PRIST DEEMED UNIVERSITY

Vallam, Thanjavur

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF
ELECTRONICS & COMMUNICATION ENGINEERING

PROGRAM HANDBOOK

M.TECH - COMMUNICATION SYSTEMS
[PART TIME]

[REGULATION 2017]

M.TECH - COMMUNICATION SYSTEMS (PART TIME) – R2017

SEMESTER I

S.N	SUB CODE	SUBJECT	L	T	P	C
Theory						
1	17248S11BP	Applied mathematics for Electronics Engineering	3	1	0	4
2	17271H12P	Statistical Signal Processing	3	1	0	4
3	17271H13P	Modern Digital Communication Systems	3	1	0	4
Practical						
4	17271L14P	Communication Systems Lab - I	0	0	3	3
Research Skill Development (RSD) Course						
5	17271CRSP	Research Led Seminar	1	0	0	**1**
Total Credits						**16**

SEMESTER II

S.N	SUB CODE	SUBJECT	L	T	P	C
Theory						
1	17271H21P	Mobile Communication Networks	4	0	0	4
2	17271H22P	Advanced Microwave Systems	4	0	0	4
3	17271E23_P	**Elective-I**	4	0	0	**4**
Practical						
4	17271L24P	Communication Systems Lab - II	0	0	3	3
5	172TECWRP	Technical Writing /Seminars	0	0	3	3
Research Skill Development (RSD) Course						
6	17271CRMP	Research Methodology	3	0	0	**3**
7	17271CBRP	Participation in Bounded Research	0	0	2	**2**
Total Credits						**23**

SEMESTER III

S.N	SUB CODE	SUBJECT	L	T	P	C
	Theory					
1	17271H31P	Communication Protocol Engineering	4	0	0	4
2	17271H32P	Advanced Radiation Systems	4	0	0	4
3	17271E33_P	**Elective – II**	4	0	0	4
Research Skill Development (RSD) Course						
4	17271CSRP	Scaffolded Research	0	0	4	**4**
Total Credits						**16**

SEMESTER IV

S.N	SUB CODE	SUBJECT	L	T	P	C
	Theory					
1	17271H41P	Wireless Sensor Networks	4	0	0	4
2	17271H42P	Fiber Optic Networking	4	0	0	4
3	17271H43_P	**Elective-III**	4	0	0	4
Project						
4	17271P44P	Project Phase – I	0	0	6	6
Total Credits						**18**

SEMESTER V

S.N	SUB CODE	SUBJECT	L	T	P	C
	Theory					
1	17271E51_P	**Elective-IV**	4	0	0	4
2	17271E52_P	**Elective-V**	4	0	0	4
3	17271E53_P	**Elective-VI**	4	0	0	4
Total Credits						**12**

SEMESTER VI

S.N	SUB CODE	SUBJECT	L	T	P	C
1	17271P61P	Project Phase – II	0	0	12	12
Total Credits						**12**
Total Credits for the Programme						**97**

LIST OF ELECTIVES

Elective-I (SEMESTER – II)

S.N	SUB CODE	SUBJECT	L	T	P	C
1.	1727E23AP	High Speed Switching Architecture	4	0	0	4
2.	17271E23BP	DSP Processor Architecture and Programming	4	0	0	4
3.	17271E23CP	Digital Speech Processing	4	0	0	4

Elective-II (SEMESTER – III)

S.N	SUB CODE	SUBJECT	L	T	P	C
1.	17271E33AP	Internetworking and Multimedia	4	0	0	4
2.	17271E33BP	Digital Image Processing	4	0	0	4
3.	17271E33CP	LASER Communication	4	0	0	4

Elective-III (SEMESTER – IV)

S.N	SUB CODE	SUBJECT	L	T	P	C
1.	17271E43AP	Digital Communication Receivers	4	0	0	4
2.	17271E43BP	Soft Computing	4	0	0	4
3.	17271E43CP	Communication Network Security	4	0	0	4

Elective-IV (SEMESTER – V)

S.N	SUB CODE	SUBJECT	L	T	P	C
1.	17271E51AP	Software Defined Radio	4	0	0	4
2.	17271E51BP	Satellite Communication	4	0	0	4
3.	17271E51CP	CDMA Systems	4	0	0	4

Elective-V (SEMESTER – V)

S.N	SUB CODE	SUBJECT	L	T	P	C
1.	17271E52AP	Wavelets and Multi Resolution Processing	4	0	0	4
2.	17271E52BP	High performance Communication Networks	4	0	0	4
3.	17271E52CP	Advanced Microprocessors and Microcontrollers	4	0	0	4

Elective-VI (SEMESTER – V)

