M.E. (ELECTRONICS & TELECOMMUNICATION) STRUCTURE

Four Semester Course w.e.f. Academic Year 2008-09.

Semester –I

Sr. No.	SUBJECT	TEACHING SCHEME			EXAMINATION SCHEME		
		L	T	P	TH	TW	OE
1.	Advanced Light wave Communication	3	-	2	100	25	-
2.	Linear Algebra & Error Control Techniques	3	1	-	100	25	-
3.	Advanced Network Systems	3	-	2	100	25	-
4.	Random Processes	3	-	2	100	25	-
5.	Elective-I	3	1	-	100	25	-
6.	Seminar -I	-	-	2	-	50	-
		15	02	08	500	175	-

Semester -II

Sr. No.	SUBJECT	TEACHING SCHEME			EXAMINATION SCHEME		
		L	T	P	TH	TW	OE
1.	RF & Microwave Circuit Design	3	-	2	100	25	-
2.	Wireless Communication	3	-	2	100	25	-
3.	Adaptive Signal Processing	3	-	2	100	25	-
4.	Elective II	3	1	-	100	25	-
5.	Elective III	3	1	-	100	25	-
6.	Seminar II	-	-	2	-	50	-
		15	02	08	500	175	-

Semester -III

Sr. No.	SUBJECT	TEACHING SCHEME					EXAMINATION SCHEME			
		L	PR	TU	DR	Total	Theory	TW	POE	OE
1.	Seminar III	-	1	-	-	1	-	50	-	-
2.	Dissertation Phase I	-	4	-	-	4	-	100	-	-
		-	5	-	-	5	-	150	-	-

1. TW marks in Seminar III shall be based on the delivery of at least two seminars in semester III, The topic of both Seminars shall be related to his/her dissertation topic.
2. T.W. marks for dissertation phase I shall be based on the work carried out by the candidate based on his/her dissertation work in consultation with his/her guide
   This work may also include related software assignment, field work, Industrial training etc. as decided by guide. The student shall submit the monthly progress report to the department. The student shall deliver a presentation at the end of Semester III based on the work.

Semester - IV

Sr. No.	SUBJECT	TEACHING SCHEME					EXAMINATION SCHEME			
		L	PR	TU	DR	Total	Theory	TW	POE	OE
1.	Dissertation Phase II	-	5	-	-	5	-	100	-	200*
		-	5	-	-	5	-	100	-	200

1. T.W. marks shall be based on the Seminar delivered by the candidate based on his/her dissertation work.
2. *Dissertation phase II Oral examination shall be based on the work carried out by the candidate in dissertation phase I and phase II.

List of Elective Subjects for Semester I and II
M.E. (Electronics & Telecommunication) w.e.f. Academic Year 2008-09.

Sr. No.	Elective - I	Elective - II	Elective - III
1.	Digital Data Compression	Multi Rate Systems & Filter Banks	Mobile Computing
2.	Optimization Technique	Cryptography & Network Security	Stochastic Models & Queuing Theory
3.	Real Time Embedded Systems	Speech & Audio Processing	Communication System Design
4.	---	---	Optical Networks

M.E. (Electronics & Telecommunication) Semester.- I

1. ADVANCED LIGHTWAVE COMMUNICATIONS

Lectures:- 3 Hrs/week Theory:- 100 marks
Practical:- 2 Hrs/week Term Work:- 25 marks.

1. Introduction to guided optical communication. Optical Fibers, types of fibers & optical Cables, Study of losses during transmission through viz. Attenuation by Absorption & Scattering, Consideration of losses in designing of High Speed / High bandwidth optical communication systems, Selection of fiber for such systems. (8)

2. Optical Sources: Types of LEDs used in optical communication, their construction & operating principle, Types of Lasers. Principle of working of Lasers, solid state & injection Lasers, Optical amplifiers, EDFA, Soliton Systems & design of system required in LAN & WAN type of applications. Calculations of Power budgets and feasibility of system design for above optical sources. (7)

3. Optical Detectors: Introduction & study of type of detectors characteristics. Spectral spread and availability of detectors for 980 nm, 1.3 μm & 1.55 μm λ systems. Calculation of detector sensitivity and design considerations of suitable receivers for LAN, WAN applications. (8)

4. Multiplexing Components & Techniques**:** Concepts of WDM, DWDM system design parameters, Optical multiplex / Demultiplex design considerations- Angular dispersive devices, Dielectric thin film filter type devices, Hybrid & planer wave guide devices, Active WDM devices, Wavelength non selective devices, System application. (8)

5. Long Haul High Band Width Tx System : Designing systems for long haul high band width consideration-Outage, Bit error rate, Cross connect, Low & high speed interphases, Multiplex / Demultiplex consideration, Regenerator spacing, Degeneration & Allowances, Application consideration. (8)

Practicals: Minimum eight experiments based on above syllabus.

Reference Books:

1. Optical Communication Systems by John Gowar (PHI)
2. Optical Fiber Communication by Gerd Keiser (MGH) .
3. Optical Fiber Communication Principles & Practice by John M. Senior (PHI pub. 1996.)

Recommended Journals

1. IEEE Proceeding In Optics.
2. Journal of Optical Society of America.
3. AT&T, Alcatel Optics Journals.
4. Hand book of Optics Vol I & II (MGH.)
5. Optics & Opto Electrics, vol I & II, Nigihawan & Gupta, (Narsoa publication.)
6. Advance In Light Wave Nypters Research Journals of AT & T ,Vol. 66
7. IIT Rourkee Compiled Seminar Proceeding of Fiber Optics in 1994.

Web sites of University of Rochester, IIT Delhi, Miles Grieut Laser equipment.

M.E. (Electronics & Telecommunication) Semester.- I

2. LINEAR ALGEBRA & ERROR CONTROL TECHNIQUES

Lectures:- 3 Hrs/week — Theory:- 100 marks
Tutorial:- 1 Hr/week — Term Work:- 25 marks.

