

# M.Tech. Electronics Communication Engineering Syllabus

Schedule/Syllabus of Teaching Schedule of Examination

4 0 4 All theory subjects 3 100 50 150

Project 50 50 100 Seminar 100 100 Dissertation Satisfactory/not Satisfactory

SEMESTER I

EC501 Wireless & Mobile Communication EC502 Electronics System Design EC503 Data Communication Network EC504 Advanced Comm. Systems EC505 Neural Network & Fuzzy Logic EC506 Lab I

SEMESTER II

EC507 Optical Communication Systems EC508 Digital Speech & Image Processing EC509 Information Theory and Coding ECElective I ECElective II EC516 Lab II

SEMESTER III

EC580 Project EC590 Seminar

SEMESTER IV

EC500 Dissertation

LIST OF ELECTIVES

ELECTIVE I

EC510 Advanced Microprocessor & Embedded Systems EC511 VLSI Design EC512 Reliability of Electronics Comm. Systems EC513 Multimedia Comm. Systems EC514 Parallel Processing EC515 Peripheral System Design & Interfacing EC517 Modeling & Simulation of Comm. Systems ELECTIVE II

EC518 Microwave Theory & Technique EC519 Detection & Estimation Theory EC520 Microelectronics Technology EC521 Internetworking & Internet Protocols EC522 RF Microwave & Antenna Theory EC523 Computational Techniques

EC501 Wireless and Mobile Communication

Max. Marks: 100 Time Allowed: 3 Hrs

Note: Eight questions of equal marks to be set covering the whole syllabus and any five to be attempted.

1. Introduction
2. Technical Background, Transmission Fundamentals, Communication Networks, Protocols and TCP/IP Suite
3. 2. Wireless Communication Technology
4. Antennas and Propagation Signal, Encoding Techniques, Spread Spectrum Coding and Error Control
5. 3. Wireless Networking
6. Satellite Communications, Cellular Transmission Principles, Cordless Systems and Wireless Local Loop Mobile IP and Wireless access protocol
7. 4. Wireless LANs
8. Wireless LAN Technology, IEEE 802, 11 Wireless LAN standard.
9. 5. CDMA Standards

10. System Architecture for CDMA. Network and Data Link Layers of CDMA.  
Signaling Applications in CDMA System. Voice Applications in CDMA System.
2. RF Engineering and Facilities

Wireless Data, Cellular Communication Fundamentals, GSM Architecture and Interfaces. Radio Link Features in GSM, GSM Logical Channels and Frame Structure. Speech Coding in GSM (Messages, Services and Call Flows in GSM).

Books Recommended:

1. Applications of CDMA in Wireless/Personal Communications by V K Garg, K Smolik
2. Principles and Applications of GSM by V K Garg Prentice Hall
3. Wireless Communication and Networks by Stallings
4. Mobile Communication Schiller Prentice Hall
5. Mobile Communication by Lee, Pearson
6. Related IEEE/IEE publications

EC502 Electronics System Design

Max. Marks: 100 Time Allowed: 3 Hrs

Note: Eight questions of equal marks to be set covering the whole syllabus and any five to be attempted.

1. Review of Digital electronics concept
  1. 2. MSI and LSI Circuits And Their Applications
  2. Arithmetic Circuits, Comparators, Multiplexers, Code Converters, XOR And ANDOR INVERTER Gates, Wired Logic, Bus Oriented Structures, TriState Bus System, Propagation Delay.
  3. 3. Sequential Machines

The Concept Of Memory, The Binary Cell, The Cell And The Bouncing Switch, Set / Reset, D, Clocked T, Clocked JK Flip Flop, Design Of Clock F/F, Conversion, Clocking Aspects, Clock Skew, State Diagram Synchronous Analysis Process, Design

1. Steps For Traditional Synchronous Sequential Circuits, State Reduction, Design Steps For Next State Decoders, Design Of Out Put Decoders, Counters, Shift Registers and Memory.
2. 4. Multi Input System Controller Design
3. System Controllers, Design Phases And System Documentation, Defining The System, Timing And Frequency Considerations, Functional, Position And Detailed Flow Diagram Development, MDS Diagram, Generation, Synchronizing Two System And Choosing Controller, Architecture, State Assignment, Next State Decoders And Its Maps, Output Decoders, Clock And Power Supply Requirements, MSI Decoders, Multiplexers In System Controllers, Indirect Addressed Multiplexers Configurations, Programmable System Controllers, ROM, PLA And PAL Based Design.
2. Asynchronous Finite State Machines

Scope, Asynchronous Analysis, Design Of Asynchronous Machines, Cycle And Races, Plotting And Reading The Excitation Map, Hazards, Essential Hazards Map Entered Variable, MEV Approaches To Asynchronous Design, Hazards In Circuit Developed By MEV Method, Electromagnetic Interference And Electromagnetic Compatibility Grounding And Shielding of Digital Circuits. Interfacing digital system with different media like fiber cable, coaxial cable etc. Books Recommended:

1. An Engineering Approach To Digital Design by Fletcher PHI 1990
2. Designing With TTL Circuits by Texas Instruments.
3. Related IEEE/IEE publications 4

EC503 Data Communication Networks

Max. Marks: 100 Time Allowed: 3 Hrs

Note: Eight questions of equal marks to be set covering the whole syllabus and any five to be attempted.

