Department of Electronics and Telecommunication Engineering
Dr. Babasaheb Ambedkar Technological University, Lonere – Raigad (M.S.)

Revised Teaching and Examination Scheme for
M. Tech. (Electronics & Telecommunication) w.e.f. July 2008

Sr. No.	Subject Code	Name of the subject	Hours/Week			Credit	Examination scheme				
							Theory		TW	PR/OR	TOTAL
			L	P	T		TH	Tests			
First Semester											
01	MTETX811	Signal Theory	03	--	-	06	50	50	--	--	**100**
02	MTETX812	Radiation and Microwave Techniques	03	--	-	06	50	50	--	--	**100**
03	MTETX813	Signal Processing Algorithms & Applications	03	--	-	06	50	50	--	--	**100**
04	MTETX814	Computer & Communication Networks	03	--	-	06	50	50	--	--	**100**
05	MTETX815	Elective-I	03	--	-	06	50	50	--	--	**100**
06	MTETX816	Seminar-I	--	02	-	02	--	--	25	25	**50**
07	MTETX817	Communication Lab-I	--	10	-	08	--	--	25	25	**50**
		Total for Semester I	**15**	**12**	**-**	**40**	**250**	**250**	**50**	**50**	**600**
Second Semester											
01	MTETX821	Estimation and Detection Theory	03	-	-	06	50	50	--	--	**100**
02	MTETX822	Numerical Methods in Electromagnetics	03	-	-	06	50	50	--	--	**100**
03	MTETX823	Information Theory and Coding	03	-	-	06	50	50	--	--	**100**
04	MTETX824	Elective- II	03	-	-	06	50	50	--	--	**100**
05	MTETX825	Seminar-II	-	04	-	04	--	--	25	25	**50**
06	MTETX826	Mini-Project-I	-	04	-	04	--	--	50	50	**100**
07	MTETX827	Communication Lab-II	-	08	-	08	--	--	25	25	**50**
		Total for Semester II	**12**	**16**		**40**	**200**	**200**	**100**	**100**	**600**
Third Semester											
1	MTETX831	Seminar-III	-	06	-	06	--	--	50	50	**100**
2	MTETX832	Mini-Project-II	-	04	-	04	--	--	50	50	**100**
3	MTETX833	Project-I	-	06	-	06	--	--	50	50	**100**
		Total for Semester III	**--**	**16**	**-**	**16**	**--**	**--**	**150**	**150**	**300**
Fourth Semester											
1	MTETX841	Project-II	-	12	-	28	-	-	100	100	**200**
		Total for Semester IV	**-**	**12**	**-**	**28**	**-**	**-**	**100**	**100**	**200**
GRAND TOTAL											**1800**

Note: 1. **L: Lecture, P: Practical, T: Tutorial, TH: Theory Paper, Tests: Test-I+Test-II+Objective Test; TW: Term-work, PR/OR: Practical/Oral**

2. **Mini-Project-I and II : Students has to model and simulate an Electronic Systems using the available software OR a design, fabrication and testing of hardware based mini-project.**

Elective-I [MTETX815]

1. Digital Systems Design [MTETX815A]
2. Electromagnetic Interference and Compatibility [MTETX815B]
3. Mobile Communication [MTETX815C]
4. Statistical Signal Processing [MTETX815D]

Elective-II [MTETX824]

1. Multirate Digital Signal Processing [MTETX824A]
2. Optical Fiber Communication [MTETX824B]
3. Embedded System Design [MTETX824C]
4. Mobile Computing[MTETX824D]

MTETX811 : SIGNAL THEORY

Weekly Teaching Hours	TH : 03		
Scheme of Marking	TH : 50	Tests : 50	Total : 100

UNIT I

Probability

The meaning of probability, The axioms of probability, Repeated trials.

UNIT II

The Concept of a Random Variable

Introduction, Distribution and density functions, Specific random variables, Conditional distributions, Asymptotic approximations for Binomial random variables.

UNIT III

Functions of One Random Variable

The Random Variable g(X), The Distribution of g(X), Mean and variance, Moments, Characteristic functions.

UNIT IV

Two Random Variables

Bi-variable distribution, One function of two random variables, Two function of two random variables, Joint moments, Joint characteristic functions, Conditional distributions, Conditional expected values.

