ACADEMIC REGULATIONS
COURSE STRUCTURE
AND
DETAILED SYLLABUS

M.Tech.

Communication Systems

(Effective for the students admitted from the Academic Year 2006-07)

Jawaharlal Nehru Technological University
Hyderabad – 500 085

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M.Tech. Communication Systems w.e.f.2006-07

COURSE STRUCTURE AND SYLLABUS

Semester-I

Course No.	Course Name	Lectures	Practicals
CS101	Linear Algebra	4	0
CS102	Detection and Estimation Theory	4	0
CS103	Coding Techniques	4	0
CS104	Digital Communications Theory and Systems	4	0
	Elective – I	4	0
	Elective – II	4	0
CS151	Communication Lab-I	0	3

Semester-II

Course No.	Course Name	Lectures	Practicals
CS201	Communication Networks	4	0
CS202	Mobile Communication Systems	4	0
CS203	Adaptive Signal Processing	4	0
CS204	Network Security and Cryptography	4	0
	Elective – III	4	0
	Elective – IV	4	0
CS251	Communication Lab-II	0	3

List of Electives

Elective - I

CS105	Advanced Radiating systems
CS106	Microwave Communication Systems
CS107	VLSI Technology and Design

Elective - II

CS108	Digital Communication Receivers
CS109	Software Defined Radio
CS110	Satellite Communications

Elective – III

CS205	Global Tracking Position System
CS206	Simulation of Communication systems and Networks
CS207	Radar System Engineering

Elective - IV

CS208	Electromagnetic Interference and Compatibility
CS209	Optical Fiber Communications
CS210	Reliability of Electronic Communication systems

SEMESTER - III & IV				
Course No.	**Course Name**	**Lectures**	**Practicals**	**Grade**
	Project & Seminar			*

*** Excellent / Good / Satisfactory / Unsatisfactory**

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M.Tech. Communication Systems w.e.f.2006-07
I Semester

LINEAR ALGEBRA

UNIT – I

Sets and functions, groups and group homomorphisms, rings and fields, vector spaces and linear maps. Direct products and internal direct sums, linear independence, bases and dimension, rank and nullity, dual space, dual basis, transpose of a map.

UNIT – II

Matrices, Linear systems, Gauss-Jordon elimination, Row-Echelon form, reduced Row-Echelon form, solution of linear systems using Gauss-Jordon elimination, matrix inversion by Gauss-Jordon elimination, similar and equivalent matrices.

UNIT – III

Matrices as representations of linear maps, matrix of the composition of two maps, change of basis.

UNIT – IV

Determinant as the multi-linear alternating normalized map, properties of determinants, nonrecursive formula, determinant of a product, determinant of the inverse.

UNIT – V

Characteristic polynomial, Eigen values, Eigen vectors, Eigen basis, Cayley-Hamilton theorem, Triangular form, Characteristic subspaces, Nilpotent maps, Jordon canonical form, minimal polynomial.

TEXT BOOK

1. Linear Algebra – R.J. Valenza

REFERENCE BOOK

1. Topics in Algebra – Herstein.

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I Semester

DETECTION AND ESTIMATION THEORY

UNIT – I Classical Detection and Estimation Theory

Introduction, simple binary hypothesis tests, M Hypotheses, estimation theory, composite hypotheses, general Gaussian problem, performance bounds and approximations.

UNIT – II Representations of Random Processes

Introduction, orthogonal representations, random process characterization, homogenous integral equations and eigen-functions, periodic processes, spectral decomposition, vector random processes.

UNIT – III Detection of Signals – Estimation of Signal Parameters

Introduction, detection and estimation in white Gaussian noise, detection and estimation in nonwhite Gaussian noise, signals with unwanted parameters, multiple channels and multiple parameter estimation.

UNIT – IV Estimation of Continuous Waveforms

Introduction, derivation of estimator equations, a lower bound on the mean-square estimation error, multidimensional waveform estimation, nonrandom waveform estimation.

UNIT – V Linear Estimation

Properties of optimum processors, realizable linear filters, Kalman-Bucy filters, fundamental role of optimum linear filters.

TEXT BOOKS

1. Harry L. Van Trees, "Detection, Estimation, and Modulation Theory," Part I, John Wiley & Sons, USA, 2001.
2. M.D. Srinath, P.K. Rajasekaran and R. Viswanathan, "Introduction to Statistical Signal Processing with Applications," Pearson Education (Asia) Pte. Ltd. /Prentice Hall of India, 2003.
3. Steven M. Kay, "Fundamentals of Statistical Signal Processing," Volume I: "Estimation Theory", Prentice Hall, USA, 1998;
4. Steven M. Kay, "Fundamentals of Statistical Signal Processing, "Volume II: "Detection Theory," Prentice Hall, USA, 1998.