1. Data Transmission

Overview of Data Communication and networking, Analog And Digital Data Transmission, Transmission Impairments, Various Transmission Media, Data Encoding.

1. 2. Digital Data Communication Techniques
  2. Asynchronous And Synchronous Transmission, Error Detection and correction techniques, Physical interfaces
  3. 3. Data Link Control
  4. Link Configurations, Protocol principles (Error control, Flow control), Bit Oriented and character oriented protocol, Data link layer services, Link Control.
2. Multiplexing

F.D.M. Synchronous TDM, Statistical TDM

1. 5. Switching and Computer Networks
  2. Communication Networks, Circuit Switching, Message Switching, Packet Switching, X.25, Virtual circuits and Data gram's, LAN/MAN Technologies, Medium Access control protocols (CSMA/CD, Token ring, FDDI, DQDB)
  3. 6. Computer Communication Architecture
  4. OSI and TCP/IP Model, Protocol And Architecture, Inter Networking, IP addressing, structure of IP, IPv4, IPv6, Transport layer Protocols, Session Service And Protocols, and Presentation/Application Controls.
  5. 7. ATM Networks
  6. Concepts, history, Architecture, Convergence and challenges
  7. 8. Network Operating Systems
  8. Overview of network operating systems (Windows NT/Unix/Linux), Mobile IP33N Operating System
2. Network security

Security issues, concept of firewalls, intrusion detection Systems

Books Recommended:

1. Data And Computer Communication by William Stallings, Prentice Hall, 4th Ed.
2. Computer Networking by Andrew Tanenbaum.
3. Data communications and networking by Forouzan

1. Engg. approach to Computer Networking by Srinivasan Keshav, Pearson Edu.
2. Data Networks by Bertsekas prentice Hall
3. Related IEEE/IEE publications 5

EC504 Advanced Communication Systems

Max. Marks: 100 Time Allowed: 3 Hrs

Note: Eight questions of equal marks to be set covering the whole syllabus and any five to be attempted.

1. 1. Introduction
  2. Introduction to communications systems, analog and digital communication systems, Applications of communication systems.
  3. 2. Digital Communication
  4. Introduction, Digital Modulation techniques, BPSK, QPSK, PCM, DPCM, Delta Modulation, Digital Transmission and Transmission Impairments.
2. Optical Networks

WDM, TDM, Telecommunication Infrastructure, Switching, 3G systems, SONET, SDH, Architecture of Optical Transport Network, Link Management Protocols, Solutions.

1. 4. Satellite Communication
  2. Basic Transmission Theory, System Noise Temperature and G/T Ratio, Design Of Down Links, Domestic Satellite Systems Using Small Earth Stations, Uplink Design, Design Of Satellite Link For Specified (C/N). Multiple Access Techniques, Frequency Division Multiple Access (FDMA), TDMA, CDMA, Estimating Channel Requirements, Practical Demand Access Systems, Random Access, Multiple Access With On Board Processing. VSAT
2. Mobile Communications

Mobile telephone service, Transmission protocols, Introduction to GSM, GPRS, CDMA, Switching techniques, Fading, Quality of service (QOS).

Books Recommended:

Advanced Communication Systems by Wayne Tomasi; Pearson.

- Digital Communication by Proakis; PHI
- Optical Networks by Uyles Black; Pearson
- Satellite Communication by Timothy Pratt; Addison Wesley.
- Related IEEE/IEE publications 6

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EC505 Neural Networks & Fuzzy Logics

Max. Marks: 100 Time Allowed: 3 Hrs

Note: Eight questions of equal marks to be set covering the whole syllabus and any five to be attempted.

1. Neural networks characteristics, History of development in neural networks principles, Artificial neural net terminology, Model of a neuron, Topology, Learning, types of learning, Supervised, Unsupervised, Reinforcement learning. Knowledge representation and acquisition.
2. Basic Hop field model, Basic learning laws, Unsupervised learning, Competitive learning, Kmeans clustering algorithm, Kohonen`s feature maps.
3. Radial basis function neural networks, Basic learning laws in RBF nets, Recurrent back propagation, Introduction to counter propagation networks, CMAC network, and ART networks.
4. Applications of neural nets such as pattern recognition, Optimization, Associative memories, speech and decisionmaking. VLSI implementation of neural networks.
5. Fuzzy Logic: Basic concepts of fuzzy logic, Fuzzy vs. Crisp set, Linguistic variables, Membership functions, Operations of fuzzy sets, Fuzzy IFTHEN rules, Variable inference techniques, DeFuzzification, Basic fuzzy inference algorithm, Fuzzy system design, FKBC & PID control, Antilock Breaking system (ABS), Industrial applications.

