### SREE VIDYANIKETHAN ENGINEERING COLLEGE

**Department of ECE**

**COURSE STRUCTURE for M.Tech. (CMS)**

**I – SEMESTER**

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<th>S. No.</th>
<th>Course Code</th>
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**Total:** 27 - 4 29 305 470 775

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*Fulltime Project Work

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*Fulltime Project Work

**Total Credits: 73**

**Total Marks: 1700**
M. Tech. (VLSI) - I Semester (Elective-I)  
M. Tech. (CMS) - I Semester  
(14MT15706) ADVANCED DIGITAL SIGNAL PROCESSING

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PRE-REQUISITES: Courses on Digital Signal Processing at UG level.

COURSE DESCRIPTION:
Design of digital filter banks; Power spectral estimation; Digital signal processing algorithms; DSP applications.

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

CO1. Demonstrate advanced knowledge in
- Filter banks and Wavelets
- Efficient power Spectral Estimation Techniques.
- Adaptive filters.
- Applications of Multirate signal processing

CO2. Analyze complex engineering problems critically for conducting research in Adaptive filter design.

CO3. Solve engineering problems by designing computationally efficient DSP algorithms for feasible and optimal solutions in digital signal processing field.

CO4. Contribute to scientific research in signal processing and inter disciplinary areas like cellular mobile communications, multirate signal processing and spectral analysis.

DETAILED SYLLABUS:

UNIT I: MULTIRATE FILTER BANKS  
(Periods:12)  

UNIT II: POWER SPECTRAL ESTIMATIONS  
(Periods:11)  

UNIT III: PARAMETRIC METHODS OF POWER SPECTRAL ESTIMATION  
(Periods:11)  
UNIT IV: DSP ALGORITHMS (Periods: 10)
Fast DFT algorithms based on Index mapping, Sliding Discrete Fourier Transform, DFT Computation Over a narrow Frequency Band, Split Radix FFT, Linear filtering approach to Computation of DFT using Chirp Z-Transform.

UNIT V: APPLICATIONS OF DIGITAL SIGNAL PROCESSING (Periods: 11)
Digital cellular mobile telephony, Adaptive telephone echo cancellation, High quality A/D conversion for digital Audio, Efficient D/A conversion in compact hi-fi systems, Acquisition of high quality data, Multirate narrow band digital filtering, High resolution narrowband spectral analysis.

Total periods: 55

TEXT BOOKS:

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

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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 n-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)

UNIT-II: DIGITAL MODULATION TECHNIQUES  
(Periods:11)
UNIT–III: OPTIMUM RECEIVERS FOR THE ADDITIVE GAUSSIAN NOISE CHANNEL  
(Periods:10)

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

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

Total periods: 50

TEXT BOOKS:

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

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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:
CO 1. Demonstrate in-depth knowledge on
   a. Architectures and functioning of Advanced Wireless LAN and WAN technologies such as Wi-Fi, Wi-Max, Frame Relay, ATM networks etc.
   b. Protocols like MPLS, RSVP, VOIP associated with modern computer network systems.
   c. Know the security features associated with modern computer network systems.
CO 2. Analyze various design issues for conducting research related to the Internet protocol (IP), Wireless LANs and ATM network technologies prominent in high performance scenario.
CO 3. Formulate solutions for engineering problems pertaining to the advanced networking technologies.
CO 4. 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)

Total Periods: 56

TEXT BOOKS:

REFERENCE BOOKS:
2. LEON-GARCIA, INDRA WIDJAJA, “Communication Networks – Fundamental concepts and Key architectures”, TMH, 2000
M. Tech. (DECS & CMS) - I Semester
(14MT13809) LINEAR ALGEBRA

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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
   (a) solving Linear equations
   (b) finding the bases and dimensions of Vector Spaces
   (c) determining the Linear Transformation between different Vector Spaces.
CO2. Develop skills in
   (a) designing the Dynamical Systems in electrical circuits
   (b) analyzing Discrete time signals
   (c) applying complex Eigen Values in Decoupling systems
   (d) 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)

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

UNIT – III: INNER PRODUCT SPACES (Periods: 10)
Inner product, Norm, Inner product space, Orthogonality , 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 