UNIT V

Sequences of Random variables

General concepts conditional densities, Characteristic functions and normality, Mean square estimation stochastic convergence and limit theorem, Random Numbers: Meaning and Generation.

UNIT VI

Stochastic Processes

Introduction, Estimation, Parameter Estimation, Hypothesis Testing General concept, Random walks and other applications, Spectral representation and estimation, Mean square estimation, Markov chains.

Text and References

1. A. Papoulis, S. Pillai, Probability, Random Variables and Stochastic Processes, Tata McGraw Hill
2. T Veerajan, Probability, Statistics and Random Processes
3. R.P.Singh, S.D. Sapre, Communication Systems,Analog &Digital
4. B.P.Lathi, Modern Digital and Anolog Communication Systems, Third Ed

MTETX812 : Radiation and Microwave Techniques

Weekly Teaching Hours	TH : 03		
Scheme of Marking	TH : 50	Tests : 50	Total : 100

UNIT I

Review of EM Theory

Introduction, Maxwell's equations, Wave equations, TEM/TE/TM/HE Wave definitions.

UNIT II

Microwaves

Introduction to microwaves, Microwave transmission lines, Smith chart and its applications at microwaves, Microwave measurements.

UNIT III

Microstrip lines and Antennas

Microstrip Lines : Types of microstrip lines, microwave components using strip lines, Methods of analysis, Design considerations, Microstrip arrays.
Microstrip Antennas : Principle of operation, Methods of analysis, feeding techniques, Polarization, Design considerations.

UNIT IV

Microwave Elements

Microwave integrated circuits, Active and passive microwave elements.

UNIT V

Microwave Communication Systems

Introduction, Analog and digital microwave communication systems, Satellite communication, Microwave antennas.

UNIT VI

Radar

Introduction, Classifications, Radar range equation, Modulators, Displays, Scanning and tracking, Doppler effect, Blind speeds, FMCW radars, radar antennas.

Text and References

1. Guro, Hijiroglu; *Electromagnetic Field Theory fundamentals* ;Thomson Publication.
2. Annapurna Das, Sisir Das; *Microwave Engineering* ;TMH Publication
3. M. Kulkarni; *Microwave and Radar Engineering* ; Umesh Publications, 3rd Edition.

MTETX813: Signal Processing Algorithms and Applications

Weekly Teaching Hours	TH : 03		
Scheme of Marking	TH : 50	Tests : 50	Total : 100

UNIT I

Introduction

Review of discrete time signals and systems, Different transforms, Filtering, Use of DFT in linear filtering, Filtering of long data sequences, Spectrum, Algorithm for convolution and DFT.

UNIT II

LTI DT System in Transform Domain and Digital Filter Structures

Simple Digital Filters**,** All Pass, Linear Phase and Minimum & Maximum phase and Complementary transfer Functions. Basic FIR and IIR Digital Filter Structures, Linear Phase Structure IIR, FIR and Allpass Lattice Structure.

UNIT III

Design of Digital Filters

General consideration, Design of FIR filters, Design of IIR filters from Analog filters, Frequency transformations, Design of Digital Filters Based on Least-square Method. Spectral Transformation of IIR Filters.

UNIT IV

Multirate Signal Processing

Filter banks, Interpolators, Decimators, Polyphase decomposition, Analysis and synthesis, Orthogonal and orthonormal filter banks.

UNIT V

Signal Representation

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, Multiresolution Analysis and Wavelet Transform.

UNIT VI

Linear Prediction and Optimum Filter Design

Least square methods for system modeling, Adaptive filters, Power spectrum estimation.

Text and References

1. Digital Signal Processing A Computer-Based Approach, Sanjit Mitra, MCG
2. Discrete Time Signal Processing; *A V Oppenheim, Schafer*; PHI.
3. Advanced Digital Signal Processing; *Proakis*; Mc Millan.
4. Multirate systems and Filter Banks; *P P Vaidyanathan*; Prentice Hall Eaglewood.
5. Digital Signal Processing : Principles, Algorithms and Applications; *John D Proakis*; PHI.
6. Adaptive Filter Theory; *S Hykin*; PHI.

