# M. TECH. (ECE) – SCHEME – 2024-2026

## MTech SCHEME

| 1st Year, SEMESTER – I | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **SN** | **Category** | **Course Code** | **Course Name** | **Periods** | | | **Credit** | **Evaluation Scheme** | | | | | **Subject Total** |
| | | | | | | | | **Theory** | | | **Practical** | | |
| | | | | **L** | **T** | **P** | | **ABQ** | **MSE** | **ESE** | **IP** | **EXP** | |
| **1** | PCC | EC-501 | Advanced Wireless Communication | 3 | 0 | 0 | 3 | 15 | 25 | 60 | - | - | 100 |
| 2 | BSC | AM - 501 | Advanced Engineering Mathematics | 3 | 1 | 0 | 4 | 15 | 25 | 60 | | | 100 |
| 3 | PCC | RM-501 | Research Process & Methodology | 3 | 1 | 0 | 4 | 15 | 25 | 60 | - | - | 100 |
| 4 | PCC | EC-503 | Advanced Digital Signal Processing | 3 | 1 | 0 | 4 | 15 | 25 | 60 | - | - | 100 |
| 5 | PCC | EC-505 | Digital Communication & Information Theory | 3 | 0 | 0 | 3 | 15 | 25 | 60 | - | - | 100 |
| 6 | LC | EC-553 | Advanced Digital Signal Processing Lab | 0 | 0 | 4 | 2 | - | - | - | 60 | 40 | 100 |
| **Total** | | | | **15** | **3** | **4** | **20** | | | | | | **600** |

## M.Tech 2nd sem

| 1st Year, SEMESTER – II | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **SN** | **Category** | **Course Code** | **Course Name** | **Periods** | | | **Credit** | **Evaluation Scheme** | | | | | **Subject Total** |
| | | | | | | | | **Theory** | | | **Practical** | | |
| | | | | **L** | **T** | **P** | | **ABQ** | **MSE** | **ESE** | **IP** | **EXP** | |
| **1** | PCC | EC-506 | Advanced Optical Fiber Communication System | 3 | 1 | 0 | 4 | 15 | 25 | 60 | - | - | 100 |
| 2 | PCC | EC-508 | Embedded Systems | 3 | 0 | 0 | 3 | 15 | 25 | 60 | | | 100 |
| 3 | PCC | EC-510 | Computer Vision | 3 | 0 | 0 | 3 | 15 | 25 | 60 | - | - | 100 |
| 4 | PCC | EC-512 | Microelectronics and VLSI Design | 3 | 0 | 0 | 3 | 15 | 25 | 60 | - | - | 100 |
| 5 | PCC | EC-514 | Advanced Antenna Theory | 3 | 0 | 0 | 3 | 15 | 25 | 60 | - | - | 100 |
| 6 | LC | EC-558 | Embedded Systems Lab | 0 | 0 | 4 | 2 | - | - | - | 60 | 40 | 100 |
| 7 | LC | EC-562 | Microelectronics and VLSI Design Lab | 0 | 0 | 4 | 2 | | | | 60 | 40 | 100 |
| **Total** | | | | **15** | **1** | **8** | **20** | | | | | | **700** |

## M.Tech 3rd sem

| 2nd Year, SEMESTER – III | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **SN** | **Category** | **Course Code** | **Course Name** | **Periods** | | | **Credit** | **Evaluation Scheme** | | | | | **Subjec Total** |
| | | | | | | | | **Theory** | | | **Practical** | | |
| | | | | **L** | **T** | **P** | | **ABQ** | **MSE** | **ESE** | **IN** | **EX** | |
| **1** | PCC | EC-607 | Wireless Sensor Network | 3 | 1 | 0 | 4 | 15 | 25 | 60 | - | - | 100 |
| 2 | PCC | EC-609 | Detection and Estimation Theory | 3 | 1 | 0 | 4 | 15 | 25 | 60 | | | 100 |
| 3 | PCC | EC-611 | Neural Networks and Fuzzy Logic | 3 | 1 | 0 | 4 | 15 | 25 | 60 | - | - | 100 |
| 4 | PCC | EC-613 | Underwater Communication | 3 | 0 | 0 | 3 | 15 | 25 | 60 | - | - | 100 |
| 5 | PCC | EC-661 | Neural Networks and Fuzzy Logic Lab | 0 | 0 | 2 | 1 | | | | 60 | 40 | 100 |
| 6 | PRC | EC-663 | Project | 0 | 0 | 4 | 2 | - | - | - | - | - | 100 |
| 7 | PRC | EC-665 | Seminar-I | 0 | 0 | 2 | 1 | - | - | - | - | - | 100 |
| 8 | PRC | EC-667 | Dissertation Phase-I | 0 | 0 | 12 | 6 | - | - | - | - | - | 100 |
| **Total** | | | | **12** | **3** | **20** | **25** | | | | | | **800** |

## M.Tech 4th sem

| 2nd Year, SEMESTER – IV | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **S.No** | **Category** | **Course Code** | **Course Name** | **Periods** | | | **Credit** | **Evaluation Scheme** | | | | | **Subject Total** |
| | | | | | | | | **Theory** | | | **Practical** | | |
| | | | | **L** | **T** | **P** | | **ABQ** | **MSE** | **ESE** | **IP** | **EXP** | |
| **1** | PCC | EC-608 | Radar System Analysis and Design | 3 | 1 | 0 | 4 | 15 | 25 | 60 | - | - | 100 |
| 2 | PCC | EC-610 | Architectural Design of Digital Integrated Circuits | 3 | 1 | 0 | 4 | 15 | 25 | 60 | - | - | 100 |
| 3 | PRC | EC-666 | Seminar-II | 0 | 0 | 4 | 2 | - | - | - | - | 100 | 100 |
| 4 | PRC | EC-668 | Dissertation Phase-II | 0 | 0 | 30 | 15 | - | - | - | - | 100 | 100 |
| **Total** | | | | **6** | **2** | **4** | **25** | | | | | | **400** |

## DETAILED SYLLABUS

**Ist Year**

**SEMESTER – I**

| S.No. | Category | Course Code | Course Name | Periods | | | Credit |
|---|---|---|---|---|---|---|---|
| | | | | L | T | P | |
| 1 | PCC | EC-501 | **Advanced Wireless Communication** | 3 | 0 | 0 | 3 |

**Course Outcomes:**

At the end of this course, students will be able to

CO1 Design appropriate mobile communication systems.

CO2 Apply frequency-reuse concept in mobile communications, and to analyze its effects on

interference, system capacity, handoff techniques

CO3 Distinguish various multiple-access techniques for mobile communications e.g. FDMA,

TDMA, CDMA, and their advantages and disadvantages.

CO4 Analyze path loss and interference for wireless telephony and their influences on a system's performance.

