SREE VIDYANIKETHAN ENGINEERING COLLEGE
(AUTONOMOUS)
Sree Sainath Nagar, Tirupati

Department of Electronics and Communication Engineering

Supporting Document for 1.1.3

Courses having focus on

Employability/ Entrepreneurship/ skill Development

Program:
M.Tech.- Digital Electronics and Communication Systems

Regulations : SVEC-14

The Courses (with course outcomes) under SVEC-14 Regulations which focus on ***employability/ entrepreneurship/ skill development*** are highlighted with the following colours.

Skill

Employability

Entrepreneurship

M. Tech. (DECS)-I Semester
(14MT13801) COMPUTER ARCHITECTURES

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	4	--	--	4

PRE-REQUISITES:
Courses on Digital design and Computer Architecture & Organization at UG level.

COURSE DESCRIPTION:
Basic computer architectural concepts; Instructional and thread level parallelism; Memory design; Multiprocessor interconnection networks.

COURSE OUTCOMES:
After completion of the course, students should be able to:
CO1. Demonstrate potential knowledge relating to
- Instruction level Parallelism
- Memory hierarchy design
- Cache coherency
- Multiprocessor Interconnection Networks

CO2. Gain experience by critically analyzing and evaluating metrics for implementing high performance architectures
CO3. Consider architecture related issues and work together to solve engineering problems towards system architecture choice to meet set of performance goals
CO4. Familiarize with available architectures to overcome ever increasing system design complexity to revolutionize system architectures

DETAILED SYLLABUS

UNIT-I: FUNDAMENTALS OF COMPUTER DESIGN (Periods:10)
Technology trends, Trends in cost, Performance-measuring, reporting and summarization. Quantitative principles of computer design.

UNIT-II: INSTRUCTION LEVEL PARALLELISM (Periods:12)
ILP – Concepts and challenges, Compiler techniques for exposing ILP. Branch prediction - static and dynamic. Dynamic Scheduling, Speculation – Hardware speculation, Techniques, Implementation issues. ILP Limitations.

UNIT-III: MULTIPROCESSORS AND THREAD LEVEL PARALLELISM (Periods:12)
Introduction- Taxonomy of Parallel Architectures, Memory Architecture and Communication models, Parallel Processing Challenges. Symmetric and distributed shared memory architectures, Performance issues, Synchronization, Models of memory consistency.

UNIT-IV: MEMORY HIERARCHY DESIGN (Periods:11)
Introduction- Levels in Memory Hierarchy. Optimizations for Cache Performance, Memory Technology and Optimizations – SRAM, DRAM.

Protection- Virtual Memory and Virtual Machines. Design of Memory Hierarchies.

UNIT-V: MULTIPROCESSOR INTERCONNECTION NETWORK (Periods:11)

Interconnection Networks and their Taxonomy, Bus based Dynamic Interconnection Networks, Switch based Interconnection Networks, Static Interconnection Networks, Analysis and Performance Metrics.

Total Periods: 55

TEXT BOOKS:

1. John L. Hennessey and David A. Patterson, "Computer architecture – A quantitative approach", Morgan Kaufmann/Elsevier Publishers, 4th Edition, 2007.
2. Hesham El-Rewini, Mostafa Abd-El-Barr, "Advanced Computer Architecture and Parallel Processing", A John Wiley & Sons, Inc Publication, 2005.

REFERENCE BOOKS:

1. David E. Culler, Jaswinder Pal Singh, "Parallel computing architecture: A hardware/software approach", Morgan Kaufmann /Elsevier Publishers, 1999.
2. Kai Hwang and Zhi.Wei Xu, "Scalable Parallel Computing", Tata McGraw Hill, New Delhi, 2003.

M. Tech. (CMS & DECS)-I Semester
(14MT13802) DIGITAL COMMUNICATION TECHNIQUES

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	4	-	-	4

PRE-REQUISITES:
A Course on Digital Communications at UG Level

COURSE DESCRIPTION:
Representation of band pass signals and systems; Digital modulation techniques; Design of optimum receivers; Generation and detection of spread spectrum signals.

COURSE OUTCOMES: On successful completion of this course the students will be able to
CO1. Demonstrate in-depth knowledge in
- Characterization of communication signals and systems.
- Digital modulation techniques
- Communication over AWGN channels
- Optimum receivers
- Spread spectrum techniques

CO2. Analyze numerical and analytical problems critically for conducting research in the field of Digital Communication Systems.
CO3. Solve engineering problems and arrive at optimal solutions pertaining to digital communications.
CO4. Apply appropriate techniques to complex engineering activities in the field of signal processing and communications.

DETAILED SYLLABUS
Review of random Variables and Processes

UNIT–I: CHARACTERIZATION OF COMMUNICATION SIGNALS AND SYSTEMS (Periods:10)

Representation of Band Pass Signals and Systems – Representation of Band-Pass Signals, Representation of Linear Band-Pass System, Response of a Band-Pass System to a Band-Pass Signal. Signal Space Representations – Vector Space Concepts, Signal Space Concepts, Orthogonal Expansion of Signals. Representation of Digitally Modulated Signals – Memory Less Modulation Methods – PAM Signals, Phase Modulated Signals, QAM Signals, Multidimensional Signals, Orthogonal Multidimensional Signals. Spectral Characteristics of Digitally Modulated Signals – Power Spectra of Linearly Modulated Signals.

UNIT–II: DIGITAL MODULATION TECHNIQUES (Periods:11)

Digital Modulation – Factors that Influence the Choice of Digital Modulation, Bandwidth and Power Spectral Density of Digital Signals. Linear Modulation Techniques – BPSK, DPSK, QPSK, OQPSK, ∏/4 QPSK. Constant Envelope Modulation Techniques – MSK, GMSK, Combined Linear and Constant Envelope Modulation Techniques – M-ary PSK, M- ary QAM.

UNIT–III: OPTIMUM RECEIVERS FOR THE ADDITIVE GAUSSIAN NOISE CHANNEL (Periods:10)

Optimum Receiver for Signals Corrupted by AWGN – Correlation Demodulator, Matched Filter Demodulator, the Optimum Detector. Performance of the Optimum Receiver for Memory Less Modulation – Probability of Error for Binary Modulation, M-ary Orthogonal Signals, M-ary PAM, M-ary PSK, QAM. Optimum Receiver for Signals with Random Phase in AWGN Channel – Optimum Receiver for Binary Signals, Optimum Receiver for M-ary Orthogonal Signals.

UNIT–IV: SPREAD SPECTRUM TECHNIQUES (Periods:10)

Introduction, Model of Spread Spectrum Digital Communication System, Direct Sequence Spread Spectrum Signals – Introduction, The Processing Gain and Jamming Margin. Applications of Direct Sequence Spread Spectrum Signals – Anti-jamming Application, Low-Detectability Signal Transmission, Code Division Multiple Access. Generation of PN-Sequences, Frequency-Hopped Spread Spectrum Signals, Other Types of Spread Spectrum Signals.

UNIT–V: DETECTION OF SPREAD SPECTRUM SIGNALS (Periods:09)

Coherent Direct-Sequence Receivers, Coherent Carrier Tracking – Delay-Lock Loop Analysis, Tau-Dither Loop. Non Coherent Carrier Tracking, Non coherent Frequency-Hop Receiver, Acquisition of Spread-Spectrum Signals – Acquisition by Cell-By-Cell Searching. Reduction of Acquisition Time – Acquisition with Matched Filters, Matched filters for PN Sequences, Matched Filters for Frequency-Hopped Signals.

Total periods: 50

TEXT BOOKS:

1. John G. Proakis, "Digital Communications", McGraw Hill, 4th edition, 2001.
2. Theodore S. Rappaport, "Wireless Communications", Pearson Education, 2nd edition, 2002.
3. George R. Cooper & Clare D. McGillem, "Modern Communication and Spread Spectrum", McGraw-Hill Book Company, 1986.

REFERENCE BOOKS:

1. Marvin K. Simon, Jim K Omura, Robert A. Scholtz & Barry K.Levit, "Spread Spectrum Communications", Computer Science Press, 1995.
2. J.Marvin, K.Simon, Sami. M.Hinedi and William C. Lindsey, "Digital Communication Techniques", PHI, 2009.

M. Tech. (DECS)-I Semester
(14MT13803) DIGITAL SYSTEM DESIGN

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	4	--	--	4

PRE-REQUISITES:
A Course on Switching Theory and Logic Design at UG Level

COURSE DESCRIPTION:
Design of digital systems using ROMs, PLAs, CPLDs and FPGAs; Fault diagnosis in combinational and sequential circuits; Fault modeling in programmable logic array.

COURSE OUTCOMES: At the end of the course students will be able to
CO1: Demonstrate in-depth knowledge in
- Design of combinational and sequential circuits
- Identifying various Faults in combinational and sequential circuits
- Test generation algorithms
- Programmable Logic Devices (PLDs)
- Design of complex digital systems using Programmable Logic Arrays

CO2: Analyze complex engineering problems critically for conducting research in the field of digital system design.
CO3: Conceptualize and solve engineering problems to obtain solutions for the design of digital machines.

DETAILED SYLLABUS:
UNIT - I: DESIGN OF DIGITAL SYSTEMS (Periods:12)
ASM charts, Hardware description language and control sequence method, Reduction of state tables, state assignments, Design of Iterative circuits, Design of sequential circuits - using ROMs , PLAs , CPLDs and FPGAs.
UNIT - II: FAULT MODELING & TEST PATTERN GENERATION (Periods:17)
Fault classes and models – Stuck at faults, bridging faults, transition and intermittent faults. Fault diagnosis of Combinational circuits by conventional methods – Path Sensitization technique, Boolean difference method. Kohavi algorithm, D – algorithm, PODEM, Random testing, transition count testing, Signature Analysis and testing for bridging faults.