REFERENCES:
1. Gilbert Strang, Introduction to Linear Algebra, Fourth edition, South 
2. Otto Bretscher, Linear Algebra with applications, Third edition, 
   Pearson education, India. (2007)
M. Tech. (CMS)-I Semester
M. Tech. (DECS)-II Semester (Elective-II)
(14MT23808) OPTICAL COMMUNICATIONS AND NETWORKS

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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)

UNIT-IV: MODULATION AND DEMODULATION  (Periods:08)

UNIT-V: OPTICAL NETWORKS  (Periods:10)

Total Periods: 53

TEXT BOOKS:

REFERENCE BOOKS:
M. Tech. (CMS)-I Semester (Elective-I)
(14MT16101) RF CIRCUIT DESIGN

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PRE-REQUISITES:
Concept of Basic Electronics and Wave Theory at UG level

COURSE DESCRIPTION:
Radio frequency electronics; Transmission lines; RF passive and active components; RF transistor amplifiers and oscillators.

COURSE OUTCOMES:
On successful completion of this course the students will be able to
CO1. Demonstrate advanced knowledge in
- RF Electronics
- Transmission line analysis
- Matching and biasing networks
- RF Passive and Active components
- RF Transistor amplifier design
- Oscillators and RF Mixers.

CO2. Analyze complex problems critically in the domains of RF field, RF Passive and Active components as well as a smart antenna techniques for better spectrum exploitation for conducting research.

CO3. Solve engineering problems to arrive at optimal solutions in compliance with public health and safety, cultural, societal and environmental factors in the core areas of RF Circuit design.

CO4. Apply appropriate techniques to for the development of scientific knowledge in wireless communication Systems and allied areas.

DETAILED SYLLABUS

UNIT – I: INTRODUCTION TO RF ELECTRONICS (Periods:10)

UNIT – II: TRANSMISSION LINE ANALYSIS (Periods:14)
UNIT -III: MATCHING AND BIASING NETWORKS (Periods:13)
Impedance matching using discrete components, Micro strip line matching networks, Amplifier classes of Operation and Biasing networks.
RF Passive and Active Components: Filter Basics, Lumped filter design, Distributed Filter Design, Diplexer Filters, Crystal and Saw filters, Active Filters, Tunable filters. Power Combiners / Dividers: Directional Couplers, Hybrid Couplers, Isolators. RF Diodes: BJT's, FETs, HEMTs and Models.

UNIT – IV: RF TRANSISTOR AMPLIFIER DESIGN (Periods:09)

UNIT – V: OSCILLATORS (Periods:11)
Oscillator basics, Low phase noise oscillator design, High frequency Oscillator configuration, LC Oscillators, VCOs, Crystal Oscillators, PLL Synthesizer, and Direct Digital Synthesizer.
RF Mixers: Basic characteristics of a mixer, Active mixers, Image Reject and Harmonic mixers, Frequency domain considerations.

Total periods: 57

TEXT BOOKS:

REFERENCE BOOKS:
M. Tech. (CMS)-I Semester (Elective-I)  
(14MT16102) SATELLITE COMMUNICATIONS

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PREREQUISITES: A course on ‘Digital Communications’ at UG level.

COURSE DESCRIPTION:
Orbital mechanics and satellite sub-systems; Non-geostationary satellite systems; Demand assignment multiple access techniques and packet communications; Spread spectrum communications; Satellite applications.

COURSE OUTCOMES:
After completion of this course, student will be able to:
CO1. Demonstrate advanced knowledge in
- Satellite Orbits and Sub-Systems
- NGSO Constellation Designs
- DAMA Interfaces
- Satellite Packet Communications and ALOHA systems
- Spread spectrum Communications
- Satellite Applications such as VSAT, MSAT, Direct Broadcast Satellite Television.

CO2. Investigate and analyze complex engineering problems critically for conducting research in satellite systems.

CO3. Solve engineering problems with feasible and economical solutions in satellite communications.

CO4. Apply appropriate techniques to engineering activities in the field of satellite communications.

CO5. Follow ethical code of conduct in the field of satellite communications as per the regulations of International Telecommunications Union (ITU).

DETAILED SYLLABUS

UNIT–I: SATELLITE ORBITS AND SUBSYSTEMS  
(Periods:11)

UNIT– II: LOW EARTH ORBIT AND NON-GEOSTATIONARY SATELLITE SYSTEMS  
(Periods:10)

UNIT III: EFFICIENT TECHNIQUES & SATELLITE PACKET COMMUNICATIONS (Periods: 11)

Demand Assignment Multiple Access and Digital Speech Interpolation: The ERLANG B Formula, Types of Demand Assignments, DAMA Characteristics, Real-Time Frame Reconfiguration- Frame and Burst Structures for DA-TDMA. DAMA Interfaces, SCPC-DAMA, SPADE, Digital Speech Interpolation.