Books Recommended:

6. Neural Networks by Simon Haykin
7. Fuzzy logic with engineering application by ROSS J.T (Tata Mc)
8. Neural Networks & Fuzzy Logic by Bart Kosko
9. Neural computing theory & practice by P.D. wasserman (ANZA PUB).
10. Introduction to applied Fuzzy Electronics Ahmad M.Ibrahim (PHI)
11. Introduction to artificial neural systems by J.M. Zurada.(Jaico Pub)
12. An introduction to Fuzzy control by D. Driankor, H. Hellendorn, M. Reinfrank (Narosa Pub.)
13. Fuzzy Neural Control by Junhong NIE & DEREK LINKERS (PHI)
14. Related IEEE/IEE publications
15. Fuzzy System Design Principles, Building Fuzzy IFTHEN Rule Bases – by Riza C.Berkiu & Trubatch, IEEE Press 7

EC506 LabI

Max. Marks: 100 Time Allowed: 2hrs

At least ten experiments are to be performed related to the subjects related to the subjects taught in 1st semester. 8

EC507 Optical Communication Systems

Max. Marks: 100 Time Allowed: 3 Hrs

Note: Eight questions of equal marks to be set covering the whole syllabus and any five to be attempted.

1. 1. Introduction to optical fibers
  2. Wave propagation Dispersion and its limitations, losses and nonlinear effects
  3. 2. Optical transmitters
  4. LEDs Semiconductor lasers and their characteristics. Transmitter Design
  5. 3. Optical receiver
  6. Photo detectors and their characteristics. Receiver Design. Noise and Sensitivity in Optical Receivers Sensitivity degradation
  7. 4. Optical Amplifiers
  8. Semiconductor Optical Amplifier Raman Amplifier. EDFA
  9. 5. Dispersion management
  10. Need Precompensation Schemes Best Compensation Techniques. Dispersion Compensatory Fibers Optical Filters Fiber Bragg Grating
  11. 6. Multichannel Systems
  12. WDM Light wave Systems WDM Components System Performance tissues TDM. CDM
16. Solution Systems

Fiber Solutions Soliton based Communications Loss Managed Solitons Dispersion - Managed Solitons High Speed Soliton Systems WDM Soliton Systems

Books Recommended:

17. FiberOptic Communication Systems by GP Aggarwal John Wiley & Sons
18. FiberOptic Communication Systems by Mynbev John Wiley & Sons
19. Related IEEE/IEE publications 9

EC508 Digital Speech & Image Processing

Max. Marks: 100 Time Allowed: 3 Hrs

Note: Eight questions of equal marks to be set covering the whole syllabus and any five to be attempted.

- Review of Filter design. Linear phase FIR filters. Methods of FIR filter design. Methods of IIR filter design. Applications of FIR & IIR filters in speech, image, seismic, medical and other areas.
- 2. Speech Processing
  1. Review of human speech and Acoustic theory, nature of sound, harmonics, resonance measurement, virtual display. Music theory, pitch, duration, intervals, rhythm. Human speech production, the vocal tract, the Larynx, the source filter. Speech signal processing the phasor mode, Fourier transfer, DFT, FFT. The hardware use of FIR & IIR filters. Software, Elements of speech Synthesis speech Recognition speech in the computer human interface.
- Image Processing

Characterization of images as twodimensional discrete fields, unitary transforms— DFT. Hadamard, slant and cosine transforms, compression schemes Karhunen Loeve compression predictive coding schemes. Image enhancement gray scale modification, edge enhancement, restoration Wiener filtering, constrained deconvolution, recursive filtering. Segmentation, edge detection, thresholding, textural properties, geometry and shape description.

Books Recommended:

23. Digital Signal Processing by Proakis & Manolakis
24. Speech and Audio Processing for multimedia PC's by Iain Murray
25. Digital Image Processing by Keenneth R Castleman, Pearson Education Society.
26. Digital Image Processing by Rafact Gonzalez and Richard E. Woods, Pearson Education Society.
27. Related IEEE/IEE publications 10

EC509 Information Theory & Coding

Max. Marks: 100 Time Allowed: 3 Hrs

Note: Eight questions of equal marks to be set covering the whole syllabus and any five to be attempted.