Section - I

1. Finite Dimension vector space, sub spaces, linear independent spaces & dimensions. (6)
2. Algebra of transformations, linear transformations, matrix algebra, simultaneous equations. (5)
3. Sum & intersection of subspaces, invariant sub spaces, Eigen Values, Characteristic vectors. (5)
4. Introduction to Inner product, Space, Schwarz's Inequality, Orthogonality (4)

Section - II

5. The arithmetic of Finite Fields finite fields based on the integrator ring and polynomial ring; primitive elements. Structure of finite fields. Linear block codes matrix description of linear block codes; standard arrays; hamming codes and Reed -Muller codes. (5)

6. Cyclic codes polynomial description of cyclic codes; minimal polynomials and conjugates; matrix description of cyclic codes; circuits for implementation of cyclic codes BCH codes definition of the codes. (5)

7. The Peterson decoder, fast decoding of BCH codes; Reed-Solomon codes. Code based on the spectral techniques Fourier transforms in a Galois field; Reed-Solomon codes. Code based on the spectral techniques Fourier transform in a Galois field. Conjugacy constraints and idempotent; spectral description of cyclic codes; extended Reed – Solomon codes and extended BCH codes; decoding algorithms based on spectral techniques. (7)

8. Convolutional codes; encoding of convoluional codes, structural properties of convolutional codes, distance properties of convolutional codes, maximum likelihood decoding of convolutional codes and majority logical decoding of convoluional codes. (5)

Reference Books:

1. Linear Algebra – David c. Lay (Pearson Education.)
2. Linear Algebra – Krushanamurty, V.P. Mainra, J,L. Arora
3. Linear Algebra- Haufmann K & Kunze R, (Pearson Education, 1972)
4. An Introduction to Error Correcting Codes- Lin (PHI 1992).
5. Error Correcting Codes- W.W. Paterson & E.J. Weldon Jr, (Addison Wisley-1994.)
6. Theory & Practice of Error Control Code- R.E. Salhut , (Addison Wesley-1995.)
7. Text books on Error Control Codes - Williams (Springer Press.)
8. Digital Communication with Matlab - Proakis (TMH)

M.E. (Electronics & Telecommunication) Sem.- I

3. ADVANCED NETWORK SYSTEMS

Lectures:- 3 Hrs/week | Theory:- 100 marks
Practical:- 2 Hrs/week | Term Work:- 25 marks.

1. Internet Technology: Internet address, ARP, RARP, Routing IP, Datagram, ICMP, UDP, TCP, DHCP and Mobile IP, Internet Routing Protocols, multicast Routing, IP V6. (6)
2. DNS Techniques: Names for machines, Flat Namespace, Hierarchical Names, Delegation of Authority for names, Subset Authority, TCP/IP Internet domain names, official and unofficial Internet, Domain names, items named and syntax of names, mapping domain, names to addresses, domain names resolution, efficient translation caching. The key to efficiency, Domain mapping message format, compressed name format, abbreviation of domain names, inverse mappings, pointer queries, object types and resource record contents, obtaining authority for a sub domain. (5)
3. FTP: File access and transfer, online shared access, sharing by file transfer, the major view of FTP, An example of anonymous FTP session, TFTP, NFS, NFS Implementation, Remote procedure call (RPC). (2)
4. Electronic Mail: Electronic Mail, Mailbox names and Aliases, Alias expansion and mail, Forwarding the the relationship of internetworking and mail, TCP/IP standards for electronic mail service, Electronic mail addresses, Pseudo domain addresses, simple mail transfer protocol (SMTP), The MIME extension for Non-ASCII Data, MIME multipart messages. (4)
5. Internet Security and firewall Design: Protection resources, the need for and information policy, communication, cooperation, and mutual mistrust, mechanisms for internet security, firewalls and Internet access, multiple connections and weakest links, firewall implementation and High-speed hardware, packet-level filters, security and packet filter specifications, the consequence of restricted access for clients, Accessing services through A firewall, the details of firewall architecture, Types of fire walls, stub network, An alternative Firewall implementation, monitoring and logging. (6)
6. ATM Networks: Need of ATM, BISDN model, ATM layer, ATM Adaptation Layer, ATM signaling, PNNI Routing. (8)
7. Advanced Network Architecture: IP forwarding Architecture, Overlay model MPLS, Integrated Services in the internet, RSVP, Differentiated Services (6)
8. Giga Bit Ethernet: Architecture and overview of Giga Ethernet, MAC, Physical layer, IEEE 802.32 Standard. (6)

Practicals: Minimum eight experiments based on above syllabus.

Reference Books:

1. Internet working with TCP/IP D.E. Comer, (for chapter 1& 2)
2. Communication Networks: Fundamental & concepts and Key Architectures by Leon-Garcia, widjaja (for cheaper 3 & 4) (Tata McGraw-Hill)
3. ATM – Rich Seifert (for chapter 5)
4. Unix Network Programming by W. Richard Stevens
5. Gigabit Ethernet: Technology and Applications for High Speed LANs, (Addison Wesley).
6. Gigabit Ethernet Networking, David Cunningham, William G. Lane, Bill Lane.(Pearson Higher Education)
7. Data Communication & Networking- Behrmz Foruzan (TMH)

M.E. (Electronics & Telecommunication) Semester.- I

4. RANDOM PROCESSES

Lectures:- 3 Hrs/week — Theory:- 100 marks
Practical:- 2 Hrs/week — Term Work:- 25 marks.

1. Concepts of Probability: Conditional probability and Baye's theorem, Independence of events, Bernoulli trails. (5)

2. Random variables: Cumulative distribution, Joint probability density function, Statistical properties, Jointly distributed Gaussian random variables, Conditional probability density, properties of sum of random variables, Central limit theorem, Estimate of population means, expected value and variance and covariance, Computer generation of random variables. (6)

3. Multiple Random Variables: joint cumulative distribution function, Joint probability density function statistical properties, Jointly distributed Gaussian random variables, Conditional probability density, properties of sum of random variables, Central limit theorem, Estimate of population means, Expected value and variance and covariance, Computer generation of random variables. (7)

4. Markov Chains: Chapman Kolmogorov equation, Classification of states, Limiting probabilities, Stability of Markov system, Reducible chains, Markov chains with continuous state space. (6)

5. Queuing Theory: Introduction, Cost equation, steady state probabilities, Models of single server exponential queuing system with no limit and with finite buffer capacity (M/M/I, M/M/N). Queuing system with bulk service, Network of queues with open system and closed system. The M/G/I system and application of work to M/G/I. (5)

6. Random Processes: Properties, Auto correlation and cross correlation function, Estimate of auto correlation function. (5)

7. Spectral Density: Definition, Properties, white noise, Estimation of auto-correlation function using frequency domain technique, Estimate of spectral density, cross spectral density and its estimation, coherence. (5)

Practicals: Minimum eight experiments based on above syllabus.