REFERENCE BOOKS

1. Louis L Scharf, "Statistical Signal Processing: Detection, Estimation and Time series Analysis", Addison Wesley, 1991.
2. K Sam Shanmugam, Arthur M Breipohl, "Random Signals: Detection, Estimation and Data Analysis", John Wiley & Sons, 1998.

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M.Tech. Communication Systems w.e.f.2006-07
I Semester

CODING TECHNIQUES

UNIT – I INTRODUCTION AND MEASURE OF INFORMATION

Basic communication system models, discrete and continuous discrete-time channels, waveform channels. Measure of information: entropy, relative entropy, Mutual information

UNIT – II SOURCE CODING THEORY

Lossy and lossless coding, Kraft's inequality, source coding theorems. Huffman code, Shannon – Fano code, arithmetic code, Lempel – Ziv code, run-length code.

UNIT – III ADDITIVE WHITE GAUSSIAN NOISE CHANNELS(AWGN)

Channel capacity and channel coding theorems, capacity of binary symmetric channel, differential entropy and capacity of discrete-time Gaussian channels, waveform channels, capacity of continuous-time AWGN channels. Single error detecting codes – Parity check codes, Hamming codes.

UNIT – IV CHANNEL CODING TECHNIQUES

Binary BCH codes – Turbo codes, Non binary Parity codes, Coding for dispersive channels, Trellis code modulation (TCM), Convolutional codes, Viterbi Algorithm.

UNIT – V ERROR CONTROL CODING

Constrained codes, Iterative coding, Coding for recording channels, Turbo coding for multi tracking channels.

TEXT BOOKS

1. Digital Communications – John G. Proakis, McGraw Hill Inc., 4th Edition.
2. Elements of Information theory – T.M. Cover and J.A. Thomas
3. Information theory and reliable communication – R.G. Gallager

REFERENCE BOOKS

1. Algorithms for Communication Systems and Applications – N. Benvenuto, G. Cherubini, John Wiley Publications, 2005.
2. Error Control Coding – TODD, John Wiley Publications, 2005.
3. Coding and Signal Processing for Magnetic Recording Systems – B. Vasic, Emkurts, CRC Press, 2005.
4. Information Theory Coding and Cryptography – Ranjan Bose, TMH, 2003.

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M.Tech. Communication Systems w.e.f.2006-07
I Semester

DIGITAL COMMUNICATIONS THEORY AND SYSTEMS

UNIT – I
Representation of band pass signals and systems, signal space representations, Representation of digitally modulated signals, spectral characteristics of digitally modulated signals.

UNIT – II
Baseband data transmission, Duo-binary Systems, Modified Duo-binary systems, M-array signaling schemes, Eye patterns, Adaptive Equalization, Synchronization, Scrambler, Unscrambler.

UNIT – III
ASK, BPSK, QPSK, 8 Phase PSK, QAM, 16 QAM, DPSK, MSK, FSK, Optimum Receiver for Signals corrupted by AWGN, Optimum Receiver for CPM, Correlation Receiver, Matched Filter.

UNIT – IV
Multichannel digital communications in AWGN channels, Multi carrier communications, Model of spread spectrum digital communication system, Direct sequence spread spectrum signals, Frequency - hopped spread spectrum signal, Other types of spread spectrum signals, Synchronization of spread spectrum systems.

UNIT –V
Characterization of fading multi-path channels, The effect of signal characteristics on the choice of a channel model, Frequency non-selective, Slowly fading channel, Diversity techniques for fading multi-path channels, Digital signaling over a frequency selective slowly fading channel.

TEXT BOOKS

1. Digital Communication – John G. Proakis – M G H - 4th edition, 2001.
2. Digital Communication – Sklar – Pearson Education – 2nd edition, 2002
3. Digital and Analog Communication systems – K.S. Shanmugan – Wiley, 1985
4. Principles of Digital Communication – J.Das, S.K. Mullick, P.K. Chatterjee – Wiley Eastern, 1992.

REFERENCE BOOKS

1. Introduction to Digital Signal Processing – John G. Proakis et. Al – PHI, 1997
2. Statistical and Adaptive Signal Processing – D.G. Manolakis, Ingele and S.M. Kogon – Mc Graw Hill, Int. edition, 2000.
3. Algorithms for statistical signal processing – John G. Proakis, Rader, et. Al – Pearson Education, Asia publishers, India edition, 2002.
4. Modern Spectral Estimation "Theory & Applications" – S.Kay – PH Publication – 1st ecition, 1987

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M.Tech. Communication Systems w.e.f.2006-07
I Semester

ADVANCED RADIATING SYSTEMS

UNIT – I Basic Concepts of Radiation

Radiation mechanism – Basic sources of Radiation- Current distribution on antennas, Basic antenna parameters

UNIT – II Analysis and Synthesis of Antennas

Vector potential, Antenna theorems and definitions, dipole, loop, reflector, slot antennas. Types of linear arrays, current distribution in linear arrays, Antenna synthesis techniques.