Satellite Packet Communications: Preliminaries, Message Transmission by FDMA-The M/G/1 Queue, Message Transmission by TDMA, Pure ALOHA-Satellite Packet Switching, Slotted ALOHA, Packet Reservation, Tree Algorithm.

UNIT IV: SATELLITE SPREAD SPECTRUM COMMUNICATIONS (Periods: 12)


UNIT V: SATELLITE APPLICATIONS (Periods: 11)

Very Small Aperture Terminal Networks: VSAT Technologies, Network Configurations, Multi-access and Networking, Network Error Control.


Direct Broadcast Satellite Television and Radio

Total periods: 55

TEXT BOOKS:

REFERENCE BOOKS:
M. Tech. (CMS)-I Semester (Elective-I)  
(14MT16103) SPEECH PROCESSING

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PRE-REQUISITES: Courses on Signals & Systems and Digital Signal Processing in UG

COURSE DESCRIPTION:
Acoustic theory of speech production; Models for speech signals and speech processing systems; Mathematical analysis of speech signals - homomorphic and LPC models; Speech and speaker recognition systems.

COURSE OUTCOMES:
On successful completion of this course the students will be able to
CO1. Demonstrate advanced knowledge in
  • Digital model representation of speech signal
  • LPC analysis
  • Homomorphic models.
CO2. Analyze complex engineering problems critically for conducting research in speech signal processing.
CO4. Apply speech and speaker verification techniques to complex engineering activities in the field of speech processing.

DETAILED SYLLABUS:
UNIT-I: DIGITAL MODEL FOR THE SPEECH SIGNAL  
(Periods:13)

UNIT - II : TIME DOMAIN MODELS FOR SPEECH PROCESSING  
(Periods:10)
Introduction, Window considerations, Short time energy and average magnitude, Short time average zero crossing rate, Speech vs silence discrimination using Average energy and zero crossing, Pitch period estimation using parallel processing approach, The short time autocorrelation function, The short time average magnitude difference function, Pitch period estimation using the autocorrelation function.

UNIT-III: HOMOMORPHIC SPEECH PROCESSING  
(Periods:09)
Homomorphic systems for convolution – properties of the complex Cepstrum, computational considerations. The complex Cepstrum of speech, pitch detection, formant estimation, Homomorphic vocoder.
UNIT-IV : LINEAR PREDICTIVE CODING OF SPEECH  
(Periods:12)

UNIT-V: SPEECH AND SPEAKER RECOGNITION SYSTEMS  
(Periods:08)
Speaker recognition system-speaker verification system, speaker identification systems.
Speech recognition system- isolated digit recognition system, continuous digit recognition system, LPC distance measure.

TEXT BOOKS:

REFERENCE BOOKS:

Total periods: 52
M. Tech. (DECS & CMS)-I Semester (Elective-I) 
(14MT13808) TRANSFORM TECHNIQUES

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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
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:

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)
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)

Total Periods: 54

TEXT BOOKS:

REFERENCE BOOKS:
### M. Tech. – I Semester

**((14MT10310) RESEARCH METHODOLOGY**

*(Common to all M. Tech. Programmes)*

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**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. Carry out 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)*

**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:

REFERENCE BOOKS:
**M. Tech. (CMS) - I SEMESTER**  
(14MT16121) **COMMUNICATIONS LAB - I**

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**PRE-REQUISITES:** Simulation Lab at UG Level

**COURSE DESCRIPTION:**
Design and simulation of communication systems - Baseband Communication Systems with Optimum terminal filters, QPSK communication system for AWGN channel, Base Band Direct Sequence Spread Spectrum (DS/SS) System; Generation of different density and distribution functions; Generation of maximal and Gold code sequences.

**COURSE OUTCOMES:**
At the end of the course, students will be able to

- CO1. Demonstrate skills in
  - The generation of Maximal and Gold Sequences & verification of their properties.
  - Design of Communication system for Band limited Channels: Signal Design for Zero ISI.
  - Evaluation of QPSK over AWGN Channel, 16MPSK, 16QAM.
  - Design of Baseband Communication Systems with Optimum terminal filters.
  - The Simulation of Base Band Direct Sequence Spread Spectrum (DS/SS) System.