Reference Books:

1. Introduction to probability Models,(Third edition) - Sheldon M. Ross.
2. Probability and Random Processes for Electrical Engg.-Alberto Lean-Garcia (Pearson Education.)
3. Stochastic Processes – J. Medhi , (New Age International.)
4. Probability random variables & Stochastic process- Athanasios Papoulis (MGH)
5. Introduction to Probability and Random Processes. By Jorge I. Aunin, V. Chandrashekar.
6. Probability & Statistics- Murrary R. Spiegel – (MGH.)

M.E. (Electronics & Telecommunication) Semester - II

5. RF & MICROWAVE CIRCUIT DESIGN

Lectures: - 3 Hrs/week
Practical: - 2 Hr/week

Theory: - 100 marks
Term Work:- 25 marks.

1. Review of EM Theory : Maxwell's equations, Plane waves in dielectric & conducting media, Energy & Power, Transmission lines, Solid state devices. (7)

2. Monolithic Microwave Integrated Circuits & Technology : History of Monolithic Microwave Integrated Circuits, Monolithic circuit components planner, Transmission Lines, Lumped and Distributed, Passive Elements, GaAs MESFET, Other active devices. Metal Semi-conductor Functions, and their characterization, Physical characteristics, modeling of GaAs MESFET & HEMT. Material and fabrication techniques of GaAs MESFET. Properties of GsAs. Electron Beam and X-ray lithography, Plasma assisted deposition, Molecular beam epitaxy & MOCVD, Ion milling, S-Parameter measurements and their use in GaAs MESFET, S-Parameter measurements : General concept, measurements, utilization of S-Parameters in circuit design, Amplifiers (Narrow band/Broad band), Oscillators, Mixers, Active & Passive Phase shifters, Monolithic Microwave Integrated circuit Process, Optical Control of MMIC's. (16)

3. RF And Microwave Circuit Design: Single & multi port network, Basic definitions, interconnecting networks, network properties, & applications, scattering parameters. RF filter design, filter configurations, special filter realizations, filter implementation, coupled filter, Active components : Semiconductor basics, RF diodes, bipolar junction transistor, RF field effect transistors, High electron mobility transistors.
   Active RF components modeling : Diodes models, transistor models, measurement of active devices, scattering parametric device characterization. Matching & biasing network: Impedance matching using discrete components, micro strip line matching networks, amplifier class of operation, biasing networks. RF transistor amplifier design, amplifier power relations, stability considerations, constant gain, noise figure circles, constant VSWR circles, broadband, high power & multistage amplifiers, Oscillators & Mixer: basic oscillator model, High Frequency oscillator configuration, basic characteristics of mixers. (16)

Practicals: Minimum eight experiments based on above syllabus.

Reference Books

1. RF circuit design, theory & applications- Reinhold Ludwig, Pavel Bretchko, (Pearson Education – LPE)
2. Microwave Engineering-David M. Pozar (John Wiley & Sons)
3. Microwave Amplifier Design- Samuel Y. Liao, (PHI)
4. Microwave Engineering- Sisodiya and Raghuvanshi, (PHI)
5. Microwave Devices & Circuit Design"-Gupta & Shrivastava(PHI)

M.E. (Electronics & Telecommunication) Semester.- II

6. WIRELESS COMMUNICATION

Lectures: - 3 Hrs/week
Practical: - 2 Hr/week

Theory: - 100 marks
Term Work:- 25 marks.

1. Review: 2G, 3G wireless networks, WLL, Cellular Concept (5)
2. Mobile Radio Propagation: Large Scale Path Loss: Introduction to Radio Wave propagation, Free Space propagation model, Relating Power to Electric Field, The Three Basic Propagation Mechanisms, Reflection, Ground Reflection (Two-Ray) Model, Diffraction, Scattering, Practical Link Budget Design Using Path Loss Models, Outdoor Propagation Models, Indoor Propagation Models, Signal Penetration into Buildings, Ray Tracing And Site Specific Modeling, Problem. (7)
3. Mobile Radio Propagation- Small-Scale Fading and Multipath : Small-Scale Multipath Propagation, Impulse Response Model of a Multipath Channel, Small-Scale Multipath Measurements, Parameters of Mobile Multipath Channels, Types of small-Scale Fading, Rayleigh and Ricean Distributions, Statistical Models for Multipath Fading Channels, Theory of Multipath shape factor for small- Scale Fading wireless Channels, Summary, Problem. (7)
4. Multi Access Technique for wireless communication: Introduction, Frequency Division multiple Access (FDMA), Time Division Multiple Access (TDMA) Spread Spectrum Multiple Access, Space Division Multiple Access (SDMA) Packet Radio, Capacity of cellular Systems, Problems. (6)
5. Wireless Networking: Introduction to wireless Networks, Difference Between Wireless and Fixed Telephone Networks, Development of Wireless Networks, Fixed Network Transmission Hierarchy, Traffic Routing in Wireless Networks, Wireless Data Services, Common Channel Signaling (CCS), Integrated services Digital networks (ISDN), Signaling System No. 7 (SS7), An Example of SS7-Global Cellular Network Interoperability, Personal Communication services / Networks (PCS/PCNs), protocols for Network Access, Network Databases, Universal Mobile Telecommunication System (UMTS), Summary. (7)
6. Wireless Systems & Standards: AMPS and ETACS, United States Digital Cellular (IS-54 ad IS-136) Global System for Mobile (GSM) CDMA digital Cellular Standard (IS-95), CT2 standard for cordless Telephones, Digital European Cordless Telephones (DECT) PACS- Personal Access Communication Systems, Pacific Digital Cellular (PDC), Personal Handy phone System (PHS), US PCS and ISM Bands, US wireless Cable Television, Summary Of Standards throughout the world, problems. IEEE 802.11 (7)

Practicals: Minimum eight experiments based on above & Communication System Design syllabus.