UNIT – III Microstrip Antennas / Antenna Measurement

Feeding structure, patch antenna, microstrip array. Gain directivity, impedance, polarization and radiation pattern measurements.

UNIT – IV Smart Antennas

Spatial processing for wireless systems: Introduction, Vector channel impulse response & the spatial signature. Spatial processing receivers, fixed beamforming Networks, switched beam systems, Adaptive antenna systems, Wide band smart antennas, Digital radio receiver & software radio for smart antennas

UNIT – V Smart Antenna Techniques for CDMA

Non-coherent & coherent CDMA spatial processors, spatial processing rake receiver, Multi-user spatial processing, dynamic resectoring, downlink beam forming for CDMA.

TEXT BOOKS

1. Balanis A., "Antenna Theory Analysis and Design", John Wiley and Sons, New York, 1982.
2. Joseph C. Liberti, Theodore S. Rappaport – "Smart Antennas for Wireless Communications : IS95 and third generation CDMA Applications", Prentice Hall, Communications Engineering and Emerging Technologies Series.

REFERENCE BOOK

1. Kraus J.D., "Antennas", II edition, John Wiley and Sons, New York, 1977.

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M.Tech. Communication Systems w.e.f.2006-07
I Semester

MICROWAVE COMMUNICATION SYSTEMS

UNIT – I Introduction

PCS Architecture, Cellular telephony, Cordless telephony and low tier PCS, Third and Fourth generation wireless systems; Mobility management,

UNIT – II Wireless Technology

Handoff, roaming management for SS& and CT2, handoff Detection, strategies for handoff detection, channel assignment, link transfer types, hard Handoff soft handoff; IS-41 signaling, IS-41 handoff and authentication, CDPD architecture, CDPD air Interface, radio resource allocation;

UNIT – III GSM and GPRS

GSM architecture, location tracking, data services, HSCPD, GPRS, OSM network signaling, GSM mobility management, GSM short message service, International Roaming for GSM, VOIP for GSM networks.

UNIT – IV Architecture

GPRS functional groups, architecture, network nodes, interfaces, procedures, billing, evolving from GSM to GPRS,WAP protocols, W-CDMA and CDMA 2000, QOS in 3G, paging network architectures, wireless local loop architectures, Bluetooth core Protocols;

UNIT – V Wireless LANS

Introduction to wireless LANS, 802.11 WLANs, physical and MAC layers, Wireless ATM and HIPERLAN, 802.15 WPAN, Bluetooth, interference between Bluetooth and 802.11, wireless geolocation system architecture, standards, performance measures, introduction other wireless LAN standards 802.lle, 802.16, 802.17, 802.19, 802.20

Text Books:

1. Yi-Bing Lin, Imrich Chlamtac, Wireless and mobile network architectures, John Wiley, 2001
2. Kaveh Pablavan, P. Krishnamurthy, Principles of wireless networks, Pearson education, 2002
3. P. Venkataram, S. S. Manvi, B. P. Vijaykumar, WLANs: Architectures, Protocols and Applications, Pearson education (In Press), 2005

Marlyn Mallick, Mobile and wireless design essentials, Wiley, 2003

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I Semester

VLSI TECHNOLOGY AND DESIGN

UNIT – I

Review of Microelectronics and Introduction to MOS technologies: (MOS, CMOS, BiCMOS) Technology trends and projections.

UNIT – II

Basic Electrical Properties of MOS, CMOS & BiCOMS Circuits: Ids-Vds relationships, Threshold voltage V_t, G_m, G_{ds} and W_o, Pass Transistor, MOS, CMOS and BiCMOS Inverters, Zpu/Zpd, MOS Transistor circuit model, Latch-up in CMOS circuits.

UNIT – III

Layout Design and Tools and Logic Gates and Layouts: Transistor structures, Wires and Vias, Scalable Design rules, Layout Design Tools. Static complementary gates, switch logic, Alternative gate circuits, low power gates, Resistive and Inductive interconnect delays.

UNIV – IV

Combinational Logic Networks and Sequential Systems: Layouts, Simulation, Network delay, interconnect design, Power optimization, Switch logic networks, Gate and Network testing, Memory cells and Arrays, clocking disciplines, Design, Power optimization, Design validation and testing.

UNIT – V

Floor Planning and Architecture Design and Introduction to CAD Systems (Algorithms) and Chip Design: Floor planning methods, off-chip connections, High-level synthesis, Architecture for low power, SOCs and Embedded CPUs, Architecture testing, Layout Synthesis and Analysis, Scheduling and printing; Hardware/Software Co-design, chip design methodologies – A simple Design example.