UNIT - III: FAULT DIAGNOSIS IN SEQUENTIAL CIRCUITS (Periods:10)
Circuit Test Approach, Transition Check Approach - State identification and fault detection experiment, Machine identification, Design of fault detection experiment.

UNIT - IV: PLA MINIMIZATION AND TESTING (Periods:10)
PLA minimization-PLA folding. Fault model in PLA, Test generation and Testable PLA design.

UNIT - V: ASYNCHRONOUS SEQUENTIAL MACHINES (Periods:07)

Fundamental-mode model, The flow table, Reduction of incompletely specified Machines, races, cycles and hazards.

Total Periods: 56

TEXTBOOKS:

1. Charles H. Roth, Jr., "Fundamentals of Logic Design ", Cengage Learning, 5th edition,2004.
2. N. N. Biswas, "Logic Design Theory", PHI, 1993.
3. Miron Abramovici, Melvin Breuer, Arthur Friedman, "Digital Systems Testing and Testable Design", Jaico Publishing House, 2001.

REFRENCES:

1. Samuel C. Lee," Digital Circuits and Logic Design, PHI, 1976.
2. Norman Balabanian, Bradley Carlson, "Digital Logic Design Principles", John Wily&Sons,Inc., 2002.
3. Parag K. Lala," Fault Tolerant and Fault Testable Hardware Design", BS Publications, 1990.

M. Tech. (DECS & CMS) - I Semester
(14MT13809) LINEAR ALGEBRA

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	4	--	--	4

PRE-REQUISITES: Courses on Mathematics at UG level.

COURSE DESCRIPTION:
Solving linear systems of equations; Abstract structures with underlying mathematics such as vector spaces, linear transforms, inner products, Eigen values and Eigen vectors; Engineering applications of linear algebra.

COURSE OUTCOMES: On successful completion of course the student will be able to

CO1. Demonstrate advanced knowledge in
- solving Linear equations
- finding the bases and dimensions of Vector Spaces
- determining the Linear Transformation between different Vector Spaces .

CO2. Develop skills in
- designing the Dynamical Systems in electrical circuits
- analyzing Discrete time signals
- applying complex Eigen Values in Decoupling systems
- applying concepts of Inner Product Spaces in Fourier Series Analysis.

CO3. Apply Eigen Values and Eigen Vectors in diagonalisation of matrices related to transformations.

DETAILED SYLLABUS:

UNIT – I: VECTORS AND LINEAR EQUATIONS (Periods:09)

System of linear equations, Vector equations, the matrix and vector equations AX=B and AX=0.Solution sets of linear system, Linear combinations, Linear dependence and independence of vectors. Solutions of equations using LU decomposition.

UNIT – II: VECTOR SPACES AND LINEAR TRANSFORMATIONS (Periods:10)

Vector spaces – subspaces, Null and column Spaces of a matrix, Bases, Coordinate systems, Dimension of a Vector Space. Linear transformation, Properties of linear transformations Rank and Nullity, Matrix of linear transformations.

UNIT – III: INNER PRODUCT SPACES (Periods:10)

Inner product, Norm, Inner product space, Othrogonality, Orthogonal sets, Ortho normal basis - Orthogonal projections, Gram-Schmidt orthogonalisation process.

UNIT – IV: EIGEN VALUES AND EIGEN VECTORS (Periods:12)

Eigen Values and Eigen Vectors of a matrices and linear transformations, Eigen values and Eigen vectors of complex matrices. Diagonalisation, Quadratic

forms- Nature, Orthogonality of symmetric matrices. Singular value decomposition (SVD).

UNIT – V: ENGINEERING APPLICATIONS OF LINEAR ALGEBRA (Periods:14)

Applications to Difference equations, Discrete-time signals. Linear Independence in the space signals, Applications to Decoupling a dynamical system , Complex Eigen Values in Decoupling systems, Applications of inner product spaces to Fourier Series Analysis.

Total Periods: 55

TEXT BOOKS :

1. David C. Lay, **Linear Algebra and its applications**, Fourth edition, Pearson education, India. (2014).
2. Jim DeFramza and Dan Gagliardi **Introduction to Linear Algebra with applications,** The McGraw. Hill Companies, India. (2012)

REFERENCES:

1. Gilbert Strang, **Introduction to Linear Algebra**, Fourth edition, South Asian edition, Cambridge Press. (2009).
2. Otto Bretscher, **Linear Algebra with applications**, Third edition, Pearson education, India. (2007)

M. Tech. (DECS)-I Semester
(14MT13804) MODERN DIGITAL SIGNAL PROCESSING

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	4	--	--	4

PRE-REQUISITES:
A Course on Digital Signal Processing at UG Level

COURSE DESCRIPTION:
Design of digital filter banks; Power spectral estimation; Principles of adaptive filters; Algorithms for error minimization.

COURSE OUTCOMES: On completion of the course, the student will be able to
CO1. Demonstrate in-depth knowledge in
- Filter banks and Wavelets
  - Efficient power Spectral Estimation Techniques.
  - Characteristics of adaptive systems
  - Searching algorithms such as gradient and steepest descent
  - Adaptive algorithms like LMS, RLS and Kalman filtering
  - Non-linear adaptive filtering

CO2. Analyze complex engineering problems critically in digital filter design and the domain of adaptive filtering for conducting research.
CO3. Solve engineering problems for feasible and optimal solutions in the core areas of Multirate signal processing and Adaptive signal processing.
CO4. Contribute positively to scientific research in signal processing, antennas and spectral analysis.

DETAILED SYLLABUS

UNIT I: MULTIRATE FILTER BANKS (Periods:12)
Decimation, Interpolation, Sampling rate conversion by a rational factor I/D, Multistage Implementation of sampling rate conversion. **Digital Filter Banks**: Two-Channel Quadrature-Mirror Filter Bank, Elimination of aliasing, condition for Perfect Reconstruction, Polyphase form of QMF bank, Linear phase FIR QMF bank, IIR QMF bank , Perfect Reconstruction Two-Channel FIR QMF Bank .

UNIT II: POWER SPECTRAL ESTIMATIONS (Periods:12)
Estimation of spectra from finite duration observation of signals, **Non-Parametric Methods**: Bartlett, Welch, Blackmann & Tukey methods. Performance Characteristics of Nonparametric Power Spectrum Estimators, Computational Requirements of Nonparametric Power Spectrum Estimates. **Parametric Methods:** Relation between auto correlation & model parameters, Yule-Walker & Burg Methods, MA & ARMA models for power spectrum estimation.

UNIT III: DEVELOPMENT OF ADAPTIVE FILTER THEORY & SEARCHING THE PERFORMANCE SURFACE (Periods:10)
Introduction to Filtering, Smoothing and Prediction, Linear Optimum Filtering, Problem statement, Principle of Orthogonality - Minimum Mean Square Error, Wiener- Hopf equations, Error Performance - Minimum Mean Square Error.

Searching the Performance Surface: Methods & Ideas of Gradient Search methods, Gradient Searching Algorithm & its Solution, Stability & Rate of convergence - Learning Curves.

UNIT IV: STEEPEST DESCENT ALGORITHMS, LMS ALGORITHM & APPLICATIONS (Periods:10)

Gradient Search by Newton's Method, Method of Steepest Descent, Comparison of Learning Curves.

LMS Algorithm: Overview - LMS Adaptation algorithms, Stability & Performance analysis of LMS Algorithms - LMS Gradient & Stochastic algorithms, Convergence of LMS algorithm.

Applications: Noise cancellation, Cancellation of Echoes in long distance telephone circuits, Adaptive Beam forming.

UNIT V: RLS ALGORITHM AND KALMAN FILTERING (Periods:13)

RLS Algorithm : Matrix Inversion lemma, Exponentially weighted recursive least square algorithm, update recursion for the sum of weighted error squares, convergence analysis of RLS Algorithm, Application of RLS algorithm on Adaptive Equalization.

Kalman Filtering: Introduction, Recursive Mean Square Estimation Random variables, Statement of Kalman filtering problem, The Innovations Process, estimation of the state using the Innovations Process, Filtering, Initial conditions.

Total periods: 57

TEXT BOOKS:

1. John G. Proakis, Dimitris G. Manolakis, *Digital signal processing, principles, Algorithms and applications,* Prentice Hall, 4th Edition, 2007.
2. Simon Haykin, *Adaptive Filter Theory,* PE Asia, 4th Edition, 2002.

REFERENCE BOOKS:

1. Bernard Widrow, Samuel D. Strearns, *Adaptive Signal Processing,* PE, 1985.
2. Emmanuel C Ifeacher Barrie. W. Jervis, "*DSP - A Practical Approach*", Pearson Education, 2nd Edition, 2002.

M. Tech. (CMS) – I Semester
M. Tech. (DECS) – I Semester (Elective-I)
(14MT13805) COMPUTER NETWORKS

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	4	--	--	4

PRE-REQUISITES:
A Course on Computer Networks at UG Level

COURSE DESCRIPTION:
Protocols & standards of computer and wireless networks; Advanced network architectures; Upper layers protocols; Network security.

COURSE OUTCOMES:
After completion of the course, students should be able to:
CO1. Demonstrate in-depth knowledge on
- Architectures and functioning of Advanced Wireless LAN and WAN technologies such as Wi-Fi, Wi-Max, Frame Relay, ATM networks etc.
- Protocols like MPLS, RSVP, VOIP associated with modern computer network systems.
- Know the security features associated with modern computer network systems.