Reference Books

1. Wireless Communications Principals & Practice- Theodore S. Rappaport, (P.E.)
2. Wireless & Mobile Network Architecture- Yi-Bing Lin, Imrich Chiamtac (John Wiley)
3. Fundamental of Wireless Communication- David Tse, Pramod Viswanath (Cambridge)

M.E. (Electronics & Telecommunication) Semester.- II

7. ADAPTIVE SIGNAL PROCESSING

Lectures: - 3 Hrs/week
Practical: - 2 Hr/week

Theory: - 100 marks
Term Work:- 25 marks.

Section - I

1. General Introduction

   Adaptive systems-Definition and characteristics, areas of applications, general properties, open and closed loop adaptation, applications of closed loop adaptation.

   The adaptive liner combiner-General description, input signal and weight vectors, desired response and error, the performance function, gradient and minimum mean square error. example of performance surface, alternative expression of the gradient,decorrelation of error and input components. (6)

2. Theory of adaptation with stationary signals.

   Properties of the quadratic performance surface-Normal form of the input correlation matrix,eigen values and eigen vectors of the input correlation matrix, an example with two weights, geometrical significance of eigen vectors and eigen values.

   Searching the performance surface-Methods of searching the performance surface, basic ideas of gradient search methods, a simple gradient search algorithm and its solution, stability and rate of convergence, Gradient estimation and its effects on adaptation – Gradient component estimation by derivative measurement, the performance penalty, derivative measurement and performance penalties with multiple weights, varience of the gradient estimate (8)

3. Stochastic processes and models: Partial Characterization of a Discrete-Time Stochastic Process, Mean Ergodic Therom, Correlation Matrix, Correlation Matrix of Sine Wave Plus Noise, Stochastic Models, Wold Decomposition, Asymptotic Stationarity of an Autoregressive Process, Yule-Walker Equations, Computer Experiment: Autoregressive Process of Order Two, Selecting the Model Order, Complex Gaussian Process, Power Spectral Density, Properties of Power Spectral Density, Transmission of a Stationary Process Through a Liner Filter, Cramer Spectral Representation for a Stationary Process, Powe Spectrum Estimation, Other Statistical Characteristics of a Stochastic Process, Polyspectra, Spectral-Correlation Density. (6)

Section - II

4. Wiener filters: Linear Optimum Filtering, Statement of the problem, Principle of Orthogonality, Minimum Mean-Square Error (4)

5. Adaptive algorithms and structures: The LMS algorithms, The z-transform in ASP, Other adaptive algorithms and structures. (6)

6. RLS adaptive filters: Some Preliminaries, The Matrix Inversion Lemma, The Exponentially Weighted Recursive Least-Squares Algorithm, Selection of The Regularizing Parameter, Update Recursion for the sum of weighted Error Squares, Example, Single-weight Adaptie noise canceller, convergence analysis of the RLS Algorithm, Computer Experiment on Adaptive Equalization, Robustness of RLS filter (6)

7. Applications : Adaptive modeling and system identification, Inverse adaptive modeling, deconvolution, and equalization., Adaptive control systems, Adaptive interference canceling (4)

Practical: Minimum eight experiments based on above syllabus.

Text Books

1. Adaptive Filter Theory- S. Haykin, (Pearson edition 4th Edition)
2. Adaptive Signal Processing, - B. Windrow, S.D. Sterns, (Pearson Education).

Reference Books

1. Digital Signal Processing, S. K. Mitra, TMH
2. Digital Signal Processing: Princiaples, Algorithums & Applications, John G Prokis, D. G. Manolakis, PHI

M.E. (Electronics & Telecommunication) Semester.- I

8. DIGITAL DATA COMPRESSION

Elective - I

Lectures: - 3 Hrs/week — Theory:- 100 marks
Tutorial: - 1 Hr/week — Term Work:- 25 marks.

1. Introduction to Data Compression: Data compression, Loss less compression, Lossy Compression, Performance Measures, Coding, Modeling, Grading Compression Algorithms. (4)

2. Minimum Redundancy Coding: The Shannon-Fano algorithm, The Huffman Algorithm, Adaptive coding: Adaptive Huffman Coding, Updating The Huffman trace, Decoding, The overflow problem, Rescaling Bonus, Arithmetic Coding: Difficulties, Practical Matters, a complication, Decoding. (8)

3. Statistical Modeling: Higher order modeling, finite context modeling, adaptive modeling, Escape code as a fall back, Improvements. Highest order modeling, updating the model, Escape probabilities, score boarding, data structures, modes flushing and implementation. (8)

4. Static v/s Adaptive Compression: Adaptive Methods, Sliding window compression: The algorithm and encoding problem. Speech compression: Digital audio concepts, fundamentals, sampling variables, PC- Based sound, Lossless compression of sound, problem and result, Lossy compression, silence compression, companding and other techniques. (4)

5. Lossy Graphics Compression: Statistical and Dictionary compression methods, Lossy Compression, Differential modulation, JPEG-overview, JPEG-Enhancement, Loss less JPEG, JPEG Compression, The discrete cosine transform, Implementing The DCT, Matrix Multiplication, Improvements, output of the DCT, quantization methods, selection of quantization of coding: zigzag sequence, entropy encoding and about color. (8)

6. Speech Compression: MPEG, MP3.Video compression: Pixel details, Motion estimation, quantization and bit packing, MPEG-2. Fractal Image compression: History, Iterated function system (IFS), Basic IFS, Image compression with IFS and with partitioned IFS. Fractal Image decoding, Resolution independence. Introduction to Wavelet based compression Techniques. (7)

Reference Books

1) The Data Compression- Mark Nelson, Jean-Ioup Gailly, 2nd edition, (M&T pub.)
2) Data Compression: The complete Reference-David Saloman, D., 3rded, (Springer publication.)
3) Introduction to Data Compression-Khalid Sayood, 2nd ed. (Academic press ltd.)
4) Introduction to Information Theory and Data Compression- Darrel Hankerson, 2nd ed, (Chapman and Hall/CRC publications.)
5) Handbook of Image and video Processing-Al Bovik(Academic press ltd. Publication.)
6) Compression Algorithms for Real Programmers- Peter Wayner (Academic press ltd.)

M.E. (Electronics & Telecommunication) Semester.- II

9. OPTIMIZATION TECHNIQUES

Elective - I

Lectures: - 3 Hrs/week
Tutorial: - 1 Hr/week

Theory: - 100 marks
Term Work:- 25 marks.