TEXT BOOKS

1. Essentials of VLSI Circuits and Systems, K. Eshraghian et al (3 authors) PHI of India Ltd., 2005.
2. Modern VLSI Design, 3rd Edition, Wayne Wolf, Pearson Education, fifth Indian Reprint, 2005.

REFERENCES

1. Principles of CMOS Design – N.H.E Weste, K. Eshraghian, Adison Wesley, 2nd Edition.
2. Introduction to VLSI Design – Fabricius, MGH International Edition, 1990.
3. CMOS Circuit Design, Layout and Simulation – Baker, Li Boyce, PHI, 2004.

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M.Tech. Communication Systems w.e.f.2006-07
I Semester

DIGITAL COMMUNICATION RECEIVERS

UNIT – I Review Of Digital Communication Techniques

Base band and band pass communication, signal space representation, linear and nonlinear modulation techniques, and Spectral characteristics of digital modulation

UNIT – II Optimum Receivers For AWGM Channel

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

UNIT – III Receivers For Fading Channels

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

UNIT – IV Synchronization Techniques

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

UNIT – V Adaptive Equalization

Zero facing algorithm, LMS algorithm, adaptive decision-feedback equalizer and Equalization of Trellis-coded signals. Kaiman algorithm, blind equalizers and stochastic gradient algorithm. Echo cancellation

TEXT BOOKS

1. Heinrich Meyer, Mare Moeneclacy, Stefan.A.Fechtel, " Digital communication recievers ", Vol I & Vol II, John Wiley, New York, 1997.
2. John.G.Proakis, " Digital communication " 4th Edition, McGraw-Hill, New York, 2001.
3. E.A.Lee and D.G.Messerschmitt, " Digital communication ", 2nd Edition, Allied Publishers,New Delhi, 1994.
4. Simon Marvin, " Digital communication over fading channel; An unified approach to performance Analysis ", John Wiley, New York, 2000.

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M.Tech. Communication Systems w.e.f.2006-07
I Semester

SOFTWARE DEFINED RADIO

UNIT – I MULTI RATE SIGNAL PROCESSING

Introduction to Software Radio Concepts, Sample Rate Conversion Principles, Polyphase Filters, Digital Filter Banks, Timing Recovery in Digital Receivers Using Multirate Digital Filters

UNIT – II DIGITAL GENERATION OF SIGNALS

Introdution, Comparison of Direct Digital Synthesis with Analog Signal Synthesis, Approaches to Direct Digital Synthesis, Analysis of Spurious Signals, Spurious Components due to Periodic Jitter, Bandpass Signal Generation, Hybrid DDS-PPL Systems, Generation of Random Sequences, ROM Compression Techniques, Since-Phase Difference Algorithm Approach, Modified Sine-Phase Difference Approach (Parabolic Approximation), Parameters of Ideal Data Converters, Parameters of Practical Data Converters, Techniques to Improve Data Converter Performance.

UNIT – III SMART ANTENNAS

Introduction, Vector Channel Modeling, Benefits of Smart Antennas, Structures for Beamforming Systems, Smart Antenna Algorithms, Diversity and Space-Time Adaptive Signal Processing, Algorithms for Transmit STAP, Hardware Implementation of Smart Antennas

UNIT – IV DIGITAL HARDWARE CHOICES

Introduction, Key Hardware Elements, DSP Processors, Field Programmable Gate Arrays, Trade-Offs in Using DSPs, FPGAs, and ASICs, Power Management Issues, Using a Combination of DSPs, FPGAs, and ASICs

UNIT – V OBJECT-ORIENTED REPRESENTATION OF RADIOS AND NETWORK RESOURCES

Introduction, Networks, Object-Oriented Programming, Object Brokers, Mobile Application Environments, Joint Tactical Radio System, JTRS, Wireless Information Transfer System.

TEXT BOOKS

1. Software Radio: A modern Approach to Radio Engineering, Jeffrey H Reed, Pearson Education, 2006.

REFERENCE BOOKS

1. Software Radio Architecture: Object Oriented Approaches to Wireless System Engineering, Joseph Mitola, III, John Wiley & Sons, 2000.
2. R. F. Microelectronics, B. Razavi, Prentice Hall, 1998.
3. Digital Signal Processing: A Computer Based Approach, S.K. Mitra, McGraw Hill, 1998.

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M.Tech. Communication Systems w.e.f.2006-07
I Semester

SOFTWARE DEFINED RADIO

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2. R. F. Microelectronics, B. Razavi, Prentice Hall, 1998.
3. Digital Signal Processing: A Computer Based Approach, S.K. Mitra, McGraw Hill, 1998.