CO2. Analyze various design issues for conducting research related to the Internet protocol (IP), Wireless LANs and ATM network technologies prominent in high performance scenario.
CO3. Formulate solutions for engineering problems pertaining to the advanced networking technologies.
CO4. Apply appropriate techniques and tools to complex engineering activities in the field of computer networks.

DETAILED SYLLABUS
UNIT- I: INTRODUCTION TO COMPUTER NETWORKS (Periods:11)
Data communications & Networking for Today's Enterprise, Data Communications, Network Edge, Network core, Internet, OSI, TCP/IP models, Data Link Control Protocols - HDLC, Point to Point Protocol (PPP);
UNIT- II: WIRELESS NETWORKS (Periods:12)
Ethernet, Fast Ethernet, Gigabit Ethernet, WLANS – Merits and topologies, IEEE 802.11 WLAN Standard – Physical Layer, MAC Layer, Frame structure, IEEE 802.11 a, b, g, e and n standards, Applications; Bluetooth & WiMax- features, standards, protocols and utility; Virtual LANs
UNIT- III: ADVANCED NETWORK ARCHITECTURES (Periods:13)
Circuit switching network - SONET/SDH; Virtual Circuit Networks – Frame Relay, ATM - Protocol Architecture, Logical Connections, ATM Cells, Transmission of ATM Cells, ATM Service Categories; Signaling Protocols - MPLS, RSVP; VPN architectures, IP over ATM, Connecting Devices: Repeaters, Bridges, Routers, Gateways.

UNIT- IV: INTERNET TRANSPORT AND APPLICATION PROTOCOLS (Periods:12)

Internet protocol - IPv6, Transport protocols – Connection Oriented protocol TCP, Connectionless protocol UDP; Congestion control in TCP, Socket interface, Domain Name System, Simple Mail Transfer Protocol, WWW and HTTP, Multimedia Applications – RTP, Voice Over IP.

UNIT- V: SECURITY IN COMPUTER NETWORKS (Periods:08)

Simple Network Management Protocol, Network security, Cryptography - Symmetric Key Cryptography, Public Key Cryptography, Firewalls - Packet filtering, Application Gateway, Digital Signature, IP Sec.

Total Periods: 56

TEXT BOOKS:

1. William Stallings, "Data and Computer Communication", 9th edition, Prentice hall, 2010
2. Behrouz A. Forouzan, "Data Communications and Networking", 4th Ed, Tata McGraw-Hill, New Delhi, 2006
3. Jim Kurose, Keith Ross, "Computer Networking: A Top Down Approach", 4th edition, Addison Wesley, July 2007.

REFERENCE BOOKS:

1. Andrew S. Tanenbaum "Computer Networks", 4th Edition, Pearson Education, 2008
2. LEON-GARCIA, INDRA WIDJAJA, "Communication Networks – Fundamental concepts and Key architectures", TMH, 2000

M. Tech. (DECS)-I Semester (Elective-I)
(14MT13806) LOW POWER CMOS VLSI DESIGN

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	4	--	--	4

PRE-REQUISITES:
A Course on VLSI Design at UG Level.

COURSE DESCRIPTION:
Power dissipation and estimation of CMOS circuits; Design, synthesis and testing of low power circuits; Low power static RAM architectures; Energy recovery techniques; Synthesis of low power circuits.

COURSE OUTCOMES: On successful completion of this course the students will be able to

CO1: Demonstrate in-depth knowledge in
- Design of Logic Circuits for High performance and Low Power requirements using CMOS processes.
- Special low power techniques
- Power estimation and analysis
- Low power architecture & Systems.

CO2: Analyze the low power CMOS circuits effects of devices and judge independently the best suited device for fabrication of smart devices for conducting research in ULSI design.

CO3: Solve problems of Low power design challenges, tradeoff between area, speed and power requirements.

CO4: Apply appropriate techniques, resources and tools to engineering activities in low power VLSI circuits.

DETAILED SYLLABUS:

UNIT –I **(Periods:05)**

Power Dissipation in CMOS VLSI design: Need for low power VLSI chips, Sources of Power dissipation , Power dissipation in MOS & CMOS Devices, Limitations of low Power design.

UNIT –II **(Periods:12)**

Power Estimation: Modeling of Signals, Signal Probability Calculation, Probabilistic Techniques for Signal activity Estimation, Statistical Techniques, Estimation of Glitching Power, Sensitivity Analysis, Power Estimation using input vector Compaction, Estimation of Maximum Power.

UNIT-III **(Periods:13)**

Synthesis for Low Power: Behavioral Level Transforms, Logic Level optimization of low power, Circuit level.

Design and Test of Low Voltage CMOS Circuits: Circuit Design Style, Leakage current in Deep Sub micrometer Transistors, Low voltage Circuit Design Techniques, Multiple Supply Voltages.

UNIT-IV **(Periods:10)**

Low Power Static RAM Architectures: Organization of Static RAM, MOS Static RAM Memory Cell, Banked Organization of SRAMs, Reducing Voltage Swing in Bit lines, Reducing Power in Sense Amplifier Circuits.

UNIT-V **(Periods:12)**

Low Energy Computing using Energy Recovery Techniques: Energy Recovery Circuit Design, Designs with partially Reversible logic, Supply Clock Generation.

Software design for low power: Sources of software power dissipation, software power estimation, Software power estimation, Co-design for low power.

Total Periods: 52

TEXT BOOKS:

1. Kaushik Roy, Sharat Prasad, "Low-Power CMOS VLSI Circuit Design" WileyStudent Edition, 2000.

REFERENCE BOOKS:

1. Kiat-Seng Yeo,Samir S.Rofail and Wang-Ling Goh, "CMOS/BiCMOS ULSI: Low power, Low Voltage, "Pearson education, 2002.

M. Tech. (DECS) I Semester (Elective- I)
(14MT13807) EMBEDDED SYSTEM DESIGN

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	4	--	--	4

PRE-REQUISITES:
Courses on Digital Logic Design and Programming using 'C' language at UG Level

COURSE DESCRIPTION:
Embedded system components, techniques and their choice; Real world interfacing concepts; Development tools and programming concepts.

COURSE OUTCOMES: After completion of the course, students should be able to:

CO1. Demonstrate in-depth knowledge in
- Hardware used in embedded systems
- Software used in embedded systems
- Embedded system-on-chip
- Structural Units in a Processor
- Embedded Programming
- Requirement and specification analysis

CO2. Analyze critically and resolve the issues pertaining to the selection of operating system and system components from the available lot.

CO3. Think laterally and originally, apply independent judgment with intellectual and creative advancements while developing programs for multi-processes in an application.

CO4. Contribute positively in developing solutions with embedded systems for multidisciplinary scientific problems with open mindedness, objectivity and rational approach.

DETAILED SYLLABUS

UNIT- I: AN INTRODUCTION TO EMBEDDED SYSTEMS (Periods:10)
Embedded systems-definition, how are they different, Challenges in Embedded Computing System Design. Processor Embedded into a System, Selection Process, Hardware Units and Devices in a System, Exemplary Embedded Systems, Embedded System-On-Chip (SOC) and use of VLSI Circuit Design Techno logy, Classification of Embedded Systems

UNIT- II: (Periods:12)
Processor Architectures, Memory Organization and Real World Interfacing: Advanced Architectures, Processor and Memory Organization, Performance Metrics, Memory-Types, Maps and Addresses. Processor and Memory Selection

Survey of Software Architectures: Round- Robin, Round- Robin with Interrupts, Function-Queue Scheduling, Real-Time Operating System Architectures, Selecting Architecture.

UNIT- III: PROGRAMMING CONCEPTS AND EMBEDDED PROGRAMMING IN C, C++ AND JAVA (Periods:11)

Software Programming in Assembly language (ALP) and in High-Level language 'C', C Program Elements- Header, Source Files and Preprocessor Directives, Macros and Functions, Data Types, Data Structures, Modifiers, Statements, Loops and Pointers. Object-Oriented Programming, Embedded Programming in C++, Java

UNIT- IV: PROCESSES AND OPERATING SYSTEMS (Periods:11)

Introduction, Multiple Tasks and Processes, Pre-emptive RTOS, Priority Based Scheduling, Inter process Communication Mechanisms, Evaluating OS Performance, Power Management and Optimization for Processes.

UNIT- V (Periods:11)

Embedded Software Development Tools: Host and Target Machines, Linkers/Locators for Embedded Software, Getting Software into the Target System.

System Design Techniques: Introduction, Design Methodologies, Requirement Analysis, Specifications, System Analysis and Architecture Design.

Total Periods: 55

TEXTBOOKS:

1. Rajkamal, "Embedded systems: Architecture, Programming and Design", TMH, Second Edition, 2008.
2. Wayne wolf, "Computers as a component: principles of embedded computing system design", Morgan Kaufmann Publishers, Second Edition, 2008.
3. David E. Simon, "An embedded software primer", Pearson Education , 2008

REFERENCE BOOKS:

1. Arnold S Burger, "Embedded Systems Design: An Introduction to Processes, Tools, and Techniques", CMP Books
2. Steve Heath, Butterworth Heinenann, "Embedded systems design: Real world design", Newton mass USA 2002.

M. Tech. (DECS & CMS)-I Semester (Elective-I)
(14MT13808) TRANSFORM TECHNIQUES

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	4	--	--	4

PRE-REQUISITES:
Course on Signal Processing at UG Level.

COURSE DESCRIPTION:
Continuous wavelet transforms; Discrete wavelet transforms; Multi resolution analysis; Wavelet packets; Applications of wavelet transforms.

