Sharnbasva University, Kalaburagi
Scheme of Teaching and Examination 2018-19
Outcome Based Education(OBE) and Choice Based Credit System (CBCS)
(Effective from the academic year 2018-19)

V SEMESTER B.Tech (E & CE)

Sl. No	Course Code		Course Title	Teaching Department	Teaching Hours/week			Examination				Credits
					Theory Lecture	Tutorial	Practical/Drawing	Duration in Hours	CIE Marks	SEE Marks	Theory Lecture	
1	HSMC	18ES51	Management and Entrepreneurship Development	Humanities	4			3	50	50	100	04
2	PCC	18EC52	Digital Signal Processing	ECE	3	1		3	50	50	100	04
3	PCC	18EC53	Electromagnetic waves and Antennas	ECE	3	1		3	50	50	100	04
4	PEC	18EC54X	Professional Elective -1	ECE	3			3	50	50	100	03
5	PCC	18ECL55	Digital Signal Processing Lab	ECE			2	3	50	50	100	01
6	PCC	18ECL56	Electromagnetic waves and Antennas Lab	ECE			2	3	50	50	100	01
7	PEC	18ECL57X	Professional Elective-1 Lab	ECE			2	3	50	50	100	01
8	PRJ	18PRJ58	Project-V	ECE			2	3	50	50	100	01
9	HSMC	18HSM59	Soft Skills	Humanities	1			3	50	50	100	01
Total					**14**	**2**	**08**	**27**	**450**	**450**	**900**	**20**

PCC-Professional Core, PEC- Professional Elective, OEC- Open Elective, HSMC-Humanity and Social Science, PRJ-Project

SI NO	Professional Elective -1	Subject Code	Professional Elective -1 Lab	Subject Code
1	Verilog HDL	18EC541	Verilog HDL Lab	18ECL571
2	Microprocessor 8086	18EC542	Microprocessor 8086 Lab	18ECL572

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VI SEMESTER B.Tech (E & CE)

Sl.No	Course Code		Course Title	Teaching Department	Teaching Hours/week			Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Duration in Hours	CIE Marks	SEE Marks	Theory Lecture	
1	PCC	18EC61	VLSI Circuits	ECE	3	1		3	50	50	100	04
2	PEC	18EC62X	Professional Elective-2	ECE	3			3	50	50	100	03
3	PEC	18EC63X	Professional Elective-3	ECE	3			3	50	50	100	03
4	OEC	18XX64X	Open Elective -1	ECE	3			3	50	50	100	03
5	PCC	18ECL65	VLSI Lab	ECE			2	3	50	50	100	01
6	PEC	18ECL66X	Professional Elective-2 Lab	ECE			2	3	50	50	100	01
7	PEC	18ECL67X	Professional Elective-3 Lab	ECE			2	3	50	50	100	01
8	PRJ	18PRJ68	Project-VI	ECE			2	3	50	50	100	01
9	HSMC	18HSM69	Professional Ethics	Humanities	1			3	50	50	100	01
Total					**13**	**1**	**08**	**27**	**450**	**450**	**900**	**18**

PCC-Professional Core, PEC- Professional Elective, OEC- Open Elective, HSMC-Humanity and Social Science, PR-Project

COURSE CODE UNDER 18EC62X	COURSE TITLE	COURSE CODE UNDER 18ECL66X	COURSE TITLE
18EC621	Arm Cortex M3 & Embedded Systems	18ECL661	Embedded Systems Lab
18EC622	Machine Learning	18ECL662	Machine Learning Lab
PROFESSIONAL ELECTIVE-3			
COURSE CODE UNDER 18EC63X	**COURSE TITLE**	**COURSE CODE UNDER 18ECL67X**	**COURSE TITLE**
18EC631	IOT Technology	18ECL671	IOT Lab
18EC632	Wireless Sensor Networks	18ECL672	Wireless Sensor Networks Lab
OPEN ELECTIVE-1			
COURSE CODE UNDER 18XX64X	**COURSE TITLE**		
18EC641	Control System		
18EC642	Automotive Electronics		

MANAGEMENT AND ENTREPRENEURSHIP DEVELOPMENT

[As per Choice Based Credit System (CBCS) Scheme]

SEMESTER-V

Subject Code	18ES51	CIE Marks	50
Number Lecture Hour/Week	4L	SEE Marks	50
Number of Lecture Hours	50	Exam Hours	03

CREDITS-04

Course Objectives The objectives of the course is to enable students to:

- Understand basic skills of Management.
- Understand the need for Entrepreneurs and their skills.
- Identify the Management functions and Social responsibilities.
- Distinguish between management and administration.
- Understand Project identification and Selection.