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I Semester

SATELLITE COMMUNICATIONS

UNIT – I Orbital theory

Satellite frequency bands for communication, Orbital mechanics look angle determinations, numerical examples, orbital perturbations, orbit determination, launches and launch vehicles, orbital effects in communication system performance, Azimuth & elevation calculations

UNIT – II Spacecraft systems

Attitude and orbit control system (AOCS), telemetry, tracking, command (TT&C) and monitoring, power systems, communications subsystems, transponders, spacecraft antennas, Equipment reliability and space qualification.

UNIT – III Satellite link design

Basic transmission theory, noise figure and noise temperature and G/T ratio, Satellite down link design, Satellite systems using small earth stations, satellite uplink design, design for specified C/N ratio, Combining C/N and C/I values in Satellite links, System design examples.

UNIT – IV Modulation, Multiplexing, Multiple access Techniques

Analog telephone transmission, Fm theory, FM Detector theory, analog TV transmission, S/N ratio Calculation for satellite TV linking, Digital transmission, base band and band pass transmission of digital data, BPSK, QPSK , FDM, TDM, Access techniques: FDMA, TDMA, CDMA and Random access.

UNIT – V Propagation and Earth station Technology

Earth paths and its influence on link design: propagation effects, rain and ice effects, elimination of the above effects. Design of large antennas, equipments for earth stations video receiver, frequency coordination, , VSAT technology, Direct Broadcast by satellite (DBS), Intelsat and Imarsat

TEXT BOOKS

1. Timothy Pratt, Charles W. Bostian, "Satellite communication:, John Wiley &sons, 1986
2. Dennis Roddy, "Satellite Communication", TMH, 3ed, 2001
3. Wilbur L. Pritchard, Henri G. Suyderhoud, Robert A. Nelson, "**Satellite Communication Systems Engineering**," Prentice Hall, January 1993,

REFERENCE BOOKS

1. Tom Logs Don, "Mobile communication satellites: theory and applications", McGraw Hill,1995
2. J.J. Spilker, Digital Communication by satellite, PH Publication, 1997
3. J. Martin, Communication satellite systems, PH, 4th Edition, 2005

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M.Tech. Communication Systems w.e.f.2006-07
I Semester

COMMUNICATIONS LAB - I

Minimum of 10 experiments have to be conducted
All Experiments should be simulated using MATLAB and to be verified practically.

1. Implementation of Matched Filter
2. Optimum Receiver for the AWGM Channel
3. Design of FIR Filter using window method
4. Measurement of effect of Inter symbol Interference
5. Design of Transmitter and Receiver Filters in Duo-binary signaling
6. Design of a Five-Tap Zero forcing equalizer
7. Design of Adaptive equalizer
8. Generation of constant envelope PSK signal wave form for different values of M.
9. Simulation of PSK system with M=4
10. Design of DPSK system with M=4
11. Design of FSK system
12. Simulation of correlation type demodulator for FSK signal
13. Verification of minimum distance in Hamming code
14. Determination of output of convolutional encoder for a given sequence
15. Efficiency of DS spread spectrum technique
16. Simulation of FH system

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II Semester

COMMUNICATION NETWORKS

UNIT – I

General issues in the transport of information over networks of communication links.

UNIT – II

Circuit switched and packet switched networks, and their relationships. The ISO-OSI layered architecture, and the evolution of packet switched networks (X.25, Frame Relay, ATM, TCP/IP networking.

UNIT – III

Digital transmission standards and hierarchies, Various architectures for packet switching: relaying, bridging, routing. Data link layer: ARQ schemes and their analyses.

UNIT – IV

Local area networks and their analysis: ALOHA, CSMA/CD (Ethernet), CSMA/CA (wireless LANs) various types of traffic, and quality of service objectives. Models for the flow of circuit switched and packet switched traffic in networks, and their analysis; control of traffic, including flow and congestion control

UNIT – V

Network topology and routing; important routing protocols: RIP, OSPF and BGP. An introduction to adhoc networks.

TEXT BOOKS

1. Data Networks – D. Bertsekas and R.G. Galleger.
2. Performance Communication Networks – J.W. Walrand and P. Varaiya.
3. Communication Networking: An analytical approach – A. Kumar, D. Manjunath and J. Kuri

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M.Tech. Communication Systems w.e.f.2006-07
II Semester

MOBILE COMMUNICATION SYSTEMS

UNIT – I Cellular Concepts – System Design Fundamentals
Introduction, Frequency Reuse, Channel Assignment Strategies, Channel Assignment Strategies, Handoff Strategies, Interference and System Capacity, Trunking and Grade of Service, Improving Coverage and Capacity in Cellular Systems, Summary, Problems

UNIT – II 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, Problems.

UNIT – III 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 Factors for Small-Scale Fading Wireless Channels, Summary, Problems.