COURSE OUTCOMES:
On successful completion of this course the students will be able to
CO1. Demonstrate advanced knowledge in
- Multiresolution Analysis
- Continuous wavelets
- Discrete wavelets
- Alternative wavelets & Wavelet packets

CO2. Analyze complex engineering problems critically for conducting research in Signal Processing.
CO3. Solve engineering problems with wide range of solutions in the areas of Biomedical Signal Processing, Image Processing, Radar Signal Processing and Communications.
CO4. Contribute to collaborative multidisciplinary scientific work on Data compression, Noise reduction, Communications, Image and signal Processing.
CO5. Apply appropriate Transform techniques, resources and tools to engineering activities in the fields of Signal Processing and Communications.

DETAILED SYLLABUS
UNIT –I: (Periods:14)
Review of Transforms:
Fourier series and Geometry- Vector space, functions and function spaces. Fourier transform, short-time Fourier transform, Walsh, Hadamard, Haar, Slant, KLT, Hilbert transforms.
Continuous Wavelet Transform:
Introduction, Continuous-Time Wavelets, Definition of the CWT, The CWT as a correlation, Constant Q-Factor Filtering Interpretation and Time-Frequency Resolution, The CWT as an operator, Inverse CWT.
UNIT –II: DISCRETE WAVELET TRANSFORM AND ORTHOGONAL WAVELET DECOMPOSITION (Periods:08)
Introduction, Approximations of vectors in nested linear vector spaces, Example of an MRA-Bases for the Approximation Subspaces and Harr Scaling Function, Bases for the Detail Subspaces and Harr Wavelet, Digital Filter Implementation of the Harr Wavelet Decomposition.

UNIT –III: MRA ORTHONORMAL WAVELETS, AND THEIR RELATIONSHIP TO FILTER BANKS (Periods:12)

Introduction, Formal Definition of an MRA, Construction of a General Orthonormal MRA, A Wavelet basis for MRA, Digital Filtering Interpretation, Examples of Orthogonal Basis Generating Wavelets, Interpreting Orthonormal MRAs for Discrete time signals, Miscellaneous issues Related to PRQMF Filter Banks, Generating Scaling Functions and Wavelets from Filter Coefficients.

UNIT-IV: ALTERNATIVE WAVELET REPRESENTATIONS (Periods:09)

Bi-orthogonal Wavelet Bases, Filtering Relationship for Bi-orthogonal Filters, Examples of Bi-orthogonal Scaling Functions and Wavelets, Two-Dimensional Wavelets, Non-separable Multidimensional Wavelets, Wavelet Packets.

UNIT–V: APPLICATIONS OF WAVELETS (Periods:11)

Wavelet De-noising, Speckle Removal, Edge Detection and Object Isolation, Image Fusion, Object Detection by Wavelet Transforms of Projections, Communication Applications-Scaling Functions as signaling pulses, Discrete Wavelet Multitone Modulation.

Total Periods: 54

TEXT BOOKS:

1. Raghuveer M.Rao and Ajit S.Bopardikar, "*Wavelet Transforms-Introduction to theory and applications"*, Pearson edu, 1998.
2. Soman.K.P, Ramachandran.K.I, Resmi.N.G, "*Insight into Wavelets from theory to Practice"*, PHI, Third Edition, 2010.

REFERENCE BOOKS:

1. R. C. Gonzalez, R. E. Woods, "*Digital Image Processing*," 2nd Edition, Pearson Education, 1992.
2. Jaideva C Goswami, Andrew K.Chan, "*Fundamentals of Wavelets-Theory, Algorithms and Applications*", John Wiley and sons, 1999.
3. C.Sidney Burrus, Ramesh A Gopinath and Haitao Guo, "*Introduction to Wavelets and Wavelet Transforms",* Prentice Hall, 1998.

M. Tech. – I Semester
(14MT10310) RESEARCH METHODOLOGY
(Common to all M. Tech. Programmes)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	--	--	3

PRE-REQUISITES: --

COURSE DESCRIPTION:
Fundamentals of research work - research problem and design; Data collection, Analysis and hypothesis; Statistics in Research; Interpretation and Report Writing.

COURSE OUTCOMES:
On successful completion of course, the student will be able to
CO1. Demonstrate knowledge on research approaches, research process and data collection.
CO2. Identify and analyze research problem.
CO3. Solve the research problems using statistical methods.
CO4. Carryout literature survey and apply good research methodologies for the development of scientific/ technological knowledge in one or more domains of engineering.
CO5. Learn, select and apply modern engineering tools to complex engineering activities.
CO6. Write effective research reports.

DETAILED SYLLABUS:
UNIT-I: INTRODUCTION TO RESEARCH METHODOLOGY (Periods:07)
Objectives and Motivation of Research, Types of Research, Research Approaches, Research Process, Criteria of good Research.
UNIT-II: RESEARCH PROBLEM AND DESIGN (Periods:09)
Defining and Formulating the Research Problem, Problem Selection, Necessity of Defining the Problem, Techniques involved in Defining a Problem. Features of Good Design, Research Design Concepts, Different Research Designs.
UNIT-III: DATA COLLECTION, ANALYSIS, AND HYPOTHESIS (Periods:09)
Different Methods of Data Collection, Processing Operations, Types of Analysis, Basic Concepts of Testing of Hypothesis, Hypothesis Testing Procedure.
UNIT-IV: STATISTICS IN RESEARCH (Periods:09)
Review of Statistical Techniques - Mean, Median, Mode, Geometric and Harmonic Mean, Standard Deviation, Measure of Asymmetry. Normal Distribution, Chi-Square Test as a Test of Goodness of Fit.
UNIT-V: INTERPRETATION AND REPORT WRITING (Periods:06)
Interpretation – Techniques and Precautions. Report Writing – Significance, Stages, Layout. Types of reports, Precautions in Writing Reports.

Total Periods: 40

TEXT BOOK:

1. C.R. Kothari, *Research Methodology: Methods and Techniques*, New Age International Publishers, New Delhi, 2nd Revised Edition, 2004.

REFERENCE BOOKS:

1. Ranjit Kumar, *Research Methodology: A step-by-step guide for beginners*, Sage South Asia, 3rd ed., 2011.
2. R. Panneerselvam, Research Methodology, PHI learning Pvt. Ltd., 2009

M. Tech. (DECS)-I Semester
(14MT13821) DIGITAL SYSTEM DESIGN LAB

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
25	50	75	-	-	4	2

PRE-REQUISITES:
A Course on Digital Design at UG Level

COURSE DESCRIPTION:
Design and simulation of digital circuits; Implementing digital circuits in FPGAs.

COURSE OUTCOMES:
On successful completion of this course the students will be able to
CO1: Demonstrate skills in
- Behavioral system modeling: concurrency and event-driven simulation
- Digital design modeling using various styles (behavioral, structural and dataflow)
- Designing Combinational and sequential circuits
- Verifying the Functionality of Designed circuits using function Simulator
- Checking for critical path time calculation
- Placement and routing in FPGA
- Implement digital designs in FPGA device.

CO2: Conceptualize and solve problems in logic verification and timing calculation of Digital circuits.
CO3: Perform projects efficiently in Digital system design to achieve optimization for high device utilization and performance in industrial needs.
CO4: Acquire research skills in the domain of Digital Systems.
CO5: Create, develop and use modern CAD tools to analyze problems of RTL, Technology schematic, and system implementation.

LIST OF EXPERIMENTS
PART- I: (Design and Simulation Experiments) (12 Slots)
1. Simulation and Verification of Logic Gates. **(1 Slot)**
2. Design and Simulation of Half adder, Serial Binary Adder, Multi Precession Adder, Carry Look Ahead Adder and Full Adder. **(1 Slot)**
3. Simulation and Verification of Decoder, MUXs, Encoder using all Modeling Styles. **(1 Slot)**
4. Modeling of Flip-Flops with Synchronous and Asynchronous reset. **(1 Slot)**
5. Design and Simulation of Counters- Ring Counter, Johnson Counter, and Up- Down Counter, Ripple Counter. **(2 Slots)**
6. Design of a N- bit Register of Serial-in Serial-out, Serial in Parallel out, Parallel in Serial out and Parallel in Parallel Out. **(1 Slot)**

Design of Sequence Detector (Finite State Machine- Mealy and Moore Machines) **(1 Slot)**

7. 4- Bit Multiplier, Divider. (for 4-Bit Operand) **(1 Slot)**
8. Design ALU to Perform – ADD, SUB, AND-OR, 1's and 2's COMPLIMENT, Multiplication, Division. **(2 Slots)**
9. Design of RAM/ROM **(1 Slot)**

PART-II: (Implementation Steps for Experiments in Part-I) **(2 Slots)**

1. Verification of the Functionality of the circuit using function Simulators.
2. Timing Simulator for Critical Path time Calculation.
3. Synthesis of Digital Circuit.
4. Place and Router Techniques for FPGA's like Xilinx, Altera, Cypress, etc.,
5. Implementation of Design using FPGA and CPLD Devices.

Total Time Slots: 14

REQUIRED SOFTWARE TOOLS:

1. Mentor Graphic tools/Cadence tools/ Synopsys's tools.(220 nm Technology and Above)
2. Xilinx ISE 10.1i and above for FPGA/CPLDS.

REFERENCES:

1. John F. Wakerly, "Digital Design: Principles and Practices", Prentice Hall, Third Edition, 2000.
2. Digital System Design Lab Manual

M. Tech. (DECS)-II Semester
(14MT23801) DISPLAY TECHNOLOGIES AND DEVICES

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	4	--	--	4

PRE-REQUISITES:
A Course on Semiconductor Devices and Circuits at UG Level

COURSE DESCRIPTION:
Principles of display technology; Inorganic display technologies; Measurements of display systems; Characteristics of liquid crystal display, thin film transistor, Active matrix LCD and organic LED.