1. 1. Elements of information theory
  2. Source coding theorem, Huffman coding, Channel coding theorem, channel capacity theorem, Shenonfano theorem, entropy
  3. 2. Sampling Process
  4. Base band and band pass sampling theorems reconstruction from samples, Practical aspects of sampling and signal recovery TDM
  5. 3. Waveform Coding Techniques
  6. PCM Channel noise and error probability DPCM and DM Coding speech at low bit rates Prediction and adaptive filters. Base band shaping for data transmission, PAM signals and their power spectra Nyquist criterion ISI and eye pattern Equalization.
  7. 4. Digital Modulation Techniques
  8. Binary and Mary modulation techniques, Coherent and noncoherent detection, Bit Vs symbol error probability and bandwidth efficiency. Bit error analysis, using orthogonal Signaling
28. Error Control Coding

Rationale for coding Linbear block codes, cyclic codes and convolution codes Viterbi decoding algorithm and trellis codes.

Books Recommended:

29. Principles of digitals communication: J. Dass. , S.K. Malik & P.K. Chatterjee, 1991.
30. Introduction to the theory of Error correcting codes: Vera Press, 1992
31. Information Theory and Reliable Communication: Robert G. Gallanger Mc Graw Hill, 1992

### 32. Related IEEE/IEE publications 11

EC510 Advanced Microprocessor & Embedded Systems

Max. Marks: 100 Time Allowed: 3 Hrs

Note: Eight questions of equal marks to be set covering the whole syllabus and any five to be attempted.

1. 1. Microprocessor Architectural Concepts
2. Review of 16bit Microprocessor Architecture, Word Lengths, Addressable Memory, Microprocessor Speed, Architecture Characteristics, Registers, Instructions, Memory Addressing Architecture, ALU, GPR's, Control Logic And Internal Data Bus, Introduction to Pentium Architecture.
3. 2. Microprocessor Instructions And Communications
4. Instruction Set, Mnemonics, Basic Instruction Types, Addressing Modes, Interfacing I/O Microprocessor, Polling And Interrupts, Interrupts And DMA.
5. 3. Microprocessor I/O
6. Data Communication, Parallel I/O Serial Communication, Serial Interface And UART, Modem, I/O Devices, D/A & A/D Interface, Interface, Special I/O Devices.

### 33. Embedded Controllers & Systems

Architecture of 80186 & 80188 CPU subsystems, Addressing Modes, Instruction set, Basic IO subsystems, Memory Subsystem, Example embedded controllers.

Books Recommended:

34. Intel Series Of Microprocessors: By Berry B. Bray, TMH.
35. 8086 microprocessor & Architecture by Liu, Gibson; PHI.
36. Embedded Microprocessor System Design by Kenneth L. Short, Pearson Education.
37. Embedded Controllers by Berry B. Bray Pearson Education.
38. Related IEEE/IEE publications 12

EC511 VLSI Design

Max. Marks: 100 Time Allowed: 3 Hrs

Note: Eight questions of equal marks to be set covering the whole syllabus and any five to be attempted.

- o 1. Overview
- o Overview of combinational and sequential circuits, timing analysis of combinational and sequential circuits, metastability, methods to eliminate metastability single synchronizer and double synchronizer, MTBF Clocking strategies.
41. 2. Sequential Machine Design
42. State diagram, state minimization, state assignments, design of mealy and Moore machines, design of RAM, SDR, SRAM, DRAM, ROM. Charge Coupled Devices (CCD's).



- 43. 3. Programmable logic Devices
- 44. Basic concepts, programmable logic array (PLA), Programmable Array Logic (PAL), Structure of standard PLD's Complex (PLD's), Complex PLD's (CPLD), Xilinx Xc9500. Introduction to field programmable gate array types of FPGA's, Configurable logic Block (CLB) Input/ Output Block (IOB). Introduction to Xilinx series. FPGA, XC4000 family, Implementation of Design in PLD's.
- 45. 4. VHDL
- 46. Need for HDL's, Design flow, overview of VHDL, data types, Logic Operators, Data flow Modeling, Structural Modeling, Behavioral Modeling, Mixed Modeling, Modeling of combinational and sequential circuits.
- Verilog

Verilog as HDL, HDL model abstraction behavioral, RTL, structural, switch model, verification, Modeling of combinational logic, sequential logic, tasks and functions, Advanced Modeling concepts, User defined primitives.

Books Recommended:

1. Fundamentals of Digital Design by Charles. H. Roth, Jr., Jaico Publishing House
2. Digital Design Principle & Practice – by John. F. Wakerly, PHI
3. VHDL Analysis & Modeling of Digital Systems – by Z Navabi, Mc. Graw Hill
4. An Engg. Approach to Digital Design by William. I. Fletcher
5. Verilog HDL: Digital Design & Synthesis – by Samir Palnitker
6. Documents of Xilinx]
7. Related IEEE/IEE publications 13

PTU/BOS/EC/201/28072004 EC512 Reliability of Electronics & Communication Systems

Max. Marks: 100 Time Allowed: 3 Hrs

Note: Eight questions of equal marks to be set covering the whole syllabus and any five to be attempted.