UNIT – IV Multiple Access Techniques for Wireless Communications
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

UNIT – V Wireless Networking
Introduction to Wireless Networks, Differences 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 Network (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)

TEXT BOOKS

1. Rappaport T.S., "Wireless Communications"; Principles and Practice, Prentice Hall,NJ, 1996, 2nd Edition.

REFERENCE BOOKS

1. William Stallings, "Wireless communication & Networking", Pearson Education, 2002.

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II Semester

ADAPTIVE SIGNAL PROCESSING

UNIT I DISCRETE RANDOM SIGNAL PROCESSING

Review of Linear Algebra, Discrete Random Processes, Expectations, Variance, Co-Variance, Scalar Product, Energy of Discrete Signals- Parseval's Theorem, Wiener Khintchine Relation- Power Spectral Density - Periodogram - Sample Autocorrelation- Sum Decomposition Theorem, Spectral Factorization Theorem- Discrete Random Signal processing by Linear Systems – Simulation of White Noise – Low Pass Filtering of White Noise.

UNIT II SPECTRUM ESTIMATION

Non-Parametric Methods- Correlation Method- Co-Variance Estimator- Performance Analysis of Estimators- Unbiased, Consistent Estimators- Periodogram Estimator- Barlett Spectrum Estimation- Welch Estimation- Model Based Approach- AR, MA, ARMA Signal Modeling- Parameter Estimation Using Yule-Walker Method.

UNIT III LINEAR ESTIMATION AND PREDICTION

Linear Estimation of Signals- Prediction, Filtering, Smoothing, Correlation Cancellation. Maximum Likelihood Criterion- Efficiency of Estimator- Least Mean Squared Error Criterion – Wiener Filter- Discrete Wiener Hoff Equations.

UNIT IV RECURSIVE ESTIMATION

Recursive Estimators- Kalman Filter- Linear Prediction, Prediction Error- Whitening Filter, Inverse Filter- Levinson Recursion, Lattice Realization, and Levinson Recursion Algorithm for Solving Toeplitz System of Equations.

UNIT V ADAPTIVE FILTERS

FIR Adaptive Filters- Newton's Steepest Descent Method- Adaptive Filter Based on Steepest Descent Method- Widrow Hoff LMS Adaptive Algorithm- Adaptive Channel Equalization- Adaptive Echo canceller- Adaptive Noise Cancellation- RLS Adaptive Filters- Exponentially weighted RLS- Sliding window RLS- Simplified IIR LMS Adaptive Filter- Delay Line Structures.

TEXT BOOK

1. Monson H.Hayes, "Statistical Digital Signal Processing and Modeling", John Wiley and Sons, Inc., New York, 1996

REFERENCE BOOKS

1. Sopocles J. Orfanidis, "Optimum Signal Processing", McGraw Hill, 1990.
2. John G.Proakis, Dimitris G.Manolakis, "Digital Signal Processing", Prentice Hall of India, 1995
3. B.Farhang-Boroujeny, "Adaptive Filters : Theory and Application", 1998
4. Haykins S , "Adaptive Filter Theory", Prentice-Hall, USA, 1996.
5. Vaidyanathan P.P, "Multirate Systems and Filter Banks", Prentice Hal, 1983

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M.Tech. Communication Systems w.e.f.2006-07
II Semester

NETWORK SECURITY AND CRYPTOGRAPHY

UNIT – I Introduction
Attacks, Services and Mechanisms, Security attacks, Security Services, A Model for Internetwork security. Classical Techniques: Conventional Encryption model, Steganography, Classical Encryption Techniques.

UNIT – II Modern Techniques:
Simplified DES, Block Cipher Principles, Data Encryption standard, Strength of DES, Differential and Linear Cryptanalysis, Block Cipher Design Principles and Modes of operations. Algorithms: Triple DES, International Data Encryption algorithm, Blowfish, RC5, CAST-128, RC2, Characteristics of Advanced Symmetric block cifers. Placement of Encryption function, Traffic confidentiality, Key distribution, Random Number Generation. Public Key Cryptography: Principles, RSA Algorithm, Key Management, Diffie-Hellman Key exchange, Elliptic Curve Cryptography.

UNIT – III Number Theory:
Prime and Relatively prime numbers, Modular arithmetic, Fermat's and Euler's theorems, Testing for primality, Euclid's Algorithm, the Chinese remainder theorem, Discrete logarithms. Message Authentication and Hash functions: Authentication requirements and functions, Message Authentication, Hash functions, Security of Hash functions and MACs.

UNIT – IV Applications and Hash and Mac Algorithms:
Kerberos, X.509 directory Authentication service. Electronic Mail Security: Pretty Good Privacy, S/MIME. MD File, Message digest Algorithm, Secure Hash Algorithm, RIPEMD-160, HMAC. Digital signatures and Authentication protocols: Digital signatures, Authentication Protocols, Digital signature standards.