COURSE OUTCOMES: On successful completion of this course the students will be able to

CO1: Demonstrate in-depth knowledge in
- Display Technologies
- Display Measurements
- Liquid Crystal, TFT, AMLCD and OLED.

CO2: Analyze complex engineering problems critically for conducting research in Display devices.

CO3: Solve engineering problems with wide range of solutions in different Display technologies.

CO4: Apply appropriate techniques, resources and tools to engineering activities in Display Technologies.

CO5: Contribute positively to multidisciplinary scientific research in design and development of Display Devices well suited for wide range of applications.

DETAILED SYLLABUS:

UNIT-I: FUNDAMENTALS OF DISPLAY TECHNOLOGY (Periods:09)
Light, Modulation of Light, Human vision and perception for display – Performance of the Human Visual system. Luminescence, Photoluminescence, Cathodoluminescence (CL), Electroluminescence (EL).

UNIT-II: INORGANIC DISPLAY TECHNOLOGY (Periods:12)
Cathode-ray tube (CRT) display, flat-panel display; field emission display (FED), plasma display panel (PDP), semiconductor light-emitting diode (LED) display, micro display and others.

UNIT-III: DISPLAY MEASUREMENTS (Periods:06)
Photometric measurements, Colorimetric Measurements, Display Measurement System.

UNIT-IV: LIQUID CRYSTAL Displays AND TFT (Periods:12)
Liquid Crystal – Liquid Crystal Materials, Liquid Crystal Alignment, Twisted Nematic, In-plane switching, Fringe Filed switching.
Thin film transistors (TFT) – Basic Concepts of Crystallized semiconductor Materials, Disordered Semiconductors, TFT Characteristics.

UNIT-V: AMLCD and OLED (Periods:11)

Active matrix liquid crystal display (AMLCD) - structure of AMLCD, Operating Principles of AMLCD, Manufacturing of AMLCD, AMLCD Electronics, Performance characteristics.

Organic light emission diode (OLED) – Generation of Excited States by Charge Recombination, electrical and optical Characteristics of OLEDs.

Total Periods: 50

TEXT BOOKS:

1. John Wilson and John Hawkes, "Optoelectronics: An Introduction", Prentice Hall, 3rd Edition, 1998.
2. Jiun-Haw Lee, david N.Liu, Shin-Tson Wu,"Introduction to Flat Panel Displays, John Wiley & Sons, 2008.
3. Matthew S.brennesholtz, Edward H.stupp," Projection Displays", John Wiley & Sons, 2008.

REFERENCE BOOKS:

1. Willem den Boer, "Active Matrix Liquid Crystal Displays", Elsevier, 2005.
2. Jan Kalinowski, "Organic Light-Emitting Diodes", Marcel Dekker, 2005.
3. David Armitage, Ian Underwood and Shin-Tson Wu, "Introduction to Microdisplays", John Wiley & Sons Ltd, 2006.
4. Robert L.Myers, "Display Interfaces: Fundamentals and Standards", John Wiley & sons, 2003.

M. Tech. (CMS & DECS)-II Semester
(14MT23802) INFORMATION THEORY AND CODING TECHNIQUES

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	4	--	--	4

PRE-REQUISITES:
A Course on Digital Communications at UG Level

COURSE DESCRIPTION:
Information theory; Channel capacity; Channel coding techniques – Linear block codes, Cyclic codes, Convolutional codes; Reed-Solomon and Turbo codes.

COURSE OUTCOMES: After completion of the course, students should be able to:

CO1. Demonstrate knowledge in
- Various aspects of source and channel coding techniques
- channel capacity
- Performance evaluation of various source coding techniques

CO2. Analyze complex engineering problems critically in the domain of information, source and line encoding.

CO3. Conceptualize and Solve engineering problems for feasible and optimal solutions in the core area of information theory and coding techniques.

CO4. Apply appropriate techniques to complex engineering activities in the field of information and communications.

DETAILED SYLLABUS

UNIT I: INTRODUCTION (Periods:12)

Entropy: Discrete stationary sources, Markov sources, Entropy of a discrete Random variable- Joint, conditional, relative entropy, Mutual Information and conditional mutual information. Chain rules for entropy, relative entropy and mutual information, Differential Entropy - Joint, relative, conditional differential entropy and Mutual information.

Loss less Source coding: Uniquely decodable codes, Instantaneous codes, Kraft's inequality, optimal codes, Huffman code, Shannon's Source Coding Theorem.

UNIT II: CHANNEL CAPACITY (Periods:10)

Capacity computation for some simple channels, Channel Coding Theorem, Fano's inequality and the converse to the Coding Theorem, Equality in the converse to the coding theorem, The joint source Channel Coding Theorem, The Gaussian channels- Capacity calculation for Band limited Gaussian channels, Parallel Gaussian Channels, Capacity of channels with colored Gaussian noise.

UNIT III: CHANNEL CODING-1 (Periods:08)

Linear Block Codes: Introduction to Linear block codes, Generator Matrix, Systematic Linear Block codes, Encoder Implementation of Linear Block Codes, Parity Check Matrix, Syndrome testing, Error Detecting and correcting capability of Linear Block codes, Application of Block codes for error control in data storage Systems.

UNIT IV: CHANNEL CODING-2 (Periods:14)

Cyclic Codes: Algebraic Structure of Cyclic Codes, Binary Cyclic Code Properties, Encoding in Systematic Form, Systematic Encoding with an (n - k)-Stage Shift Register, Error Detection with an (n - k)-Stage Shift Register, Well-Known Block Codes-Hamming Codes, Extended Golay Code, BCH Codes.

Convolutional Codes: Convolution Encoding, Convolutional Encoder Representation, Formulation of the Convolutional Decoding Problem, Properties of Convolutional Codes, Sequential Decoding, Feedback Decoding, Application of Viterbi and sequential decoding.

UNIT V: CHANNEL CODING-3 (Periods:12)

Reed-Solomon Codes- Reed-Solomon Error Probability, Finite Fields, Reed-Solomon Encoding, Reed-Solomon Decoding, Interleaving and Concatenated Codes- Block Interleaving, Convolutional Interleaving, Concatenated Codes. Coding and Interleaving Applied to the Compact Disc Digital Audio System-CIRC Encoding, CIRC Decoding. Turbo Codes- Turbo Code Concepts, Encoding with Recursive Systematic Codes, Feedback Decoder, The MAP Decoding Algorithm.

Total Periods: 56

TEXT BOOKS:

1. Thomas M. Cover and Joy A. Thomas, Elements of Information Theory, John Wiley & Sons, 1 st Edition,1999.
2. Bernard sklar, "Digital Communications – Fundamental and Application", Pearson Education, 2 nd Edition, 2009.

REFERENCES:

1. Robert Gallager, Information Theory and Reliable Communication, John Wiley & Sons,1st Edition,1968.
2. John G. Proakis, "Digital Communications", Mc. Graw Hill Publication, 5th Edition, 2008.
3. SHU LIN and Daniel J. Costello, Jr., "Error Control Coding – Fundamentals and Applications", Prentice Hall, 2nd Edition, 2002.

M. Tech. (DECS)-II Semester
(14MT23803) MICROCONTROLLER BASED SYSTEM DESIGN

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	4	--	--	4

PRE-REQUISITES:
Computer Architecture, Digital design, Software design, Microprocessors and Interfacing.

COURSE DESCRIPTION:
System design involving microcontrollers –8051, ARM, PIC;

COURSE OUTCOMES: After completion of the course, students should be able to:

CO1. Demonstrate potential knowledge in
- Advanced Microcontrollers architecture and programming
- Features of modern microcontrollers and their usage
- Interfacing with external peripherals

CO2. Gain design experience by critically analyzing modern microcontrollers suitable for a specific application.

CO3. Consider trade-offs in the way hardware and software components of a system work together to solve engineering problems to exhibit a specific behavior, given a set of performance goals and technology.

CO4. Familiarize with available controllers to overcome ever increasing embedded system design complexity combined with reduced time-to-market window to revolutionize embedded system design process.

CO5. Promote multidisciplinary research in the area of embedded systems.

DETAILED SYLLABUS

UNIT- I: 8051/31 MICROCONTROLLERS (Periods:10)

8051 Architecture: Architecture, Memory organization, Addressing modes, Instruction set, Timers, Interrupts, I/O ports, Interfacing I/O Devices, Serial Communication.

8051 Programming: Timer Counter Programming, Serial Communication Programming, Interrupt Programming.

UNIT- II: ARM CONTROLLERS (Periods:11)

ARM Embedded Systems, ARM processor fundamentals- Register organization , Pipeline, Core extension. ARM instruction set- Data processing, Branch, Load-Store, Interrupts & Program Status Register Instructions. Thumb Instruction Set – Register usage, ARM Thumb interworking, Branch, Data processing, Load store instructions, Stack and Software Interrupt.

UNIT- III: PIC MICROCONTROLLER (Periods:08)

Introduction to PIC Controllers - Block diagram of PIC16C74A, PIC16C62A, PIC Development tools. CPU Architecture and Instruction Set- Harvard architecture and Pipelining, Program Memory considerations, Register file structure and Addressing modes, CPU registers, Instruction set , simple operations.

UNIT- IV PIC INTERRUPTS AND TIMERS (Periods:14)

Loop Time, Subroutine, Timer2 and Interrupts: Timer2 use, Interrupt logic, Timer2 Scalar initialization, IntService Interrupt Service Routine, Loop Time Subroutine.

