EC-517 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, Univariat & Multivariat Models, Deterministic & Stochastic models, Continuous & Discreet Models, Analog & Digital Simulation, Real Time Simulation, Hybrid Simulation, Advantages & Limitations of Simulation, Steps in Simulation Study

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

3. 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

4. Modeling of communication system
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.

5. Simulation and modeling methodology
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.

6. PSpice
Simulation of analog systems using PSpice

7. Case studies
Case study of 64-OAM 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. Discreet Event System Simulation – by Banks, Carsen, Nelson, Persian Edu. Asia.
5. Related IEEE/IEE publications

EC-518 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.

2. Transmission Lines

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 Quarter-wave Transformer, Stub Matching, Binomial Matching, Line Connections, The Parallel-Plate Line, The Co-axial Line, Application of Conformal Mapping, The strip transmission Line.

3. Elementary Theory of Wave guides

Review of rectangular & circular wave guides.
Inhomogeneously Filled Wave guides: Dielectric Slab- Loaded Rectangular Guides, The ray leigh - Qitz method, Ferrite slabs in rectangular guides, Excitation of different modes in a wave guide. Perturbation techniques & its application, Vvariation techniques & its application.

4. Microwave components

Microwave Amplifier: Design using s-parameter, 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

EC-519 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. Statical communication theory

Representation of deterministic signals, orthogonal representation of signals. Dimensionality of signal spaces. Construction of orthogonal basis functions. Time-bandwidth relationship: RMS duration and bandwidth, uncertainty relations.

2. Review of random processes

Definition and classification, stochastic integrals, Fourier transforms of random processes, stationary and non-stationary processes, correlation functions. Ergodicity, power spectral density, transformations of random processes by linear systems. Representation of random processes (via sampling, K-L expansion & narrow band representations), special random processes (white gaussian noise, Wiener-Levy processes, special random processes, shot-noise processes Markov processes).

3. Optimum filtering

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.

4. 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 non-parametric 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

EC-520 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
Technical Background, Transmission Fundamentals, Communication Networks, Protocols and TCP/IP Suite

2. Wireless Communication Technology
Antennas and Propagation Signal, Encoding Techniques, Spread Spectrum Coding and Error Control

3. Wireless Networking
Satellite Communications, Cellular Transmission Principles, Cordless Systems and Wireless Local Loop Mobile IP and Wireless access protocol

4. Wireless LANs
Wireless LAN Technology, IEEE 802, 11 Wireless LAN standard.

5. CDMA Standards
System Architecture for CDMA. Network and Data Link Layers of CDMA. Signaling Applications in CDMA System. Voice Applications in CDMA System.

6. 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 - byV 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

EC-521 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. Review of MOS technology
Basic MOS transistors, enhancement and depletion model transistors, N-MOS and C-MOS processor, thermal aspects of processing, and production of masks.

2. Electrical properties of MOS circuit
Parameters of MOS transistors, pass transistor, N-MOS inverter, pull-up to pull down ratio for an N-MOS inverter, C-MOS inverters, MOS transistor circuit model, latch up on C-MOS circuits.

3. Design processes
MOS layers, stick diagram, design rules, AWA OX C-MOS process description, double metal single poly silicon C-MOS process.

4. Basic circuit concepts
Sheets resistance, area capacitance delay unit, inverter delay, super buffers, propagation delays.

5. 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

EC-522 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. Introduction and Overview
The need of Internet, TCP/IP Internet, Internet services, History & scope, Protocol standardization.

2. Review of Underlying Technologies
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.

3. Internet Addresses
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).

4. Internetworking
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.

5. 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 vol-1 by Comer, PHI.
2. TCP/IP Illustrated by Stevan; Pearson.
3. TCP/IP Suite by Forouzan; TMH.
4. Related IEEE/IEE publications

EC-523 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. S-parameters 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, Impendence transformers: Tapped-C transformer, Tapped-L Transformer. RF Impedance Matching: The L-Network, the Absorption Method, and the Resonance Method.

4. Microwave Antenna Theory
Concepts of radtrlion, 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:

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

EC-524 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

2. 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, Single-step methods. Runga-Kutta Methods, Multisteps Methods, Predictor Corrector Methods. Adams- Bashforth Method. Milne's methods, Simultaneous and Higher order equations, Two-point boundary value problems.

Numerical solution of partial differential equations, Finite-difference 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:

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