UNIT –V IP Security and Intruders, Viruses and Worms
IP Security: Overview, Architecture, Authentication, Encapsulating Security Payload, Combining security Associations, Key Management. Web Security: Web Security requirements, Secure sockets layer and Transport layer security, Secure Electronic Transaction. Intruders, Viruses and Worms: Intruders, Viruses and Related threats. Fire Walls: Fire wall Design Principles, Trusted Systems.

TEXT BOOKS

1. Cryptography and Network Security: Principles and Practice – William Stallings, Pearson Education., 2000.

M.Tech. Communication Systems w.e.f.2006-07
II Semester

GLOBAL TRACKING POSITION SYSTEMS

UNIT – I Introduction

GPS and GLONASS Overview – Satellite Navigation -Time and GPS – User position and velocity calculations – GPS – Satellite Constellation – Operation Segment – User receiving Equipment – Space Segment Phased development

UNIT – II Signal Characteristics

GPS signal components - purpose, properties and power level – signal acquisition and tracking – Navigation information extraction – pseudorange estimation – frequency estimation – GPS satellite position calculation

UNIT – III GPS Receivers & Data Errors

Receiver Architecture – receiver design options – Antenna design – SA errors – propagation errors – Methods of multipath mitigation – Ephemeris data errors – clock errors

UNIT – IV Differential GPS

Introduction – LADGPS – WADGPS, Wide Area Augmentation systems – GEO Uplink subsystem – GEO downlink systems – Geo Orbit determination – Geometric analysis – covariance analysis – GPS /INS Integration Architectures

UNIT – V GPS Applications

GPS in surveying, Mapping and Geographical Information System – Precision approach Aircraft landing system – Military and Space application – Intelligent transportation system

TEXT BOOKS

1. Mohinder S.Grewal , Lawrence R.Weill, Angus P.Andrews, "Global positioning systems – Inertial Navigation and Integration", John wily & sons , 2001.
2. E.D.Kaplan, "Understanding GPS Principles and Applications", Artech House Bos.

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M.Tech. Communication Systems w.e.f.2006-07
II Semester

SIMULATION OF COMMUNICATION SYSTEMS AND NETWORKS

UNIT – I Modeling and Communication Systems

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

UNIT – II Simulation of Random Variables and Random Process

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

UNIT – III Estimation of Performance Measures

Quality of an estimator, estimator fo SNR, Probability density functions of analog communication system, BER of digital communication systems, Montre carlo method and Importance sampling method, estimation of power spectral density of a process

UNIT – IV Communication Networks

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

UNIT – V Network of Queues

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

TEXT BOOKS

1. M.C.Jeruchim,Philip Balaban and K.Sam Shanmugam, "Simulation of communication systems",Plenum Press,New York,1992
2. A.M.Law and W.David Kelton, "Simulation Modelling and analysis", Mc Graw Hill Inc.,New York ,1991
3. J.F.Hayes, "Modelling and Analysis of Computer Communiocation networks,Plenum Press,New York,1984
4. Jerry Banks and John S.Carson,Deiscrete-event system Simulation",Prentice Hall,Inc.,New Jersey,1984

M.Tech. Communication Systems w.e.f.2006-07
II Semester

RADAR SYSTEM ENGINEERING

UNIT – I Radar signal Transmission

Radar Range equation, Transmitter and Receiver parameters and model, Types of Radars, Transmitted Waveforms (Time and Frequency Domains), Energy, Radar signal analysis using autocorrelation and Hilbert Transform., Pulse Compression, Clutter — Properties, reduction, Coding and Chirp.

UNIT – II Radar Antennas and Propagation

Reflector types, side lobe control; -Arrays;- Array factor and Beam width, Synthetic Aperture, Adaptive Antennas; Multipath effects, Low Altitude effects, Ionosphere effects.

UNIT – III Radar networks

Matched Filter Response and noise considerations

UNIT – IV Data Processing

Fast Fourier transform, Digital MTI, tracking, Plot Track,

UNIT – V Applications

Secondary Surveillance, Multi static, Over the Horizon, Remote sensing and meteorological radars.

TEXT BOOKS

1. M.LSkolnik; "Radar handbook"TMH, 2003
2. M.J.B.Scanlan; "Modem radar techniques".
3 Peyton Z Peebles, "Radar Principles", Wiley-Inter science

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Hyderabad -- 500 085

M.Tech. Communication Systems w.e.f.2006-07
II Semester

ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY

UNIT – I EMI Environment

Sources of EMI, counducted and radiated EMI, Transient EMI, EMI-EMC Definitions and units of parameters.

UNIT – II EMI Coupling Principles

Conducted, Radiated and Transient Coupling, Common Impedance Ground Coupling, Radiated Common Mode and Ground Loop Coupling, Radiated Differential Mode Coupling, Near Field Cable to Cable Coupling, Power Mains and Power Supply Coupling.

