J. S. University, Shikohabad

M. Tech.

(Communication Engineering)

Scheme

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Syllabus

[Effective from the session 2015-16]

STUDY AND EVALUATION SCHEME FOR

M.Tech. (Communication Engineering)

I- SEMESTER

S.No.	Subject Code	Name of Subject	Periods Per Week				Evaluation Scheme			
			L	T	P	D	Sessional	End Exam	Total	Duration
1	MTEC-11	Advanced Digital Communication	3	1	-	-	50	100	150	3
2	MTEC-12	Antenna Theory and Design	3	1	-	-	50	100	150	3
3	MTEC-13	Optical Communication	3	1	-	-	50	100	150	3
4	MTEC-14	RF Circuit Design	3	1	-	-	50	100	150	3
								Grand Total	600	

STUDY AND EVALUATION SCHEME FOR

M.Tech. (Communication Engineering)

II- SEMESTER

S.No.	Subject Code	Name of Subject	Periods Per Week				Evaluation Scheme			
			L	T	P	D	Sessional	End Exam	Total	Duration
1	MTEC-21	Advanced Digital Signal Processing	3	1	-	-	50	100	150	3
2	MTEC-22	Information Theory & Coding	3	1	-	-	50	100	150	3
3	MTEC-23	Microwave Communication Engineering & Systems	3	1	-	-	50	100	150	3
4	MTEC-24	Advanced Wireless Networks	3	1	-	-	50	100	150	3
								Grand Total	600	

STUDY AND EVALUATION SCHEME FOR

M.Tech. (Communication Engineering)

III- SEMESTER

S.No.	Subject Code	Name of Subject	Periods Per Week				Evaluation Scheme			
			L	T	P	D	Sessional	End Exam	Total	Duration
THEORY SUBJECT										
1	MTEC-31	Advanced Optical Networks	3	1	-	-	50	100	150	3
2	MTEC-32	Advanced Satellite Communication	3	1	-	-	50	100	150	3
3	MTEC-33	Seminar	-	-	2	-	100	-	100	3
4	MTEC-34	Project	-	-	8	-	50	-	50	3
								Grand Total	450	

STUDY AND EVALUATION SCHEME FOR

M.Tech. (Communication Engineering)

IV- SEMESTER

1	MTEC-41	DISSERTATION a) Continuous Evaluation b) Project Report c) Viva Voice	-	-	18	-	150	200	350	
								Grand Total	350	

SEMESTER-I

[MTEC-11] Advanced Digital Communication

Baseband data transmission- Nyquist criterion for zero ISI, Correlative level coding, Optimum design of transmit and receive filters, Equalization.
Passband Digital transmission- Digital modulation schemes, Carrier synchronization methods, Symbol timing estimation methods.
Error control coding - Linear block codes, cyclic codes-encoding and decoding, Non-binary codes, Convolutional codes, Decoding of convolutional codes, Trellis coded modulation, Interleaver, Turbo coding, Performance measures.
Spread spectrum communication- D S and F H spread spectrum, CDMA system based on FH and DS spread spectrum signals, Applications, Synchronization of spread spectrum signals. Multichannel and Multicarrier communication Systems, Multi user communication systems.

Reference Books:

1. J.G.Proakis, Digital Communication, McGraw- Hill
2. S. Haykin, Communication systems,John Wiley
3. B.P. Lathi, Zhi Ding, Modern Digital and Analog Communication Systems,Oxford University Press
4. S.Lin&D.J.Costello, Error Control Coding, Pearson