Module -1	**Teaching Hours**
Management: Nature and Functions of Management – Importance, Definition, Management Functions, Levels of Management, Roles of Manager, Managerial Skills, Management & Administration, Management as a Science, Art &Profession. **Planning**: Planning-Nature, Importance, Types, Steps and Limitations of Planning; Decision Making – Meaning, Types and Steps in Decision Making. **RBT: L1,L2**	10 Hours
Module -2	
Organizing and Staffing: Organization-Meaning, Characteristics, Process of Organizing, Principles of Organizing, Span of Management (meaning and importance only), Departmentalization, Committees–Meaning, Types of Committees; Centralization V/S Decentralization of Authority and Responsibility; **Staffing-**Need and Importance, Recruitment and Selection Process. **Directing and Controlling:** Meaning and Requirements of Effective Direction, Giving Orders; Motivation-Nature of Motivation, Motivation Theories (Maslow's Need-Hierarchy Theory and Herzberg's Two Factor Theory); Communication – Meaning, Importance and Purposes of Communication; Leadership-Meaning, Characteristics, Behavioral Approach of Leadership; Coordination-Meaning, Types, Techniques of Coordination; Controlling – Meaning, Need for Control System, Benefits of Control, Essentials of Effective Control System, Steps in Control Process. **RBT: L1,L2**	10 Hours
Module -3	
Social Responsibilities of Business: Meaning of Social Responsibility, Social Responsibilities of Business towards Different Groups, Social Audit, Business Ethics and Corporate Governance. **Entrepreneurship:** Definition of Entrepreneur, Importance of Entrepreneurship, concepts of Entrepreneurship, Characteristics of successful Entrepreneur, Classification of Entrepreneurs, Myths of Entrepreneurship, Entrepreneurial Development models, Entrepreneurial development cycle, Problems faced by Entrepreneurs and capacity building for Entrepreneurship. **RBT: L1,L2**	10 Hours

Module -4	
Modern Small Business Enterprises: Role of Small Scale Industries, Impact of Globalization and WTO on SSIs, Concepts and definitions of SSI Enterprises, Government policy and development of the Small Scale sector in India, Growth and Performance of Small Scale Industries in India, Sickness in SSI sector, Problems for Small Scale Industries, Ancillary Industry and Tiny Industry (Definition only) **Institutional Support for Business Enterprises:** Introduction, Policies & Schemes of Central Level Institutions, State Level Institutions. **RBT: L1,L2**	10 Hours
Module -5	
Projects Management: A Project. Search for a Business idea: Introduction, Choosing an Idea, Selection of product, The Adoption process, Product Innovation, Product Planning and Development Strategy, Product Planning and Development Process. Concepts of Projects and Classification: Introduction, Meaning of Projects, Characteristics of a Project, Project Levels, Project Classification, Aspects of a Project, The project Cycle, Features and Phases of Project management, Project Management Processes. Project Identification: Feasibility Report, Project Feasibility Analysis. Project Formulation: Meaning, Steps in Project formulation, Sequential Stages of Project Formulation, Project Evaluation. **Project Design and Network Analysis:** Introduction, Importance of Network Analysis, Origin of PERT and CPM, Network, Network Techniques, Need for Network Techniques, Steps in PERT, CPM, Advantages, Limitations and Differences. **RBT: L1,L2,L3**	10 Hours

Course Outcomes: After studying this course, students will be able to:

CO1- Understand core principles of management and planning to effectively apply these concepts in real-world scenarios.

CO2- Understand essential elements of Organizing, Staffing, and Directing and controlling, which are vital for effective management.

CO3- Comprehend the key aspects of Social Responsibilities of Business and Entrepreneurship, with a focus on corporate governance and the entrepreneurial journey.

CO4- Understand concepts, government policies, challenges, and entrepreneurial development.

CO5- Explain project management concepts, network analysis techniques, and the formulation and identification process for effective planning and execution.

Text Books:

1. Principles of Management – P.C Tripathi, P.N Reddy, McGraw Hill Education, 6th Edition, 2017. ISBN-13:978-93-5260-535-4.
2. Entrepreneurship Development Small Business Enterprises- Poornima M Charantimath, Pearson Education 2008, ISBN 978-81-7758-260-4.
3. Dynamics of Entrepreneurial Development and Management by Vasant Desai. HPH 2007, ISBN: 978- 81-8488-801-2.
4. Robert D. Hisrich, Mathew J. Manimala, Michael P Peters and Dean A. Shepherd, "Entrepreneurship", 8th Edition, Tata Mc-graw Hill Publishing Co.ltd.-new Delhi, 2012

Reference Books:

1. Essentials of Management: An International, Innovation and Leadership perspective by Harold Koontz, Heinz Weihrich McGraw Hill Education, 10th Edition 2016. ISBN- 978-93-392-2286-4.

COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):

Note: 1-Low, 2-Medium, 3-High

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	3	2	2	2	3	2	3	-	-	3
CO2	-	-	-	-	-	3	2	3	3	3	2	3	-	-	3
CO3	-	-	-	-	-	2	2	3	3	3	3	3	-	-	3
CO4	-	-	-	-	-	3	2	3	3	3	3	3	-	-	3
CO5	-	-	-	-	-	3	3	3	3	3	3	3	-	-	3

DIGITAL SIGNAL PROCESING

[As per Choice Based Credit System (CBCS) Scheme]

SEMESTER-V

Subject Code	18EC52	CIE Marks	50
Number of Lecture Hour/Week	3L+1T	SEE Marks	50
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS-04

Course Objectives: This course will enable students to:

- Understand the frequency domain sampling and reconstruction of discrete time signals.
- Study the properties and the development of efficient algorithms for the computation of DFT.
- Learn the procedures to design of IIR filters from the analog filters using impulse invariance and bilinear transformation.
- Study the different windows used in the design of FIR filters and design appropriate filters based on the specifications.
- Realization of FIR and IIR filters in different structural forms.

Module -1	**Teaching Hours**
Discrete Fourier Transforms (DFT): Frequency domain sampling and reconstruction of discrete time signals. DFT as a linear transformation, its relationship with other transforms. Properties of DFT, multiplication of two DFTs- the circular convolution. **(Text 1 & Ref 1)** **RBT: L1,L2,L3**	10 Hours
Module -2	
Additional DFT properties, Application of DFT: use of DFT in linear filtering, overlap-save and overlap-add method. Fast-Fourier-Transform (FFT) algorithms: Direct computation of DFT, need for efficient computation of the DFT (FFT algorithms). **(Text 1 & Ref 1)** **RBT: L1,L2,L3**	10 Hours
Module -3	
Radix-2 FFT algorithm for the computation of DFT and IDFT–decimation-in-time and decimation-in-frequency algorithms. Goertzel algorithm and chirp-z transform. **(Text 2 & Ref 2)** **RBT: L1,L2,L3**	10 Hours
Module -4	
Structure for IIR Systems: Direct form, Cascade form, Parallel form structures. IIR filter design: Characteristics of commonly used analog filter – Butterworth and Chebyshev filters, analog to analog frequency transformations. Design of IIR Filters from analog filter using Butterworth filter: Impulse invariance, Bilinear transformation. **(Text3& Ref 3)** **RBT: L1,L2,L3**	10 Hours
Module -5	
FIR filter design: Magnitude and frequency response of Rectangular, Hamming, Hanning, Bartlett windows. Introduction to FIR filters, design of FIR filters using window method, Structure for FIR Systems: Direct form, Linear Phase, Frequency sampling structure, Lattice structure. **(Text3& Ref 3)** **RBT: L1,L2,L3**	08 Hours

Course Outcomes: After studying this course, students will be able to:

CO1-Apply the discrete time Fourier transform algorithm and its properties on discrete time signals.
CO2-Perform linear filtering on discrete time signals using discrete time Fourier transform.
CO3-Apply the discrete in time and discrete in frequency fast Fourier transform, Chirp-Z transform, and Goertzel algorithms on discrete time signals to perform the discrete Fourier transform efficiently.
CO4-Design of infinite impulse response (IIR) filters and develop IIR structures.
CO5-Design of finite impulse response filters and develop FIR structures.

Text Books:

1. Digital signal processing – Principles Algorithms & Applications, Proakis&Monalakis, Pearson education, 4th Edition, New Delhi, 2007.
2. Digital signal processing-Theory and Lab practice, D.GaneshRao, VineetaP.Gejji, Second addition, PEARSON, 2010.

Reference Books:

1. Discrete Time Signal Processing, Oppenheim & Schaffer, PHI, 2003.
2. Digital Signal2. Processing, S. K. Mitra, Tata Mc-Graw Hill, 3rd Edition, 2010.
3. Digital Signal Processing, Lee Tan: Elsevier publications, 2007.

COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):

Note: 1-Low, 2-Medium, 3-High

CO/PO	PO.1	PO.2	PO.3	PO.4	PO.5	PO.6	PO.7	PO.8	PO.9	PO.10	PO.11	PO.12	PSO.1	PSO.2	PSO.3
CO1	3	3	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	3	3	2	-	-	-	-	-	-	-	-	-	3	-	-
CO3	3	3	2	-	-	-	2	-	-	-	-	-	3	-	-
CO4	2	3	3	-	-	-	-	-	-	-	-	-	3	-	-
CO5	3	3	3	-	-	-	-	-	-	-	-	-	3	-	-

ELECTROMAGNETIC WAVES AND ANTENNAS

[As per Choice Based Credit System (CBCS) Scheme]

SEMESTER-V

Subject Code	18EC53	CIE Marks	50
Number Lecture Hour/Week	3L+1T	SEE Marks	50
Number of Lecture Hours	50	Exam Hours	03

CREDITS-04

Course Objectives: The objectives of the course is to enable students to:

- Physical significance of Divergence, Curl and Gradient.
- Understand the applications of Coulomb's law and Gauss law to different charge distributions and the Laplace's and Poisson's Equations
- Know the physical interpretation of Maxwell's equations and applications for Plane waves for their behavior in free space, Dielectrics.
- Acquire knowledge of Poynting theorem and its application of power flow.
- Introduce and discuss different types of Antennas, various terminologies, excitations.

Module -1	**Teaching Hours**
Experimental law of Coulomb, Electric field intensity, Field due to continuous volume charge distribution, Field of a line charge, Electric flux density. Gauss law, Divergence. Maxwell's First equation (Electrostatics), Vector Operator and divergence theorem. (2.1,2.2,2.4,3.1,3.2,3.5,3.6,3.7 of Text 1) **RBT: L1,L2,L3**	10 Hours
Module -2	
The line integral, Definition of potential difference & potential, The potential field of point charge, Potential Gradient, Current and Current density, Continuity of current, Derivation of Poisson's and Laplace's Equations, Uniqueness theorem, Biot-Savart Law, Ampere's circuital law, Curl, Stokes' theorem (4.2, 4.3, 4.4, 4.6, 5.1, 5.2, 7.1, 7.2, 8.1, 8.2, 8.3, 8.4 of Text 1) **RBT: L1,L2,L3**	10 Hours
Module -3	
Magnetic flux and magnetic flux density, Scalar and Vector Magnetic Potentials. Farday's law, displacement current, Maxwell's equations in point form, Maxwell's equations in integral form. Wave propagation in free space, Dielectrics, Poynting's Theorem and wave power(8.5, 8.6, 10.1, 10.2, 10.3, 10.4, 12.1, 12.2,1 2.3) **RBT: L1,L2,L3**	10 Hours
Module -4	
Antenna Basics: Introduction, Basic Antenna Parameters, Patterns, Beam Area, Radiation Intensity, Beam Efficiency, Directivity and Gain, Antenna Apertures, Effective Height, Bandwidth, Radio Communication Link, Antenna Field Zones & Polarization. Point Sources and Arrays: Introduction, Point Sources, Power Patterns, Power Theorem, Radiation Intensity, Field Patterns, Phase Patterns, Arrays of Two Isotropic Point Sources, Pattern Multiplication, Linear Arrays of n Isotropic Point Sources of equal Amplitude and Spacing. (2.1-2.11, 2.13, 2.15, 5.1-5.10, 5.13 of Text 2) **RBT: L1,L2,L3**	10 Hours
Module -5	
Electric Dipoles: Introduction, Short Electric Dipole, Fields of a Short Dipole (General and Far Field Analyses), Radiation Resistance of a Short Dipole, Thin Linear Antenna (Field Analyses), Radiation Resistances of Lambda/2 Antenna(No derivations for fields and radiation resistance).Helical Geometry, Practical Design Considerations of Helical Antenna, Yagi-Uda array, Parabola General Properties, Log Periodic Antenna. Microstrip Antennas (6.1-6.6, 8.3, 8.5, 8.8, 9.5, 11.7, 14.1-14.5, 14.13 of Text 2) **RBT: L1,L2,L3**	10 Hours

Course Outcomes: After studying this course, students will be able to:

CO1- Explain and analyze electric field due to point, linear, and volume charges by applying Conventional method or Gauss law.

CO2- Analyze the potential energy of a point charge through Laplace's equation and examine laws linking magnetic fields to electric current.

CO3- Apply Maxwell's equations for time-varying electromagnetic fields and EM wave propagation in free space, then use Poynting's theorem to calculate wave power and energy.

CO4- Analyze the fundamentals of antenna theory.