S. N	SUB CODE	SUBJECT	L	T	P	C
1.	17271E53AP	Simulation of Communication Networks	4	0	0	4
2.	17271E53BP	Medical Imaging	4	0	0	4
3.	17271E53CP	Mobile ADHOC networks	4	0	0	4

M.TECH (PART TIME) - COMMUNICATION SYSTEMS

COURSE STRUCTURE AND CREDITS DISTRIBUTION

Sem.	Core Courses						Elective Courses		Total Credits
	Theory Courses		Practical Courses		Courses on *RSD				
	Nos.	Credits	Nos.	Credits	Nos.	Credits	Nos.	Credits	
I	03	12	01	03	01	01	-	-	16
II	02	08	02	06	02	05	01	04	23
III	02	08	-	-	01	04	01	04	16
IV	02	08	-	-	01	06	01	04	18
V	-	-	-	-	-	-	03	12	12
VI	-	-	-	-	01	12	-	-	12
Total Credits									97

HOD **DEAN**

SEMESTER I

17248S11PB **3 1 0 4**

APPLIED MATHEMATICS FOR ELECTRONICS ENGINEERS

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**

BOOKS FOR REFERENCES:

1 M.K.Venkataraman , "Higher Mathematics for Engineering & Science", National Publishing Company,2000
2 Kandasamy, "Engineering Mathematics Volume – II", S.Chand & Co., 2001.
3 P.K.Gupta , D.S.Hira, "Operations Research", S.Chand &Co., 1999
4 T.Veerarajan,"Probability, Statistics & Random Processes", TMH, 2002.

SEMESTER I

17271H12P **3 1 0 4**

STATISTICAL SIGNAL PROCESSING

UNIT I DISCRETE RANDOM SIGNAL PROCESSING

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

UNIT II SPECTRUM ESTIMATION

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

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

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

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.

Tutorial :15 **Total:60**

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.

SEMESTER I

17271H13P **3 1 0 4**

MODERN DIGITAL COMMUNICATION SYSTEMS

UNIT I COHERENT AND NON-COHERENT COMMUNICATION:

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:

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:

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:

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

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.

Tutorial :15 **Total:60**

BOOKS FOR REFERENCES:

1. M.K.Simon, S.M.Hinedi and W.C.Lindsey, Digital communication techniques; Signalling and detection, Prentice Hall India, New Delhi. 1995.
2. Simon Haykin, Digital communications, John Wiley and sons, 1998
3. 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

SEMESTER I

17271L14P **0 0 3 3**

COMMUNICATION SYSTEM LABORATORY-I

1. Antenna Radiation Pattern measurement.
2. Simulation of Modulation and Coding in a AWGN Communication Channel using Simulation Packages.
3. Implementation of Adaptive Filters, periodogram 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.

SEMESTER II

17271H21P **4 0 0 4**

MOBILE COMMUNICATION NETWORKS

UNIT I OPERATION OF MOBILE COMMUNICATION NETWORKS

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

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

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

Wireless Local Area Networks , General Characteristics of the Hyper LAN 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

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.

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 Key Architectures", 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.

SEMESTER II

17271H22P **4 0 0 4**

ADVANCED MICROWAVE SYSTEMS

UNIT I TECHNOLOGY OF HYBRID MICS

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

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

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

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

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.

BOOKS FOR 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.

SEMESTER II

17271L24P **0 0 3 3**

COMMUNICATION SYSTEMS LABORATORY-II

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.

SEMESTER II
ELECTIVE - I

17271E23AP **4 0 0 4**

HIGH SPEED SWITCHING ARCHITECTURE

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

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 - I

17271E23BP **4 0 0 4**

DSP PROCESSOR ARCHITECTURE AND PROGRAMMING

UNIT I FUNDAMENTALS OF PROGRAMMABLE DSPs

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

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

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 I

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

UNIT V
ADVANCED PROCESSORS II

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

BOOKS FOR REFERENCES:

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

SEMESTER II
ELECTIVE - I

17271E23CP **4 0 0 4**

DIGITAL SPEECH PROCESSING

UNIT I MECHANICS OF SPEECH

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

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

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

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

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.

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

17271CRMP **3 0 0 3**

RESEARCH METHODOLOGY

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, Science Direct 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.