[MTEC-12] Antenna Theory and Design

Antenna fundamental and definitions: Radiation mechanism - overview, EM fundamentals, Solution of Maxwell's equations for radiation problems, Ideal dipole, Radiation patterns, Directivity and gain, Antenna impedance, Radiation efficiency, Antenna polarization.
Resonant Antennas: Wires and patches, Dipole antenna, Yagi-Uda antennas, Microstrip antenna.
Arrays: Array factor for linear arrays, Uniformly excited equally spaced linear arrays, Pattern multiplication, Directivity of linear arrays, Nonuniformly excited equally spaced linear arrays, Mutual coupling, Multidimensional arrays, Phased arrays, Feeding techniques, Perspectives on Arrays.
Broadband antennas: Travelling wave antennas Helical antennas, Biconical antennas Sleeve antennas, and Principles of frequency independent antennas, Spiral antennas, and Log – periodic antennas.
Aperture antennas: Techniques for evaluating gain, Reflector antennas - Parabolic reflector antenna principles, Axi-symmetric parabolic reflector antenna, Offset parabolic reflectors, Dual reflector antennas, Gain calculations for reflector antennas, Feed antennas for reflectors, FiECS representations, Matching the feed to the reflector, General feed model, Feed antennas used in practice.
Antenna Synthesis: Formulation of the synthesis problem, Synthesis principles, Line sources shaped beam synthesis, Linear array shaped beam synthesis, Fourier series, Woodward - Lawson sampling method, Comparison of shaped beam synthesis methods, low sidelobe narrow main beam synthesis methods, Dolph Chebyshev linear array, Taylor line source method.
Method of moments: Introduction of the methods moments, Pocklington's integral equation, Integral equation and Kirchhoff’s networking equations, Source modeling weighted residual formulations and computational consideration, Calculation of antenna and scatter characteristics.

Computational EM: FTTD methods, Geometrical optics, Wedge diffraction theory, Ray fixed coordinate system, Uniform theory of wedge diffraction, E--plane analysis of horn antennas. Cylindrical parabolic antennas, Radiation by a slot on a finite ground plane, Radiation by a monopole on a finite ground plane, Equivalent current concepts, Multiple diffraction formulation by a curved surfaces, Physical optics, Methods of stationary phase, physical theory of diffraction, Cylindrical parabolic reflector antennas.

Reference Books:

1. C. A. Balanis, "Antenna Theory Analysis and Design", John Wiley.
2. J. D. Kraus, "Antennas", McGraw Hill TMH.
3. Stutman and Thiele, Antenna theory and design, John Wiley and sons Inc.
4. Sachidnanda et al, "Antennas and propagation", Pearson Education

[MTEC-13] Optical Communication

Fundamentals of Coherent Systems: Basic concepts. Modulation and demodulation schemes. System performance
Semiconductor optical amplifiers:EDFA and Raman amplifiers – modeling and analysis.Analysis and digital transmission with high power fiber amplifiers.
Multichannel systems: WDM lightwave systems. TDM and code division multiplexing.Advances in wavelength division multiplexing / demultiplexing technologies. Multiple Access Schemes in Optical Communication Systems.
SONET/SDH, ATM, IP, storage area networks. Wavelength routed networks. Next generation optical Internets.
Soliton systems: Nonlinear effects. Soliton – based communication. High speed and WDM Soliton systems

Reference Books:

1. G.P.Agrawal, Fiber Optic Communication Systems, Wiley
2. B.P.Pal , Guided Wave Optical Components and Devices, Elsevier
3. C.S.Murthy&M.Gurusamy, WDM Optical Networks, PHI
4. R.Ramaswami, K.N. Sivarajan, Optical Networks, Elsevier
5. G.P.Agrawal, Non linear Fiber Optics, (4/e), Elsevier

[MTEC-14] RF CIRCUIT DESIGN

UNIT-I INTRODUCTION:
Reasons for using RF, Applications, RF Spectrum, Microwave bands–RF behavior of Passive components: Tuned resonant circuits, Vectors, Inductors and Capacitors-Voltage and Current in capacitor circuits–Tuned RF / IF Transformers. Micro Strip Transmission Lines-Special Termination Conditions-sourced and Loaded Transmission Lines.

UNIT-IIRF/MICROWAVE AMPLIFIERS:
Types of amplifiers-small signal amplifier design-design of different types of amplifiers – narrow band, high gain, maximum gain, low noise broad band amplifier design -Multistage small signal amplifier design, Minimum Noise Multi stage amplifier design, Large signal design, High power amplifiers, Microwave power combining/dividing techniques, signal distortion due to intermodulation products, Multistage amplifiers large signal amplifiers design

UNIT-IIIRF OSCILLATORS:
RF/Microwave oscillator design-Oscillator versus amplifier design-oscillations conditions, design of transistor oscillators, fixed frequency, Frequency tunable oscillators.