1. Introduction : Historical development, Application to Engg. problems, Statement of optimization. (4)

2. Classification of Optimization, Multivariable optimization with and without constraints, linear programming standard form of linear programming, Geometry, Simplex programming, revised simplex algorithm, Revised simplex method. (8)

3. Duality in linear programming – Decomposition principle, Transportation problem. (4)

4. Nonlinear programming – single dimensional minimization methods, Exhaustive search, Fibonnaci method, Golden section, Quadrature interpolation, Cubic interpolation , Direct root method, Steepest decent method, Fletcher-Reeves method, David-Fletcher-Powell Method. (10)

5. Dynamic programming – Multistage decision process, principle of optimality, Computational procedures in dynamic programming, Linear programming as a case of dynamic programming. (8)

6. Optimization application for assignment & Network problems, Pareto optimality, Finite element based optimization. (5)

Note: - Term Work based on tutorials using MATLAB Optimization Tool Box

Reference Books

1. Optimization Theory & application - S.S. Rao (Wiely Eastern)
2. Linear Programming - G. Hadly (Welsly)
3. An Introduction to Optimization - Peithpler Philips Wilde (PHI)
4. Optimization concepts & application in Engg. -A. D. Belegundu, Tirupati R. Chandrupatla (Pearson Edn.)

M.E. (Electronics & Telecommunication) Semester. - I

10. REAL TIME EMBEDDED SYSTEMS

Elective - I

Lectures: - 3 Hrs/week — Theory:- 100 marks
Tutorial: - 1 Hr/week — Term Work:- 25 marks.

Section I

1. Fundamentals of Real-Time Theory : Real-time, embedded multitasking systems challenges, Best effort, Hard real-time, Soft real-time, Best Effort scheduling (Round-Robin Time slice Scheme - Review), Introduction to Fixed priority preemptive scheduling, Introduction to Dynamic priority scheduling, Utility Curves (5)

2. Real-Time Services : Service Release Timeline, The CPU, I/O, Memory Resource Space (Characterizing RT Applications), Introduction to Timing diagrams (interference), Introduction to Hard real-time safe resource utilization bounds, The hard real-time requirements and performance (5)

3. Rate Monotonic Policy and Feasibility Overview: Rate Monotonic Assumptions and Constraints, More on Fixed priority preemptive scheduling, Hard real-time safe resource utilization bounds, EDF and LLF Overview (4)

4. Introduction to Feasibility Tests (1)

5. Deadline Monotonic Policy and Feasibility Overview (1)

6. HW and HW+FW Implementations of RT Services (1)

7. SW Implementations of RT Services (1)

8. Synchronization and Resource Issues : Problems with Blocking (resources other than CPU, e.g. I/O), Break up into more threads (better scheduling control), Interrupt driven I/O - e.g. Programmable FIFOs, Model Blocking Time, Priority inversion (general concept), Unbounded priority inversion problem (mutex C.S.), Priority inheritence, Priority ceiling (4)

Section II

9. Scalable Embedded Systems Architectures : Intro to PCI Architecture and I/O Architectures, PCI Plug and Play Concept, Embedded System PCI Form Factors and Standards (3)

10. Device Drivers and Characterization of Embedded I/O : I/O interfaces, Digital, Analog (ADC, DAC interfaces), Microprocessor interface types (word or block), Register-based control, status, data, Higher rate FIFO I/O, Block-oriented 1st/3rd party DMA tx/rx between I/O interfaces and memory, Bus burst transfers and block transfers, system memory map for MMIO devices - DRAM/SDRAM/DDR, BOOTROM, Flash, External interface types, CPU local bus IO/MMIO E.g. PCI 2.x, GPIO, DRAM, Flash, Point-to-point or switched devices E.g. RS-232, RS-422, PCI-Express, Network multi-access devices E.g. Ethernet (4)

11. Device interfaces- introduction to drivers: Top half (driver entry point interface to tasks), bottom half (interface to devices), ring buffers, blocking/non-blocking, ioctl, ISRs and signals/semaphores, scheduled I/O (handle buffering and processing in task), (4)

12. PowerPC Architecture: PowerPC 8xx architecture review, Power PC 8xx and 82xx Architecture Power Point Overviews (1)

13. Xscale Architecture: Xscale Architecture Docs, x86 Architecture:, IA32 Architecture Docs (1)

14. Estimating/Measuring Performance Based on CPU Architecture: Measuring / Controlling CPU Efficiency, Trace Ports (e.g. IBM PowerPC 4xx series, Strong Arm), Built-in PMU (Performance Monitoring Units) (e.g. Intel Pentium, Xscale), External Methods, Logic Analyzer Memory Traces (Cache Misses, DMA, Un-cached access), Memory Port Markers (Writes to Un-cached Memory), Profiling Code by Function or Block, Software in Circuit Methods (e.g. CodeTest Trace SW In-Circuit, gprof), Hardware Supported Profiling (e.g. Intel Vtune, CodeTest HW In-Circuit), Cycle-based profiling, Event-based profiling, Cache Coherency, Harvard I-Cache, D-cache Architecture, Cache Invalidate, Flush, Lock, Pre-fetch, Measuring/Controlling I/O Efficiency, Bus Analyzers - e.g. PCI Event Traces, Logic Analyzer with Support Package (5)

Reference Books:

1. Real-Time Embedded Systems and Components: Sam Siewert, ISBN 1584504684 Books, Barnes & Noble
2. PCI System Architecture (Paperback) Mindshare Inc Tom Shanleyr), Don Anderson

M.E. (Electronics & Telecommunication) Semester.- II

11. MULTIRATE SYSTEMS AND FILTER BANKS

Elective - II

Lectures: - 3 Hrs/week — Theory: - 100 marks
Tutorial: - 1 Hr/week — Term Work:- 25 marks.