CO5 Analyze and design CDMA system functioning with knowledge of forward and reverse

channel details, advantages and disadvantages of using the technology

**UNIT I:** Introduction to wireless communication system; various generation wireless networks; Wireless channel: physical modeling for wireless channels, input/output model of wireless channel, time and frequency response, statistical models.

**UNIT II:** GSM & MODULATION TECHNIQUES: Modulation technique for mobile radio; spread spectrum modulation techniques; rake receiver. Multiple Access Technique for wireless communication; FDMA, TDMA, CDMA, spectral effect of

multiple access Schemes. **GSM:** Architecture; frame structure; GSM channel; signal processing in GSM.

**UNIT III:** FADING AND MOBILE CHARACTERISTICS REPRESENTATION: Small scale fading; frequency selective fading; fading effect due to Doppler spread; coherence BW and coherence time; Rayleigh fading distribution; Ricean fading; Nakagami distribution; level crossing.

**UNIT IV:** MULTIPLE-INPUT MULTIPLE-OUTPUT WIRELESS COMMUNICATION SYSTEMS: Spatial multiplexing and channel modeling, multiplexing capability of MIMO channels, MIMO transmitter and receiver architectures, fading MIMO channel.

**UNIT V:** OVERVIEW OF MULTICARRIER CDMA: Introduction, frequency domain spreading assisted multicarrier CDMA scheme, orthogonal multicarrier DS-CDMA scheme, transmitter and receiver model of MC-CDMA System.

**Text Books:**


1. Rappaport T.S, "Wireless Communications", Prentice Hall,1996.
2. William C.Y. Lee, "Mobile Communications Design Fundamentals", 2nd Edition, John Wiley, February1993.


**Reference Books:**


1. David Tse, P. Viswanath, Fundamentals of wireless communication‖, Cambridge, 2006.
2. Andreas Molisch, Wireless communications, Wiley India Pvt Ltd., 2009.
3. Gordon L. Stuber, "Principles of Mobile Communication", Kluwer Academic, 2nd Edition, 2001.
4. W. Stallings, "Wireless Command Network", Prentice Hall of India, 2003.
5. Schiller, J., "Mobile Communication", Addison Wesley, 2002.
6. Branka Vucetic & Jinhong Yuan, "Space-Time Coding", John Wiley & Sons Ltd, 2003.

| S.No. | Category | Course Code | Course Name | Periods | | | Credit |
|---|---|---|---|---|---|---|---|
| | | | | L | T | P | |
| 2 | BSC | AM-501 | **Advanced Engineering Mathematics** | 3 | 1 | 0 | 4 |

**UNIT I:** Integration in series, ordinary and singular points, power series, frobenius method to find the general solution of higher order linear ordinary differential equation with constant variable coefficients, Legendre and Bassels equation, Legendre polynomials, Bessel functions, Boundary value, Strum-Liouville problem, Orthogonal eigen function expansions.

**UNIT II:** Laplace Transform, Laplace Inverse Transform, Application of Laplace Transform and Inverse Laplace Transform in the particular solution of integral equation and integro- differential equations, Infinite Fourier sine and cosine transforms and its applications, Fourier-Legendre series, Fourier-Bessel series.

**UNIT III:** Interpolation, Extrapolation, Lagrangs method, Missing-terms problems, Hermite interpolation, Spline interpolation, Cubic spline, Fitting of a curve in given sub-interval using cubic spline interpolation, Representation of a tabulated function in power of (x-a) using Newtons divided difference formula.

**UNIT IV:** Numerical integration using Romberg method, Gauss-Legendre and Lobatto methods, Gaussian integration and numerical; double integration, Numerical solution of a system of non-linear equations using Newton Raphson method, Solution of system of linear equations in four variables using Gauss-Jordan and Crout's methods.

**UNIT V:** Partial Differential Equations, Modeling, Vibrating String, Wave Equations. Product solutions o1'Laplaceequations, heat conduction equations, wave equations, Poisson'sequations by the method of separation of valiables and its applications in boundary value problems, Conversiou of a differeirtial equation into integral equation and vice versa, Solutions of Fredholur and Volterra integral equations of first and second kind.

**Text /Reference Books:**


1. Higher Engineering Mathematics, B. S. Grewal, Khanna Publishers.
2. Advanced Engineering Mathematics, Erwin Kreyszig,Wiley Eastern lndia.
3. Numerical Methods for Scientific and Engineering Computation, M. K. Jain, S. R. K. Iyengar and R.K..Jain, New Age International (P) Ltd.

| S.No. | Category | Course Code | Course Name | Periods | | | Credit |
|---|---|---|---|---|---|---|---|
| | | | | L | T | P | |
| 3 | PCC | RM-501 | **Research Process & Methodology** | 3 | 1 | 0 | 4 |

**Course Outcomes:**

At the end of this course, students will be able to

CO1 Understand research problem formulation.

CO2 Analyze research related information

CO3 Follow research ethics

CO4 Understand that today's world is controlled by Computer, Information Technology, but

tomorrow world will be ruled by ideas, concept, and creativity.

CO4 Understanding that when IPR would take such important place in growth of individuals

& nation, it is needless to emphasis the need of information about Intellectual Property

Right to be promoted among students in general & engineering in particular.

CO5 Understand that IPR protection provides an incentive to inventors for further research

work and investment in R & D, which leads to creation of new and better products, and

in turn brings about, economic growth and social benefits

**Unit 1:** Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

**Unit 2:** Effective literature studies approaches, analysis Plagiarism, Research ethics, Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

**Unit 3:** Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

**Unit 4:** Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

**Unit 5:** New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

**Text Books:**

1. Research Methodology: An Introduction"• Ranjit Kumar, 2 nd Edition,
2. Research Methodology: A Step by Step Guide for beginners & engineering students'" Wayne Goddard and Stuart Melville.

**Reference Books:**

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science.
2. Resisting Intellectual Property, Taylor & Francis Ltd .

| S.No. | Category | Course Code | Course Name | Periods | | | Credit |
|---|---|---|---|---|---|---|---|
| | | | | L | T | P | |
| 4 | PCC | EC-503 | **Advanced Digital Signal Processing** | 3 | 1 | 0 | 4 |

**Course Outcomes:**

At the end of this course, students will be able to

1. To understand theory of different filters and algorithms
2. To understand theory of multirate DSP, solve numerical problems and write algorithms
3. To understand theory of prediction and solution of normal equations
4. To know applications of DSP at block level.

1 **DISCRETE TIME SIGNALS AND SYSTEMS:** Introduction; discrete-time signals - sequences i.e. basic sequences and operations; discrete time systems; memory-less systems; linear time invariant systems; causality; stability properties of linear time-invariant systems; frequency-domain representation of discrete-time signals and systems; Representation of sequences by Fourier transforms; symmetry properties and theorems of Fourier transform; discrete-time random signals.