UNIT-IVRF CONVERTERS AND MIXERS:
Rectifier design-detector design Formulation, Properties of S Parameters, Smith charts, applications on distributed circuit applications, lumped element circuit applications. Mixer design-UP conversion, down conversion, Conversion loss for SSB Mixers, SSB verses DSB Mixers conversion loss, one diode mixers, two diode mixer

UNIT-VRF MATCHING NETWORKS:
Design of matching networks using lumped elements, design rules for matching networks, Using distributed elements -using single stub matching Short or Open circuited stubs.

Reference Books:
1. Matthew M Radmanesh, Radio Frequency and Microwave Electronics, Pearson Education Asia.
2. Vendalin, Microwave Circuit Design using Linear and Nonlinear Techniques, Wiley.
3. Cotter W. Sawyer, Complete Wireless Design, McGraw Hill.
4. Less Besser and Rowan Gilmore, " Practical RF Circuit Design for Modem Wireless Systems ", Vol.2.
5. Reinhold Ludwing, Pavel Bretchko, " RF circuit design: Theory and applications ", Pearson Education Asia Publication.

SEMESTER-II

[MTEC-21] Advanced Digital Signal Processing

UNIT-1: Discrete Random Signal Processing

Discrete Random Processes - Ensemble averages, stationary processes, Autocorrelation and Auto covariance matrices. Parseval's Theorem, Sum Decomposition Theorem. Wiener - Khintchine Relation - Power Spectral Density - Periodogram Spectral Factorization, Filtering random processes. Low Pass Filtering of White Noise. Parameter estimation: Bias and consistency.

UNIT-2: Spectrum Estimation

Estimation of spectra from finite duration signals, Non - Parametric Methods - Correlation Method , Periodogram Estimator, Performance Analysis of Estimators - Unbiased, Consistent Estimators - Modified periodogram, Bartlett and Welch methods, Blackman & Tukey method. Parametric Methods - AR, MA, and ARMA model based spectral estimation. Parameter Estimation - Yule - Walker equations, solutions using Durbin‟s algorithm.

UNIT-3: Linear Estimation and Prediction

Linear prediction - Forward and backward predictions, Solutions of the Normal equations – Levinson - Durbin algorithms. Least mean squared error criterion - Wiener filter for filtering and prediction, FIR Wiener filter and Wiener IIR filters, Discrete Kalman filter.

UNIT-4: Adaptive Filters and Multirate DSP

FIR adaptive filters - adaptive filter based on steepest descent method – Widrow - Hoff LMS adaptive algorithm, Normalized LMS. Adaptive channel equalization - Adaptive echo cancellation - Adaptive noise cancellation -

Adapti ve recursive filters (IIR). RLS adaptive filters - Exponentially weighted RLS - sliding window RLS. Polyphase filter structures, time - variant structures. Multistage implementation of multirate system. Application to sub band coding -Wavelet transform and filter bank implementation of wavelet expansion of signals.

UNIT-5: Digital Signal Processors and its Applications

General purpose Digital Signal Processors: Texas Instruments TMS320 family –Motorola DSP 56333 family –Analog devices ADSP 2100 family –Instruction set of TMS320C50 –simple programs. Detection of fetal heart beats during labour – FFT Spectrum Analyser –Musical Sound Processing.

