuffle switch - tandem banyan.

UNIT IV QUEUES IN ATM SWITCHES 9

Internal queuing – Input, output and shared queuing - multiple queuing networks –combined input,output and shared queuing – performance analysis of queued switches.

UNIT V IP SWITCHING 9

Addressing mode - IP switching types-flow driven and topology driven solutions - IP Over ATM address and next hop resolution – multicasting - IPv6 over ATM.

Total:45 Periods

OUTCOMES:

- The student would be able to identify suitable switch architectures for a specified networking scenario and demonstrate its blocking performance.
- The student would be in a position to apply his knowledge of switching technologies, architectures and buffering strategies for designing high speed communication networks and analyse their performance

BOOKS FOR REFERENCES :

1. Achille Patavina, Switching Theory: Architectures and performance in Broadband ATM Networks.John Wiley & Sons Ltd., New York.1998.
2. Christopher Y Metz, Switching protocols & Architectures. McGraw Hill, New York.1998.
3. Ranier Handel, Manfred N Huber, Stefan Schrodder. ATM Networks-concepts, protocols, applications,3rd Edition, Adisson Wesley, New York,1999.

4. John A.Chiong: Internetworking ATM for the internet and enterprise networks. McGraw Hill, NewYork, 1998.

SEMESTER II

ELECTIVE - II

17271E24B DSP PROCESSOR ARCHITECTURE AND PROGRAMMING

L T P C
4 0 0 4

AIM:

The aim of this course is to provide in-depth knowledge on digital signal processor basics.

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.

UNIT I FUNDAMENTALS OF PROGRAMMABLE DSPs 9

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

UNIT II TMS320C3X PROCESSOR 9

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

UNIT III ADSP PROCESSORS I 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 IV ADVANCED PROCESSORS 9

Architecture of TMS320C54X: Pipeline operation, Addressing modes and assembly language instructions Introduction to Code Composer studio

UNIT V ADVANCED PROCESSORS II 9

Architecture of TMS320C6X - Architecture of Motorola DSP563XX – Comparison of the features of DSP family processors.

Total:45 Periods

OUTCOMES:

Students should be able to:

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

BOOKS FOR REFERENCES :

1. B.Venkataramani and M.Bhaskar, “Digital Signal Processors – Architecture, Programming andApplications” – Tata McGraw – Hill Publishing Company Limited. New Delhi, 2003.
2. User guides Texas Instrumentation, Analog Devices, Motorola.

SEMESTER II

ELECTIVE - II

17271E24C DIGITAL SPEECH PROCESSING

L T P C
4 0 0 4

AIM:

To illustrate the concepts of speech signal representations and coding.

OBJECTIVES:

- To introduce speech production and related parameters of speech.
- To understand different speech modeling procedures such as Markov and their implementation issues.
- To gain knowledge about text analysis and speech synthesis.

UNIT I MECHANICS OF SPEECH 9

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

UNIT II TIME DOMAIN METHODS FOR SPEECH PROCESSING 9

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

UNIT III FREQUENCY DOMAIN METHOD FOR SPEECH PROCESSING 9

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

UNIT IV LINEAR PREDICTIVE ANALYSIS OF SPEECH 9

Formulation of Linear Prediction problem in Time Domain – Basic Principle – Auto correlation method– Solution of LPC equations — Durbin's Recursive algorithm – lattice formation and solutions – Comparison of different methods — Formant analysis – VELP – CELP.

UNIT V APPLICATION OF SPEECH & AUDIO SIGNAL PROCESSING 9

Algorithms: Spectral Estimation, dynamic time warping, hidden Markov model – Music analysis – Pitch Detection – Feature analysis for recognition – Music synthesis – Automatic Speech Recognition – Feature Extraction for ASR — ASR systems– Voice response system – Speech Synthesis: Text to speech, voice over IP.

Total:45 Periods

OUTCOMES:

Students will be able to:

- Model speech production system and describe the fundamentals of speech.
- Extract and compare different speech parameters.
- Choose an appropriate statistical speech model for a given application.
- Design a speech recognition system.
- Use different text analysis and speech synthesis techniques.

BOOKS FOR REFERENCES :

1. Ben Gold and Nelson Morgan, Speech and Audio Signal Processing, John Wiley and Sons Inc. , Singapore, 2004
2. L.R.Rabiner and R.W.Schaffer – Digital Processing of Speech signals – Prentice Hall - 1978
3. Quatieri – Discrete-time Speech Signal Processing – Prentice Hall – 2001.
4. J.L.Flanagan – Speech analysis: Synthesis and Perception – 2nd edition – Berlin – 1972

5. I.H.Witten – Principles of Computer Speech – Academic Press – 1982

SEMESTER -II

ELECTIVE – II

17271E24D	**ASIC AND FPGA DESIGN**	**L T P C** **4 0 0 4**

AIM:

The aim of the course is to understand the issues involved in ASIC design, including technology choice, design management, tool-flow, verification, debug and test, as well as the impact of technology scaling on ASIC design.

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 - floorplanning - 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

OUTCOMES:

- Demonstrate VLSI tool-flow and appreciate FPGA architecture.
- Understand the issues involved in ASIC design, including technology choice, design management, tool-flow, verification, debug and test, as well as the impact of technology scaling on ASIC design.
- Understand the algorithms used for ASIC construction
- Understand the basics of System on Chip, On chip communication architectures like AMBA,AXI and utilizing Platform based design.
- Appreciate high performance algorithms available for ASICs

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.

ELECTIVE - III

SEMESTER II

17271E25A DIGITAL COMMUNICATION RECEIVERS L T P C
4 0 0 4

AIM:

The aim of this course is to understand the basic principles of digital communication techniques.

OBJECTIVES:

- To understand the basic principles of digital communication techniques.
- To gain knowledge about receivers for AWGN channel and Fading channels.
- To understand the concepts of synchronization and adaptive equalization techniques.