CO5- Understand and analyze the functionality and applications of different antennas.

Text Books:

1. W.H. Hayt and J.A. Buck, "Engineering Electromagnetics", 7th Edition, TataMcGraw-Hill, 2009, ISBN-978-0-07-061223-5.
2. D. Krauss, "Antennas and Wave Propagation", McGraw Hill TMH, 4th Edition, 2010.

Reference Books:

1. C. A. Balanis, "Antenna Theory Analysis and Design", John Wiley, 2nd Edition 2007.
2. A.R.Harish, M.Sachidanada, "Antennas and propagation", Pearson Education, 2015.

COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):

Note: 1-Low, 2-Medium, 3-High

CO/PO	PO.1	PO.2	PO.3	PO.4	PO.5	PO.6	PO.7	PO.8	PO.9	PO.10	PO.11	PO.12	PSO.1	PSO.2	PSO.3
CO1	3	3	2	-	-	-	-	-	-	-	-	-	3	-	-
CO2	3	3	2	-	-	-	-	-	-	-	-	-	3	-	-
CO3	3	3	2	-	-	-	-	-	-	-	-	-	3	-	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	3	-	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-	3	-	-

VERILOG HDL

[As per Choice Based Credit System (CBCS) Scheme]

SEMESTER-V

Subject Code	18EC541	CIE Marks	50
Number of Lecture Hour/Week	3L	SEE Marks	50
Number of Lecture Hours	40	Exam Hours	03

CREDITS-03

Course Objectives: The objectives of the course is to enable students to::

- Learn different Verilog HDL constructs.
- Familiarize the different levels of abstraction in Verilog.
- Understand timing and delay Simulation.
- Understand the concept of logic synthesis and its impact in verification.

Module -1	**Teaching Hours**
Overview of Digital Design with Verilog HDL: Evolution of CAD, emergence of HDLs, typical HDL-flow, why Verilog HDL?, trends in HDLs. **Hierarchical Modeling Concepts:** Top-down and bottom-up design methodology, differences between modules and module instances, parts of a simulation, design block, stimulus block. **RBT: L1,L2,L3**	08 Hours
Module -2	
Basic Concepts: Lexical conventions, data types, system tasks, compiler directives. **Modules and Ports:** Module definition, port declaration, connecting ports, hierarchical name referencing. **RBT: L1,L2,L3**	08 Hours
Module -3	
Gate-Level Modeling: Modeling using basic Verilog gate primitives, description of and/or and buf/not type gates, rise, fall and turn-off delays, min, max, and typical delays. **Dataflow Modeling:** Continuous assignments, delay specification, expressions, operators, operands, operator types. **RBT: L1,L2,L3**	08 Hours
Module -4	
Behavioral Modeling: Structured procedures, initial and always, blocking and non-blocking statements, delay control, generate statement, event control, conditional statements, Multiway branching, loops, sequential and parallel blocks. **RBT: L1,L2,L3**	08 Hours
Module -5	
Switch Level Modelling: Switch modeling elements: MOS Switches, CMOS Switches, Bidirectional switches, Power& Ground , Resistive Switches, Delay Specification on Switches, Examples. **Logic Synthesis with Verilog:** Logic Synthesis, Impact of logic synthesis, Verilog HDL Synthesis, Synthesis design flow, Verification of Gate-Level Netlist**.** **RBT: L1,L2,L3**	08 Hours

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

CO1- Emphasize the importance of Verilog HDL, design methodology, and abstraction levels in relation to a particular digital design.

CO2- Grasp the fundamental concepts, components, and internal structure of Verilog HDL.

CO3- Analyze and design circuits at gate level and data flow level by applying the basic knowledge of delay and operators.

CO4- Design and explain a behavioral circuit using structured procedures and conditional statements.

CO5- Develop fundamental switch-level circuits and analyze the various constructs used in logic synthesis.

Text Books:

1. Samir Palnitkar, "Verilog HDL: A Guide to Digital Design and Synthesis", Pearson Education, Second Edition.

Reference Books:

1. Donald E. Thomas, Philip R. Moorby, "The Verilog Hardware Description Language", Springer Science+Business Media, LLC, Fifth edition.
2. Michael D. Ciletti, "Advanced Digital Design with the Verilog HDL" Pearson (Prentice Hall), Second edition.
3. Padmanabhan, Tripura Sundari, "Design through Verilog HDL", Wiley, 2016 or earlier.

COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):

Note: 1-Low, 2-Medium, 3-High

CO/PO	PO.1	PO.2	PO.3	PO.4	PO.5	PO.6	PO.7	PO.8	PO.9	PO.10	PO.11	PO.12	PSO.1	PSO.2	PSO.3
CO1	3	2	3	-	-	-	-	-	-	-	-	-	3	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	3	-	-
CO3	2	3	3	-	-	-	-	-	-	-	-	-	3	-	-
CO4	2	3	3	-	-	-	-	-	-	-	-	-	3	-	-
CO5	3	3	3	-	-	-	-	-	-	-	-	-	3	-	-

MICROPROCESSORS (8086)

[As per Choice Based Credit System (CBCS) Scheme]

SEMESTER-V

Subject Code	18EC542	CIE Marks	50
Number of Lecture Hour/Week	3L	SEE Marks	50
Number of Lecture Hours	40	Exam Hours	03

CREDITS-03

Course Objectives: This course will enable students to:

- Familiarize basic architecture of 8086 microprocessor.
- Program 8086 Microprocessor using Assembly Level Language.
- Use Macros and Procedures in 8086Programs.
- Understand interfacing of 16 bit microprocessor with memory and peripheral chips involving system design.
- Understand the architecture of 8088, 8087 Coprocessor and other CPU architectures.

Module -1	**Teaching Hours**
8086 PROCESSOR: Historical background 8086 CPU Architecture Addressing modes, Machine language instruction formats, Machine coding the program **INSTRUCTION SET OF 8086:** Data transfer and arithmetic instructions. Control/Branch Instructions, Illustration of these instructions with example programs. **RBT: L1,L2,L3**	08 Hours
Module -2	
Logical Instructions, String manipulation instructions, Flag manipulation and Processor control instructions, Illustration of these instructions with example programs. Assembler Directives and Operators, Assembly Language Programming and example programs. **RBT: L1,L2,L3**	08 Hours
Module -3	
Stack and Interrupts: Introduction to stack, Stack structure of 8086, Programming for Stack. Interrupts and Interrupt Service routines, Interrupt cycle of 8086, NMI, INTR, Interrupt programming, Passing parameters to procedures, Macros, Timing and Delays. **RBT: L1,L2,L3**	08 Hours
Module -4	
8086 Bus Configuration and Timings: Physical memory Organization, General Bus operation cycle, I/O addressing capability, Special processor activities, Minimum mode 8086 system and Timing diagrams, Maximum Mode 8086 system and Timing diagrams. **Basic Peripherals and their Interfacing with 8086 (Part 1)**: Static RAM Interfacing with 8086 (5.1.1), Interfacing I/O ports, PIO 8255, Modes of operation – Mode-0 and BSR Mode, Interfacing Keyboard and 7-Segment digits using 8255. **RBT: L1,L2,L3**	08 Hours
Module -5	
Basic Peripherals and their Interfacing with 8086 (Part 2): Interfacing ADC-0808/0809, DAC-0800, Stepper Motor using 8255, Timer 8254 – Mode 0, 1, 2 & 3 and Interfacing programmes for these modes. **INT 21H DOS Function calls** - for handling Keyboardand Display. **Other Architectures:** Architecture of 8088 and Architecture of NDP 8087 Von-Neumann & Harvard CPU architecture and CISC & RISC CPU architecture. **RBT: L1,L2,L3**	08 Hours

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

CO1-Explain the History of evaluation of Microprocessors, Architecture of 8086, 8088, 8087, CISC & RISC, Von-Neumann & Harvard CPU architecture.

CO2-Write 8086 Assembly level programs using the 8086instructionset.

CO3-Write modular programs using procedures and macros.

CO4-Write 8086 Stack and Interrupts programming.

CO5-Interface 8086 to Static memory chips and 8255, 8254, 0808 ADC, 0800 DAC, Keyboard, Display and Stepper motors.

Text Books:

1.The Intel Microprocessor, Architecture, Programming and Interfacing - Barry B. Brey, 6e, Pearson Education / PHI,2003.

2. Advanced Microprocessors and Peripherals - A.K. Ray and K.M. Bhurchandi, TMH, 3rdEdition, 2012, ISBN 978-1-25-900613-5.

Reference Books:

1. Microprocessor and Interfacing - Douglas V Hall, SSSP Rao, 3rdedition TMH,2012.
2. Microcomputer systems-The 8086 / 8088 Family– Y.C.Liuand A. Gibson, 2ndedition, PHI-2003.
3. The 8086 Microprocessor: Programming & Interfacing the PC – Kenneth J Ayala, CENGAGE Learning,2011.

COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):

Note: 1-Low, 2-Medium, 3-High

CO/PO	PO.1	PO.2	PO.3	PO.4	PO.5	PO.6	PO.7	PO.8	PO.9	PO.10	PO.11	PO.12	PSO.1	PSO.2	PSO.3
CO1	3	2	3	-	-	-	-	-	-	-	-	2	-	3	-
CO2	2	3	1	-	3	-	-	-	-	-	-	2	-	3	-
CO3	2	3	2	-	-	-	-	-	-	-	-	2	-	3	-
CO4	2	3	2	-	-	-	-	1	3	2	-	2	-	3	-
CO5	2	2	2	-	-	-	-	-	-	3	3	2	-	3	-

DIGITAL SIGNAL PROCESSING LAB

[As per Choice Based Credit System (CBCS) Scheme]

SEMESTER-V

Subject Code	18ECL55	CIE Marks	50
Number of Lecture Hour/Week	2P	SEE Marks	50
Total Number of Hours	20	Exam Hours	03

CREDITS-01

Course Objectives: This course will enable students to:

- Simulate discrete time signals and verification of sampling theorem.
- Compute the DFT for a discrete signal and verification of its properties using SCILAB.
- Find solution to the difference equations and computation of convolution and correlation along with the verification of properties.
- Compute and display the filtering operations and compare with the theoretical values.
- Implement the DSP computations on DSP hardware and verify the result.

List of Experiments:

Following Experiments to be done using MATLAB / SCILAB / OCTAVE or equivalent:

1. Specifications (using different window techniques). Verification of sampling theorem.
2. Linear and circular convolution of two given sequences, Commutative, distributive and associative property of convolution.
3. Auto and cross correlation of two sequences and verification of their properties.
4. Solving a given difference equation.
5. Computation of N point DFT of a given sequence and to plot magnitude and phase spectrum (using DFT equation and verify it by built-in routine, Study the frequency resolution with different values of N).
6.
   (i) Verification of DFT properties (like Linearity and Parseval's theorem, etc.)
   (ii) DFT computations of square pulse and sinc function etc.
7. Design and implementation of FIR filter to meet given.
8. Design and implementation of IIR filter to meet given specifications.

Following Experiments to be done using DSP kit

1.Linear convolution of two sequences
2.Circular convolution of two sequences
3.N-point DFT of a given sequence
4.Impulse response of first order and second order system
5.Implementation of FIR filter

Course Outcomes: After studying this laboratory course, students will be able to:

CO1- Develop a strong foundation in applying theoretical concepts by designing /simulating the experiment.

CO2-Utilize laboratory instruments/simulation tools to Build, and test experiments.

CO3- Analyze experimental data/simulation results and interpret findings to draw meaningful conclusions.

CO4- Learn to work effectively in teams while identifying and correcting faults in electronic circuits/programs.

CO5- Manage time effectively in a simulation/laboratory environment, balancing experimental work, data collection, and report writing within specified deadlines.

COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):
Note: 1-Low, 2-Medium, 3-High

CO/PO	PO.1	PO.2	PO.3	PO.4	PO.5	PO.6	PO.7	PO.8	PO.9	PO.10	PO.11	PO.12	PSO.1	PSO.2	PSO.3
CO1	3	2	3	-	-	-	-	-	-	-	-	-	-	3	-
CO2	2	3	1	-	3	-	-	-	-	-	-	-	-	3	-
CO3	2	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO4	2	3	2	-	-	-	-	3	3	2	-	-	-	3	-
CO5	2	2	2	-	-	-	-	3	-	3	3	-	-	3	-

ELECTROMAGNETIC WAVES AND ANTENNAS LAB [As per Choice Based Credit System (CBCS) Scheme] SEMESTER-V			
Subject Code	18ECL56	CIE Marks	50
Number of Lecture Hour/Week	2P	SEE Marks	50
Total Number of Hours	24	Exam Hours	03
CREDITS-01			

Course Objectives: This course will enable students to:

- Radiation pattern of antennas.
- Determining gain and directivity of a given antenna.
- Working of Klystron source.
- Study of directional coupler, Microstrip ring resonator.

List of Experiments:

1. Measurement of frequency, guide wavelength, power, VSWR and attenuation in microwave test bench.
2. Measurement of directivity and gain of microstrip dipole
3. Measurement of directivity and gain of Yagi antennas.
4. Measurement of directivity and gain of horn antennas.
5. Impedance measurements of Horn/Yagi/dipole/Parabolic antennas
6. Determination of Coupling and isolation characteristics of microstrip directional coupler.
7. Resonance characteristics of microstrip ring resonator and computation of dielectric constant of the substrate.
8. Power division and isolation of microstrip power divider.