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

17271H31P **4 0 0 4**

COMMUNICATION PROTOCOL ENGINEERING

UNIT I NETWORK REFERENCE MODEL 9

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

UNIT II PROTOCOL SPECIFICATIONS 9

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

UNIT III PROTOCOL VERIFICATION/VALIDATION 9

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

UNIT IV PROTOCOL CONFORMANCE/PERFORMANCE TESTING 9

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

UNIT V PROTOCOL SYNTHESIS AND IMPLEMENTATION 9

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

Tutorial :15 **Total:60 Periods**

BOOKS FOR REFERENCES:

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

SEMESTER III

17271H32P **4 0 0 4**

ADVANCED RADIATION SYSTEMS

UNIT I CONCEPTS 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- Babinets principle Fraunhoffer 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. Phasecenter.Microstrip antennas – feeding methods. Rectangular patch- Transmission line model – Circular patchParabolic Reflector antennas – Prime focus and cassegrain reflectors. Equivalent focal length of Cassegrain antennas. Spillover and taper efficiencies. Optimum illumination.

Tutorial :15 **Total:60 Periods**

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

SEMESTER III
ELECTIVE - II

17271E33AP **4 0 0 4**

INTERNETWORKING AND MULTIMEDIA

UNIT I MULTIMEDIA NETWORKING

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

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

Multicast over shared media network, multicast routing and addressing, scaling multicast and NBMA networks, Reliable transport protocols, TCP adaptation algorithm, RTP, RTCP. MIME, Peer- to-Peer computing, shared application, video conferencing, centralized and distributed conference control,distributed virtual reality, light weight session philosophy.

UNIT IV MULTIMEDIA COMMUNICATION STANDARDS

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

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.

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, Newyork. 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 III
ELECTIVE – II

17271E33BP **4 0 0 4**

DIGITAL IMAGE PROCESSING

UNIT I DIGITAL IMAGE FUNDAMENTALS

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

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

UNIT III ENHANCEMENT AND RESTORATION

Histogram modification and specification techniques - Noise distributions - Spatial averaging - Directional Smoothing – Median - Geometric mean - Harmonic mean - Contraharmonic 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

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.

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 usingMATLAB”, Pearson Education, Inc., 2004.
5. William K. Pratt, “Digital Image Processing”, John Wiley, NewYork, 2002.
4. Milman Sonka, Vaclav Hlavac, Roger Boyle, “Image Processing Analysis and Machine Vision”, 2nd edition, Brooks/Cole, Vikas Publishing House, 1999.

SEMESTER III
ELECTIVE – II

17271E33CP **4 0 0 4**

LASER COMMUNICATION

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

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.

SEMESTER IV

17271H41P **4 0 0 4**

WIRELESS SENSOR 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 Wakeup Concepts - S-MAC , The Mediation Device Protocol, Wakeup Radio Concepts, Address and Name Management, Assignment of MAC Addresses, Routing Protocols- Energy-Efficient Routing, Geographic Routing.

UNIT IV INFRASTRUCTURE ESTABLISHMENT 9

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

UNIT V SENSOR NETWORK PLATFORMS AND TOOLS 9

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

TOTAL= 45 PERIODS

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 IV

17271H42P **4 0 0 4**

FIBER OPTIC NETWORKING

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, Multihop, and Shufflenet multihop 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 test beds.

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

BOOKS FOR REFERENCES:

1. Rajiv Ramaswami and Kumar Sivarajan, Optical Networks: A practical perspective, Morgan Kaufmann, 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, Kluwer Academic Publishers, 2002.
4. Biswanath Mukherjee, Optical Communication Networks, McGraw Hill, 1997

SEMESTER IV
ELECTIVE – III

17271E43AP **4 0 0 4**

DIGITAL COMMUNICATION RECEIVERS

UNIT I REVIEW OF DIGITAL COMMUNICATION TECHNIQUES

Base band and band pass communication, signal space representation, linear and non- linear modulation techniques, and spectral characteristics of digital modulation.

UNIT II OPTIMUM RECEIVERS FOR AWGN CHANNEL

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

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

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

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

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, New Delhi, 1994
4. Simon Marvin, “Digital Communication Over Fading channel; An unified approach to performance Analysis”, John Wiley, New York, 2000
5. Bernard Sklar, “Digital Communication Fundamentals and Applications, Prentice Hall, 1998

SEMESTER IV
ELECTIVE – III

17271E43BP **4 0 0 4**

SOFT COMPUTING

UNIT I ARTIFICIAL NEURAL NETWORKS

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

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

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

UNIT IV NEURO-FUZZY MODELLING

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

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

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, ewYork,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 IV
ELECTIVE – III

17271E43CP **4 0 0 4**

COMMUNICATION NETWORK SECURITY

UNIT I SYMMETRIC CIPHERS

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 Crypt Analysis, Block Cipher Design Principles, BlockCipher Modes of peration,Stegnography;

UNIT II ADVANCED ENCRYPTION STANDARD AND STREAM CIPHERS

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

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

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

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

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 V
ELECTIVE - IV

17271E51AP **4 0 0 4**

SOFTWARE DEFINED RADIO

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. Polyshase 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.