- CO2. Analyze complex engineering problems critically for conducting research in the field of Communications.


- CO4. Use MATLAB Toolboxes to complex engineering activities in the domain of communication.

- CO6. Demonstrate Knowledge and understanding of Engineering Principles to execute the Projects effectively in the field of communications.

**List of experiments:**

1. Generation of discrete time Independent, Identically Distributed (i.i.d) random processes with different distributions (Bernoulli, Binomial, Geometric, Poisson, Uniform, Gaussian, Exponential, Laplacian, Rayleigh, Rician). (2 time slots)
2. Communication system Design for Band limited Channels: Signal Design for Zero ISI. (2 time slots)
3. Design of Baseband Communication Systems with Optimum terminal filters. (2 time slots)
4. Simulation & performance evaluation of QPSK communication system for AWGN channel. (1 time slot)
5. Simulation of maximal sequences of any length & verification of their properties. (1 time slot)
6. Generation of Gold Codes & verification of auto-correlation & cross-correlation properties. (1 time slot)
7. Design and simulation of code matched filter in spread spectrum communication system. (2 time slots)
8. Comparison of 16-MPSK and 16-QAM. (1 time slot)
9. Design and Simulation of Base Band Direct Sequence Spread Spectrum (DS/SS) System. (2 time slots)

**Tools:**
Numerical Computing Environments – GNU Octave or MATLAB or any other equivalent tool.

**REFERENCE BOOKS:**
PRE-REQUISITES:
A Course on Signal Processing at UG Level

COURSE DESCRIPTION:
Adaptive systems; Steepest descent algorithms; Least mean square algorithms; Kalman filtering; Recursive filtering.

COURSE OUTCOMES:
On completion of the course, the student will be able to
CO1. Demonstrate in-depth knowledge in
  • Required mathematical framework
  • Characteristics of adaptive systems
  • Searching algorithms such as gradient and steepest descent
  • Adaptive algorithms like LMS, RLS and Kalman filtering
  • Non-linear adaptive filtering, Ordered-recursive adaptive filters
CO2. Analyze complex engineering problems critically in the domain of adaptive filtering for conducting research.
CO3. Solve engineering problems for feasible and optimal solutions in the core area of adaptive signal processing.
CO4. Contribute positively to multidisciplinary scientific research in signal processing with objectivity and rational analysis.

DETAILED SYLLABUS
UNIT - I: INTRODUCTION TO ADAPTIVE SYSTEMS & DEVELOPMENT OF ADAPTIVE FILTER THEORY (Periods:10)

UNIT – II: SEARCHING THE PERFORMANCE SURFACE & STEEPEST DESCENT ALGORITHMS: (Periods:08)
Searching the Performance Surface- Methods & Ideas of Gradient Search methods, Gradient Searching Algorithm & its Solution, Stability & Rate of convergence - Learning Curves
Gradient Search by Newton’s Method, Method of Steepest Descent, Comparison of Learning Curves

UNIT III: LMS AND RLS ALGORITHMS (Periods:13)

UNIT - IV: KALMAN FILTERING AND NON LINEAR ADAPTIVE FILTERING  
(Periods:12)

NON LINEAR ADAPTIVE FILTERING
Theoretical and Practical considerations of Blind Deconvolution, Buss Gang Algorithm for blind Equalization.

UNIT V: ORDER-RECURSIVE ADAPTIVE FILTERS  (Periods:12)
Gradient-Adaptive Lattice Filter, order-recursive adaptive filters using least square estimation, adaptive forward linear prediction, adaptive backward linear prediction, conversion factor, I east-square lattice predictor, angle normalized estimation errors, first order state space models for lattice filtering, QR-Decomposition-Based Least-Squares Lattice Filters, Recursive Least-Squares lattice Filters Using a Posteriori Estimation Errors.

Total periods: 55

TEXT BOOKS:

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

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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)

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)

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:

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

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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)
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)**


**Total Periods: 56**

**TEXT BOOKS:**

**REFERENCES:**
M. Tech. (CMS)-II Semester
(14MT26102) SOFTWARE DEFINED RADIO

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

COURSE DESCRIPTION:
Principles of software defined radio; Multirate signal processing; Digital generation of signals; Smart antennas with applications.