Section - I

1. Fundamentals of Multi-rate Systems: Basic multi-rate operations, interconnection of building blocks, poly-phase representation, multistage implementation, applications of multi-rate systems, special filters and filter banks. (7)

2. Multirate Filter Banks:
   Maximally decimated filter banks: Errors created in the QMF bank, alias-free QMF system, power symmetric QMF banks, M-channel filter banks, poly-phase representation, perfect reconstruction systems, alias-free filter banks, tree structured filter banks, trans-multiplexers. (6)

3. Para-unitary Perfect Reconstruction Filter Banks: Lossless transfer matrices, filter bank properties induced by paraunitariness, two channel Para-unitary lattices, M-channel FIR Para-unitary QMF banks, transform coding. (7)

Section -II

4. Linear Phase Perfect Reconstruction QMF Banks: Necessary conditions, lattice structures for linear phase FIR PR QMF banks, formal synthesis of linear phase FIR PR QMF lattice.
   Cosine Modulated Filter Banks: Pseudo-QMF bank and its design, efficient poly-phase structures, properties of cosine matrices, cosine modulated perfect reconstruction systems. (6)

5. Special Topics : (i) Quantization effects-Introduction, Types of quantization effects, Review of standard Techniques, Noise transitation in multirate systems, noise in filter banks, filter bank output noise, limit cycles, coefficient quantization.
   (ii) Multirate filter bank Theory and related Topics-Introduction, Block filters,LPTV systems and multirate filter banks, unconventional sampling Theorems. (6)

6. Wavelet Transform: Short-time Fourier transform, Wavelet transform, discrete-time Ortho-normal wavelets, continuous-time Ortho-normal wavelets. (5)

7. Multidimensional Multirate Systems:- Introduction, Multidimensional signals, sampling a multidimensional signals, minimum sampling density,multirate fundamentals, Alias free decimation. Cascade connections, multifilter design. Special filters and filter banks. (5)

Text Books:

1. P.P. Vaidyanathan, “Multirate Systems and Filter Banks," Pearson Education (Asia) Pte. Ltd, 2004.
2. Gilbert Strang and Truong Nguyen, "Wavelets and Filter Banks," Wellesley-Cambridge Press, 1996.
3. N. J. Fliege, "Multirate Digital Signal Processing,” John Wiley & Sons, USA, 2000.

M.E. (Electronics & Telecommunication) Semester.- I

12. CRYPTOGRAPHY & NETWORK SECURITY

Elective - II

Lectures: - 3 Hrs/week
Tutorial: - 1 Hr/week

Theory: - 100 marks
Term Work:- 25 marks.

1. Overview: Services, Mechanisms, and attacks, The OSI Security Architechure. A model for network security, Classical Encryption Techniques: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Rotor Mechines, Steganography (6)

2. Block Ciphers and the Data Encryption Standard: Simplied DES, Block Cipher Principles, The Data Encryption Standard, The Strength of DES, Differential Linear Cryptanalysis, Block Cipher Design Principles, Block Cipher Modes of Operation, Contemporary symmetric Ciphers: Triple DES, Blowfish, RC5, Characteristics of Advanced Symmetric Block Ciphers, Confidentially using symmetric Encryption: Placement of Encryption Function, Traffic Confidentiality, Key Distribution, Random Number Generation. (10)

3. Public Key Cryptography and RSA: Principles of Public Key cryptosystems, The RSA Algorithm, Key Management, other Public Key Cryptosystems key Management, Diffle-Hellman Key exchange.. (5)

4. Message Authentication and hash functions: Authentication Requirements, F Authentication Function, Message Authentication Codes, Hash Functions, Security of Hash Functions and MACs. (5)

5. Hash Algorithms: MD5 Message Digest Algorithm, Secure Hash Algorithm. (4)

6. Authentification Applications: Kerberos, X. 509 Authentication Service.. (4)

7. Electronic Mail Security: Pretty Good Privacy, S/MIME, IP Security Overview, IP Security Architecture, Authentifications, Header, Encapsulating Security Payload, Combining Security Associations, Key Management. (3)

8. Web Security: Web Security Considerations, System Security: Intruders, Malicious Software, Viruses, Viruses and Related Threats, Firewalls: Firewall Design Principles (3)

Reference Books

1. Willam Stallings, Cryptography and Network Security, Third Edition, Pearson Education
2. Cbarlie Kaufman, Radia Perlman, Mike Speciner, Network Security, Provate Communication in a public world, Second Edition, Pearson Education Asia, 2002.
3. Atul Kahate, Cryptography and Network Security, Tata McGrawhill, 2003.

13. M.E. (Electronics & Telecommunication) Semester.- II

SPEECH & AUDIO PROCESSING

Elective - II

Lectures: - 3 Hrs/week Theory: - 100 marks
Tutorial: - 1 Hr/week Term Work:- 25 marks.

1. Digital models for the speech signal: Process of speech production, Acoustic theory of speech production, Lossless tube models, and Digital models for speech signals. (4)

2. Time domain models for speech processing: Time dependent processing of speech, Short time energy and average magnitude, Short time average zero crossing rate, Speech vs silence discrimination using energy & zero crossings, Pitch period estimation, Short time autocorrelation function, Short time average magnitude difference function, Pitch period estimation using autocorrelation function, Median smoothing. (5)

3. Digital representations of the speech waveform: Sampling speech signals, Instantaneous quantization, Adaptive quantization, Differential quantization, Delta Modulation, Differential PCM, Comparison of systems, direct digital code conversion. (4)

4. Short time Fourier analysis: Linear Filtering interpretation, Filter bank summation method, Overlap addition method, Design of digital filter banks, Implementation using FFT, Spectrographic displays, Pitch detection, Analysis by synthesis, Analysis synthesis systems. (4)

5. Homomorphic speech processing: Homomorphic systems for convolution, Complex cepstrum, Pitch detection, Formant estimation, Homomorphic vocoder. (4)

6. Linear predictive coding of speech: Basic principles of linear predictive analysis, Solution of LPC equations, Prediction error signal, Frequency domain interpretation, Relation between the various speech parameters, Synthesis of speech from linear predictive parameters, Applications. (4)

7. Speech Enhancement: Spectral subtraction & filtering, Harmonic filtering, parametric re-synthesis, Adaptive noise cancellation. (4)

8. Speech Synthesis: Principles of speech synthesis, Synthesizer methods, Synthesis of intonation, Speech synthesis for different speakers, Speech synthesis in other languages, Evaluation, Practical speech synthesis. (4)