MTETX814: Computer and Communication Networks

Weekly Teaching Hours	TH : 03		
Scheme of Marking	TH : 50	Tests : 50	Total : 100

Units: 1

Network Design Issues: Scope, Manageability, node placement, Link topology, Routing protocol selection. Network performance Issues: Network Terminology, Centralized and distributed approaches for networks.

Units: 2

Networks Performance, Analysis Traffic classes, Traffic Control, queuing Theory, Poisson's Model.

Units: 3

Protocol & Applications TCP/IP, frame relay, ATM, Routing algorithm, IP_V6, SNMP,LAN MAN,WAN INTERNET,INTRANET.

Units 4:

Protocol analyzer, Networks monitoring & troubleshooting, Wireless networks: fundamentals of wireless networks, WPAN (Bluetooth), WLAN, Wi-MAX

Units:5

Networks Security: Cryptography Firewalls, Security on Emails.

Units: 6

Audio/ Video data Services on IP: streaming video basics, VoIP, Video conferencing, Digital library.

Text and References

1. Computer Network (Third Edition) by A.S. Taneabaum (PHI), 2000
2. Data & Computer Communication (Fifth Edition) by W. Stalligs (PHI), 2000
3. Design and analysis of computer communication network - V. Ahuja (MGH)
4. Computer Network (Second Edition) by Uyless Black (PHI)

MTETX821 : ESTIMATION AND DETECTION THEORY

Weekly Teaching Hours	TH : 03		
Scheme of Marking	TH : 50	Tests : 50	Total : 100

UNIT I

Linear Algebra

Vector space : linear dependence, Basis and dimension, vector subspace, inner product spaces, orthonormal basis and Gram- Schmidt Process of orthogonalisation, computation of linear dependence, linear transformation and matrices, change of basis, orthogonal and unitary transformation, Eigenvalue, Eigen vectors and characteristics equation. Systems theory, stochastic processes, Gauss Markov models, representation of stochastic processes, likelihood and sufficiency

UNIT II

Binary Decision: Single Observation

Introduction to structure ofdecision and estimation problems.MaximumLikelihood decision criterian, Neyman-person criterian, Probability of error criterian, Bays risk criterian, Min-Max criterian, problems

UINT III

Binary Decision: Multiple Observations

Vector observation, The general Gaussion problem, Waveform observations and additive Gaussion noise, problems

UNIT IV

Multiple Decision: Multiple Decision

Bays risk, Probability of error: General case, Probability of error: Gaussion case, Ensure decision problems.

UNIT V

Composite And Nonparametric Decision Theory

Composite decisions Sign test, Wilason test, problems

UNIT VI

Fumdamentals of Estimation

Maximum likelihood method, Bays cost method, Relationship of Estimation, Linear minimum Variance and Least-square methods. Properties of Estimations: Unbiased estimators, Efficient estimators, Asymphotic properties.

Text and References

1. James Melsa and David Cohn, Mc-Graw Hill, Decision and Estimation Theory
2. Harry L, Van Trees, John Wiley and Sons Inc, Detection, Estimation, and Modulation Theory

MTETX822 : NUMERICAL METHODS IN ELECTROMAGNETICS

Weekly Teaching Hours	TH : 03		
Scheme of Marking	TH : 50	Tests : 50	Total : 100

UNIT I

Review of Analytical Methods

Separation of variables, conformal transformation – Green's function. Finite difference method – iterative solution, relaxation and acceleration crocesses : different boundary conditions.

UNIT II

Variational Method

Derivation of variational expression, Eulerlagrange equation , Rayleigh-Ritz method.

UNIT III

Finite Element Method

Discretization of solution region: Shape functions, element matrices and global matrix, method of solution, Method of moments, Basis functions; weighted residuals, method of least squares, numerical integration.

Text and References

1. Electromagnetic concepts and applications, Skitele C.G, PHI Inc., Englewood Cliffs N.J.,1982
2. Electromagnetic energy transmission and radiation, Adder R.B.,MIT press, Cambridge, 1969
3. Microwave Engineers handbook, Vol.I, SAAD T. and Hansen, Artech house, 1971.
4. Space charge waves and slow EM waves, Beck, A.H.U., Pergamon press, 1950

MTETX823 : INFORMATION THEORY AND CODING

Weekly Teaching Hours	TH : 03		
Scheme of Marking	TH : 50	Tests : 50	Total : 100

UNIT I

Theory of Probability and Random Processes

Concept of probability, Random variables, Probability models, Statistical averages, Central limit theorem, Correlation, Linear mean square estimation.