COURSE OUTCOMES:
On successful completion of this course the students will be able to
CO1. Demonstrate advanced knowledge in the evolving paradigm of Software defined radio and technologies for its implementation.
CO2. Analyze complex problems critically in the domains of Radio frequency implementation issues, multirate signal processing in SDR, as well as a Smart antenna techniques for better spectrum exploitation for conducting research.
CO3. Apply appropriate techniques for the development of scientific and technological knowledge in designing software defined radios and their usage for cognitive radio.

DETAILED SYLLABUS

UNIT – I: INTRODUCTION TO SOFTWARE RADIO CONCEPTS (Periods:14)
The need for Software radios and its definition, Characteristics and benefits of Software radio, Design principles of a software radio.
Radio Frequency Implementation Issues: Purpose of RF front – end, Dynamic range, RF receiver front – end topologies, Enhanced flexibility of the RF chain with software radios, Importance of the components to overall performance, Transmitter architectures and their issues, Noise and distortion in the RF chain, ADC & DAC distortion, Pre-distortion, Flexible RF systems using micro-electromechanical systems.

UNIT – II: MULTIRATE SIGNAL PROCESSING IN SDR (Periods:08)
Sample rate conversion principles, Polyphase filters, Digital filter banks, Timing recovery in digital receivers using multirate digital filters.

UNIT -III: DIGITAL GENERATION OF SIGNALS (Periods:13)
UNIT – IV: SMART ANTENNAS  
(Periods:13)
Introduction, Vector channel modelling, Benefits of smart antennas, Structures for beamforming systems, Smart antenna algorithms, Diversity and Space time adaptive signal processing, Algorithms for transmit STAP, Hardware implementation of smart antennas, Array calibration, Digital Hardware Choices-Key hardware elements, DSP processors, FPGAs, Power management issues.

UNIT – V: OBJECT ORIENTED REPRESENTATION OF RADIOS AND NETWORK  
(Peiods:10)
Networks, Object –oriented programming, Object brokers, Mobile application environments, Joint Tactical radio system.  
**Case Studies in Software Radio Design:** SPEAKEasy, JTRS, Wireless Information transfer system, SDR-3000 digital transceiver subsystem, Spectrum Ware, Brief introduction to Cognitive Networking.  
**Total periods: 58**

**TEXT BOOKS:**

**REFERENCE BOOKS:**
M. Tech. (CMS & DECS)-II Semester
(14MT23805) WIRELESS COMMUNICATIONS

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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.
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)

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


**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 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)*


**Total periods: 56**

**TEXT BOOKS:**

**REFERENCE BOOKS:**
M. Tech. (CMS)-II Semester (Elective-II)  
(14MT26103) EMI/EMC

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**PRE-REQUISITES:**
Courses on Electromagnetic waves and Transmission lines, Antennas and wave propagation & Microwave engineering at UG Level.

**COURSE DESCRIPTION:**
Sources of EMI; Standards for EMI/EMC and test sites; Interference measurements; Effects of grounding, shielding and bonding; Components for EMC.

**COURSE OUTCOMES:**
On successful completion of this course the students will be able to
CO1. Demonstrate knowledge in
- electromagnetic interference effects
- standards of EMC
- Radiated and conducted interference measurements
- Effects of grounding at high frequencies
CO2. Analysis and design of electronic systems for real time applications.
CO3. Apply appropriate research methodologies, techniques to contribute individually and in groups for the development of scientific knowledge in electronic systems.
CO4. Demonstrate knowledge and understanding of effects of electromagnetic interference and apply the same in practice.

**DETAILED SYLLABUS**

**UNIT-I: INTRODUCTION AND SOURCES OF EMI AND NONIDEAL BEHAVIOR OF COMPONENTS**  
(Periods:10)
Concepts and Definition of EMI and EMC, Natural and man-made EMI sources. Non-ideal behavior of components-Wires, printed circuit board (PCB) lands, effect of component leads, resistors, capacitors, inductors.

**UNIT-II: EMI/EMC STANDARDS AND OPEN AREA TEST SITES**  
(Periods:10)

**UNIT-III: RADIATED INTERFERENCE AND CONDUCTED INTERFERENCE MEASUREMENTS**  
(Periods:11)
Radiated Interference measurements-Anechoic chamber, Transverse Electromagnetic Cell, Reverberating chamber, Giga-Hertz TEM Cell, Comparison of test facilities.
Conducted Interference measurements- Characterization of conduction
currents/voltages, Conducted EM noise on power supply lines, Conducted EMI from equipment, Immunity to conducted EMI, Detectors and measurement.