2 **FREQUENCY TRANSFORMATIONS & DIGITAL FILTERS:** Z-transforms, FFT,(DFT), Basic structures of infinite impulse response (IIR) and finite impulse response (FIR); filters – direct form; cascade form; parallel form; feedback in IIR system; transposed forms design of FIR and IIR filters using all standard procedures

3 **MULTIRATE DIGITAL SIGNAL PROCESSING (MDSP):** Sampling rate conversion; multistage implementation of sampling rate conversion; application of multi rate DSP for design of phase shifters; narrow band low pass filters; quadrature mirror filters, digital filter banks.

4 **HARDWARE IMPLEMENTATION OF DSP:** Introduction to DSP processor; architecture of DSP processors; DSP devices: Von Neumann model, Harvard architecture.

5 **SHARC PROCESSOR:** VLIW Architecture, SHARC, SIMD, MIMD Architectures, Application: Adaptive filters-DSP based biometry receiver-speech processing-position control system for hard disk drive-DSP based power meter.

**TEXT BOOK**

**1** Proakis, “Digital Signal Processing”, Prentice Hall of India, 2002.

**REFERENCE BOOKS**

1. B. Venkatramani & M. Baskar, "Digital Signal Processor", McGraw Hill, 2000 2. Avatar Singh and S. Srinivasan, “Digital signal processing”, Thomson books, 2004 3. K.K Parhi, “VLSI DSP Systems”, John Wiley, 1999.
2. Alan, V. Oppenheim and Ronald, W. Schafer, “Digital Signal Processing”, Prentice Hall of India,1998.
3. Mitra, Sanjit K., “Digital Signal Processing”, Tata McGraw Hill, 2002.

| S.No. | Category | Course Code | Course Name | Periods | | | Credit |
|---|---|---|---|---|---|---|---|
| | | | | L | T | P | |
| 5 | PCC | EC-505 | **Digital Communication & Information Theory** | 3 | 0 | 0 | 3 |

1. **DIGITAL MODULATION TECHNIQUES**: Digital modulation formats, Coherent binary modulation techniques, Coherent quadrature – modulation techniques, Non-coherent binary modulation techniques, Comparison of binary and quaternary modulation techniques, M-ray modulation techniques, Power spectra, Bandwidth efficiency, M-array modulation formats viewed in the light of the channel capacity theorem, Effect of inter-symbol-interference, Bit verses symbol error probabilities, Synchronization, Applications.

2. **COMMUNICATION THROUGH BAND LIMITED LINEAR FILTER CHANNELS**: Optimum receiver for channel with ISI and AWGN, Linear equalization, Decision-feedback equalization, reduced complexity ML detectors, Iterative equalization and decoding-Turbo equalization.

3. **ADAPTIVE EQUALIZATION:** Adaptive linear equalizer, adaptive decision feedback equalizer, Adaptive equalization of Trellis-coded signals, Recursive least square algorithms for adaptive equalization, Self-recovering (blind) equalization.

4. **INFORMATION THEORY**: Introduction, Measure of information, Average information content of symbols in long independent sequences, Average information content of symbols in long dependent sequences. Mark-off statistical model for information source, Entropy and information rate of mark-off source.

5. **ERROR CONTROL CODE:** Encoding of the source output, Shannon's encoding algorithm. Communication Channels, Discrete communication channels, Continuous channels, Introduction to block coding and optimal decoding, Alamouti Space-Time Code, Space-Time Block Codes (STBC), STBC for Real Signal Constellations, Decoding of STBC, Space-Time Trellis Codes.

**TEXT BOOKS**


1. Proakis, J.G., "Digital Communication", 3rd edition, Tata McGraw Hill, 1990.
2. Sklar, Bernard, "Digital Communications: Fundamentals and Applications", Prentice Hall of India, 2003.


**REFERENCE BOOKS**


1. Hawkins, Simon and Wiley, John, "Communication System", 3rd edition, 2004.
2. Wilson, S.G., "Digital Modulation and Coding", Prentice Hall of India,1996.
3. Digital and analog communication systems, K. Sam Shanmugam, John Wiley, 1996.
4. Branka Vucetic & Jinhong Yuan, "Space-Time Coding", John Wiley & Sons Ltd, 2003.

| S.No. | Category | Course Code | Course Name | Periods | | | Credit |
|---|---|---|---|---|---|---|---|
| | | | | L | T | P | |
| 6 | PCC | EC-553 | **Advanced Digital Signal Processing Lab** | 0 | 0 | 4 | 2 |

**Course Outcomes:**

At the end of this course, students will be able to

1. Design different digital filters in software
2. Apply various transforms in time and frequency
3. Perform decimation and interpolation

**LIST OF EXPERIMENTS USING MATLAB**

1. Write a Program for generation of unit impulse, unit step, ramp, exponential, sinusoidal and cosine sequence.
2. Write a Program for computing inverse Z-transform of a rational transfer function.
3. Write a Program for linear convolution.
4. Write a Program for plotting the frequency response of first order system.
5. Write a Program for computing Discrete Fourier Transform (DFT).
6. Design a Butterworth Low pass IIR filter using Bilinear Z- transform method.
7. Design FIR Low pass filter and High pass filter using rectangular window.
8. Transform an analog filter in to a digital filter using Impulse Invariant method.
9. Design a Chebyshev Low pass filter.
10. Design FIR low pass filter using Kaiser Window.
11. Determine the execution time of the FFT function.
12. Demonstrate the effectiveness of high-speed convolution FFT algorithm.

Note: At-least 10 experiments are to be performed from the above list.

## SEMESTER – II

| S.No. | Category | Course Code | Course Name | Periods | | | Credit |
|---|---|---|---|---|---|---|---|
| | | | | L | T | P | |
| 1 | PCC | EC-506 | Advanced Optical Fiber Communication System | 3 | 1 | 0 | 4 |

**UNIT – I: Optical Fibers:** Structures, wave guiding and Fabrication: Nature of Light, Basic optical laws and definitions, Single-mode fibers, Graded index fiber structure, Attenuation, Signal Dispersion in fibers, Optical sources – LEDs, Laser Diodes, Line Coding.

**UNIT – II: Photo Detectors:** Photo detector noise, Detector response time, Avalanche Multiplication Noise, Optical Receiver Operation – Fundamental receiver operation, Digital receiver performance, Eye Diagrams, WDM Concepts and Components – Passive optical Couplers, Isolators and Circulators.

**UNIT – III: Digital Links**: Point-to-point Links, power penalties, error control, coherent Deptection, DQPSK, Analog Links: C/N, Multichannel Transmission Techniques, RF over Fiber, Radio over fiber link, Microwave Photonics.