1. 1. Concept of reliability
2. Failures of systems and its modes. Measure of Reliability, Reliability function, Hazard rate MTBF and their interrelations.
3. 2. Reliability Data and Analysis
4. Data sources. Data collection, use of Reliability Data, Reliability Analysis, Performance Parameters, calculation of failure rate, Application of Weibull distribution.
5. 3. System Reliability and Modeling
6. Series systems, Parallel system, series parallel systems. Time dependence, Reliability Determination, Stand by systems, r out of n, Configurations, Methods of tie set and cut sets of Or reliability evaluation, simulation and Reliability prediction. Monte Carlo method, concepts of network topology. Overall reliability evolution.
7. 4. Maintainability and Availability

8. Maintainability and its equation. Factors Affecting maintainability. Measures of Maintainability, Mean Down Time, Availability Intrinsic availability equipment availability & Mission availability. Replacement processes and Policies.
9. 5. Life Testing of Equipments
10. Nondestructive tests, destruction tests and their Mathematic modeling. Quality and Reliability, Measurement & prediction of Human Reliability, Reliability and safety, safety margins in critical Devices, case studies.

## 1. Value Engineering

Techniques in value Engg; Structure of value Engg. Reliability Management.

Books Recommended:

1. Reliability Engg. By Govil, 1992.
2. Reliability Engg. By Dr.A.K.Aggarwal, 1992.
3. Related IEEE/IEE publications 14

EC513 Multimedia Communication Systems

Max. Marks: 100 Time Allowed: 3 Hrs

Note: Eight questions of equal marks to be set covering the whole syllabus and any five to be attempted.

1. 1. Multimedia Communications
2. Introduction to various multimedia comm. Techniques, Applications, Networks, Protocols and Standards, bandwidth and compression issues.
3. 2. Digital Communication basics
4. Source encoding, Channel encoding, Circuit switched Networks; Packet switched networks, ATM, Frame Relay.
5. 3. Multimedia Information Representation
6. Different types of multimedia information, Information representation.
7. 4. Compression Techniques
8. Encoding and decoding techniques, Text compression techniques, Image compression techniques, Audio and Video Compression, Standards for Multimedia Compression, Huffman, Run length, Variable length, Lossy/ Lossless compression.
9. 5. Multimedia File Formats
10. Various files formats for multimedia and their applications, BMP, PNG, TIFF, JPEG, DFX, AVI, MPEG Audio/ Video Standards, Challenges for encryption and decryption.

## 2. World Wide Web

The Internet, Internet Multimedia Applications, Enterprise networks, Entertainment Networks, High Speed Modems, Application Support Functions, Audio/ Video Streaming, Video Conferencing.

Books Recommended:

Multimedia Communications by Fred Halsall, Prentice Hall.

- Digital Communication by Proakis, Prentice Hall.
- Internet Resources.
- Related IEEE/IEE publications 15

#### EC514 Parallel Processing

Max. Marks: 100 Time Allowed: 3 Hrs

Note: Eight questions of equal marks to be set covering the whole syllabus and any five to be attempted.

##### 1.Theory Of Parallelism

Parallel computer models the state of computing, Multiprocessors and Multicomputers and Multivectors and SIMD computers, PRAM and VLSI models, Architectural development tracks. Program and network properties Conditions of parallelism, Program partitioning and scheduling, Program flow mechanisms, System interconnect architectures. Principles of scalable performance performance matrices and measures, parallel processing applications, speedup performance laws, scalability analysis and approaches.

1. 2. Hardware Technologies
  2. Processor and memory hierarchy advanced processor technology, superscalar and vector processors, memory hierarchy technology, virtual memory technology, bus cache and shared memory backplane bus systems, cache memory organisations, shared memory organisations, sequential and weak consistency models.
  3. 3. Pipelining And Superscalar Technologies
  4. Parallel and scalable architectures, Multiprocessor and Multicomputers, Multivector and SIMD computers, Scalable, Multithreaded and data flow architectures.
2. Software And Parallel Programming

Parallel models, Languages and compilers, Parallel program development and environments, UNIX, MACH and OSF/1 for parallel computers.

Books Recommended:

1. Kai Hwang, "Advanced Computer Architecture", McGraw Hill International, 1993.
2. William Stallings, "Computer Organization and Architecture", Macmillan Publishing Company, 1990.
3. M. J. Quinn, "Designing Efficient Algorithms for Parallel Computers", McGraw Hill International, 1994.
4. John L. Hennessy and David A. Patterson, Computer Architecture A Quantitative approach, Morgan Kaufman Publishers. Inc., 1990.
5. D.P. Siewiorek, G.G. Bell, A. Newell, Computer Structures, Principle and Examples, McGraw Hill, 1982.
6. Related IEEE/IEE publications 16

#### EC515 Peripheral System Design & Interfacing

Max. Marks: 100 Time Allowed: 3 Hrs

Note: Eight questions of equal marks to be set covering the whole syllabus and any five to be attempted.