UNIT I REVIEW OF DIGITAL COMMUNICATION TECHNIQUES 9

Baseband and bandpass communication, signal space representation, linear and non- linear modulation techniques, and spectral characteristics of digital modulation.

UNIT II OPTIMUM RECEIVERS FOR AWGN CHANNEL 9

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

UNIT III RECEIVERS FOR FADING CHANNELS 9

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

UNIT IV SYNCHRONIZATION TECHNIQUES 9

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

UNIT V ADAPTIVE EQUALIZATION 9

Zero forcing algorithm, LMS algorithm, Adaptive decision – feedback equalizer, and equalization of Trellis-coded signals, Kalman algorithm, blind equalizers, and stochastic gradient algorithm, Echo cancellation

Total:45 Periods

OUTCOMES:

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

- Apply basic principles of digital communication techniques.
- Discuss on receivers for AWGN & Fading channel
- Describe various synchronization techniques.
- Design adaptive equalization algorithms to satisfy the evolving demands in digital communication.

BOOKS FOR REFERENCES :

1. Heinrich Meyer, Mare Moeneclacy and Stefan.A. Fechtel, “Digital Communication Receivers”, Vol I& II, John Wiley, New York, 1997
2. John. G. Proakis, “Digital Communication”, 4th ed., McGraw Hill, New York, 2001
3. E.A. Lee and D.G. Messerschmitt, “Digital Communication”, 2nd edition, Allied Publishers, NewDelhi, 1994
4. Simon Marvin, “Digital Communication Over Fading channel; An unified approach to performanceAnalysis”, John Wiley, New York, 2000
5. Bernard Sklar, “Digital Communication Fundamentals and Applications, Prentice Hall, 1998

SEMESTER II

ELECTIVE - III

17271E25B SOFT COMPUTING L T P C
4 0 0 4

AIM:

The aim of this course is to know the basics of artificial neural networks.

OBJECTIVES:

- To provide adequate knowledge about feed forward /feedback neural networks
- To apply the concept of fuzzy logic in various systems.
- To have the idea about genetic algorithms.
- To provide adequate knowledge about the applications of Soft Computing.

UNIT I ARTIFICIAL NEURAL NETWORKS 9

Basic concepts-single layer perceptron-Multi layer perceptron-Adaline-Madaline-Learning rules-Supervised learning-Back propagation networks-Training algorithm, Practical difficulties, Advanced algorithms-Adaptive network- Radial basis network-modular network-Applications

UNIT II UNSUPERVISED NETWORKS 9

Introduction- unsupervised learning -Competitive learning networks-Kohonen self organising networks-Learning vector quantisation - Hebbian learning - Hopfield network-Content addressable nature, Binary Hopfield network, Continuous Hopfield network Traveling Salesperson problem - Adaptive resonance theory –Bidirectional Associative Memory-Principle component Analysis

UNIT III FUZZY SYSTEMS 9

Fuzzy sets-Fuzzy rules: Extension principle, Fuzzy relation- fuzzy reasoning – fuzzy inference systems:Mamdani model, Sugeno model. Tsukamoto model -Fuzzy decision making- Multi objective Decision Making,-Fuzzy classification-Fuzzy control methods -Application

UNIT IV NEURO-FUZZY MODELLING 9

Adaptive Neuro Fuzzy based inference systems – classification and regression trees: decision tress, Cart algorithm – Data clustering algorithms: K means clustering, Fuzzy C means clustering, Mountain clustering, Subtractive clustering – rule base structure identification – Neuro fuzzy control: Feedback Control Systems, Expert Control, Inverse Learning, Specialized Learning, Back propagation through Real –Time Recurrent Learning.

UNIT V GENETIC ALGORITHM 9

Fundamentals of genetic algorithm-Mathematical foundations-Genetic modeling-Survival of the fittest crossover-Inversion and Deletion-mutation-reproduction-Generational cycle-rank method-rank space method- Other derivative free optimization-simulated annealing, Random search, Downhill simplex search-Application

Total:45 Periods

OUTCOMES:

- Knowledge on concepts of soft computational techniques.
- Able to apply soft computational techniques to solve various problems.
- Motivate to solve research oriented problems.

BOOKS FOR REFERENCES :

1. Jang J.S.R.,Sun C.T and Mizutani E – “Neuro Fuzzy and Soft computing”, Pearson education(Singapore) 2004
2. David E.Goldberg : “Genetic Algorithms in Search, Optimization, and Machine Learning”, PearsonEducation, Asia,1996
3. Laurene Fauseett:”Fundamentals of Neural Networks”, Prentice Hall India, New Delhi,1994.
4. Timothy J.Ross:”Fuzzy Logic Engineering Applications”, McGrawHill, New York,1997.

5. S.Rajasekaran and G.A.Vijayalakshmi Pai “Neural networks,Fuzzy logics,and Genetic algorithms”,Prentice Hall of India,2003
6. George J.Klir and Bo Yuan,”Fuzzy Sets and Fuzzy Logic”,Prentice Hall Inc., New Jersey,1995

SEMESTER II

ELECTIVE - III

17271E25C COMMUNICATION NETWORK SECURITY **L T P C**
4 0 0 4

AIM:

The aim of this course is to understand the need and concept of security.

OBJECTIVES :

The students should be made to:

- Understand the need and concept of security
- Learn cryptosystems

UNIT I SYMMETRIC CIPHERS **9**

Introduction – Services, Mechanisms and Attacks, OSI security Architecture, Model for network Security;Classical Encryption Techniques- Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Product ciphers , Data Encryption Standard- Block Cipher Principles, Strength of DES,Differential and Linear CryptAnalysis, Block Cipher Design Principles, Block Cipher Modes of operation, Stegnography.