**UNIT – IV:** Optical Networks, Network Concepts, Network Topologies, SONET/SDH, High-speed light wave link, optical add/drop multiplexing, Optical Switching, WDM network, passive optical network, IP over DWDM, optical Ethernet, Mitigation of transmission Impairments.

**UNIT -V: Performance Measurement and Monitoring:** Measurement Standards, Basic Test Equipment, Optical power measurement, Optical fiber characterization, Eye diagram tests, optical time domain reflectometer, optical performance monitoring, optical fiber system performance measurements.

**TEXTBOOKS:**


1. Gerd Keiser, “Optical Fiber Communications”, 5th Edition, McGraw Hill.
2. Rajeev Ramaswamy and Kumar N. Sivarajan. “Optical Networks: A practical Perspective”, 2nd Ed., 2004, Elsevier Morgan Kaufmann Publishers (An imprint of Elsevier).


**REFERENCE BOOKS:**


1. John M. Senior, “Optical Fiber Communication: Principes and Practice”, 2nd Ed., 2000, PE.
2. S. C. Gupta, “Optical Fiber Communications and its Applications”, 2004, PHI.
3. Uyless Black, “Optical Networks: Third Generation Transport Systems”, 2nd Ed., 2009, PEI.
4. Govind Agarwal, “Optical Fiber Communications”, 2nd Ed, 2004, TMH.

| S.No. | Category | Course Code | Course Name | Periods | | | Credit |
|---|---|---|---|---|---|---|---|
| | | | | L | T | P | |
| 2 | PCC | EC-508 | Embedded Systems | 3 | 0 | 0 | 3 |

**Unit – I:** Definition of Embedded System, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributed of Embedded Systems.

**UNIT – II:** Embedded Systems Vs General Computing Systems, Core of the Embedded System, General purpose and Domain Specific Processors, ASICs, PLDs, Commercial Off-the-Shelf Components (COTS).

**UNIT – III: Memory:** ROM, RAM, Memory according to the type of Interface, Memory Shadowing, Memory selection for Embedded Systems, Sensors and Actuators, Communication Interface: Onboard and External Communication Interfaces.

**Unit – IV:** Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling, Shared Memory, Message Passing, Remote Procedure Call and Sockets.

**UNIT – V: Task Synchronization:** Task Communication/Synchronization Issues, Task Synchronization Techniques, Device Drivers, how to choose an RTOS.

**TEXTBOOKS:**

K. V. Shibu, “Introduction to Embedded Systems”, McGraw Hill.

**REFERENCE BOOKS:**

1. Raj Kamal, “Embedded Systems”, TMH.
2. Frank Vahid, Tony Givargis, “Embedded System Design”, John Wiley.
3. Lyla, “Embedded System Design”, Pearson, 2013.
4. Daid E. Simon, “An Embedded Software Primer”, Pearson Education.

| S.No. | Category | Course Code | Course Name | Periods | | | Credit |
|---|---|---|---|---|---|---|---|
| | | | | L | T | P | |
| 3 | PCC | EC-510 | Computer Vision | 3 | 0 | 0 | 3 |

**Course Outcomes:** At the end of this course, students will be able to

1. Study the image formation models and feature extraction for computer vision.
2. Identify the segmentation and motion detection and estimation techniques.
3. Develop small applications and detect the objects in various applications.

**UNIT – I: Introduction:** Fundamental steps in digital image processing, Components of an image processing system, Digital Image Fundamentals – Image sampling and quantization, Some basic relationships between pixels, Linear and non-linear operation.

**UNIT – II: Image Enhancement in Spatial Domain:** Some basic grey level transformations, Histogram processing, Smoothing and Sharpening spatial filers, Fuzzy techniques for intensity transformations and spatial filtering, Image Enhancement in Frequency Domain – Smoothing and Sharpening frequency domain filters Homomorphic filtering.

**UNIT – III: Image Restoration:** Noise models, Restoration in the presence of noise only – spatial filtering, Estimating the degradation functions, Inverse Filtering, Color Image Processing – Colour models, Pseudo-colour processing, Image Compression, Image compression Models, Lossless and Lossy Compression.

**UNIT – IV: Morphological Image Processing:** Dilation and erosion; Opening and closing; some basic morphological algorithms; Image Segmentation: Detection of discontinuities, Edge linking and Boundary Detection, Region based Segmentation, Segmentation by morphological watersheds; Representations – Chain codes, Polygonal Approximations, Signatures, Boundary segments, Skeletons; Description – Boundary descriptors, Topological descriptors, Texture, Moment invariants, Use of principal components for description, Relational descriptors.

**UNIT – V: Object Recognition:** Patterns and pattern classes, Recognition based on decision – theoretic methods, Matching, Optimum statistical classifiers, Neural networks, Structural Methods, Matching shape numbers, String Matching.

**TEXTBOOK:**

R. C. Gonzalez and R. E. Woods, "Digital Image Processing", Pearson Education, 3rd Edition, 2009.

**REFERENCE BOOKS:**

1. A. K. Jain, "Fundamentals of Digital Image Processing", Pearson Education, 2007.
2. J. R. Parker, "Algorithms for Image Processing and Computer Vision", Wiley and Sons, Second Edition, 2010.

| S.No. | Category | Course Code | Course Name | Periods | | | Credit |
|---|---|---|---|---|---|---|---|
| | | | | L | T | P | |
| 4 | PCC | EC-512 | Microelectronics and VLSI Design | 3 | 0 | 0 | 3 |

**UNIT – I: Introduction:** Review of Digital Systems, Introduction to VLSI Design, Fundamentals of transistors: BJT & FET, Introduction to MOS Circuits – NMOS, PMOS, CMOS, BiCMOS devices, GaAs technology.

**UNIT -II:** Fabrication and Processing Technology - Crystal Growth Wafer Preparation, Epitaxial growth, Lithography, Oxidation, Diffusion, Ion-implantation, Metallization; MOS Transistor Theory – V-I Characteristics Design and detailed analysis of MOS inverters, enhancement load, and depletion load CMOS inverter, delay and power analysis, Design layout of simple CMOS gates.

**UNIT – III: Operational amplifier design:** Differential amplifier and Analog Filters, Circuit implementation of combinations and sequential circuits, Memory system design, Low-power CMOS logic Circuits System Simulation using HDL, specification of VHDL constructs, behavioral, structural, data flow description.

**UNIT – IV:** Transistor Physics – Accumulation, Depletion, Inversion, Threshold Voltage, V-I Characteristics, Body Effect, Noise Magin, Latch-up Resistance, Switching Characteristics, Power Consumption; Yield Scaling of MOS Transistor dimensions; Digital Logic Design = Optimization of combinational logic, synchronous sequential logic design, Mealy & Moore Machines, Basics of VLSI Testing Process & Fault Modeling.