9. Automatic Speech Recognition: Introduction, Speech recognition vs. Speaker recognition, Signal processing and analysis methods, Pattern comparison techniques, Hidden Markov Models, Artificial Neural Networks. (4)

10. Audio Processing: Auditory perception and psychoacoustics - Masking, frequency and loudness perception, spatial perception, Digital Audio, Audio Coding - High quality, low-bit-rate audio coding standards, MPEG, AC-3, Multichannel audio - Stereo, 3D binaural and Multichannel surround sound. (4)

Text Books:

1. L. R. Rabiner and R. W. Schafer**,** "Digital Processing of Speech Signals," Pearson Education (Asia) Pte. Ltd., 2004.
2. D. O'Shaughnessy, "Speech Communications: Human and Machine," Universities Press, 2001.
3. L. R. Rabiner and B. Juang, "Fundamentals of Speech Recognition," Pearson Education (Asia) Pte. Ltd., 2004.
4. Z. Li and M.S. Drew**,** "Fundamentals of Multimedia," Pearson Education (Asia) Pvt. Ltd., 2004.

Reference Book:

1. C Becchetti & L P Ricotti, "Speech Recognition Theory & C++ Implementation" John Wiley & Sons
2. D. O'Shaughnessy, "Speech Communication Human & Machine", Universities Press.
3. B. Gold & N. Morgan "Speech & Audio Signal Processing", John Wiley & Sons

M.E. (Electronics & Telecommunication) Semester.- II

14. MOBILE COMPUTING

Elective - III

Lectures: - 3 Hrs/week — Theory: - 100 marks

Tutorial: - 1 Hr/week — Term Work:- 25 marks.

Section - I

1. Wireless network technology : Global System for Mobile Communication (GSM) , Wireless media access control protocols; Wireless LAN, TDMA, PRMA, CDMA, etc. (7)
2. Routing in wireless networks: Unicast routing protocol, Dynamic source routing, DSR optimization, route caching , Relative distance micro discovery routing, On-demand distance vector routing, power aware routing, Hybrid protocols (5)
3. Location management: Location management in internet, Location management in cellular phone network and PCN, performance issues, future research directions (2)
4. Transport protocols in mobile environments :I-TCP, snooping protocols, Multicast transport services (5)

Section - II

5. Services in wireless networks : Quality of service, Delays, error and packet loss, Error control schemes (5)
6. Mobile distributed application support :Operating system support, Mobile middleware and object architecture, Mobile transaction, Remote execution and mobile RPC, Cache strategies for wireless networks (5)
7. Security issues in mobile computing: security technique s and algorithms, security protocol, public key infrastructure, trust, security model, security frame work (4)
8. Wireless devises with symbian OS: Symbian OS architecture, control and compound control, active objects, Localization, security on the symbian OS (4)

Reference :

1. Mobile Computing, edited by T. Imielinski and H.F. Korth, Kluwer Academic
2. Mobile computing by Asok Talukdar, Roopa Yawagal, TMH

M.E. (Electronics & Telecommunication) Semester.- II

15. STOCHASTIC MODELS & QUEUING THEORY

Elective - III

Lectures: - 3 Hrs/week Theory: - 100 marks

Tutorial: - 1 Hr/week Term Work:- 25 marks.

1. Renewal Theory And Regenerative Processes : Definition of a Stochastic Process, Realizations, Renewal Processes, Reward and cost models, Cumulative processes, Equilibrium distribution and the inspections paradox, The Batch Effects, The Poisson Process, Stopping Time, The connection Between the time averages and the point wise limits, Point Distribution Process, Defective Renewal Processes, Regenerative Processes, Time Average and The mean of a Limiting distribution, Wald's Equation, The Expected-Value Version of the elementary Renewal Theorem, Renewal equation, Transient Behavior & the Renewal Equation for General Renewal Processes, Stationary Regenerative Processes, Transient Expressions, Lattice Distributions, Blackwell's Theorem, Key Renewal Theorem and point wise Limits, Asymptotic Normality and the regenerative method. (10)
2. Discrete Markov Chains : Discrete Markov Chains, Transition Probabilities, Connections with Renewal Theory, Communication Classes and Class Properties, Irreducible Chains-Positive States, Frequencies and Relatives Frequencies for Positive Irreducible Chains, Costs and reward for Positive Irreducible Chains, Transient Behavior, Periodic and aperiodic States, Point wise Limits, Branching Processes, Reversed and Reversible Positive Irreducible chains, Stationary measures For Recurrent Irreducible Chains. (6)
3. Continuous-Time Markov Chains : Pure-Jump Continuous-Time Chains, Regular Chains, The Birth and Death Process, Time and Death Process, Time and Transition Averages for Recurrent Irreducible Chains, Semi-Markov Processes. (6)
4. Introduction to Queuing Theory: The M/M/I Queue with Queue limit, Birth and Death Models, The M/M/C Queue: Comparison with Single-channel Queues, Markovian Queues, The M/G/c Loss System-Insensitivity, Balancing Equitation's & Generating Functions, M/G/1 Queue, Poisson Arrivals See Time Averages (PASTA). (4)
5. Reversible Chains: Tandem Queues, Jackson Networks Computing The throughput of Closed Jackson Networks, Approximating Closed Networks: The Fixed Population-Mean(FPM) Method, open Networks with General Customer Routes, Networks of Quasi-Reversible Stations, symmetric Queues, The two Stage Model, The G/M/∞ Queue, The G/M/ℓ Loss System, The Two-Stage Model with Poisson Arrivals. (4)
6. Petri Net Models: Classical Petri Nets- Preliminary Definitions, Transition Firing and Reachability, Representational Power, Properties of Petri Nets, Generalized stochastic Petri Nets- Exponential Timed Petri Nets, Definition and Firing Rules, Analysis of GSPNs, Computation of performance measures, Representational Power of GSPN Models, GSPN Modeling of Kanban Systems-Description of the system, GSPN Model, Numerical Results, Deadlock Analysis Using Petri Nets: Deadlock Prevention, Deadlock Avoidance, Performance Evaluation in the presence of Deadlocks. (6)

Reference Books

1. Stochastic Modeling & The Theory of Queues- Ronald W. Wolff, (PH, International Edition).
2. Stochastic Processes- J Medhi (New Age International)
3. Performance Modeling of Automated Manufacturing System"- N. Viswanadham, Y. Narahari (PHI)

M.E. (Electronics & Telecommunication) Semester.- II

16. COMMUNICATION SYSTEM DESIGN

Elective - III

Lectures: - 3 Hrs/week
Tutorial: - 1 Hr/week

Theory: - 100 marks
Term Work:- 25 marks.