UNIT II ADVANCED ENCRYPTION STANDARD AND STREAM CIPHERS 9

Evaluation Criteria for AES, AES Cipher; Contemporary Symmetric Ciphers- Triple DES, Blowfish, RC5-Characteristics of Advanced Symmetric Block Ciphers, Stream ciphers based on LFSRs,RC4 Stream Cipher; Random Number Generation. Traffic Confidentiality, Key Distribution.

UNIT III PUBLIC-KEY ENCRYPTION AND HASH FUNCTIONS **9**

Public Key Cryptography and Key Management- RSA Algorithm and other public key cryptosystems-,Diffie-Hellman Key Exchange, Elliptic Curve arithmetic, Elliptic Curve Cryptography; Message Authentication and Hash Functions- Authentication Requirements, -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- overview and 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 SYSTEM SECURITY **9**

Intruders- Intruder Detection, Password Management; Malicious Software- Virus and Related Threats,Virus Counter Measures; Firewalls- Firewall Design Principles, Trusted Systems.

Total:45 Periods

OUTCOMES:

At the end of this course, the students should be able to:

- Explain digital signature standards
- Discuss authentication
- Explain security at different layers

BOOKS FOR REFERENCES:

1. William Stallings, “Cryptography and Network Security”, 3rd Edition. Prentice Hall of India, New Delhi,2004
2. William Stallings, “Network Security Essentials”, 2nd Edition. Prentice Hall of India, New Delhi, 2004
3. Charlie Kaufman , “Network Security: Private Communication in Public World”, 2nd Edition. PrenticeHall of India, New Delhi ,2004

SEMESTER II

ELECTIVE –III

17271E25D RADAR SIGNAL PROCESSING L T P C

4 0 0 4

AIM:

The aim of this course is to understand the Radar Signal acquisition and sampling in multiple domains.

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

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

OUTCOMES:

- Know how a radar is built and understand the principles of behavior.
- Have a basic understanding of how radar signals propagate through a medium, and the mechanisms for signal reflection from the target and unwanted reflections (“clutter”).
- Understand the basic principles of signal processing done in a radar.
- Be able to estimate the performance of a radar based on parameters provided, for example at what distance the radar will be able to detect targets of a given size.

- Be able to assess what type of radar is suitable for which task (choice of waveforms, frequency bands, etc..).
- Be able to use numerical tools to calculate radar performance and to simulate the signal processing in a radar.

REFERENCES:

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,Elsevier
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

17271L26 COMMUNICATION SYSTEMS LAB -II L T P C
0 0 3 3

OBJECTIVES:

- To enable the students to verify the basic principles and design aspects involved in high frequency communication systems components
- To expose the student to different high frequency components and conduct the experiments to analyze and interpret data to produce meaningful conclusions and match with theoretical concepts.
- To design and develop RF components using microstrip technology

LIST OF EXPERIMENTS:

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

TOTAL: 45 PERIODS

OUTCOMES:

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

- Apply knowledge to identify a suitable architecture and systematically design an RF system.
- Comprehensively record and report the measured data, and would be capable of analyzing, interpreting the experimentally measured data and producing meaningful conclusions.
- Design and develop microstrip filters.

17271CRM RESEARCH METHODOLOGY L T P C
3 0 0 3

AIM:

To give an exposure to development of research questions and the various statistical methods suitable to address them through available literature, with basic computational operators.

OBJECTIVES:

- To understand the approaches towards and constraints in good research.
- To identify various statistical tools used in research methodology
- To appreciate and compose the manuscript for publication
- To train in basic computational and excel- skills for research in engineering.

OUTCOME:

Ability to develop research questions and the various research strategies, and compile research results in terms of journal manuscripts.

PREREQUISITES:

Research Methodology course in UG level or equivalent knowledge.

UNIT I

Introduction to Research — Criteria of Good Research, Research Problem: Definition of research problem, selecting the problem - Necessity of defining the problem - Techniques involved in defining the problem-Basic principles of experimental designs-Descriptive and experimental design – different types of experimental design – Validity of findings – internal and external validity – Variables in Research – Measurement and Scaling – Different scales. Ethics & Misconduct in research, Plagiarism

UNIT II

Formulation of Hypothesis – Sampling techniques –Sampling error and sample size-Methods of data collection – Primary and secondary data – observation – Collection of literature, manual collection from library, usage of library, collection of literature from Scopus, ScienceDirect etc., compiling literature, software utilization in literature collection- Processing and analysis of data – editing – coding – transcription – tabulation –outline of statistical analysis.

UNIT III

Data Analysis using Excel- Tabulation of Data in excel (Creating Master Table and Sub Table), Formulas and Functions, Filters and Sort and Validation Lists, Data from External Sources. Data Analysis Using Charts and Graphs(Pivot Table & Charts), Time Value of Money, Measure of central tendency: mean, median, mode, Measure of dispersion: variance, standard deviation, Coefficient of variation. Correlation, regression lines. Z-test, t- test F-test, ANOVA one way classification, Chi square test, independence of attributes. Time series: forecasting Method of least squares, Moving average method, Introduction to presentation tool, features and functions, Creating Presentation, Customizing presentation.

UNIT IV

Various research methods-Design of Experiments, Response Surface Methodology, Taguchi Methods- Modeling & Simulation of Engineering Systems, Artificial Neural Networks, Fuzzy Logic, MATLAB - Graph Theory- Finite Element Methods, Computational Fluid Dynamics -R programming in Statistics- open source software

UNIT V

Review of literature, Report writing – target audience – types of reports – contents of reports – styles and Conventions in reporting – steps in drafting a report. Basic concept of research paper writing for Journals and formats of publications in Journals, Report Structure - writing research abstract - introduction, review of literature, result, conclusions, Concepts of Bibliography and references

OUTCOMES:

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

- Understand the approaches towards and constraints in good research.
- Identify various statistical tools used in research methodology
- Train in basic computational and excel- skills for research in engineering.