Interrupt Timing And Program Size Considerations: Interrupt Constraints, Improved Interrupt servicing, shortening an Interrupt handler, Critical region.

External Interrupts and Timers: RB0/INT external interrupt input, Timer 0, Compare mode, Capture mode,Timer1/CCP Programmable period scaler,Timer1 external event counter, Timer1 and Sleep Mode, PWM outputs, Port B-Change Interrupts(pins RB7:RB4).

UNIT- V: PIC SYSTEM DESIGN (Periods:12)

I/O Port Expansion - Synchronous Serial Port module, SPI, output and input port expansion, LCD Display. I2C Bus for Peripheral Chip Access – I2C Bus Operation, I2C Bus Subroutines, DAC output, Temperature sensor, Serial EEPROM. Analog to Digital Converter – ADC characteristics, ADC use. UART – Baud rate accuracy, Baud rate selection, UART Data Handling Circuitry, Initialization, Use.

Total Periods: 55

TEXT BOOKS:

1. Muhammad Ali Mazidi, Janice G. Mazidi and Rolin D. McKinlay, 'The 8051 Microcontroller and Embedded Systems' Prentice Hall, 2005.
2. Andrew N Sloss, Dominic Symes, Chris Wright, "ARM Systems Developers Guide: Designing and Optimizing System Software", Morgan Kaufmann Publishers, 2004.
3. John B Peatman, "Design with PIC Microcontrollers", Pearson Education, I edition, 1998.

REFERENCE BOOKS:

1. Myke Predko, "Programming and customizing the 8051 Microcontroller", Tata McGraw Hill, 2001.
2. Kenneth J Ayala, "The 8051 Microcontroller: Architecture, Programming and Applications", Thomson Publications, 1991.
3. Muhammad Ali Mazidi, Rolin D. Mckinlay, Danny Causey ` PIC Microcontroller and Embedded Systems using Assembly and C for PIC18', Pearson Education 2008.
4. John Iovine, 'PIC Microcontroller Project Book ', McGraw Hill, 2000

M. Tech. (DECS)-II Semester
(14MT23804) TESTING AND TESTABILITY OF DIGITAL SYSTEMS

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	4	--	--	4

PRE-REQUISITES:
A Course on Digital Logic Design at UG Level.

COURSE DESCRIPTION:
Fault modeling; Test strategies for digital circuits; Design for testability; Testing techniques; Fault diagnosis.

COURSE OUTCOMES: On successful completion of this course the students will be able to

CO1: Demonstrate in-depth knowledge in
- Fault Modeling
- Test Generation
- Design for Testability
- BIST
- Fault Diagnosis.

CO2: Analyze complex engineering problems critically for conducting research in Testing of Circuits.

CO3: Solve engineering problems with wide range of solutions in different Test Architectures.

CO4: Apply appropriate techniques, resources and tools to engineering activities in Design for Testability.

CO5: Contribute positively to multidisciplinary scientific research in design and development of Fault Diagnosis well suited for wide range of applications.

DETAILED SYLLABUS:

UNIT I: BASICS OF TESTING AND FAULT MODELLING (Periods:10)
Introduction to Testing - Faults in digital circuits - Modeling of faults - Logical Fault Models - Fault detection - Fault location - Fault dominance - Logic Simulation - Types of simulation - Delay models - Gate level Event-driven simulation.

UNIT II: TEST GENERATION FOR COMBINATIONAL AND SEQUENTIAL CIRCUITS (Periods:08)
Test generation for combinational logic circuits - Testable combinational logic circuit design - Test generation for sequential circuits - design of testable sequential circuits.

UNIT III: DESIGN FOR TESTABILITY (Periods:11)
Design for Testability - Ad-hoc design for testability techniques- Generic scan based design - Classical scan based design -System level DFT approaches.

UNIT IV: SELF-TEST AND TEST ALGORITHMS (Periods:13)

Built-In Self Test - Test pattern generation for BIST - Circular BIST - BIST Architectures - Testable Memory Design - Test algorithms - Test generation for Embedded RAMs.

UNIT V: FAULT DIAGNOSIS (Periods:10)

Logic Level Diagnosis - Diagnosis by UUT reduction - Fault Diagnosis for Combinational Circuits -Self-checking design - System Level Diagnosis.

Total Periods: 52

TEXT BOOKS:

1. M. Abramovici, M.A. Breuer and A.D. Friedman, "Digital Systems and Testable Design", Jaico Publishing House, 2002.
2. P.K. Lala, "Digital Circuit Testing and Testability", Academic Press, 2002.
3. A.L. Crouch, "Design Test for Digital IC's and Embedded Core Systems", Prentice Hall International, 2002.

REFERENCE BOOKS:

1. M.L. Bushnell and V.D. Agrawal, "Essentials of Electronic Testing for Digital, Memory and MixedSignal VLSI Circuits", Kluwer Academic Publishers, 2002.

M. Tech. (CMS & DECS)-II Semester
(14MT23805) WIRELESS COMMUNICATIONS

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	4	--	--	4

PRE-REQUISITES:
A Course on Digital Communications at UG Level.

COURSE DESCRIPTION:
Introduction to cellular wireless communication systems; Radio propagation in mobile environment; Equalization and Diversity techniques; Multiple access techniques; Introduction to wireless networking; Multicarrier modulation techniques.

COURSE OUTCOMES:
On successful completion of this course the students will be able to
CO1. Demonstrate advanced knowledge in
- Cellular systems and wireless standards
- Radio wave propagation in wireless environment
- Equalization and diversity techniques
- Multiple access techniques and networking
- Multicarrier modulation

CO2. Analyze complex engineering problems critically for conducting research in wireless systems.
CO3. Solve engineering problems with wide range of solutions in wireless communications.
CO4. Apply appropriate techniques to engineering activities in the field of wireless communications.

DETAILED SYLLABUS

UNIT – I: INTRODUCTION TO WIRELESS COMMUNICATION SYSTEMS AND CELLULAR CONCEPT (Periods:11)

Evolution of Mobile Radio Communication Systems, Examples of Wireless Communication Systems, 1G, 2G, 2.5G, and 3G Wireless Cellular Networks and Standards, Frequency Reuse Concept, Channel Assignment Strategies, Interference and System Capacity, Trunking and Grade of Service, Improving Coverage and Capacity in Cellular Systems-cell splitting and sectoring. Problem solving.

UNIT – II: MOBILE RADIO PROPAGATION (Periods:15)

Large Scale Path Loss: Introduction, Free Space Propagation Model, Relating Power to Electric field, Propagation Mechanisms – Reflection, Diffraction, and Scattering. Practical Budget Design using Path Loss Models, Outdoor and Indoor Propagation Models. Problem solving.

Small Scale Fading and Multipath: Small Scale Multipath Propagation, Impulse Response Model of a Multipath Channel, Small Scale Multipath Measurements, Parameters of Mobile Channels, Types of Small Scale Fading

(all variations*),* Statistical Models – Clarke's Model for Flat Fading, and Jake's Model. Problem solving.

UNIT -III: EQUALIZATION & DIVERSITY TECHNIQUES (Periods:11)

Equalization: Introduction, Survey of Equalization Techniques, Linear and Non-linear Equalizers – Linear Transversal Equalizer, Decision Feedback Equalizer (DFE). Algorithms for Adaptive Equalization – Zero Forcing, LMS, and RLS. Problem solving.

Diversity Techniques: Realization of Independent Fading Paths, Receiver Diversity – System Model, Selection Combining, Threshold Combining, Maximal Ratio Combining, and Equal Gain Combining, Rake receiver. Transmit Diversity–Channel known at Transmitter, Channel unknown at Transmitter – the Alamouti Scheme, analysis.

UNIT – IV: MULTIPLE ACCESS TECHNIQUES & NETWORKING (Periods:12)

Introduction to Multiple Access: FDMA, TDMA, CDMA, SDMA, Packet Radio - Pure ALOHA, Slotted ALOHA, CSMA, and Reservation protocols. Capacity of Cellular Systems- Cellular CDMA. Problem Solving.

Introduction to Wireless Networking: Introduction to Wireless Networks, Differences between Wireless and Fixed Telephone Networks, Development of Wireless Networks, Traffic Routing in Wireless Networks, Wireless Data Services, Common Channel Signaling.

UNIT – V: MULTICARRIER MODULATION (Periods:08)

Data Transmission using Multiple Carriers, Multicarrier Modulation with Overlapping Subchannels, Discrete Implementation of Multicarrier Modulation – DFT and its properties, The Cyclic Prefix, Orthogonal Frequency Division Multiplexing (OFDM), Matrix Representation of OFDM, Vector Coding. Challenges in Multicarrier Systems. Problem solving.

Total periods: 56

TEXT BOOKS:

1. T. S. Rappaport, "Wireless Communications, Principles and Practice," Prentice Hall, 2nd Edition, 2002.
2. Andrea Goldsmith, "Wireless Communications," Cambridge University Press, 2005.

REFERENCE BOOKS:

1. David Tse, PramodViswanath, "Fundamentals of Wireless Communications," Cambridge University Press, 2006.
2. Dr. Kamilo Feher, "Wireless Digital Communications," Prentice Hall, 1995.

M. Tech. (CMS)-II Semester
M. Tech. (DECS)-II Semester (Elective-II)
(14MT23806) DETECTION AND ESTIMATION OF SIGNALS

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	4	--	--	4

PRE-REQUISITES:
A Course on Probability theory and Stochastic Processes at UG Level

COURSE DESCRIPTION:
Detection criteria for single and multiple observations; Estimation techniques; Properties of estimators; Estimation of parameters.