UNIT II

Random Processes

Random variable and random process, Power spectral density of a random process, Multiple random processes, Transmission of random processes through linear systems, Band-pass random processes, Optimum filtering.

UNIT III

Noise in Communication Systems

Behavior of analog and digital communication systems in the presence of noise, Sources of noise, Noise representation, Noise filtering, Noise bandwidth, Performance of analog and digital communication systems in the presence of noise.

UNIT IV

Information Theory

Measure of information, Joint entropy and conditional entropy, Relative entropy and mutual information, Markov sources, Source encoding, Shannon-Fano coding and Huffman coding, Shannon's fisrt and second fundamental theorems, Channel capacity theorem.

UNIT V

Error Correcting Codes

Galois fields, Vector spaces and matrices, Block codes, Cyclic codes, Burst-error detecting and correcting codes, Multiple error correcting codes, Convolutional codes, ARQ, Performance of codes, Comparison of coded and un-coded systems.

UNIT VI

Speech Coding

Characteristics of speech signal, Quantization techniques, Frequency domain coding, Vocoders, Linear predictive coders, Codecs for mobile communication, GSM codec, USDC codec, Performance evaluation of speech coders.

Text and References

1. Modern Digital and Analog Communication Systems; *B. P. Lathi*; Oxford Publication.
2. Principles of Digital Communication; *Das, Mullick, Chaterjee*; New Age International.
3. Principles of Communication Engineering (2^{nd} Edition); *Taub, Schilling*; TMH.
4. Elements of Information Theory; *Thomas M. Cover, Joy A. Thomas*; Wiley Inter-science.
5. Communication systems : Analog and Digital; *R.P.Singh, S.D. Sapre*; TMH.
6. Wireless Communication : Principles and Practice (2^{nd} Edition); *Theodore S. Rappaport*; Pearson India.

ELECTIVE I

MTETX815A : DIGITAL SYSTEM DESIGN

Weekly Teaching Hours	TH : 03		
Scheme of Marking	TH : 50	Tests : 50	Total : 100

UNIT I

Fundamentals of Sequential Logic Design

Concept of FSM and use of state diagrams, use of ASM charts, S-R Latch, D Latch, J-K flip-flop, Master Slave Flip-flops and their characteristic equations, excitation tables and timing diagrams, metastability.
Moore, Melay and mixed type synchronous state machines, synchronous design procedure, sync. Counter design, design using programmable devices.

UNIT II

Asynchronous Sequential logic Circuit Design

Asynchronous design fundamentals, differences with synchronous design. Timing diagram specification, merger diagrams, making race-free state assignment using transition diagram, essential hazards.

UNIT III

ASIC, FPGA and CPLD

Concept of ASIC, architecture of Xilinx 95XX series CPLD, 4XXX series FPGA, specifications and noise considerations, Typical applications, choice of target devices, speed grade, I/O pins and various resources.

UNIT IV

Introduction to VHDL and Elements of VHDL

Features of VHDL, concurrency, sequential behavior, used as test language, design hierarchies, levels of abstraction. Basic building blocks like entity, architecture, language elements, concurrent statements, sequential statements, signals and variables, configuration, operators, operator overloading, data types, component instantiation. Generate statement, process, loop statements, case statements, next statements, exit statements.

UNIT V

Simulation Issues and Test Benches

Steps in simulation, simulation process, simulation delta, types of delays, types of simulation. Function o test bench, design methodologies for test benches, interpreting the test bench reports.

UNIT VI

Synthesis Issues

Introduction to synthesis, synthesis tools and their features, hardware modeling examples, synthesis guidelines.