1. 1. Bus system
2. Bus systems in microcomputers ST 100 bus, Multi bus, EISA, PCI Bus, HP IB/GPIB Bus, Bus and their applications. I/O
3. 2. Interface
4. Standard I/O interfaces RS232 C, RS232 D Centronics interface, current loop interface, and RS449 communication interface.
5. 3. Design criterion with PCs
6. Application of PC buses (ISA, EISA, PCI, VESAVL) and associated signals, Handshakes, I/O and Interrupt map, Programming methodology for input/output application, GPIB signals and GPIB programming techniques operating system calls.
7. 4. Peripherals
8. Peripherals like CRT controller, Communication controllers, DMA controller, Programmable keyboard/Display interfaces and Associated circuitries.
9. 5. Controllers
10. PID controllers, Programmable logic controllers, PC based data acquisition system, Interfacing PC to various cards Stepper motor milli volts, Milliamps.
2. Development tools

Microprocessor development system, cross compilers, Simulator In circuit emulators, Automated test equipments etc.

Books Recommended:

1. Intelligent Instrumentation by George C. Barney, PHI.
2. Student Reference Manual For Electronics Instrumentation Labs by Stanley wolf and Richard F.M. Smith, PHI.
3. Instrumentation for Engg. Measurement by James W. dally, William F. Riley, John Wilay and Sons
4. Interfacing A Laboratory Approach by Deonzo, PHI
5. Related IEEE/IEE publications 17

EC516 LabII

Max. Marks: 100 Time Allowed: 2hrs

At least ten experiments are to be performed related to the subjects related to the subjects taught in 2 nd semester. 18 EC517 Modeling & Simulation of Communication Systems

Max. Marks: 100 Time Allowed: 3 Hrs

Note: Eight questions of equal marks to be set covering the whole syllabus and any five to be attempted.

1. Introduction

- Concept of Simulation, System, Model, Types of Model, Univariate & Multivariate Models, Deterministic & Stochastic models, Continuous & Discrete Models, Analog & Digital Simulation, Real Time Simulation, Hybrid Simulation, Advantages & Limitations of Simulation, Steps in Simulation Study

1. 2. Random Number

2. Pseudorandom Numbers, Generation of random numbers, properties & testing of random numbers, generation of random variables using common distributions, Bounds and approximations of Random processes.

- Review of signals and systems, Continuous & discrete LT systems. Simulation of random variables & random processors, Transformation functions, transformations of random processes, sampling & quantization for simulation

1. 4. Modeling of communication system
2. Information sources encoding/decoding, base band modulation and mapping, RF and optical modulation demodulation, Filtering communication channels and models, Noise interference and error, Control coding, Synchronization, Spread spectrum techniques.
3. 5. Simulation and modeling methodology
4. Simulation environment, Modeling consideration, Performance evaluation techniques, Error sources in simulation, design of simulation experiment – length of run, replication, elimination of initial bias, variance reduction techniques.
5. 6. PSpice
6. Simulation of analog systems using PSpice

- Case studies

Case study of 64QAM equalized digital radio link in a fading environment and satellite system.

Books Recommended:

1. Simulation of Communication Systems by M.C. Jeruchim & Others, Plenum Press.
2. Modern Digital and Communication Systems by Lathi B.P.
3. System Simulation – by DS Hira
4. Discrete Event System Simulation – by Banks, Carsen, Nelson, Persian Edu. Asia.
5. Related IEEE/IEE publications

EC518 Microwave Theory and Techniques

Max. Marks: 100 Time Allowed: 3 Hrs

Note: Eight questions of equal marks to be set covering the whole syllabus and any five to be attempted.

1. Electromagnetic Waves

Review of electromagnetic field equation and their rotation. Comparison of plane waves & transmission Line quantities. Skin depth, Propagation constant, Attenuation constant & phase constant, Electric & Magnetic fields in ellipsoids, Method of calculation, Circular polarization, Demagnetizing Factors & Depolarizing Factors.

1. 2. Transmission Lines
2. Matrix Representation of network: The impedance matrix, The admittance matrix, The Cascade matrix, Transmission line parameters, Telegraphists' equations. The Propagation of Waves on Transmission Lines: The wave equation, Solution of wave equations, Characteristics impedance and characteristics admittance, Power, Terminated lines, Short circuited line, Open Circuited Line, Lumped Element Equivalents of Lines. Transmission: Line Application & Techniques; The

Quarterwave Transformer, Stub Matching, Binomial Matching, Line Connections, The Parallel Plate Line, The Coaxial Line, Application of Conformal Mapping, The strip transmission Line.