1. Designers perspective of communication system: Wireless channel description, path loss, multi path fading (5)

2. Communication concepts, Receiver Architectures: Introduction, Overview of Modulation Schemes, Classical Channel, Wireless Channel Description, Path Losses: Detailed Discussion, Multipath Fading: Channel model and Envelope Fading, Multipath Fading: Frequency Selective and Fast Fading, Summary of Standard Translation, Introduction Receiver Architectures, Receiver front End: general discussion, Filter Design, rest of Receiver Front Eng: Nonideatlites and Design Parameters, Derivation of NF, IIP_3 of Receiver Front End, Partitioning of required NF_{rec_front} and IIP_{3,rec_front} into individual. (12)

3. Low Noise Amplifier: Introduction, Wideband LNA, Design, Narrow band LNA: Impedance Matching, Narrowband LNA: Core Amplifier, (8)

4. Active Mixer: Introduction, Balancing, Qualitative Description of The Gilbert Mixer, Conversion Gain, Distortion, Low-Frequency Case: Analysis of Gilbert Mixer, Distortion, High- Frequency Case, Noise, A Complete Active Mixer, References, Problems. (8)

5. Analog to Digital Converters: Demodulators, A to D Converters used in receivers, Low cost Sigma delta modulators and it's implementation. (8)

6. Design Technology for Wireless Systems: Design entry / simulation, Validation and analysis tools (2)

Reference Books

1. VLSI for Wireless Communication- Bosco Leuing, (PE).
2. The design of CMOS Radio frequency integrated circuits – T Lee (Cambridge university press)
3. Analysis and design of analog integrated circuits – P Gray and R Meyer (John Wiley & Sons)
4. Microelectronics Transistor Amplifier, Analysis and design G Gonzalez (Prentice Hall)

M.E. (Electronics & Telecommunication) Semester.- II

17. OPTICAL NETWORKS

Elective - III

Lectures: - 3 Hrs/week | Theory: - 100 marks
Tutorial: - 1 Hr/week | Term Work:- 25 marks.

1. Sonet & SDH : Brief history of Sonet & SDH, Multiplexing hierarchy, Multiplexing structure – Functional components, Problem detection, Virtual tributaries & containers, Concatenation. (4)
2. Architecture of OTN: Digital wrapper, control planes, Control signaling, Multiplexing hierarchies, Current digital hierarchy, revised hierarchies, Optical & Digital Transport hierarchies, Functionality stacks, Encapsulation & Decapsulation, GFP. (4)
3. WDM, DWDM Topologies : Relationship with SONET / SDH, EDF, WDM Amplifiers, Multiplexers, WADM I/P & O/P ports, spanloss & chromatic, dispersion, Tunable DWDM lasers. (4)
4. Network Topologies & Protection schemes : Non-negotiable requirements of robust networks, Line & Path protection switching, Type of Topologies, Optical Channel Concatenation, Meshed topologies, PON's, Optical Ethernets, Wide area Backbones, Metro optical networking (4)
5. MPLS & Optical networks : Label switching, FEC, Scalability & granuility : labels & wavelength, MPLS nodes, Distribution & Binding methods, MPLS support of virtual private networks, Traffic Engineering, MPLS, Relationships of OXC, MPLS operation, MPLS & optical Traffic Engineering, Similarities. Control & Dataplanes interworking (5)
6. Architecture of IP & MPLS based optical transport Networks : IP, MPLS & Optical control planes- Interworking, The three control planes, Framework for IP Vs. Optical networks, Generalized MPLS use in optical networks, Bidirectional LSP's in optical network, Next horizon of GMPLS, ODVK General communication channels, Traffic parameters (5)
7. Link Management protocol (LMP): What is managed, Data Bearing links, Basic function of LMP, LMP messages, LMP message header, TLW's control channel management, LPC, LCV, Fault management, Extending LMP operations to optical links (4)
8. Optical Routers Management : Switching in optical internets: State of art in optical switching, clarification of Key terms, Evolution of switching technologies, Speeds of electronics & photonics, Optical routers, Control element, switching technologies MEMS, OSP, Setting up protection paths between nodes H, G & J, Expanding the Role of nodes G & I, Node failure, Coupling, decoupling, node to node wavelengths, Approach to problem of LSP & OSP interworking, Thermo-optic switches, Bubble switch. (5)
9. Optical compilers : Building blocks, Serial Binary adder with carry delay, Fiber delay line memory loop, Bit serial, optical counter design, Lumped delay design, Distributed delay design, Time multiplex multiprocessor, Time slot interchange with $2 \log_2 (N-1)$ switch, Hatch design support system. (5)

Reference Books

1. Optical Networks– Third generation transport system -Uyless Black (Prentice Hall)
2. Opto Electronic computing system – Jordan

Shivaji University, Kolhapur

Equivalence for subjects in the old syllabus of M.E. (Electronics & Telecommunication. Engg.) to the revised syllabus to be introduced from July 2008.

Semester - I

Sr. No.	Subject in old syllabus	Equivalent Subject in revised syllabus
1	Advanced Light wave communication	Advanced Light Wave Communication
2	Linear Algebra	Linear Algebra & Error control Techniques
3	Advanced Network systems	Advanced Network systems
4	Random Processes	Random Processes
5	Elective-I 1. Digital Communication 2. Error Control coding & Cryptography	Elective –I 1. Digital Data Compression 2. Optimization Techniques

Semester II

Sr. No.	Subject in old syllabus	Equivalent Subject Revised Syllabus
1	Advanced Microwave Engg.	RF & Microwave Circuit Design
2	Adaptive signal Processing	Adaptive Signal Processing
3	Wireless Communication	Wireless Communication
4	Elective II 1. Optical Networks	Elective II 1. Multirate systems & Filter Banks

	2. Optimization Techniques	2. Speech & Audio Processing
5	Elective III 1. Communication System Design 2. Stochastic Models & Queing Theory	Elective III 1. Communication system Design 2. Stochastic Models & Queing Theory