Reference Books

1.Monson H. Hayes, Statistical Digital Signal Processing and Modeling, John Wiley and Sons, Inc., Singapore, 2002.
2. John G. Proakis, Dimitris G.Manolakis, Digital Signal Processing, Pearson Education, 2002.
3.John G. Proakis Algorithms for Statistical Signal Processing, Pearson Education, 2002.
4. Emmanuel C. Ifeachor, Barrie W. Jervis, Digital Signal Processing –A Practical Approach, Addison Wesley, 1993.
5.A.V. Oppenheim and Schafer, Discrete Time Signal Processing, Prentice Hall, 1989. Texas Instruments, Users Guide TMS320C50

[MTEC-22] Information Theory & Coding

Unit 1

Entropy, Relative Entropy, and Mutual Information: Entropy, Joint Entropy and Conditional Entropy, Relative Entropy and Mutual Information, Relationship Between Entropy and Mutual Information, Chain Rules for Entropy, Relative Entropy, and Mutual Information, Jensen's Inequality and Its Consequences, Log Sum Inequality and Its Applications, Data-Processing Inequality, Sufficient Statistics, Fano's Inequality Asymptotic Equipartition Property: Asymptotic Equipartition Property Theorem , Consequences of the AEP: Data Compression, High-Probability Sets and the Typical Set

Unit 2

Entropy Rates of a Stochastic Process: Markov Chains, Entropy Rate, Example: Entropy Rate of a Random Walk on a Weighted Graph, Second Law of Thermodynamics, Functions of Markov Chains Data Compression: Examples of Codes, Kraft Inequality, Optimal Codes, Bounds on the Optimal Code Length, Kraft Inequality for Uniquely Decodable Codes, Huffman Codes, Some Comments on Huffman Codes, Optimality of Huffman Codes, Shannon–Fano–Elias Coding, Competitive Optimality of the Shannon Code, Generation of Discrete Distributions from Fair Coins

Unit 3

Channel Capacity: Examples of Channel Capacity, Symmetric Channels, Properties of Channel Capacity, Preview of the Channel Coding Theorem, Definitions, Jointly Typical Sequences, Channel Coding Theorem

Unit 4

Context for Error Correction Coding: Introduction: Where Are Codes? , The Communications System, Basic Digital Communications , Signal Detection, Memoryless Channels , Simulation and Energy Considerations for Coded Signals, Hamming Codes Linear Block Codes: Basic Definitions, The Generator Matrix Description of Linear Block Codes, The Parity Check Matrix and Dual Codes, Some Simple Bounds on Block Codes, Error Detection and Correction over Hard-Input Channels, Weight Distributions of Codes and Their Duals, Hamming Codes and Their Duals, Performance of Linear Codes

Unit 5

Cyclic Codes, Rings, and Polynomials: Introduction, Basic Definitions, rings, Quotient Rings, Ideals in Rings, Algebraic Description of Cyclic Codes, Nonsystematic Encoding and Parity Check, Systematic Encoding, Cyclic Encoding, Syndrome Decoding, Binary CRC Codes Convolutional Codes: Definition of Codes and Equivalent Code, Decoding Convolutional Codes, Some Performance Results, Error Analysis for Convolutional Codes, Puncturing, Suboptimal Decoding Algorithms forConvolutionalCodes, Convolutional Codes as Block Codes, Trellis Representations of Block and Cyclic Codes .

Reference Books:

1. Thomas M. Cover and Joy A. Thomas,"Elements of Information Theory", Wiley Series in Telecommunications and Signal Processing). Wiley-Interscience 2006.
2. Robert B Ash. "Information Theory". Dover Publishing
3. Todd K. Moon. Error Correction Coding: Mathematical Methods and Algorithms. Wiley
4. Shu Lin, Daniel J. Costello, Error Control Coding, Pearson

[MTEC-23] Microwave Communication Engineering & Systems

UNIT-I

Microwave and millimeter wave devices:

Overview of microwave and millimeter wave vacuum tube devices, limitations of microwave vacuum tubes, Gyratron vacuum tube devices. Advances in microwave and millimeter wave solid state devices, Gunn devices, oscillator using Gunn diode, and injection locked oscillators, IMPATT devices, and microwave and mm wave performance of IMPATT. Other solid state devices like Tunnel diode, BARITT and TRAPAT.

Microwave and mm wave circuits:

UNIT-II

Review of scattering matrix concept in the light of vector network analyzer, impedance matching network k, couplers, power dividers, resonators and filters. Detectors, mixers, attenuators, phase shifters, amplifier and oscillator

Ferrite based circuits.