**UNIT – V: Future Trends:** Introduction to System on a chip, Trends in VLSI Technology.

**TEXT/REFERENCE BOOKS:**


1. S.M. Kang, Y. Leblebici, "CMOS Digital Integrated Circuit: Analysis & Design", Mc Graw Hill, 1996.
2. S. M. Sze, "Semiconductor Devices", 2nd Edition, John Wiley & Sons, 2002.
3. Wayne Wolf, "Modern VLSI Deign", 2nd Edition Pearson Education, 2008.
4. Bhasker, "VHDL Primer", PHI, 1995.
5. M. Sarafazadeh and C. K. Wong, "An introduction to VLSI Physical Design", McGraw Hill, 2003.
6. Neil H. E. Weste and Kamran Eshraghian, "Principle of CMOS VLSI Design", Addison Wesley, 2nd Edition.

| S.No. | Category | Course Code | Course Name | Periods | | | Credit |
|---|---|---|---|---|---|---|---|
| | | | | L | T | P | |
| 5 | PCC | EC-514 | Advanced Antenna Theory | 3 | 0 | 0 | 3 |

**Course Outcomes:** At the end of this course, students will be able to

CO1. Compute the far field distance, radiation pattern and gain of an antenna for given current distribution.

CO2. Estimate the input impedance, efficiency and ease of match for antennas.

CO3. Compute the array factor for an array of identical antennas.

CO4. Design antennas and antenna arrays for various desired radiation pattern characteristics.

**UNIT – I: Overview of Antennas:** Antenna Arrays, Broadside Array, end fire array, directivity of the array, 3-dimensional characteristic, Design Procesure, Non-uniform array, Binomial array, Chebyscheff array, Planar array, Array Factor, Beam Width, directivity.

**UNIT – II: General Antennas:** Travelling wave antennas, Helical Antennas, Yagi-Uda Atenna, Spiral Antenna, Log Periodic antenna, Dipole Array, Design of dipole array, Horn Antennas, Sectoral Horns, Corrugated horn antenna.

**UNIT – III: Reflector Antennas:** Plane reflector, Corner reflector, Parabolic reflector, Patterns of large circular aperture, Parabolic cylinder, Cassegrain antennas, Babinet principle and complementary antennas.

**UNIT -IV: Antenna Synthesis:** Continuous sources, Schelkunoff Polynomial methos, Fourier transform method, Woodward method, Taylor line source method, Triangular, Cosine and Cosine squared amplitude distribution, Line source Phase distribution, Continuous aperture sources.

**UNIT – V: Microstrip Antennas and Smart Antennas:** Basic characteristics, Feeding Techniques, Rectangular and circular patch antennas, Smart Antenna Analogy – Cellular radio system evolution, Signal propagation, Antenna beamforming, Mobile Adhoc Networks (MANETs), System Design.

**TEXTBOOK/REFERENCE BOOKS:**


1. Constantine A. Balanis, “Antenna Theory – Analysis and Design”, 3rd Edition, John Wiley & Sons, 2005.
2. John D. Kraus, “Antennas”, 4th Edition, Tata McGraw Hill.
3. John L. Volakis, “Antenna Engineering Hand Book”, 4th Edition, Tata McGraw Hill Companies.

| S.No. | Category | Course Code | Course Name | Periods | | | Credit |
|---|---|---|---|---|---|---|---|
| | | | | L | T | P | |
| 6 | PCC | EC-558 | Embedded Systems Lab | 0 | 0 | 4 | 2 |

1. Find GCD and LCM for given two byte length numbers.
2. BCD to seven segments.
3. Generation of 5ms delay with and without interrupt for timer.
4. Counting number of pulses in the external clock using counter.
5. Send a string serially with 9600 baud rate & receive a string serially and storing in internal RAM.
6. 16X2 LCD display interfacing.
7. Matrix keypad interfacing.
8. ADC interfacing.
9. Stepper motor interfacing.
10. Temperature sensor and Relay control/
11. Using of more complex memory and branch type instructions such as LDMFD/STMFD, B and BL.
12. Basic reg/mem visiting and simple arithmetic/logic computing.
13. Changing ARM state mode by using MRS/MMR instruction and specify a start address pf the text segment by using command line.
14. Write and debug simple C language program using KEIL IDE.
15. Write a delay function using C language.
16. Write a random number generation function using assembly language. Call this function from a C program to produce a series of random numbers and save them in the memory.
17. Configure and read/write the memory space. Use assembly and C language to read/write words, half-words, bytes, half-bytes from/to RAM.

| S.No. | Category | Course Code | Course Name | Periods | | | Credit |
|---|---|---|---|---|---|---|---|
| | | | | L | T | P | |
| 7 | PCC | EC-562 | Microelectronics and VLSI Design Lab | 0 | 0 | 4 | 2 |

1. Ring counter Realization
2. Design of Accumulator
3. CMOS Inverter
4. Differential Amplifier
5. Pseudo Random Binary Sequence Generator
6. Ripple Counters Realization – Mod-10 & Mod-12
7. CMOS 1-Bit Full Adder
8. Array Multiplier Realization
9. NOR Gate

**SEMESTER – III**

| S.No. | Category | Course Code | Course Name | Periods | | | Credit |
|---|---|---|---|---|---|---|---|
| | | | | L | T | P | |
| 1 | PCC | EC-607 | Wireless Sensor Network | 3 | 1 | 0 | 4 |

**Course Outcomes:**

At the end of this course, students will be able to

CO1 Design wireless sensor network system for different applications under consideration.

CO2 Understand the hardware details of different types of sensors and select right type of sensor for various applications.

CO3 Understand radio standards and communication protocols to be used for wireless sensor network-based systems and application.

CO4 Use operating systems and programming languages for wireless sensor nodes, performance of wireless sensor networks systems and platforms.

CO5 Handle special issues related to sensors like energy conservation and security challenges.

**Unit 1** Introduction: Architectural Elements, Basic Technology, Sensor Node, Hardware and Software, Sensor Taxonomy, Design challenges, Characteristics and requirements of WSNs, Applications.

**Unit 2** Mac Protocols For WSN: Fundamentals of MAC Protocols, Performance Requirements, Common Protocols, MAC for WSN, Schedule based protocols, Random Access based Protocols, Sensor-MAC, IEEE802.15.4 LRWPAN's Standard.

**Unit 3** Routing Protocols for WSN: Data Dissemination and Gathering, Challenges and Design Issues, Network Scale and Time-Varying Characteristics, Routing Strategies, Flooding and its variants.