Text and References

1. J. F. Wakerly, "Digital Design- principles and practices", 3rd Ed, PHI
2. Donald Givone," Digital Principles and Design" , Tata McGraw-Hill
3. Bradley Carlson, "Digital Logic Design Principles", Wiley
4. Sudhakar Yalamanchili,"introductory VHDL from Simulation to Synthesis",Pearson

MTETX815B: ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY

Weekly Teaching Hours	TH : 03		
Scheme of Marking	TH : 50	Tests : 50	Total : 100

UNIT I

Introduction to EMI / EMC:

EMI / EMC Standards, Introduction to E, H, Near and far field radiators, Receptors and antennas, Different types of EMI sources and possible remedies.

UNIT II

Measurement techniques in EMI:

Open area test sites, Radiated interference measurements, Conducted interference measurements, Interference immunity.

UNIT III

EMI reduction techniques:

Grounding, Shielding, Bonding, EMI filters.

UNIT IV

Probabilistic and Statistical Physical Model :

Introduction, Probability considerations, Statistical Physical Models of EMI / EMC, EMC of terrestrial radio communication systems.

UNIT V

Computer Based Modeling and Simulation :

Computer Based Modeling and Simulation of EMI Models and Signal Integrity.

Text and References

1. Engineering Electromagnetic Compatibility, Principles and Measurement Technologies; *V. Prasad Kodali*; IEEE Press
2. Electromagnetic Compatibility, Principles and Applications; *Devid A. Weston, Marcol Dekker*, Inc New York.

MTETX815D: STATISTICAL SIGNAL PROCESSING

Weekly Teaching Hours	TH : 03		
Scheme of Marking	TH : 50	Tests : 50	Total : 100

UNIT I

Introduction

Random Signals, Spectral Estimation, Adaptive Filtering, Random Variables, Distribution and Density Functions, Random Vectors: Definition, Transformation and Linear Combination of Random Vectors Linear System with Stationary Input, Innovations and Representation of Real Vectors, DT Stochastic Process:
Stationarity, Ergodicity and Frequency Domain Representation of SP, Principles of Estimation.

UNIT II

Stochastic Processes and Models

Characterization of DT Stochastic Process, Correlation Matrix, Properties of Correlation Matrix, Stochastic Models: MA and AR Models, ARMA Models Hold Decomposition, Asymptotic Stationarity of AR Process, Yule Walker Equations, Power Spectral Density, Properties of Power Spectral Density Transmission of Stationary Process Through a Linear Filter, Other Statistical Characteristics of Stochastic Process Power Spectral Estimation, Spectral Correlation Density, Polyspectra

UNIT III

Optimum Linear Filters

Optimum Signal Estimation, Linear Mean Square Estimation, Solution of Normal Equations, Optimum FIR Filters, Linear Prediction: Linear Signal Estimation, Forward Linear Estimation, Backward Linear Estimation, Stationary Processes and Properties, Optimum IIR Filters, Inverse Filtering and Deconvolution.

UNIT IV

Algorithms and Structures For Optimum Filters.

Fundamentals of Order-Recursive Algorithms, Interpretation of Algorithmic Quantities, Order-Recursive Algorithms for Optimum FIR Filters, Algorithms of Levinson and Levinson-Durbin, Lattice Structure for Optimum Filters, Schur Algorithm, Triangularization and Inverse of Toeplitz Matrices, Kalman Filter Algorithm.

UNIT V

Least Square Filtering

Principle of LS, Linear Least Square Error Estimation, Least Square Filter, Linear Least Square Signal Estimation, LS Computation using Normal Equations, LS Computation using Orthogonalization Techniques, LS Computation using Singular Value Decomposition Techniques, Problems.

UNIT VI

Adaptive Filtering

Introduction, Typical Applications, Principles of Adaptive Filters, Method of Steepest Decent, LMS Algorithm, RLS Adaptive Filter, Fast RLS Algorithms for FIR Filtering, Frequency Domain and Subband Adaptive Filters.

Text and References

1. Adaptive Filter Theory; S. Haykin; PHI.
2. Statistical and Adaptive Signal Processing; D. G. Manolakis, V. K. Ingle, S. M. Kogon; McGraw Hill.

ELECTIVE-II

MTETX824A : MULTIRATE DIGITAL SIGNAL PROCESSING

Weekly Teaching Hours	TH : 03		
Scheme of Marking	TH : 50	Tests : 50	Total : 100

UNIT I

Fundamentals of Multirate Systems

Introduction, Basic multirate operations, Interconnection of building blocks, Polyphase representation, Mulstage implementation, Some application of multirate systems, Special filter and filter banks.