References:

1. C. R. Kothari, Research Methodology, New Age International Publishers. New Delhi, 2004.
2. Rajammal.P. Devadas, 1976, A hand book of methodology of research, RMM Vidyalaya Press.
3. R.A Day and A.L. Underwood, Quantitative analysis, Prentice Hall, 1999.
4. R. Gopalan, Thesis writing, Vijay Nicole Imprints Private Ltd., 2005.
5. W.J. DeCoursey, Statistics and Probability for Engineering Applications With Microsoft® Excel, Newnes, 2003.
6. Archibald Fripp, Jon Fripp, Michael Fripp; Just-in-Time Math for Engineers, Elsevier Science & Technology Books, 2003.

SEMESTER III

17271H31 WIRELESS SENSOR NETWORKS **L T P C**
4 0 0 4

AIM:

The aim of this course is to study about wireless IP architecture, Packet Data Protocol and LTE network architecture.

OBJECTIVES:

- To study about advanced wireless networks, LTE, 4G and Evolutions from LTE to LTE.
- To study about adaptive link layer, hybrid ARQ and graph routing protocol.
- To study about mobility management, cellular network, and micro cellular networks

UNIT I OVERVIEW OF WIRELESS SENSOR NETWORKS 8

Challenges for Wireless Sensor Networks, Enabling Technologies For Wireless Sensor Networks.

UNIT II ARCHITECTURES 9

Single-Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes , Operating Systems and Execution Environments, Network Architecture -Sensor Network Scenarios, Optimization Goals and Figures of Merit, Gateway Concepts.

UNIT III NETWORKING SENSORS 10

Physical Layer and Transceiver Design Considerations, MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols And Wake Up Concepts - S-MAC , The Mediation Device Protocol, Wakeup Radio Concepts, Address and Name Management,Assignment of MAC Addresses, Routing Protocols- Energy-Efficient Routing,Geographic Routing.

UNIT IV INFRASTRUCTURE ESTABLISHMENT 9

Topology Control, Clustering, Time Synchronization, Localization and Positioning,Sensor Tasking and Control.

UNIT V SENSOR NETWORK PLATFORMS AND TOOLS 9

Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level software platforms, Node-level Simulators, State-centric programming.

TOTAL: 45 PERIODS

OUTCOMES:

- Familiar with the latest 4G networks and LTE
- Understand about the wireless IP architecture and LTE network architecture.
- Familiar with the adaptive link layer and network layer graphs and protocol.
- Understand about the mobility management and cellular network.
- Understand about the wireless sensor network architecture and its concept.

BOOKS FOR REFERENCES:

1. Holger Karl & Andreas Willig, " Protocols And Architectures for Wireless Sensor Networks" , John Wiley, 2005.
2. Feng Zhao & Leonidas J. Guibas, “Wireless Sensor Networks- An Information Processing Approach", Elsevier, 2007.
3. Kazem Sohraby, Daniel Minoli, & Taieb Znati, “Wireless Sensor Networks- Technology, Protocols, And Applications”, John Wiley, 2007.
4. Anna Hac, “Wireless Sensor Network Designs”, John Wiley, 2003.

SEMESTER III

ELECTIVE IV

17271E32A SOFTWARE DEFINED RADIO L T P C
4 0 0 4

AIM:

The aim of this course is to understand the concepts of software defined radio.

OBJECTIVES:

The students should be made to be

- Understand the concepts of software defined radio
- Learn spectrum sensing and dynamic spectrum access

UNIT I: Introduction to SDR 9

The Need for Software Radios-Characteristics and Benefits of a Software Radio. Design Principles of a Software Radio.Radio frequency implementation issues-The Purpose of the RF Front-End. Dynamic Range: The Principal Challenge of Receiver Design. RF Receiver Front-End Topologies. Enhanced Flexibility of the RF Chain with Software Radios. Importance of the Components -Transmitter Architectures and their Issues. Noise and Distortion in the RF Chain. ADC and DAC Distortion.

UNIT II : Direct Digital Synthesis 9

Introduction. Comparison of Direct Digital Synthesis with Analog Signal Synthesis. Approaches to Direct Digital Synthesis. Analysis of Spurious Signals. Spurious Components due to Periodic Jitter. Band pass Signal Generation. Performance of Direct Digital Synthesis Systems. Hybrid DDS-PLL Systems. Applications of direct Digital Synthesis. Generation of Random Sequences. ROM Compression Techniques.

UNIT III Signal Processor and Multi Rate Processing Techniques 9

Introduction. Sample Rate Conversion Principles. Polyphase Filters. Digital Filter Banks. Timing Recovery in Digital Receivers Using Multirate Digital Filters.

DSP Processors; Field Programmable Gate Arrays; Trade-Offs in Using DSPs, FPGAs, and ASICs; Power Management Issues; Using a Combination of DSPs, FPGAs, and ASICs.

UNIT IV: Smart Antennas 9

Vector channel modeling; Benefits of smart antennas; Structures for Beam forming Systems; Smart Antenna Algorithms.Diversity and Space-Time Adaptive Signal Processing; Algorithms for Transmit STAP; Hardware Implementation of Smart Antennas; Array Calibration.

UNIT V: Applications –Wireless Aspects of Tele-Health Care

The application of advanced telecommunication , the special requirements especially related to reliability, privacy and trust, Regulatory and safety aspects of tele-health care, Cognitive radio and flexible spectrum usage for tele-healthcare, Cooperative Communications for Tele-health. Case studies: JTRS radio system ,Software defined base stations.