**Unit 4** Transport Control Protocols for WSN: Design Issues, Congestion Detection and Avoidance, Event-to-Sink Reliable Transport, Reliable Multi-segment Transport; Pump Slowly, Fetch Quickly, GARUDA, ATP, Congestion and Packet Loss Recovery.

**Unit 5** WSN Infrastructure Establishment: Topology Control, Clustering, Time Synchronization, localization and positioning, Sensor Tasking and Control.

**References:**

1. K. Sohraby, Minoli, and T. Znati, "Wireless Sensor Networks: Technology, Protocols, and Applications", John Wiley & Sons, March 2007.

2. H. Karl and A. Willig, "Protocols and Architectures for Wireless Sensor Networks", John Wiley & Sons, October 2007.

3. C.S. Raghavendra, K.M. Sivalingam, and T. Zanti, “Wireless Sensor Networks” Editors, Springer Verlag, Sep. 2006.

4. E.H. Callaway, Jr. Auerbach, “Wireless Sensor Networks: Architectures and Protocols”, Aug. 2003

| S.No. | Category | Course Code | Course Name | Periods | | | Credit |
|---|---|---|---|---|---|---|---|
| | | | | L | T | P | |
| 2 | PCC | EC-609 | Detection and Estimation Theory | 3 | 1 | 0 | 4 |

**Course Outcomes:** At the end of this course, students will be able to

- Understand the mathematical background of signal detection and estimation
- Use classical and Bayesian approaches to formulate and solve problems for signal detection and parameter estimation from noisy signals.
- Derive and apply filtering methods for parameter estimation

**Unit 1** Background: Review of Gaussian variables and processes; problem formulation and objective of signal detection and signal parameter estimation in discrete-time domain Statistical Decision Theory: Bayesian, minimax, and Neyman-Pearson decision rules, likelihood ratio, receiver operating characteristics, composite hypothesis testing, locally optimum tests, detector comparison techniques, asymptotic relative efficiency.

**Unit 2** Detection of Deterministic Signals: Matched filter detector and its performance; generalized matched filter; detection of sinusoid with unknown amplitude, phase, frequency and arrival time, linear model. Detection of Random Signals: Estimator-correlator, linear model, general Gaussian detection, detection of Gaussian random signal with unknown parameters, weak signal detection

**Unit 3** Nonparametric Detection: Detection in the absence of complete statistical description of observations, sign detector, Wilcoxon detector, detectors based on quantized observations, robustness of detectors.

**Unit 4** Estimation of Signal Parameters: Minimum variance unbiased estimation, Fisher information matrix, Cramer-Rao bound, sufficient statistics, minimum statistics, complete statistics; linear models; best linear unbiased estimation; maximum likelihood estimation, invariance principle; estimation efficiency; Bayesian estimation: philosophy, nuisance parameters, risk functions, minimum mean square error estimation, maximum a posteriori estimation.

**Unit 5** Signal Estimation in Discrete-Time: Linear Bayesian estimation, Weiner filtering, dynamical signal model, discrete Kalman filtering.

**References:**

1. H. L. Van Trees, "Detection, Estimation and Modulation Theory: Part I, II, and III", John Wiley, NY, 1968.

2. H. V. Poor, "An Introduction to Signal Detection and Estimation", Springer, 2/e, 1998.

3. S. M. Kay, "Fundamentals of Statistical Signal Processing: Estimation Theory", Prentice Hall PTR, 1993.

| S.No. | Category | Course Code | Course Name | Periods | | | Credit |
|---|---|---|---|---|---|---|---|
| | | | | L | T | P | |
| 3 | PCC | EC-611 | NEURAL NETWORKS &FUZZY LOGICS | 3 | 1 | 0 | 4 |

**Unit 1** Introduction: Neural networks characteristics, History of development In neural networks principles, Artificial neural net terminology, Model of a neuron, Topology.

**Unit 2** Learning Methods &Neural network models: types of learning, Supervised, Unsupervised, Reinforcement learning. Knowledge, representation and acquisition. Basic Hop field model, Basic learning laws, Unsupervised learning, Competitive learning, Kmeans clustering algorithm, Kohonen's feature maps.

**Unit 3** Artificial Neural Networks: Radial basis function neural networks, Basic learning laws in REF nets, Recurrent back propagation. Introduction to counter propagation networks, CMAC network, and ART networks.

**Unit 4** Applications of neural nets: Applications such as pattern recognition, Pattern mapping, Associative memories, speech and decision-making.

**Unit 5** Fuzzy Logic: Basic concepts of fuzzy logic, Fuzzy vs. Crisp set, linguistic variables, Membership functions Fuzzy sets & Operations of fuzzy sets Fuzzy IF-THEN rules, Variable inference techniques, Defuzzification, Basic fuzzy inference algorithm, Fuzzy system design, Antilock Braking system (ABS), Industrial applications.

Text Books:

1. J.M. Zurada, "Introduction to artificial neural systems", Jaico Pub.

2. ROSS J.T , "Fuzzy logic with engineering application", TMH

Reference Books:

1. Simon Haykin, "Neural Networks", PHI

2. Ahmad M.Ibrahim, "Introduction to applied Fuzzy Electronics", (PHI) 3. P.D. wasserman, "Neural computing theory &practice", (ANZA PUB).

| S.No. | Category | Course Code | Course Name | Periods | | | Credit |
|---|---|---|---|---|---|---|---|
| | | | | L | T | P | |
| 4 | PCC | EC-613 | Underwater Communication | 3 | 0 | 0 | 3 |

Unit 1 Introduction: Basics of underwater communication, acoustic waves as carrier, challenges in acoustic communication, sound propagation mechanism.

Unit 2 Applications of Digital Signal Processing to Sonar: Characteristics of Sonar Signal propagation, Digital signal Processing for active sonar system and digital signal processing for passive sonar systems, Signal Processing Hardware -TMS 320 Series Signal Processors, real-time implementation considerations.

Unit 4 Acoustic Modem: Underwater Wireless Modem-Sweep spread carrier signal-transmission characteristics in shallow water channel-separation of time varying multipath arrivals-Typical acoustics modems-characteristics and specifications-Applications, Acoustic Releases-Real time wireless current monitoring system.

Unit 5 Underwater Sensor Network: Underwater Networking-Ocean Sampling Networks, Pollution Monitoring, Environmental Monitoring and Tactical surveillance systems, Major challenges in design of Underwater Sensor Networks, Factors that affect the UWSN-Sensor Node Architecture-GIBS, VRAP, DABSRAPT, etc.

Text Books: Underwater Communications, Marco Lanzagorta, Morgan & Claypool Publishers, 2012

References: Digital Underwater Acoustic Communications – 1 st Edition Lufen Xu Tianzeng Xu – Elsevier

| S.No. | Category | Course Code | Course Name | Periods | | | Credit |
|---|---|---|---|---|---|---|---|
| | | | | L | T | P | |
| 5 | PCC | EC-661 | NEURAL NETWORKS &FUZZY LOGICS LAB | 0 | 0 | 4 | 2 |

**List**

1.Implementation of Fuzzy Operations.