BOOKS FOR REFERENCES:

1. Jeffrey H. Reed -Software Radio: A Modern Approach to Radio Engineering Publisher: Prentice Hall PTR; May 2002 ISBN: 0170811580.
2. Wireless Communications: Principles and Practice, 2nd ed,by Rappaport, Prentice-Hall 2002. ISBN 0-13-042232-0.
3. Wireless Application Development, by Skelton, Thomson, 2003, ISBN 0-619-15931-6

SEMESTER V
ELECTIVE - IV

17271E51BP **4 0 0 4**

SATELLITE COMMUNICATION

UNIT I ORBITAL MECHANICS

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 Attitudecontrol; Satellite launch vehicles. spectrum allocations for satellite systems.

UNIT II SPACECRAFT SUB SYSTEMS AND EARTH STATION

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

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

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

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, Video conferencing and Internet connectivity

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 Systems Engineering”, 2nd Edition, Prentice Hall, New Jersey, 1993
5. Tri T.Ha, "Digital satellite communication", 2nd Edition, McGraw Hill, New york.1990

SEMESTER V
ELECTIVE - IV

17271E51CP **4 0 0 4**

CDMA SYSTEMS

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 it's properties, Generalized and Extended Prime Codes, Experimental demonstration of Optical CDMA, Synchronization of Optical CDMA networks, Multiwavelength Optical CDMA networks.

TOTAL : 45 PERIODS

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 Spectrum Communication, Addison-Wesley, 1sted. , 1995.
3. Kaveth Pahlavan,. K. Prashanth Krishnamuorthy, "Principles of Wireless Networks", Prentice Hall of India, 2006.
4. Vijay Kumar Garg, "IS –95 CDMA and CDMA 2000: Cellular/PCS Systems Implementation", Pearson Education , 2st ed. , 2003.
5. Richard Van Nee, Ramjee Prasad, " OFDM for Wireless Multimedia Communication" , 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 3G Systems", Wiley India, 2004.
8. Guu-Chang Yang, "Prime Codes with Application to Optical and Wireless Networks", Artech House, Inc., 2002.

SEMESTER V
ELECTIVE –V

17271E52AP **4 0 0 4**

WAVELETS AND MULTIRESOLUTION PROCESSING

UNIT I INTRODUCTION

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

Definition of Multi Resolution Analysis (MRA) – Haar basis - Construction of general orthonormal MRAWavelet 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

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

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

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.

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 V
ELECTIVE - V

17271E52BP **4 0 0 4**

HIGH PERFORMANCE COMMUNICATION NETWORKS

UNIT I PACKET SWITCHED NETWORKS

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

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

UNIT III ATM AND FRAME RELAY

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

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

UNIT V BLUE TOOTH TECHNOLOGY

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

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,"Blue Tooth" 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.

SEMESTER V
ELECTIVE - V

17271E52CP **4 0 0 4**

ADVANCED MICROPROCESSORS AND MICRO CONTROLLERS

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 – pipe lining – 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 – Parallel I/O ports – Flags – Real time clock – Programmable timer – pulse accumulator – serial communication interface – A/D converter – hardware expansion – Assembly language Programming

UNIT V PIC MICRO CONTROLLER **9**

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

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”, PearsonEducation 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 V
ELECTIVE –VI

17271E53AP **4 0 0 4**

SIMULATION OF COMMUNICATION NETWORKS

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, Light
wave 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 flow chart, Routing model, Network layout and Reliability

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 of Communication 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 V
ELECTIVE -VI

17271E53BP **4 0 0 4**

MEDICAL IMAGING

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 equipments, 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

BOOKS FOR REFERENCES:

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

SEMESTER V
ELECTIVE -VI

17271E53CP **3 0 0 3**

MOBILE AD HOC NETWORKS

UNIT I INTRODUCTION **9**

Introduction to Ad Hoc networks – definition, characteristics features, applications. Characteristics of Wireless channel, Adhoc 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.

UNIT IV 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.

UNIT V CROSS LAYER DESIGN AND INTEGRATION OF ADHOC 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 co-operation, co-operative antennas, Integration of ad hoc network with other wired and wireless networks.

TOTAL : 45 PERIODS

REFERENCES:

1. C.Siva Ram Murthy and B.S.Manoj, “Ad hoc Wireless Networks Architectures and protocols”, 2nd edition, Pearson Education. 2007.
2. Charles E. Perkins, “Ad hoc Networking”, Addison – Wesley, 2000.
3. Stefano Basagni, Marco Conti, Silvia Giordano and Ivan stojmenovic, “Mobile adhoc 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 Hoc Network Research,” Wireless Communication and Mobile Comp., Special Issue 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.