TOTAL : 45 PERIODS

OUTCOMES:

At the end of this course, the student should be able to

- Compare MAC and network layer design for software defined radio
- Discuss cognitive radio for Internet of Things and M2M technologies

BOOKS FOR REFERENCES:

1. Jeffrey H. Reed -Software Radio: A Modern Approach to Radio EngineeringPublisher: Prentice Hall PTR; May 2002 ISBN: 0170811580.
2. Wireless Communications: Principles and Practice, 2nd ed,by Rappaport, Prentice-Hall 2002. ISBN 0-17-042232-0.
3. Wireless Application Development, by Skelton, Thomson, 2003, ISBN 0-619-15931-6

SEMESTER III

ELECTIVE IV

17271E32B SATELLITE COMMUNICATION L T P C

4 0 0 4

AIM:

To understand the basics of satellite orbits.To understand the satellite segment and earth segment.

OBJECTIVES:

The students should be made to be

- Learn M2M developments and satellite applications
- Understand Satellite Communication In Ipv6 Environment

UNIT I ORBITAL MECHANICS 9

Kepler's laws of motion, Orbits, Orbit Equations, Orbit Description, Locating the Satellite in the Orbit and with Respect to Earth, Orbital Elements-Look Angle Determination and Visibility - Orbital Perturbations,Orbit Determination, Launch Vehicles, Orbital Effects in Communication System - Performance Attitude control; Satellite launch vehicles. spectrum allocations for satellite systems.

UNIT II SPACECRAFT SUBSYSTEMS AND EARTH STATION 9

Spacecraft Subsystems, Altitude and Orbit Control, Telemetry and Tracking, Power Systems,Communication Subsystems, Transponders, Antennas, Equipment Reliability, Earth Stations, Example of payloads of operating and planned systems.

UNIT III SPACE LINKS 9

The Space Link, Satellite Link Design - Satellite uplink -down link power Budget, Basic Transmission Theory, System Noise Temp, G/T Ratio, Noise Figure, Downlink Design, Design of Satellite Links for Specified C/N - Microwave Propagation on Satellite-Earth Paths. Interference between satellite circuits, Energy Dispersal, propagation characteristics of fixed and mobile satellite links.

UNIT IV MULTIPLE ACCESS TECHNIQUES AND NETWORK ASPECTS 9

Single access vs. multiple access (MA). Classical MA techniques: FDMA, TDMA. Single channel per carrier (SCPC) access - Code division multiple access (CDMA). Demand assignment techniques. Examples of MA techniques for existing and planned systems (e.g. the satellite component of UMTS).Mobile satellite network design, ATM via satellite. TCP/IP via satellite - Call control, handover and call set up procedures.

Hybrid satellite-terrestrial networks

UNIT V SERVICES AND APPLICATIONS 9

Fixed and mobile services - Multimedia satellite services - Advanced applications based on satellite platforms - INTELSAT series - INSAT, VSAT, Remote Sensing - Mobile satellite service: GSM. GPS,INMARSAT, Navigation System, Direct to Home service (DTH), Special services, E-mail, Videoconferencing and Internet connectivity.

Total:45 Periods

OUTCOMES:

At the end of this course, the student should be able to:

- Discuss satellite navigation and global positioning system
- Outline deep space networks and inter planetary missions

BOOKS FOR REFERENCES:

1. Dennis Roddy, “Satellite Communications”, 3rd Edition, Mc Graw Hill International Editions, 2001
2. Bruce R.Elbert, “Introduction to Satellite Communication” , Artech House Inc.,1999.
3. Timothy Pratt, Charles W. Bostian, Jeremy Allnutt, “Satellite Communications”, 2nd Edition, Wiley, John& Sons, 2002
4. Wilbur L.Pritchard, Hendri G.Suyderhood, Robert A.Nelson, “Satellite Communication SystemsEngineering”, 2nd Edition, Prentice Hall, New Jersey, 1993
5. Tri T.Ha, "Digital satellite communication", 2nd Edition, McGraw Hill, New york.1990

SEMESTER III

ELECTIVE IV

17271E32C CDMA SYSTEMS L T P C
4 0 0 4

AIM:

The aim of this course is to define the basics of cellular communications and explain the Architecture OF GSM & its Radio Channels.

OBJECTIVES:

The students should be made to be

- understand cellular concept, widely popular 2G digital, TDMA based mobile system GSM and modern mobile wireless system CDMA.

UNIT I BASIC CONCEPTS OF CDMA 9

Spread spectrum communication techniques (DS-CDMA, FH-CDMA),Synchronization in CDMA system, Detection and False alarm probabilities, Early-Late gate measurement statistics, Information capacity of Spread Spectrum Systems.

UNIT II IS-95 CDMA TECHNIQUES 9

Spreading Codes , Power control, Handover techniques, Physical and logical channels and processing (Forward and reverse links)

UNIT III WCDMA / CDMA 2000 9

Introduction to IMT 2000, CDMA 2000 - Physical layer characteristics, modulation & demodulation process , Handoff and power control in 3G systems.

UNIT IV MULTICARRIER CDMA SYSTEMS 9

Multicarrier CDMA, System design , Performance parameters – BER lower bound,Multiuser detection, UTRA, FDD and TDD systems.

UNIT V OPTICAL CDMA 9

Prime Codes and its properties, Generalized and Extended Prime Codes,Experimental demonstration of Optical CDMA, Synchronization of Optical CDMAnetworks, Multiwavelength Optical CDMA networks.

TOTAL : 45 PERIODS

OUTCOMES:

At the end of this course, the student should be able to:

- Define the basics of cellular communications.
- Explain the Architecture OF GSM & its Radio Channels.
- Distinguish between GSM & CDMA Technology
- Interpret the practical applicability of above concepts.

BOOKS FOR REFERENCES

1. John G.Proakis, “Digital Communications”, McGraw Hill International Ltd,4th ed., Singapore, 2000.
2. Andrew J. Viterbi, “ CDMA: Principles of Spread SpectrumCommunication”,Addison-Wesley, 1sted. , 1995.
3. Kaveth Pahlavan,. K. Prashanth Krishnamuorthy, "Principles of WirelessNetworks", Prentice Hall of India, 2006.
4. Vijay Kumar Garg, “IS –95 CDMA and CDMA 2000: Cellular/PCS SystemsImplementation”, Pearson Education , 2st ed. , 2003.