2 Implementation of Fuzzy Relations (Max-min Composition)

3 Implementation of Fuzzy Controller (Washing Machine)

4 Implementation of Simple Neural Network (McCulloh-Pitts model)

5 Implementation of Perceptron Learning Algorithm

6 Implementation of Unsupervised Learning Algorithm

7 Implementation of Simple Genetic Application

8 Study of ANFIS Architecture

9 Study of Derivative-free Optimization

10 Study of research paper on Soft Computing

| S.No. | Category | Course Code | Course Name | Periods | | | Credit |
|---|---|---|---|---|---|---|---|
| | | | | L | T | P | |
| 6 | PROJ | EC-663 | PROJECT | 0 | 0 | 4 | 2 |

Objective The student shall be capable of identifying a problem related to the program of study and carry out wholesome research on it leading to findings which will facilitate development of a new/improved product, process for the benefit of the society.

M.Tech projects should be socially relevant and research-oriented ones. Student is expected to do an individual project and deliver a seminar on project. The project work is carried out in III semester. Minor project of the project work shall be in continuation of Dissertation Phase I and II. At the completion of a project the student will submit a project report, which will be evaluated (end semester assessment) by duly appointed examiner(s). This evaluation will be based on the project report and a viva voce examination on the project. Student will be allowed to appear in the final viva voce examination only if he / she has submitted his / her project work in the form of paper for presentation / publication in a conference / journal and produced the proof of acknowledgement of receipt of paper from the organizers / publishers.

| S.No. | Category | Course Code | Course Name | Periods | | | Credit |
|---|---|---|---|---|---|---|---|
| | | | | L | T | P | |
| 7 | PCC | EC-665 | Seminar-I | 0 | 0 | 4 | 2 |

The student has to undertake extensive literature survey on a topic with the approval of the course coordinator. The course coordinator shall not be below the rank of Assistant Professor. The work may involve extensive search of print, audio-video materials, internet surfing etc. The work of monitoring will be done by the course coordinator and evaluation by the course coordinator and the HOD or his nominee.

| S.No. | Category | Course Code | Course Name | Periods | | | Credit |
|---|---|---|---|---|---|---|---|
| | | | | L | T | P | |
| 8 | PCC | EC-667 | Dissertation Phase-I | 0 | 0 | 12 | 6 |

The objective of Dissertation – Phase 1

1.To gear up students for preparation of Dissertation-Phase 2 in Semester-IV

2.Dissertation provides an opportunity to the students to demonstrate independence and originality in thought and application.

**Course Outcomes:**

At the end of the course:

1. Students will be exposed to self-learning various topics.

2. Students will learn to survey the literature such as books, national/international refereed

journals and contact resource persons for the selected topic of research.

3. Students will learn to write technical reports.

4. Students will develop oral and written communication skills to present and defend their

work in front of technically qualified audience

**Guidelines:**

The Project Work will start in semester III and should preferably be a problem with research

potential and should involve scientific research, design, generation/collection and analysis of data, determining solution and must preferably bring out the individual contribution. Seminar should be based on the area in which the candidate has undertaken the dissertation work as per the common instructions for all branches of M. Tech. The examination shall consist of the preparation of report consisting of a detailed problem statement and a literature review. The preliminary results (if available) of the problem may also be discussed in the report. The work has to be presented in front of the examiners panel set by

Head and PG coordinator. The candidate has to be in regular contact with his guide and the topic of dissertation must be mutually decided by the guide and student.

## SEMESTER – IV

| S.No. | Category | Course Code | Course Name | Periods | | | Credit |
|---|---|---|---|---|---|---|---|
| | | | | L | T | P | |
| 1 | PCC | EC-608 | Radar System Analysis and Design | 3 | 1 | 0 | 4 |

**UNIT – I: Radar Range Equation:** Radar Fundamentals, Derivation of range equation, the search radar equation, Jamming and radar range with jamming, Radar clutter and radar range with clutter, Radar range with combined interferences sources.

**UNIT – II: Theory of Target Detection:** Noise and False alarms, Detection of one sample of signal with noise, Integration of pulse trains, Detection of fluctuating targets, CFAR, Optimum and matched filter Theory, Loss factors in detection.

**UNIT – III: Targets and Interference:** Definition of radar cross section, Radar cross section of simple and complex objects, Spatial distribution of cross section, Bistatic cross section, CW and FM Radar, Doppler Effect, CW and FMCW Radar, Airborne Doppler Navigation, Multi frequency CW radar.

**UNIT – IV: MTI Radar:** Delay Lines and line cancellors, Subclutter Visibility, MTI using range gates and filters, Pylse Doppler Radar, Non-coherent MTI radar, Application of Digital Signal Processing to Radar System, Tracking Radar – Different types of tracking techniques, Tracking in range, Tracking in Doppler, Search Acquisition radar, Comparison of Trackers.

**UNIT – V: Introduction to Pulse Compression Radar:** Height finding radars, Air traffic control Radars and Data Handling, Atmospheric effects of radar, Electromagnetic compatibility aspects, Airborne Radars, Synthetic Aperture Radar, Secondary Surveillance Radars.

**TEXTBOOKS:**


1. David Barton K, “Modern Radar System Analysis”, Artech House, 1988.
2. Fred Nathanson E., “Radar Design Principles Signal Processing and the Environment”, McGraw Hill, 1969.


**REFERENCE BOOKS:**


1. M. Bernfield, C. E. Cook, “Radar Signals”, Academic Press, 1967.
2. Skolnik, “Introduction to Radar Systems”, McGraw Hill, 2nd Edition, 2003

| S.No. | Category | Course Code | Course Name | Periods | | | Credit |
|---|---|---|---|---|---|---|---|
| | | | | L | T | P | |
| 2 | PCC | EC-610 | Architectural Design of Digital Integrated Circuits | 3 | 1 | 0 | 4 |

**UNIT – I:** VLSI Design flow, general design methodologies, Mapping algorithms intro Architectures – Signal Flow Graph, Data dependences, data-path synthesis, Control structures, Critical path and worst – case timing analysis, concept of hierarchal system design; Data-path element – Data-path Design Philosophies, fast adder, multiplier, driver etc.

**UNIT – II:** Efficient techniques for Algorithm to Architecture Mapping, Recent trends on Adder/Subtractor/Multiplier/Divider Design, Efficient VLSI Architectures for various DSP blocks (FIR filter, CORDIC, FFT etc.)