UNIT-III

Antennas:

Hertzian dipole, loop antenna, helical antenna, frequency independent antenna: log spiral and log periodic dipole antenna array. Babinet principle, waveguide slot antenna, microstrip antenna, horn antenna, parabolic reflector. Antenna arrays and phased array antenna. Antenna measurement. Microwave and mm wave propagation. Overview of basic radio wave propagation mechanisms, Friis transmission formula, plane earth propagation model, troposcatter systems, ionosphere propagation, duct propagation, microwaveradio link and calculation of link budget. Effect on radio wave propagation due to rain, fog, snow, ice, atmospheric gases, Earth's magnetic field.

Reference Books:

1. P Bhartia & I J Bahl, "Millimeter wave engineering and Applications", John Wiley & Sons
2. David M Pozar, "Microwave Engineering", John Wiley & Sons
3. R E Collin, "Antenna & Radio wave Propagation", McGraw Hill Book Co.
4. Jordan & Balmian, "Electromagnetic waves & Radiating System", PHI.
5. R E Collin, "Microwave Engineering", McGraw Hill.

[MTEC-24] Advanced Wireless Networks

UNIT-I

GSM services and features – GSM system architecture – GSM radio subsystem – Frame structure for GSM– Signal processing in GSM – GPRS network architecture – GPRS services and features – 3G UMTSnetwork architecture – UMTS services and features.

UNIT-II

WiMAX Genesis and framework: 802.16 standard, WiMAX forum, Other 802.16 standards, Protocol layer topologies - Layers of WiMAX, CS, MAC CPS, Security layer, Physical layer, Reference model, topology.

UNIT-III

Frequency utilization and system profiles: Cellular concept, Licensed and unlicensed frequencies, Fixed WiMAX system profiles, Mobile WiMAX profiles.

WiMAX physical layer: OFDM transmission, SOFDMA, subcarrier permutation, 802.16 transmission chains, Channel coding, Turbo coding, Burst profile.

WiMAX MAC and QoS: CS layer, MAC function and frames, Multiple access and burst profile, Uplink bandwidth allocation and request mechanisms, Network entry and QoS management.

Radio engineering considerations: Radio resource management, Advance antenna technology in WiMAX, MBS. WiMAX architecture, Mobility handover and power save modes, Security.

Reference Books:

1. LoutfiNuyami, "WiMAX - Technology for broadband access", John Wiley, 2007.
2. Yan Zhang, Hsia-Hwa Chen, "Mobile WiMAX", Aurobech Publications, 2008
3. William Stallings, “Wireless Communication and Networking”, Pearson Education, 2002.
4. Siegmund M. Redl, Mathias K. Weber, Malcolm W. Oliphant, “An Introduction to GSM”, ArtechHouse Publishers, 1995.

SEMESTER-III

[MTEC-31] Advanced Optical Networks

SONET & SDH:
Brief history of SONET& SDH, Multiplexing hierarchy, Multiplexing structure – Functional components, Problem detection, Virtual tributaries & containers, Concatenation.
Architecture of OTN:
Digital wrapper, control planes, Control signaling, Multiplexing, hierarchies, Current digital hierarchy, revised hierarchies, Optical & Digital Transport hierarchies, Functionality stacks, Encapsulation & Decapsulation, GFP.
WDM, DWDM Topologies:
Relationship with SONET / SDH, EDF, WDM Amplifiers, Multiplexers, WADM I/P & O/P ports, span loss & chromatic, dispersion, Tunable DWDM lasers
Network Topologies & Protection schemes:
Non-negotiable requirements of robust networks, Line& Path protection switching, Type of Topologies, Optical Channel Concatenation, Meshed topologies, PON's, Optical Ethernets, Wide area Backbones, Metro optical networking
MPLS & Optical networks:
Label switching, FEC, Scalability & granuility: labels & wavelength, MPLS nodes, Distribution & Binding methods, MPLS support of virtual private networks, Traffic Engineering, MPLS, Relationships of OXC, MPLS operation, MPLS & optical Traffic Engineering, Similarities. Control & Data planes interworking
Architecture of IP & MPLS based optical transport Networks:
IP, MPLS & Optical control planes Interworking, The three control planes, Framework for IP Vs. Optical networks, Generalized MPLS use in optical networks, Bidirectional LSP's in optical network, Next horizon of GMPLS, ODVK General communication channels, Traffic parameters
Link Management protocol (LMP):
What is managed, Data Bearing links, Basic function of LMP, LMP messages, LMP message header, TLW's control channelManagement, LPC, LCV, Fault management, Extending LMP operations to optical links.
Optical compilers:
Building blocks, Serial Binary adder with carry delay, Fiber delay line memory loop, Bit serial, optical counter design, Lumped delay design, Distributed delay design, Time multiplex multiprocessor, Time slot interchange with 2 log 2 (N-1) switch, Hatch design support system