5. Richard Van Nee, Ramjee Prasad, ” OFDM for Wireless MultimediaCommunication” , Artech House , Boston ,London, 2000.
6. Andreas F. Molisch, “Wireless Communication”, Wiley India, 2006.
7. Raymond Steele, Chin-Chun Lee, Peter Gould, “GSM CDMA One and 3GSystems”, Wiley India, 2004.
8. Guu-Chang Yang, “Prime Codes with Application to Optical and WirelessNetworks”, Artech House, Inc., 2002.

SEMESTER III

ELECTIVE IV

17271E32D SPEECH PROCESSING AND SYNTHESIS L T P C
4 0 0 4

AIM:

To familiarize the students with the various speech signal representation, coding and recognition techniques.

OBJECTIVES:

- To understand the mathematical foundations needed for speech processing
- To understand the basic concepts and algorithms of speech processing and synthesis
- 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.

UNIT III 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

UNIT IV 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

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.

SEMESTER III
ELECTIVE - V

17271E33A WAVELETS AND MULTIRESOLUTION PROCESSING **L T P C**

4 0 0 4

AIM:

To introduce the fundamentals concepts of wavelet transforms.

OBJECTIVE:

- To study system design using Wavelets
- To learn the different wavelet families & their applications.

UNIT I INTRODUCTION **9**

Vector Spaces - properties - dot product - basis - dimension, orthogonality and orthonormality - relationship between vectors and signals - Signal spaces - concept of Convergence – Generalised Fourier Expansion.

UNIT II MULTI RESOLUTION ANALYSIS **9**

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

UNIT III CONTINUOUS WAVELET TRANSFORM **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 - Multi-band Wavelet transforms. Introduction to lifting Scheme.

UNIT V APPLICATIONS **9**

Signal Compression – Image Compression techniques: EZW-SPHIT Coding - Image denoising techniques:Noise estimation - Shrinkage rules -. Shrinkage Functions - Edge detection and object Isolation, Image Fusion, and Object Detection.

TOTAL : 45 PERIODS

OUTCOME:

- The students will be able to apprehend the detailed knowledge about the Wavelet transforms & its applications.

BOOKS FOR REFERENCES:

1. Rao .R.M and A.S.Bopardikar, "Wavelet Transforms: Introduction to theory and Applications",Pearson Education Asia Pte. Ltd., 2000.
2. Strang G, Nguyen T, "Wavelets and Filter Banks," Wellesley Cambridge Press, 1996
3. Vetterli M, Kovacevic J., "Wavelets and Sub-band Coding," Prentice Hall, 1995
4. Mallat S., "Wavelet tour of Signal Processing", Academic Press, 1996
5. David C.Lay., "Linear Algebra and its applications" Pearson education, 2007.(Unit I only)

SEMESTER III
ELECTIVE – V

17271E33B HIGH PERFORMANCE COMMUNICATION NETWORKS **L T P C**
4 0 0 4

AIM:

To familiarize concepts and terminology associated with ATM, Frame Relay, MPLS, Bluetooth technology**.**

OBJECTIVES:

- To appreciate the need for interoperable network management as a typical distributed

application
- To be aware of current trends in network technologies

UNIT I PACKET SWITCHED NETWORKS **9**

OSI and IP models, Ethernet (IEEE 802.3), Token ring (IEEE 802.5), Wireless LAN (IEEE 802.11) FDDI,DQDB, SMDS: Internetworking with SMDS

UNIT II ISDN AND BROADBAND ISDN **9**

ISDN - overview, interfaces and functions, Layers and services - Signaling System 7 (SS7)- Broadband ISDN architecture and Protocols.

UNIT III ATM AND FRAME RELAY **9**

ATM: Main features-addressing, signaling and routing, ATM header structure-adaptation layer,management and control, ATM switching and transmission.

Frame Relay: Protocols and services, Congestion control, Internetworking with ATM, Internet and ATM,Frame relay via ATM.

UNIT IV ADVANCED NETWORK ARCHITECTURE **9**

IP forwarding architectures overlay model, Multi Protocol Label Switching (MPLS), integrated services in the Internet, Resource Reservation Protocol (RSVP), Differentiated services

UNIT V BLUETOOTH TECHNOLOGY **9**

The Bluetooth module-Protocol stack Part I: Antennas, Radio interface, Base band, The Link controller,Audio, The Link Manager, The Host controller interface; The Bluetooth module-Protocol stack Part I:Logical link control and adaptation protocol, RFCOMM, Service discovery protocol, Wireless access protocol, Telephony control protocol.

TOTAL : 45 PERIODS

OUTCOMES:

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

- Diagnose problems and make minor repairs to computer networks using appropriate diagnostics software b
- Demonstrate how to correctly maintain LAN computer systems
- Maintain the network by performing routine maintenance tasks
- Apply network management tools

BOOKS FOR REFERENCES:

1. William Stallings,"ISDN and Broadband ISDN with Frame Relay and ATM", 4th edition, Pearsoneducation Asia, 2002.
2. Leon Gracia, Widjaja, "Communication networks ", Tata McGraw-Hill, New Delhi, 2000.
3. Jennifer Bray and Charles F.Sturman,"BlueTooth" Pearson education Asia, 2001.
4. Sumit Kasera, Pankaj Sethi, "ATM Networks ", Tata McGraw-Hill, New Delhi, 2000.
5. Rainer Handel, Manfred N.Huber and Stefan Schroder ,"ATM Networks",3rd edition, Pearsoneducation asia,2002.
6. Jean Walrand and Pravin Varaiya ,"High Performance Communication networks",2nd edition,Harcourt and Morgan Kauffman,London,2000.
7. William Stallings,"High-speed Networks and Internets", 2nd edition, Pearson education Asia, 2003.