**UNIT – III:** Data-path Optimization, application specific combinatorial and sequential circuit design, Pipeline and Parallel Architectures – architecture for real-time systems, latency and throughput related issues, clocking strategy, power conscious structures, array architectures; Control Strategies – Hardware implementation of various control structures, micro-programmed control techniques, VLIW architecture.

**UNIT – IV:** Efficient VLSI Architectures for Various DSP blocks, Fundamentals of Efficient Design and Implementation strategies of Digital VLSI Design (Clock Tree synthesis, Timing Closure, Synthesis Static Timing Analysis, Clock Skew, Digital VLSI based IC design.

**UNIT – V:** Trade-off issues – Optimization with regard to speed, area and power, asynchronous and low power system design, ASIC (application specific integrated circuits) and ASISP (application specific instruction set processors) design.

**TEXT/REFERENCE BOOKS:**


1. U. Meyer-Baese, Digital Signal Processing with Field Programmable Gate Arrays, Springer-Verlag, 2001.
2. S. Y. Kung, VLSI Array Processors.Prentice, Prentice-Hall, 1988.
3. K. Parhi, VLSI Digital Signal Processing Systems, Wiley & Sons, 1999.
4. J. Rabaey, A. Chandrakasan and B. Nikolic, Digital Integrated Circuits: A Design Perspective, Prentice Hall, Second Edition, 2003.

| S.No. | Category | Course Code | Course Name | Periods | | | Credit |
|---|---|---|---|---|---|---|---|
| | | | | L | T | P | |
| 3 | PROJ | EC-666 | Seminar-II | 0 | 0 | 4 | 2 |

Objective:

1.To assess the debating capability of the student to present a technical topic.

2.To impart training to students to face audience and present their ideas and thus creating in them self-esteem and courage that are essential for engineers.

Individual students are required to choose a topic of their interest from their M. Tech ECE curriculum or related topics from outside the M. Tech syllabus and give a seminar on that topic about 15 minutes. A committee consisting of at least three faculty members preferably Expertise in respective fields shall assess the presentation of the seminar and award marks to the students. Each student shall submit two copies of a write up of his/her seminar topic. One copy shall be returned to the student after duly certifying it by the chairman of the assessing committee and the other will be kept in the departmental library. Internal continuous assessment marks are awarded based on the relevance of the topic, presentation skill, quality of the report and participation.

Course Outcome:

After successful completion of the seminar, students should get validate their topic/research in front of panel. Their communication, presentation skills etc. shall be improved.

| S.No. | Category | Course Code | Course Name | Periods | | | Credit |
|---|---|---|---|---|---|---|---|
| | | | | L | T | P | |
| 3 | PROJ | EC-668 | Dissertation Phase-II | 0 | 0 | 30 | 15 |

**Course Objectives**

At the end of this course, students will be able to

1. Ability to synthesize knowledge and skills previously gained and applied to an in-depth study and execution of new technical problem.
2. Capable to select from different methodologies, methods and forms of analysis to produce a suitable research design, and justify their design.
3. Ability to present the findings of their technical solution in a written report.
4. Presenting the work in International/ National conference or reputed journals

**Course Outcomes:**

At the end of the course:

1. Students will be able to use different experimental techniques.
2. Students will be able to use different software/ computational/analytical tools.
3. Students will be able to design and develop an experimental set up/ equipment/test rig.
4. Students will be able to conduct tests on existing set ups/equipment and draw logical conclusions from the results after analysing them.
5. Students will be able to either work in a research environment or in an industrial environment.
6. Students will be conversant with technical report writing.
7. Students will be able to present and convince their topic of study to the engineering community.

**Guidelines:**

It is a continuation of Project work started in semester III. He has to submit the report in prescribed format and also present a seminar. The dissertation should be presented in standard format as provided by the department. The candidate has to prepare a detailed project report consisting of introduction of the problem, problem statement, literature review, objectives of the work, methodology (experimental set up or numerical details as the case may be) of solution and results and discussion. The report must bring out the conclusions of the work and future scope for the study. . The work has to be presented in front of the examiners panel consisting of an approved external examiner, an internal examiner and a guide, co-guide etc. as decided by the Head and PG coordinator. The candidate has to be in regular contact with his guide.

The dissertation / project topic should be selected / chosen to ensure the satisfaction of the urgent need to establish a direct link between education, national development and productivity and thus reduce the gap between the world of work and the world of study.

The dissertation should have the following

i. Relevance to social needs of society
ii. Relevance to value addition to existing facilities in the institute
iii. Relevance to industry need
iv. Problems of national importance
v. Research and development in various domain the student should complete the following:

vi. Literature survey Problem Definition
vii. Motivation for study and Objectives
viii. Preliminary design / feasibility / modular approaches
ix. Implementation and
Verification
x. Report and presentation

The dissertation stage II is based on a report prepared by the students on dissertation allotted to them. It may be based on:
a. Experimental verification / Proof of concept.
b. Design, fabrication, testing of Communication System.
c. The viva-voce examination will be based on the above report and work.

Guidelines for Dissertation Phase – I and II
As per the AICTE directives, the dissertation is a yearlong activity, to be carried out and evaluated in two phases i.e., Phase – I: July to December and Phase – II: January to June. The dissertation may be carried out preferably in-house i.e., departments laboratories and centers OR in industry allotted through departments T & P coordinator.
1. After multiple interactions with guide and based on comprehensive literature survey, the student shall identify the domain and define dissertation objectives. The referred literature should preferably include IEEE/IET/IETE/Springer/Science Direct/ACM journals in the areas of Computing and Processing (Hardware and Software), Circuits-Devices and Systems, Communication-Networking and Security, Robotics and Control Systems, Signal Processing and Analysis and any other related domain. In case of Industry sponsored projects, the relevant application notes, while papers, product catalogues should be referred and reported.
2. Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and phase wise work distribution, and submit the proposal within a month from the date of registration.
a. Phase – I deliverables: A document report comprising of summary of literature survey, detailed objectives, project specifications, paper and/or computer aided design, proof of concept/functionality, part results, A record of continuous progress.
b. Phase – I evaluation: A committee comprising of guides of respective specialization shall assess the progress/performance of the student based on report, presentation and Q & A. In case of unsatisfactory performance, committee may recommend repeating the Phase-I work.

c. During phase – II, student is expected to exert on design, development and testing of the proposed work as per the schedule. Accomplished results/contributions/innovations should be published in terms of research papers in reputed journals and reviewed focused conferences OR IP/Patents.

d. Phase – II deliverables: A dissertation report as per the specified format, developed system in the form of hardware and/or software, A record of continuous progress.

e. Phase – II evaluation: Guide along with appointed external examiner shall assess the progress/performance of the student based on report, presentation and Q & A. In case of unsatisfactory performance, committee may recommend for extension or repeating the work.