**UNIT-IV: GROUNDING, SHielding AND BONDING**  (Periods:13)

**UNIT-V: EMC FILTERS, CABLES, CONNECTORS AND COMPONENTS**  (Periods:10)

**Total Periods: 54**

**TEXT BOOKS**

**REFERENCE BOOKS**
PRE-REQUISITE: A course on Communication systems at UG level.

COURSE DESCRIPTION:
Radar range equation and matched filter; Demodulation of radar signals in the presence of noise; Wave form selection and radar clutter; Pulse compression and Phase coding techniques.

COURSE OUTCOMES: After completion of the course, the student will be able to
CO1: Demonstrate knowledge in
- Characteristics of matched filter
- Detection criteria of radar signals in noise environment.
- Radar waveform design requirements.
- Pulse compression techniques
- Different coding techniques.

CO2: Develop skills in designing Radar systems in different noise environments.

CO3: Apply appropriate techniques for radar signal de-noising.

DETAILED SYLLABUS
UNIT - I: RANGE EQUATION AND MATCHED FILTER (Periods:13)

UNIT - II: DETECTION OF RADAR SIGNALS IN NOISE (Periods:10)

UNIT - III: WAVEFORM SELECTION (Periods:09)
UNIT - IV: PULSE COMPRESSION IN RADAR SIGNALS  
(Periods:08)

UNIT - V: PHASE CODING TECHNIQUES  
(Periods:13)
Phase Coding Techniques: Principles, Binary Phase Coding, Barker Codes, Maximal Length Sequences (MLS/LRS/PN), Block Diagram of a Phase Coded CW Radar.
Poly Phase Codes : Frank Codes, Costas Codes, Non-Linear FM Pulse Compression, Doppler Tolerant PC Waveforms – Short Pulse, Linear Period Modulation (LPM/HFM), Side lobe Reduction for Phase Coded PC Signals, Complementary codes, Huffman codes, Limiting in Pulse Compression, Cross-Correlation Properties, compatibility.

Total Periods : 53

TEXT BOOKS:

REFERENCE BOOKS:
M. Tech. (CMS)- II Semester (Elective-II)
(14MT26105) TELEMETRY AND TELECONTROL

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PRE-REQUISITES:
Courses on Analog Communications, Digital Communications, Satellite Communications and Optical Communications at UG level.

COURSE DESCRIPTION:
Principles of telemetry; Channel coding; Multiplexing systems; Satellite and optical telemetry; Analog and digital telecontrol techniques.

COURSE OUTCOMES:
On successful completion of this course the students will be able to
CO1. Demonstrate in-depth knowledge in
  • Telemetry and Telecontrol systems
  • Symbols and Codes
  • Different multiplexers in telemetry
  • Satellite and optical telemetry systems
CO2. Analyze complex engineering problems critically in the domain of Telemetry and Telecontrol systems for conducting research.
CO3. Solve engineering problems for feasible and optimal solutions in the core area of Telemetry and
CO4. Apply appropriate techniques to complex engineering activities in the field of telemetry and telecontrol systems.

DETAILED SYLLABUS

UNIT – I: TELEMETRY PRINCIPLES (Periods:08)
Introduction, Functional blocks of Telemetry system, Methods of Telemetry – Non Electrical, Electrical, Pneumatic, Frequency, Power Line Carrier Communication.

UNIT – II: SYMBOLS AND CODES (Periods:07)
Bits and Symbols, Time function pulses, Line and Channel Coding, Modulation Codes, Intersymbol Interference.

UNIT – III: FREQUENCY DIVISION AND TIME DIVISION MULTIPLEXED SYSTEMS (Periods:13)

UNIT – IV: SATELLITE AND OPTICAL TELEMETRY (Periods:10)
Optical fibers Cable – dispersion, losses, connectors and splicers, Sources and detectors, Transmitter and Receiving Circuits, Coherent Optical Fiber Communication System, WDM.
UNIT – V: TELECONTROL METHODS (Periods:12)

TEXT BOOKS:

REFERENCE BOOKS:
M. Tech. (CMS & VLSI)-II Semester ( Elective-II) 
(14MT25709) WIRELESS SENSOR NETWORKS

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

COURSE DESCRIPTION:
Concepts of wireless sensor networks; Physical, Network, Transport and Application layers.