17271E33C ADVANCED MICROPROCESSORS AND MICROCONTROLLERS

L T P C
4 0 0 4

AIM:

To introduce the advanced features in microprocessors and microcontrollers.

OBJECTIVES:

- To enable the students to understand various microcontroller architectures
- To expose the students to the fundamentals of microprocessor architecture.

UNIT I MICROPROCESSOR ARCHITECTURE 9

Instruction set – Data formats – Instruction 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 – RISC properties – RISC evaluation – On-chip register files versus cache evaluation

UNIT II HIGH PERFORMANCE CISC ARCHITECTURE – PENTIUM 9

The software model – functional description – CPU pin descriptions – RISC concepts – bus operations – Super scalar architecture – pipelining – Branch prediction – The instruction and caches –Floating point unit –protected mode operation – Segmentation – paging – Protection – multitasking –Exception and interrupts – Input /Output – Virtual 8086 model – Interrupt processing -Instruction types –Addressing modes – Processor flags – Instruction set - programming the Pentium processor.

UNIT III HIGH PERFORMANCE RISC ARCHITECTURE :ARM 9

The ARM architecture – ARM assembly language program – ARM organization and implementation –The ARM instruction set - The thumb instruction set – ARM CPU cores.

UNIT IV MOTOROLA 68HC11 MICROCONTROLLERS 9

Instructions and addressing modes – operating modes – Hardware reset – Interrupt system – ParallelI/O ports – Flags – Real time clock – Programmable timer – pulse accumulator – serial communication interface – A/D converter – hardware expansion – Assembly language Programming

UNIT V PIC MICROCONTROLLER 9

CPU architecture – Instruction set - Interrupts – Timers – I/O port expansion –I2C bus for peripheral chip access – A/D converter – UART

TOTAL : 45 PERIODS

OUTCOMES:

- The student will be able to work with a suitable microprocessor / microcontroller for a specific real world application.

BOOKS FOR REFERENCES:

1. Daniel Tabak , ‘’ Advanced Microprocessors” McGraw Hill.Inc., 1995
2. James L. Antonakos, “The Pentium Microprocessor ‘’ Pearson Education, 1997.
3. Steve Furber, ‘’ ARM System –On –Chip architecture “Addison 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

Readings : Web links: www.ocw.nit.edu,www.arm.com,

SEMESTER III

ELECTIVE - V

17271E33D RECONFIGURABLE COMPUTING L T P C
4 0 0 4

AIM:

To examine the various reconfigurable computing systems.To understand the different types of compute models for programming reconfigurable architectures

OBJECTIVES

- To understand the need for reconfigurable computing
- To expose the students to various device 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

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.

SEMESTER III
ELECTIVE - VI

17271E34A SIMULATION OF COMMUNICATION NETWORKS L T P C
4 0 0 4

AIM:

The aim of this course is to learn modeling and simulation.

OBJECTIVES:

The students should be made to be

- Learn modeling and simulation
- Understand Monte Carlo simulation
- Study channel modeling and mobility modeling

UNIT I MODELLING OF COMMUNICATION SYSTEM 9

Model of speech and picture signals, Pseudo noise sequences, Non-linear sequences, Analog channel model, Noise and fading, Digital channel model-Gilbert model of bursty channels, HF, Troposcatter and satellite channels, Switched telephone channels, Analog and Digital communication system models, Lightwave system models.

UNIT II SIMULATION OF RANDOM VARIABLES AND RANDOM PROCESS 9

Univariate and multivariate models, Transformation of random variables, Bounds and approximation, Random process models-Markov and ARMA Sequences, Sampling rate for simulation, Computer generation and testing of random numbers

UNIT III ESTIMATION OF PERFORMANCE MEASURES 9

Quality of an estimator, estimator for SNR, Probability density functions of analog communication system, BER of digital communication systems, Monte Carlo method and Importance of sampling method,estimation of power spectral density

UNIT IV COMMUNICATION NETWORKS 9

Queuing models, M/M/I and M/M/I/N queues, Little formula, Burke's theorem ,M/G/I queue, Embedded Markov chain analysis of TDM systems, Polling, Random access systems

UNIT V NETWORK OF QUEUES 9

Queues in tandem, store and forward communication networks, capacity allocation, Congestion and flowchart, Routing model, Network layout and Reliability

TOTAL : 45 PERIODS

OUTCOMES:

At the end of this course, the student should be able to

- Apply Monte Carlo simulation
- Discuss Lower Layer and Link Layer Wireless Modeling
- Compare channel modeling and mobility modeling

BOOKS FOR REFERENCES:

1. M.C.Jeruchim,Philip Balaban and K.Sam Shanmugan, "Simulation of communication systems",Springer, 2nd Edition, 2002.
2. A.M.Law and W.David Kelton, "Simulation Modelling and analysis", 3rd Edition, Mc Graw Hill Inc.,1999.
3. J.F.Hayes, “Modeling and Analysis of Computer Communication networks (Applications ofCommunication Theory)”, Plenum Press, 1984.
4. Jerry Banks and John S.Carson and Barry L. Nelson, “Discrete-Event System Simulation”, 4th Edition,Prentice Hall Inc., 2004.

SEMESTER III

17271E34B MEDICAL IMAGING L T P C
4 0 0 4

AIM:

To study the production of x-rays and its application to different medical Imaging techniques. To study the different types of Radio diagnostic techniques.

OBJECTIVES:

- To study the special imaging techniques used for visualizing the cross sections of the body.
- To study the imaging of soft tissues using ultrasound technique

UNIT I PRINCIPLES OF RADIOGRAPHIC EQUIPMENTS 8

X-Ray tubes, cooling systems, removal of scatters, construction of image Intensifier tubes, angiographic setup, digital radiology.