3. 3. Elementary Theory of Wave guides
  4. Review of rectangular & circular wave guides.  
Inhomogeneously Filled Wave guides: Dielectric Slab Loaded Rectangular Guides,  
The rayleigh Qitz method, Ferrite slabs in rectangular guides, Excitation of different modes in a wave guide. Perturbation techniques & its application, Variation techniques & its application.
2. Microwave components

Microwave Amplifier: Design using sparameter, stability criteria, Constant power & gain circles. Parametric amplifiers, Oscillators & Mixers: Gunn oscillators, IMPATT diodes, TRAPATT diodes, BARITT diodes, Transited oscillators, Oscillator circuit. Mixers, Mixers noise figure, Mixed analysis. Microwave filter design based on binomial and chebychev quarterwave transforms, Impedance & Admittance coupled cavity filters and other types. Introduction to monolithic microwave integrated circuits. Hybrid integrated circuits, Microwave measurements, Dielectric constant of low loss & high loss material.

Books Recommended:

1. Field Theory of guided waves by R.E.Collin
2. Theory of Guided Electromagnetic waves by R.A. Waldron
3. Microwave Propagation & Techniques by D.C. Sarkar
4. Related IEEE/IEE publications 20

EC519 Detection & Estimation Theory

Max. Marks: 100 Time Allowed: 3 Hrs

Note: Eight questions of equal marks to be set covering the whole syllabus and any five to be attempted.

1. 1. Statical communication theory
2. Representation of deterministic signals, orthogonal representation of signals. Dimensionality of signal spaces. Construction of orthogonal basis functions. Timebandwidth relationship: RMS duration and bandwidth, uncertainty relations.
3. 2. Review of random processes

Definition and classification, stochastic integrals, Fourier transforms of random processes, stationary and nonstationary processes, correlation functions. Ergodicity, power spectral density, transformations of random processes by linear systems. Representation of random processes (via sampling, KL expansion & narrow band representations), special random processes (white gaussian noise, WienerLevy processes

1. special random processes, shotnoise processes Markov processes).

2. 3. Optimum filtering
3. Matched filters for deterministic signals in white and coloured gaussian noise. Wiener filters for random signals in white and coloured gaussian noise. Discrete and continuous time filters.
2. Detection and estimation theory

Hypothesis testing Bayes, Minimax and Neyman-Pearson criteria, Types of estimates and error bounds, General gaussian problem, Detection and estimation in coloured noise, Elements sequential and nonparametric detection. Wiener-Hopf and Kalman filtering, Applications to communication, radar and sonar systems

Books Recommended:

1. Detection Estimation and Modulation Theory by HL Van Trees Wiley New York
2. Introduction to Statistical Signal Processing with Application by MD Srinath, PK. Rajasekran, R. Viswamathan (PHI)
3. Signal detection theory by Hancock and Wintz.
4. Detection of signals and noise by AD Whalen.
5. Related IEEE/IEE publications 21

EC520 Microelectronics Technology

Max. Marks: 100 Time Allowed: 3 Hrs

Note: Eight questions of equal marks to be set covering the whole syllabus and any five to be attempted.

1. 1. Review of MOS technology
2. Basic MOS transistors, enhancement and depletion model transistors, NMOS and CMOS processor, thermal aspects of processing, and production of masks.
3. 2. Electrical properties of MOS circuit
4. Parameters of MOS transistors, pass transistor, NMOS inverter, pullup to pull down ratio for an NMOS inverter, CMOS inverters, MOS transistor circuit model, latch up on CMOS circuits.
5. 3. Design processes
6. MOS layers, stick diagram, design rules, AWA OX CMOS process description, double metal single poly silicon CMOS process.
7. 4. Basic circuit concepts
8. Sheets resistance, area capacitance delay unit, inverter delay, super buffers, propagation delays.
2. Subsystem design & layout

Architectural issues, switch logic, gate logic, examples of combinational logic, clocked sequential circuits, and other system consideration.

6. Scaling of MOS circuits

Scaling factor, limitations, scaling of wires and inter connections

Books Recommended:

1. Basic VLSI design systems & circuits by DA. And Eshrachian K (phi), 1988.

2. VLSI design techniques for analog & digital circuit by Geigar BR, Allen PE & Strader ME (Mc graw hill 1990).
3. Related IEEE/IEE publications 23

#### EC521 Internetworking and Internet Protocols

Max. Marks: 100 Time Allowed: 3 Hrs

Note: Eight questions of equal marks to be set covering the whole syllabus and any five to be attempted.