COURSE OUTCOMES:
On successful completion of this course the students will be able to
CO1. Demonstrate advanced knowledge in
   - Wireless Sensor Networks
   - Physical layer
   - Data link layer
   - Network layer
   - Transport layer
CO2. Analyze and design complex problems critically in the domains of Wireless Communications and Wireless sensor Networks for conducting research.
CO3. Apply appropriate techniques to for the development of scientific knowledge in Wireless Sensor Networks.
CO4. Demonstrate knowledge and understanding of wireless sensor networks and apply the same in practice.

DETAILED SYLLABUS
UNIT – I: INTRODUCTION TO WIRELESS SENSOR NETWORKS
(Periods:11)

UNIT – II: PHYSICAL LAYER
(Periods:11)
Introduction, wireless channel and communication fundamentals – frequency allocation, modulation and demodulation, wave propagation effects and noise, channels models, spread spectrum communication, packet transmission and synchronization, quality of wireless channels and measures for improvement. Physical layer and transceiver design consideration in wireless sensor networks - Energy usage profile, choice of modulation, Power Management.

UNIT -III: DATA LINK LAYER
(Periods:16)
MAC protocols: fundamentals of wireless MAC protocols - Requirements and design constraints for wireless MAC protocols, Important classes of MAC protocols, MAC protocols for wireless sensor networks. Low duty cycle
protocols and wakeup concepts - Sparse topology and energy management (STEM), S-MAC, Wakeup radio concepts. Contention-based protocols - CSMA protocols, PAMAS. Schedule-based protocols - SMAC, BMAC, Traffic-adaptive medium access protocol (TRAMA). Link Layer protocols – fundamentals task and requirements, error control - Causes and characteristics of transmission errors, ARQ techniques, FEC techniques, Hybrid schemes, Power control,

UNIT – IV: NETWORK LAYER (Periods:10)

UNIT – V: TRANSPORT LAYER (Periods:09)

Total periods: 57

TEXT BOOKS:

REFERENCE BOOKS:
M. Tech. (CMS) - II SEMESTER
(14MT26121) COMMUNICATIONS LAB - II

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PRE-REQUISITES: Simulation lab at UG level

COURSE DESCRIPTION:
Simulation of communication systems over communication channels with and without line coding; Design and simulation of Bussgang Blind channel equalizer; Adaptive equalizers using LMS and RLS algorithms; Image processing techniques; Design and simulation of WDM systems.

COURSE OUTCOMES: At the end of the course, students will be able to

CO1. Demonstrate skills in
- Simulation of Rayleigh fading channel in the mobile environment.
- Design and simulation of an adaptive equalizer using LMS and RLS algorithms.
- Designing communication system over a Gaussian channel and evaluate its performance.
- Simulating communication system using convolutional codes & Viterbi Decoding.
- Developing Color image in various color models.
- Performing image smoothening and sharpening.
- Designing WDM system.

CO2. Solve engineering problems for feasible and optimal solutions in the core area of Communications.

CO3. Use MATLAB Toolboxes to complex engineering activities in the domain of communications.

CO4. Demonstrate Knowledge and understanding of Engineering Principles in the field of communications.

List of experiments:
1. Simulation of Rayleigh fading channel in the mobile environment.
   (2 time slots)
2. Design and performance evaluation of CDMA communication system over a Gaussian channel.
   (2 time slots)
3. Simulation of communication system using convolutional codes & Viterbi Decoding.
   (2 time slots)
   (1 time slot)
5. Design and simulation of an adaptive equalizer using RLS algorithm.
   (1 time slot)
6. Design and simulation of communication system using Bussgang Blind channel equalizer.
   (2 time slots)
7. Smoothening and Sharpening of a given image.  
   (1 time slot)
8. Color image in various color models.  
   (1 time slot)
9. Design of WDM system.  
   (2 time slots)

**Tools required:**
MATLAB with communication & image processing tool boxes and OptSim and ModeSYS software.

**REFERENCE BOOKS:**
1. Advanced communication lab-II manual of the department.
5. OptSim and ModeSYS user manual.
M. Tech. (CMS) – II Semester
(14MT26122) SEMINAR

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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. (CMS) – III & IV Semesters
(14MT36121 & 14MT46121) PROJECT WORK

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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.