Reference Books:

1. R.Ramaswami,K.N.Sivarajan, "Optical Networks",Elsevier.
2. P.E Green, "Optical Networks" Prentice Hall.
3. Uyless Black "Optical Networks Third Generation Transport Systems" Prentice Hall
4. C.S.Murthy & M. Gurusamy, "WDM Optical Networks", Prentice Hall (India).
5. Tanenbaum Andrew S "Computer Networks" Prentice Hall(India).

[MTEC-32] Advanced Satellite Communication

UNIT -I

Orbital Mechanics: Orbit Equations, Orbit Description, Locating the Satellite in the Orbit and with Respect to Earth, Orbital Elements. Look Angle Determination and Visibility. Orbital Perturbations, Orbit Determination, Launch Vehicles, Orbital Effects in Communication System Performance.

UNIT –II

Spacecraft: Communication Subsystems, Transponders, Antennas, Equipment Reliability. Earth Stations. The Space Link, Satellite Link Design. Basic Transmission Theory. System Noise Temp., G/T Ratio, Noise Figure, Downlink Design, Design of Satellite Links for Specified C/N.

UNIT -III

Multiple Access. FDMA, FDM/FM/FDMA. Calculating the Overall Carrier to Noise Ratio on a FDM/FM/FDMA Link. Backoff. Measuring & Calculating the Effects of Intermodulation Noise.Over deviation and Companding. Companded Single Side Band. Pre-assigned and Demand Assigned FDMA.

UNIT –IV

Time Division Multiple Access. Frame Structure and Design. Reference Burst, Preamble, Network Synchronization, Unique Word Detection. TDMA. Channel Capacity, Pre-assigned and Demand Assigned TDMA, Speech Interpolation and Prediction, Downlink Analysis for Digital Transmission.

UNIT –V

Satellite Services: Satellite mobile communication, VSAT technology, Direct Broadcast by satellite (DBS).Global Positioning System. Radarsat.

Reference Books:

1. T. Pratt and C. W. Bostian. “Satellite Communications”, John Wiley & Sons.
2. R. M. Gagliardi, “Satellite Communications”, Lifetime Learning Publications, Belmont, CA.
3. W.L. Pritchard, H. G. Suyderhoud, and R. A. Nelson, “Satellite Communication System Engineering”, Prentice Hall.
4. J.J. Spilker , “Digital Communication by satellite” , PHI Publication
5. J. Martin, “Communication satellite systems”, PHI publication

[MTEC-33] SEMINAR

OBJECTIVE

The students are to select one technical topic related its branch for Seminar. The student is to submit the synopsis for assessment and approval. Progress for preparation of the seminar topic would be continuously assessed from time to time. Two periods per week are to be allotted and students are expected to present the seminar Progress. A faculty guide is to be allotted and he / she will guide and monitor the progress of the student and maintain the attendance.

Students have to give a final presentation for 15 minutes on his topic. Students are encouraged to use various teaching aids such as over head projectors, power point presentation and demonstrative models. This will enable them to gain confidence in facing the placement interviews

[MTEC-41] DISSERTATION

The student will submit a synopsis at the beginning of the semester for the approval from the University project committee in a specified format. Synopsis must be submitted within atwo weeks. The first defence, for the dissertation work, should be held within a one month. Dissertation Report must be submitted in a specified format to the University for evaluation purpose.