UNIT II

Maximally Decimaled Filter Banks

Introduction, Errors created in the QMF bank, A simple alias free QMF system, Power symmetric QMF banks, M-channel filter banks, Polyphase representation, Perfect reconstruction system, alias free filter banks, Tree structured filter banks, Transmultiplexer.

UNIT IV

Paranitary Perfect Reconstruction Filter Banks

Introduction, Lossless transfer matrices, Filter banks properties induced by paraunitariness, Two channel FIR paraunitary QMF banks, Two channel paraunitary QMF lattice, M - channel FIR paraunitary filter banks, Tranform coding and LOT.

UNIT V

Linear Phase and Cosine Modulated Filter Banks

Introduction, Some necessary conditions, Lattice structure for linear phase FIR PR banks, formal synthesis of linear phase FIR PR QMF Lattice. Pseudo QMF banks, Design of the pseudo QMF bank, Efficient polyphase structure, Cosine modulated perfect reconstruction system.

UNIT V

The Wavelet Transform and its Relation to Multirate Filter Banks

Introduction, Background and outline, Short time fourier transform, The Wavelet transform, DT orthonomal Wavelets, Continuous time orthonormal Wavelet basis.

UNIT VI

Multidimensional, Multivariable and Lossless Systems

Introduction, Multidimensional signals, Sampling a multidimensional Signals, Multirate fundamentals. Review of discrete time multi-input multi-output LTI System, ParaUNITary and lossless system.

Text and References

1. P.P.Vaidyanathan , PTR Prentice Hall, Englewood Cliffs , New Jersey, Multirate System and Filter Banks
2. N.J.Fliege , John Wiley & Sons, Multirate Digital Signal Processing
3. Raghuveer Rao, Ajit Bopardikar, Pearson Education Asia,Wavelet Transforms Introduction to Theory and Application
4. C. Sidney Burrus , R.A.Gopianath , Pretice Hall, Introduction to wavelet and wavelet Transform

MTETX824C : EMDEDDED SYSTEM DESIGN

Weekly Teaching Hours	TH : 03		
Scheme of Marking	TH : 50	Tests : 50	Total : 100

UNIT I

Fundamentals of Embedded System

Embedded System overview, Design challenges, Processor Technology, IC Technology, Design Technology.

UNIT II

Embedded System Hardware

Evaluation of Processors, Microprocessor architecture overview- CISC and RISC, Case study of Pentium processor architecture.

UNIT III

Microcontroller Architecture and **Interfacing**

Architecture of 8051, Instruction set, Addressing modes, Programming Examples. Interfacing of LED/LCD, keyboard, stepper motor, ADC/DAC and sensors, RTC, serial communication with micro-controller.

UNIT IV

Study of semiconductor memory

Memory device characteristics, SRAM, DRAM, SSRAM, SDRAM, RDRAM, FLASH, Smart card memory and interfacing of memory with micro-controller.

UNIT V

Introduction to DSP Processors

Architecture, features, instruction set, typical applications (TMS320XX or ADSP 21010).

UNIT VI

Embedded software and Applications

Introduction to software Engg, C cross compiler, Computational models, FSM, Concurrent state model, Concurrent Processes, Communication among processes, synchronization among processes. Introduction to RTOS**:** Windows CE, VX works.
Applications: Network protocols- TCP/IP, Embedded Ethernet, CANBUS, I2C bus, Mod Bus, Digital Camera.

Text and References

1. Frank Vahid and Tony Givargis, "EMBEDDED SYSTEM DESIGN A Unified Hardware/Software Introduction", John Wiley and sons ltd., 2002
2. M.A. Mazidi and J.G. Mazidi, "The 8051 Micro-controller and Embedded System" Pearson Education Asia, 2000
3. K.J. Ayala, "The 8051 Micro-controller", Penram International Pub., 1996
4. INTEL Microcontroller Manual
5. J. Zimmermann: "Fuzzy set theory and its applications, second edition, Allied Publishers limited, New Delhi, 1996.