COURSE OUTCOMES:
On successful completion of this course the students will be able to
CO1. Demonstrate advanced knowledge in
- Different decision criteria
- Estimation techniques and their properties
- Selection of an efficient estimator for the given specifications.
- Design of Kalman and Matched filters
- Statistical estimation of parameters

CO2. Analyze complex engineering problems critically for conducting research in the field of signal detection and estimation.
CO3. Conceptualize and solve engineering problems to obtain solutions for the design of optimum receivers.
CO4. Apply appropriate techniques to engineering activities in the field of Communications.

DETAILED SYLLABUS
UNIT – I: DETECTION THEORY (Periods:12)
Binary Decisions: Single observation – Maximum-likelihood decision criterion, Neyman-Pearson criterion, Receiver operating characteristics, Probability-of-error criterion, Bayes risk criterion, Min-max criterion. Problem solving.
UNIT–II: BINARY DECISIONS: MULTIPLE OBSERVATIONS (Periods:11)
Vector observations, the general Gaussian Problem, Waveform Observation in Additive Gaussian Noise, The Integrating Optimum Receiver, Matched Filter Receiver, Problem solving.
UNIT - III: ESTIMATION THEORY (Periods:12)
Maximum-likelihood estimation, Bayes estimation criterion - Mean Square Error Criterion, Uniform Cost Function, Absolute-Value Cost Function. Linear minimum-Variance and Least Squares Method, Estimation in the presence of Gaussian noise - Linear observation, Non-linear estimation. Problem solving.
UNIT – IV: PROPERTIES OF ESTIMATORS (Periods:08)
Bias, Efficiency, Cramer-Rao bound, Asymptotic properties, Sensitivity and error analysis.

UNIT–V: STATE ESTIMATION AND STATISTICAL ESTIMATION OF PARAMETERS (Periods:11)

State Estimation: Prediction, Kalman filter, Problem solving.

Statistical Estimation of Parameters: Concept of sufficient statistics, Exponential families of Distributions, Exponential families and Maximum likelihood estimation, uniformly minimum-variance unbiased estimation.

Total periods: 54

TEXT BOOKS:

1. James L.Melsa & David L.Cohn, "Decision and Estimation Theory", McGraw Hill, 1978.
2. Steven M. Kay, "Fundamentals of Statistical Signal Processing Vol. 1: Estimation Theory, Prentice Hall, 1993, Vol. 2: Detection Theory", Prentice Hall Inc., 1998.

REFERENCE BOOKS:

1. Harry L. Van Trees, "Detection, Estimation and Modulation Theory", Part 1, John Wiley & Sons Inc. 1968.
2. Jerry M. Mendel, "Lessons in Estimation Theory for Signal Processing, Communication and Control", Prentice Hall Inc., 1995.
3. Sophocles J.Orfanidis, "Optimum Signal Processing", McGraw Hill, 2nd edition, 1988.

M. Tech. (DECS)-II Semester (Elective-II)
(14MT23807) NEURAL NETWORKS AND FUZZY SYSTEMS

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	4	--	--	4

PRE-REQUISITES:
Courses on Digital Electronics and Communication Systems at UG level.

COURSE DESPCRIPTION:
Concepts of Artificial Neural Networks; Classification of neural network; Implementation and applications of neural networks; Concepts of fuzzy logic systems; Design of fuzzy logic systems; Applications of neuro-fuzzy systems.

COURSE OUTCOMES:
On successful completion of the course, the student will be able to
CO1. Demonstrate in depth knowledge on Neural networks and Fuzzy Systems.
CO2. Design and implement neural networks and neuro-fuzzy systems for particular problem.
CO3. Apply and evaluate Neural networks and Fuzzy Systems in communication engineering.

DETAILED SYLLABUS

UNIT-I: FUNDAMENTAL CONCEPTS OF ANN (Periods:11)
Historical development of Neural Networks, Biological neuron, Artificial neuron, Activation functions in ANN, Architectures of ANN, McCulloch-Pitts neuron model, Supervised and unsupervised learning, learning rules: Hebbian, Perceptron, Winner-takes-all, Out-star. Concept of linear separability.

UNIT-II: FEED FORWARD AND FEEDBACK ANN (Periods:14)
Back propagation NN: Introduction, delta learning rule, training algorithm. ADALINE architecture, LMS algorithm, Self Organizing Feature Maps(SOFM): topology, training algorithm. Learning Vector Quantization(LVQ): architecture, training algorithm. Discrete-time Hopfield Networks: architecture, training algorithm. Full Counter Propagation Networks: architecture, training algorithm, Basic concepts of associative memory: auto and hetero associative memory.

UNIT-III: HARDWARE IMPLEMENTATION AND APPLICATIONS OF ANN (Periods:10)
Neurocomputing hardware requirements, digital and analog electronic neurocomputing circuits, integrated circuit synaptic connections: voltage controlled Weights, analog storage of adjustable weights, digitally programmable weight, learning weight implementation.
Applications: Adaptive noise cancellation, Real time data compression.

UNIT-IV: FUZZY LOGIC SYSTEMS (Periods:12)
Crisp sets, fuzzy sets, operations on fuzzy sets, fuzzy relations and compositions. linguistic variables, types of membership functions, block diagram of fuzzy logic system, fuzzification, fuzzy rule base, fuzzy reasoning, defuzzification methods: centroid, weighted average method, center of sums.

UNIT-V: NEURO– FUZZY MODELING AND APPLICATIONS (Periods:08)

Introduction to Neuro-Fuzzy systems, Adaptive Neuro Fuzzy Inference System (ANFIS): architecture, hybrid learning algorithm, ANFIS as universal approximator.

Applications: Printed character recognition, Channel equalization.

Total Period: 55

TEXT BOOKS:

1. Jacek M. Zurada, "Introduction to Artifical Neural Systems", JAICO Publishing House, 2006.
2. Timothy J. Ross, "Fuzzy Logic with Engineering Applications", 3rd edition, Wiley India Pvt. Ltd., 2011.
3. Jyh-Shing Roger Jang, Chen-Tsai Sun and Eiji Mizutani, "Neuro-Fuzzy and Softcomputing – A Computational Approach to Learning and Machine Intelligence", Prentice Hall, 1977.

REFERENCE:

1. S.N.Sivanandam, S.Sumathi,S. N. Deepa, "Introduction to Neural Networks using MATLAB 6.0", 1st edition, Tata McGraw-Hill, 2006
2. Simon Haykin, "Neural Networks - A Comprehensive Foundation", Pearson Education, 2001.
3. Laurene Fausett, "Fundamentals of Neural Networks", Pearson Education, 2004.

M. Tech. (CMS)-I Semester
M. Tech. (DECS)-II Semester (Elective-II)
(14MT23808) OPTICAL COMMUNICATIONS AND NETWORKS

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	4	--	--	4

PRE-REQUISITES:
A Course on Optical Communications at UG Level.

COURSE DESCRIPTION:
Characteristics of fiber materials; Optical cables design and connectors; Fiber optic components; Modulation and demodulation of optical signals; Optical networks.

COURSE OUTCOMES:
At the end of the course, the students will be able to
CO1. Demonstrate Knowledge in
- Linear and Non-linear Characteristics of Optical fiber.
- Fiber design considerations.
- Minimization of Losses in Cable design.
- Understanding the operation of advanced fiber optic components
- Modulation and demodulation techniques
- Access networks

CO2. Analyze complex engineering problems critically in the domain of optical communication for conducting research.
CO3. Formulate solutions to problems related to optical communication to meet societal and industrial needs.
CO4. Apply appropriate techniques to complex engineering activities in the field of communication networks.

DETAILED SYLLABUS
UNIT I: INTRODUCTION (Periods:11)
Evolution of fiber types, guiding properties of fibers, cross talk between fibers, coupled modes and mode mixing, dispersion properties of fibers, nonlinear effects of optical fibers- SRS, SBS, intensity dependent refractive index. Characterizations of materials for fibers, fiber preform preparation- Soot deposition, MCVD. Fiber drawing and control, roles of coating and jacketing.
UNIT II: OPTICAL CABLE DESIGN (Periods:10)
Fiber design considerations-Fiber diameter, Cladding thickness, Low and high bit rate systems. Design objectives and cable structures, Fiber splicing- fiber end preparation, single and array splices, measurement of splicing effects. Optical fiber connectors-The role of connectors, Connector alignment techniques.
UNIT-III: FIBER OPTIC COMPONENTS FOR COMMUNICATION AND NETWORKING (Periods:14)
Couplers, Isolators and Circulators, Multiplexers & filters- Bragg Gratings, Fabry-Perot Filters, Mach-Zehnder Interferometers, Arrayed Waveguide

Grating, Acousto-Optic Tunable Filter, High Channel Count Multiplexer Architectures. Optical Amplifiers- Erbium Doped Fiber amplifiers, Raman amplifiers, Transmitters- LED, Lasers, Direct and External Modulation, Detectors- Photo detectors. Optical Switches – Large Optical Switches. Wavelength Converters – Optoelectronic Approach, Optical gating.

UNIT-IV: MODULATION AND DEMODULATION (Periods:8)

Signal formats for Modulation, Subcarrier Modulation and Multiplexing, Optical Modulations – Duo binary, Single Side Band and Multilevel Schemes, Demodulation- Ideal and Practical receivers, Bit Error Rates, Coherent Detection, Timing Recovery and Equalization, Reed-Solomon Codes for Error Detection and Correction.