1. 1. Introduction and Overview
  2. The need of Internet, TCP/IP Internet, Internet services, History & scope, Protocol standardization.
  3. 2. Review of Underlying Technologies
  4. LAN, WAN, MAN, Ethernet Topology, Token Ring, ARPANET, PRO net technology, FDDI. Internetworking concepts and architectural model, application level Internet connection, Interconnection through IP gateway, users view.
  5. 3. Internet Addresses
  6. Universal Identifiers, Three Primary Classes of IP Addresses, Structure of IP packets, network and broadcast addresses, class less addressing, supernet/ subnet addressing, Addressing Conventions, Mapping Internet Addresses to Physical Addresses (ARP/ RARP), Determining Internet Addresses at Startup (DHCP, Bootp).
  7. 4. Internetworking
  8. Internet as a virtual network, Internetworking devices (routers, bridges, gateways), Protocol layering, routing algorithms, congestion control techniques, ICMP, IP fragmentation, difference between X.25 and Internet layering, Gateway to Gateway Protocol (GGP), OSPF, Exterior Gateway Protocol (EGP). Managing Internet.
2. Security Issues

Reliable Transactions and Security on Internet, Data encryption, IPsec, SSL, Concept of Firewalls, Intrusion Detection Systems, Denial of Service Attacks.

Books Recommended:

1. Internetworking with TCP/IP vol1 by Comer, PHI.
2. TCP/IP Illustrated by Stevan; Pearson.
3. TCP/IP Suite by Forouzan; TMH.
4. Related IEEE/IEE publications 24

#### EC522 RF Microwave and Antenna Theory

Max. Marks: 100 Time Allowed: 3 Hrs

Note: Eight questions of equal marks to be set covering the whole syllabus and any five to be attempted.

1. Introduction



- RF and Microwaves, Review of Maxwell equations, properties of RF and Microwaves. Applications of RF/Microwave – Communications, Radar, Navigation, Remote sensing, Wireless applications.
  - 2. RF and Microwave Circuit design
  - Low RF Circuit design considerations, high RF and microwave circuits, lumped and distributed circuit elements. Sparameters description of passive and active networks, Network concepts: obstacles in wave guides, waveguide function, excitations of wave guides and cavities.
  - 3. RF Electronic concepts
  - Resonant circuits; Analysis of a simple circuit in Phasor domain; loaded Q, Impedance transformation, Insertion loss, Impedance transformers: TappedC transformer, TappedL Transformer. RF Impedance Matching: The LNetwork, the Absorption Method, and the Resonance Method.
- Microwave Antenna Theory

Concepts of radiation, Dipoles, Aperture Antennas, Reflectors, Horns, Slot antennas, printed antennas, broad band antenna, mutual coupling, arrays and phase arrays. Lens antennas low frequency active antenna. Antennas and wireless communication.

Books Recommended:

- Radio Frequency & Microwave Electronics Mathew. M. Radmanesh (Pearson Education Asia)
- Foundation of Microwave Engineering by RE Collin
- Antenna and Radio Wave Propagation – by RE Collin
- Antennas: Theory and Practice – by R Chatterjee
- Related IEEE/IEE publications 25

EC523 Computational Techniques

Max. Marks: 100 Time Allowed: 3 Hrs

Note: Eight questions of equal marks to be set covering the whole syllabus and any five to be attempted.

- 1. Errors in Numerical Calculation
- Introduction, Numbers and their accuracy, errors, Absolute, Relative and percentage errors and their analysis, general error Formula
- Interpolation

Finite differences, forward differences, Backward difference, Central Difference, Symbolic Relations, Difference of a Polynomial, Newton's Formulae for interpolation, Central Difference, Stirling Formula, Bessel's Formula, Gauss Central Difference Formulae, Everett's Formula, Interpolation with unevenly spaced points: Lagrange's, Interpolation Formula, Hermite Interpolation, Newton's General Interpolation Formula.

Numerical Differentiation, Numerical Integration, Trapezoidal rule, Simpson's Rule, Gaussian quadrature,

### 3. Numerical Solution of Ordinary differential equations

Initial value problems, Singlestep methods. RungeKutta Methods, Multisteps Methods, Predictor Corrector Methods. AdamsBashforth Method. Milne's methods, Simultaneous and Higher order equations, Twopoint boundary value problems. Numerical solution of partial differential equations, Finitedifference approximation to derivatives, Solution of Laplace equation by Jacobi's Methods. Finite element method, Weighted Residual Method, Variational Methods. Finite elements, Application to boundary value problems

Books Recommended:

- Elementary Numerical Analysis – S.D Conte. McGraw Hill
- Introduction methods of Numerical analysis S.S Sastry, Prentice Hall of India
- Numerical Mathematical Analysis, J.B. Scarborough, Oxford
- Numerical Solution of differential Equations by M.K. Jain, Wiley Eastern
- Introduction to Finite Element Method, By Desai & Abel, Van Nostrand
- Introduction to Matrix & Numerical Methods By K.I. Majid, Wood Stock Publishing.
- Numerical Methods By Dr. B.S. Grewal, Khanna Publisher 26