UNIT – III EMI Standards and Measurements

Units of specifications, Civilian standards Military standards. EMI Test Instruments /Systems, EMI Test, EMI Shielded Chamber, Open Area Test Site, TEM Cell Antennas, Conductors Sensors/Injectors/Couplers, Military Test Method and Procedures, Calibration Procedures.

UNIT – IV EMI Control Techniques

Shielding, Filtering, Grounding, Bonding, Isolation Transformer, Transient Suppressors, Cable Routing, Signal Control, Component Selection and Mounting.

UNIT – V EMI Design of PCBs

PCB Traces Cross Talk, Impedance Control, Power Distribution Decoupling, Zoning, Mother board Designs and Propagation Delay Performance Models.

TEXT BOOKS

1. Bernhard Keiser, " Principles of Electromagnetic Compatibility ", Artech house, 3rd Ed, 1986.
2. Henry W.Ott, " Noise Reduction Techniques in Electronic Systems ", John Wiley and Sons, 1988.
3. V.P.Kodali, "Engineering EMC Principles, Measurements and Technologies ", IEEE Press, 1996.

M.Tech. Communication Systems w.e.f.2006-07
II Semester

OPTICAL FIBRE COMMUNICATIONS

UNIT – I Optical Components

Propagation of signals in optical fiber, different losses, nonlinear effects, solitons, optical sources, detectors. Couplers, isolators, circulators, multiplexers, filters, gratings, interferometers, amplifiers.

UNIT – II Transmission System Engineering

Formats, ideal receivers, Practical detection receivers, Optical preamplifier, Noise considerations, Bit error rates, Coherent detection, system model, power penalty, Transmitter, Receiver, Different optical amplifiers, Dispersion.

UNIT – III Optical Networks

Client layers of optical layer, SONET/SDH, multiplexing, layers, frame structure, ATM functions, adaptation layers, Quality of service and flow control, ESCON, HIPPI.

UNIT – IV WDM network elements

Optical line terminal optical line amplifiers, optical cross connectors, WDM network design, cost trade offs, LTD and RWA problems, Routing and wavelength assignment, wavelength conversion, statistical dimensioning model.

UNIT – V Control and management

network management functions, management frame work, Information model, management protocols, layers within optical layer performance and fault management, impact of transparency, BER measurement, optical trace, Alarm management, configuration management.

TEXT BOOKS

1. John M. Senior, "Optical fiber Communications", Pearson edition, 2000.
2. Rajiv Ramswami, N Sivaranjan, "Optical Networks", M. Kauffman Publishers, 2000.

REFERENCE BOOKS

1. Gerd Keiser, "Optical Fiber Communication", MGH, 1 991.
2. G. P. Agarawal, "Fiber Optics Communication Systems", John Wiley NewYork, 1997
3. P.E. Green, "Optical networks", Prentice Hall, 1994.

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M.Tech. Communication Systems w.e.f.2006-07
II Semester

RELIABILITY OF ELECTRONICS & COMMUNICATION SYSTEMS

UNIT – I Reliability and Data Analysis

Failures of systems and its modes. Measure of Reliability, Reliability function, Hazard rate MTBF and their interrelations. Data sources. Data collection, use of Reliability Data, Reliability Analysis, Performance Parameters, calculation of failure rate, Application of Weibill distribution.

UNIT – II System Reliability and Modeling

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.

UNIT – III Maintainability and Availability

Maintainability and its equation. Factors Affecting maintainability. Measures of Maintainability, Mean Down Time, Availability Intrinsic availability equipment availability & Mission availability. Replacement processes and Policies.

UNIT – IV Life Testing of Equipments

Non-destructive 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.

UNIT – V Value Engineering

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

TEXT BOOKS

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

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M.Tech. Communication Systems w.e.f.2006-07
II Semester

COMMUNICATIONS LAB – II

Minimum of 10 experiments have to be conducted

1. Measurement of bit error rate using binary data
2. Study of eye pattern
   a) Observation and Calculation of noise margin percentage
   b) Observation and Calculation of timing jitter.
3. BPSK Modulation and Demodulation Techniques
4. DPSK Modulation and Demodulation Techniques
5. QPSK Modulation and Demodulation Techniques
6. DQPSK Modulation and Demodulation Techniques
7. 8-QAM Modulation and Demodulation Techniques
8. DQAM Modulation and Demodulation Techniques
9. Implementation of Protocols
   a) Stop and Wait b) Go back-N
10. Public Key Algorithm a) RSA b) El-Gamal Encryption
11. Crypt analysis of DES
12. Crypt analysis of RSA
13. Crypt analysis of El-Gamal Encryption
14. Implement of Digital Signature algorithms

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M.Tech. Communication Systems w.e.f.2006-07
II Semester

SEMESTER III & IV

Dissertation work