UNIT-V: OPTICAL NETWORKS (Periods:10)

Access Networks - architecture overview, Enhanced HFC, Fiber to the curb (FTTC). Photonic packet switching - OTDM, Synchronization, OTDM test beds. Deployment considerations- Designing the transmission layer using SDM, TDM, WDM, Unidirectional versus Bidirectional WDM systems.

Total Periods: 53

TEXT BOOKS:

1. S.E.Miller, A.G.Chynoweth, "*Optical Fiber Telecommunication",* 1979
2. Rajiv Ramaswamy, Kumar N. Sivaranjan and Galen H.Sasaki,"*Optical Networks* ", Elsevier, 3rd edition,2010.

REFERENCE BOOKS:

1. Govind P.Agarwal "Fiber – Optic Communication Systems", Wiley India, 3rd edition, 2002.
2. Gerd Kaiser, "*Optical Fiber Communication"*, McGraw Hill,4th edition,2008.
3. John. M. Senior, "*Optical fiber communications: Principles and Practice",* Pearson, 3rd edition, 2010.

M. Tech. (DECS)-II Semester (Elective-II)
(14MT23809) REAL TIME SYSTEMS

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	4	--	--	4

PRE-REQUISITES:
Digital system design, Operating systems and embedded systems.

COURSE DESCRIPTION:
Real time system reference model; Real time scheduling approaches; Fault tolerant real time systems; Real time operating system concepts; Commercial RTOS.

COURSE OUTCOMES:
After completion of the course, students should be able to:
CO1. Demonstrate potential knowledge in
- Characterizing Real Time Systems
- Various Scheduling approaches
- Fault tolerant techniques
- Real Time Operating System Services

CO2. Gain design experience by critically analyzing various Operating Systems using contemporary bench marks
CO3. Consider trade-offs in Real Time System designing to solve engineering problems to exhibit specific behavior, given a set of performance goals and technology
CO4. Familiarize with fault tolerant and scheduling techniques to overcome ever increasing embedded system design complexity combined with reduced time-to-market window to revolutionize embedded system design process

DETAILED SYLLABUS

UNIT-I: REAL TIME SYSTEMS (Periods:10)
Hard Vs Soft Real Time Systems, a Reference Model of Real Time Systems- Processors and Resources, Temporal Parameters of Real Time Workload, Periodic Task Model, Precedence Constraints and Data Dependency. Functional Parameters, Resource Parameters of Jobs and Parameters of Resources, Scheduling hierarchy.

UNIT-II: APPROACHES TO REAL TIME SCHEDULING (Periods:10)
Clock Driven, Weighted Round Robin, Priority Driven, Dynamic Vs Static Systems, Effective Release Times and Dead Lines, Optimality and Non-optimality of EDF and LST algorithms, Challenges in Validating Timing Constraints in Priority Driven Systems, Offline Vs Online Scheduling.

UNIT-III (Periods:12)
Scheduling Real Time Tasks in Multiprocessor and Distributed Systems: Multiprocessor task allocation, Dynamic allocation of tasks, Fault tolerant scheduling of tasks, Clocks in distributed Real Time Systems.

Fault Tolerance Techniques: Introduction, Failures- Causes, Types, Detection. Fault and Error Containment, Redundancy- Hardware, Software, Time. Integrated Failure Handling.

UNIT-IV: OPERATING SYSTEMS (Periods:11)

Overview- Threads and Tasks, the Kernel. Time Services and Scheduling Mechanisms, Basic Operating System Functions- Communication and Synchronization, Event Notification and Software Interrupt Memory Management, I/O and Networking. Processor Reserves and Resource Kernel, Capabilities of Commercial Real Time Operating Systems.

UNIT-V: COMMERCIAL REAL TIME OPERATING SYSTEMS (Periods:12)

UNIX as RTOS - non preemptive kernel, Dynamic Priority levels and deficiencies. UNIX based Real Time Operating Systems - Extension to UNIX kernel, Host Target Approach, Preemption Point Approach, Self host systems. Windows as RTOS- features of Windows NT, Shortcomings, Windows NT vs UNIX. POSIX - Open software, Genesis of POSIX, Overview of POSIX, Real Time POSIX standard. Survey of Contemporary Real Time Operating Systems- PSOS, VRTX, VXworks, QNX, µC/OS-II, RT Linux, Lynx, Windows CE. Bench-marking Real Time Systems.

Total Periods: 55

TEXT BOOKS:

1. Jane W.S. Liu, "Real Time Systems", Pearson Education, I Edition, April 2000.
2. C. M. Krishna, Kang G Shin, "Real Time Systems", MCgraw-Hill Series, Dec. 1996.
3. Rajib Mall, "Real Time Systems-Theory and Practice", Pearson Education India, I Edition, Nov.2012.

REFERENCE BOOKS:

1. Phillip A. Laplante and Seppo J. Ovaska, "Real-Time Systems Design and Analysis: Tools for the Practitioner", Wiley-IEEE Press, 4 edition, Nov. 2011.
2. Hermann Kopetz, "Real-Time Systems: Design Principles for Distributed Embedded Applications ", Springer; 2nd Edition, 2011.

M. Tech. (DECS)-II Semester

(14MT23821) COMMUNICATIONS AND SIGNAL PROCESSING LAB

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
25	50	75	--	--	4	2

PRE-REQUISITES:
Simulation Lab at UG Level

COURSE DESCRIPTION:
Design of FIR and IIR filters; Equalization of multi path channel; Generation of PN sequences; Performance evaluation of QPSK modulation scheme; Image smoothening and sharpening techniques.

COURSE OUTCOMES:
On successful completion of this course the students will be able to
CO1. Demonstrate skills in
- The generation of Maximal and Gold Sequences
- Design of FIR and IIR filters
- Evaluation of QPSK System
- Equalization of multipath channel using RLS and LMS Algorithms
- The Simulation of Rayleigh fading Channel using Jake's Model
- Performing image Smoothening and Sharpening
- Developing Color image in various color models for conducting research in the field of Communications and Signal Processing.

CO2. Solve engineering problems for feasible and optimal solutions in the core areas of Communication and Signal Processing.
CO3. Acquire research skills in the domains of Communications and Signal processing.
CO4. Use MATLAB Toolboxes to complex engineering activities in the domains of communication and signal procesing.
CO5. Contribute to multidisciplinary groups in communications and signal processing with objectivity and rational analysis.

LIST OF EXPERIMENTS:
1. Design and Simulation of FIR Filter Using any Windowing Technique. **(1 time slot)**
2. Design of IIR Filters from Analog Filters. **(1 time slot)**
3. Generation of Maximal Sequences and Gold Sequences. **(2 time slots)**
4. Performance Evaluation of QPSK System over AWGN Channel. **(1 time slot)**
5. Equalization of Multipath Channel using LMS or RLS Algorithms. **(1 time slot)**
6. Simulation of Rayleigh Fading Channel Using Either Clarke's Model or Jake's Model for different Doppler Spreads (Ex. 50 Hz and 100 Hz). **(2 time slots)**
7. Performance Evaluation of RAKE Receiver over Slow Fading Channel. **(2 time slots)**

8. Performance Evaluation of QPSK System over Rayleigh Fading Channel. **(2 time slots)**
9. Smoothening & Sharpening of a given image. **(1 time slot)**
10. Color image in various color models. **(1 time slot)**

TOOLS REQUIRED:

MATLAB with Communication, Signal and image Processing Tool Boxes.

REFERENCES:

1. Communications and Signal Processing Lab Manual of the Department.
2. W.H. Tranter, K. Sam Shanmugham, T.S. Rappaport, and K.L. Kosbar, "Principles of Communication System Simulation with Wireless Applications," Pearson, 2004.
3. J.G. Proakis, and M. Salehi, "Contemporary Communication Systems using MATLAB and Simulink ," Cengage learning, 2nd Edition, 2004.
4. R.C. Gonzalez, R. E. Woods, Steven L.Eddins, "Digital Image Processing using MATLAB, Gatesmark Publishing, 2 nd Edition, 2009

M. Tech. (DECS) – II Semester
(14MT23822) SEMINAR

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
--	50	50	--	--	--	2

PRE-REQUISITES: --

COURSE DESCRIPTION:
Identification of seminar topic; Literature survey; Preparation of technical report and Presentation.

COURSE OUTCOMES:
On successful completion of the course, the student will be able to

CO1. Demonstrate capacity to identify an advanced topic for seminar in core and allied areas.

CO2. Extract information pertinent to the topic through literature survey.

CO3. Comprehend extracted information through analysis and synthesis critically.

CO4. Plan, organize, prepare and present effective written and oral technical report on the topic.

CO5. Adapt to independent and reflective learning for sustainable professional growth.

M. Tech. (DECS) – III & IV Semesters
(14MT33821 & 14MT43821) PROJECT WORK

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
80	120	200	--	--	--	16

PRE-REQUISITES: --

COURSE DESCRIPTION:
Identification of topic for the project work; Literature survey; Collection of preliminary data; Identification of implementation tools and methodologies; Performing critical study and analysis of the topic identified; Time and cost analysis; Implementation of the project work; Writing of thesis and presentation.

COURSE OUTCOMES:
On successful completion of the course, the student will be able to

CO1. Demonstrate capacity to identify an advanced topic for project work in core and allied areas.
CO2. Gather information related to the topic through literature survey.
CO3. Comprehend gathered information through critical analysis and synthesis.
CO4. Solve engineering problems pertinent to the chosen topic for feasible solutions.
CO5. Use the techniques, skills and modern engineering tools necessary for project work.
CO6. Do time and cost analysis on the project.
CO7. Plan, prepare and present effective written and oral technical report on the topic.
CO8. Adapt to independent and reflective learning for sustainable professional growth.