UNIT II COMPUTER AIDED TOMOGRAPHY 10

Need for sectional images, Principles of sectional scanning, Method of convolution and Back-Propagation, Methods of reconstruction, Artifacts, Principle of 3D imaging

UNIT III RADIO ISOTOPIC IMAGING 9

Radiation detectors, Radio isotopic imaging equipment, scanners, Principle of semiconductor detectors, Gamma ray camera, Positron Emission tomography. SPECT.

UNIT IV ULTRASONIC SYSTEMS 9

Wave propagation and interaction in Biological tissues, Acoustic radiation, continuous and pulsed excitation, Transducers and imaging systems, Scanning methods, Principle of image generation.

UNIT V MAGNETIC RESONANCE IMAGING 9

Principles of MRI, Relaxation processes and their measurements, Pulse sequencing and MR image acquisition.

TOTAL:45 PERIODS

OUTCOMES:

At the end of this course, the students should be able to:

- Explain computer aided tomography
- Discuss ultrasonic systems
- Outline magnetic resonance imaging

BOOKS FOR REFERENCES:

1. D.N.Chesney and M.O.Chesney Radiographic imaging, CBS Publications, New Delhi, 1987.
2. Peggy, W., Roger D.Ferimarch, MRI for Technologists, McGraw Hill, New York, 1995.
3. Steve Webb, The Physics of Medical Imaging, Taylor& Francis, New York.1988.

SEMESTER III
ELECTIVE – VI

17271E34C MOBILE ADHOC NETWORKS **L T P C**
4 0 0 4

AIM:

The aim of this course is to understand the basics of Ad-hoc & Sensor Networks.

OBJECTIVES:

- To learn various fundamental and emerging protocols of all layers.
- To study about the issues pertaining to major obstacles in establishment and efficient management of Ad-hoc and sensor networks.
- To understand the nature and applications of Ad-hoc and sensor networks.
- To understand various security practices and protocols of Ad-hoc and Sensor Networks.

UNIT I INTRODUCTION 9

Introduction to Ad Hoc networks – definition, characteristics features, applications.Characteristics of Wireless channel, Ad Hoc Mobility Models: - entity and group models.

UNIT II MEDIUM ACCESS PROTOCOLS 9

MAC Protocols: design issues, goals and classification. Contention based protocols,reservation based protocols, scheduling algorithms, protocols using directional antennas. IEEE standards: 802.11a, 802.11b, 802.11g, 802.15. HIPERLAN.

UNIT III NETWORK PROTOCOLS 9

Addressing issues in ad hoc network, Routing Protocols: Design issues, goals and classification. Proactive Vs reactive routing, Unicast routing algorithms, Multicast Routing algorithms, hybrid routing algorithm, Power/ Energy aware routing algorithm,Hierarchical Routing, QoS aware routing.

UNITIV END -TO - END DELIVERY AND SECURITY 9

Transport layer: Issues in designing- Transport layer classification, adhoc transport protocols. Security issues in adhoc networks: issues and challenges, network security attacks, secure routing protocols.

UNITV CROSS LAYER DESIGN AND INTEGRATION OF AD HOC FOR 4G 9

Cross layer Design: Need for cross layer design, cross layer optimization, parameter optimization techniques, Cross layer cautionary perspective, Co-operative networks:-Architecture, methods of cooperation, co-operative antennas, Integration of
ad hoc networks with other wired and wireless networks.

TOTAL : 45 PERIODS

OUTCOMES:

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

- Identify different issues in wireless ad hoc and sensor networks.
- To analyze protocols developed for ad hoc and sensor networks.
- To identify and address the security threats in ad hoc and sensor networks.
- Establish a Sensor network environment for different types of applications.

BOOKS FOR REFERENCES:

1. C.Siva Ram Murthy and B.S.Manoj, “Adhoc Wireless Networks Architectures and protocols”, 2nd edition, Pearson Education, 2007.
2. Charles E. Perkins, “Adhoc Networking”, Addison – Wesley, 2000.
3. Stefano Basagni, Marco Conti, Silvia Giordano and Ivan stojmenovic, “Mobile Ad Hoc networking”, Wiley-IEEE press, 2004.
4. Mohammad Ilyas, “The handbook of adhoc wireless networks”, CRC press,2002.
5. T. Camp, J. Boleng, and V. Davies “A Survey of Mobility Models for Ad HocNetwork Research,” Wireless Communication and Mobile Comp., SpecialIssue on Mobile Ad Hoc Networking Research, Trends and Applications, vol. 2,no. 5, 2002, pp. 483–502.
6. Fekri M. Abduljalil and Shrikant K. Bodhe , “A survey of integrating IP mobility protocols and Mobile Ad hoc networks”, IEEE communication Survey and tutorials, v 9.no.1 2007.
7. V.T.Raisinhani and S.Iyer “Cross layer design optimization in wireless protocol stacks”, Computer communication, vol 27 no. 8, 2004.
8. V.T.Raisinhani and S.Iyer, ” ÉCLAIR; An Efficient Cross-Layer Architecture for wireless protocol stacks”, World Wireless cong., San Francisco, CA,May 2004.

SEMESTER III
ELECTIVE – VI

17271E34D ULTRA WIDEBAND COMMUNICATION L T P C
4 0 0 4

AIM:

To give fundamental concepts related to Ultra wide band .

OBJECTIVES:

- To understand the channel model and signal processing for UWB.
- To acquire knowledge about UWB antennas and regulations.

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 MODEL 9

Impulse Radio , Pulsed Multiband, Multiband OFDM, features : Complexity, Power Consumption, Security and achievable data rate. MIMO Multiband OFDM, Differential multiband ofdm, Performance 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 Broadband 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

TOTAL:45 PERIODS

OUTCOMES:

Students learn about

- Radio technology that can use a very low energy level for short-range, high-bandwidth communications over a large portion of the radio spectrum.

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.