Course Outcomes: On the completion of this laboratory course, the students will be able to:

CO1- Develop a strong foundation in applying theoretical concepts by designing /simulating the experiment.

CO2-Utilize laboratory instruments/simulation tools to Build, and test experiments.

CO3-Analyze experimental data/simulation results and interpret findings to draw meaningful conclusions.

CO4- Learn to work effectively in teams while identifying and correcting faults in electronic circuits/programs.

CO5- Manage time effectively in a simulation/laboratory environment, balancing experimental work, data collection, and report writing within specified deadlines.

COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):

Note: 1-Low, 2-Medium, 3-High

CO/PO	PO.1	PO.2	PO.3	PO.4	PO.5	PO.6	PO.7	PO.8	PO.9	PO.10	PO.11	PO.12	PSO.1	PSO.2	PSO.3
CO1	3	2	3	-	-	-	-	-	-	-	-	-	-	3	-
CO2	2	3	1	-	3	-	-	-	-	-	-	-	-	3	-
CO3	2	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO4	2	3	2	-	-	-	-	3	3	2	-	-	-	3	-
CO5	2	2	2	-	-	-	-	3	-	3	3	-	-	3	-

HDL LABORATORY

[As per Choice Based Credit System (CBCS) Scheme]

SEMESTER-V

Subject Code	18ECL571	CIE Marks	50
Number of Lecture Hour/Week	2P	SEE Marks	50
Total Number of Hours	20	Exam Hours	03

CREDITS-01

Course Objectives: This course will enable students to:

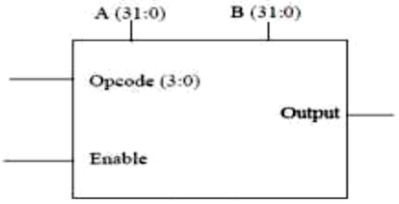
- Familiarize with the CAD tool to write HDL programs.
- Understand simulation and synthesis of digital design.
- Program FPGAs/CPLDs to synthesize the digital designs.
- Interface hardware to programmable ICs through I/O ports.
- Choose either Verilog or VHDL for a given Abstraction level.

Note: Programming can be done using any compiler. Download the programs on a FPGA/CPLD board and performance testing may be done using 32 channel pattern generator and logic analyzer apart from verification by simulation with tools such as Altera/Modelsim or equivalent.

List of Experiments:

Part–A: PROGRAMMING

1. Write Verilog code to realize all the logic gates
2. Write a Verilog program for the following combinational designs
    a. 2 to 4 decoder
    b. 8 to 3 (encoder without priority & with priority)
    c. 8 to 1 multiplexer.
    d. 4 bit binary to gray converter
    e. Multiplexer, de-multiplexer, comparator.
3. Write a Verilog code to describe the functions of a Full Adder using
4. three modeling styles.
5. Write a Verilog code to model 32 bit ALU using the schematic diagram shown



ALU should use combinational logic to calculate an output based on the four bit op-code input.
ALU should pass the result to the out bus when enable line in high, and tri-state the out bus when the enable line is low.
ALU should decode the 4 bit op-code according to the example given below.

OPCODE	ALU OPERATION
1.	A+B
2.	A-B
3.	A Complement
4.	A*B
5.	A AND B
6.	A OR B
7.	A NAND B
8.	A XNOR B

6. Develop the Verilog code for the following flip-flops, SR, D, JK and T.

7. Design a 4 bit binary, BCD counters (Synchronous reset and Asynchronous
8. reset) and ―any sequence‖ counters, using Verilog code.

Part–B: INTERFACING (at least four of the following must be covered using HDL)

9. Write HDL code to display messages on an alpha numeric LCD display.
10. Write HDL code to interface Hex key pad and display the key code on sevensegment display.
11. Write HDL code to control speed, direction of DC and Stepper motor.
12. Write HDL code to accept Analog signal, Temperature sensor and display thedata on LCD or Seven segment display.
13. Write HDL code to generate different waveforms (Sine, Square, Triangle, Rampetc.,) using DAC - change the frequency.
14. Write HDL code to simulate Elevator operation.

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

CO1- Develop a strong foundation in applying theoretical concepts by designing /simulating the experiment.

CO2-Utilize laboratory instruments/simulation tools toBuild, and test experiments.

CO3- Analyze experimental data/simulation results and interpret findings to draw meaningful conclusions.

CO4- Learn to work effectively in teams while identifying and correcting faults in electronic circuits/programs.

CO5- Manage time effectively in a simulation/laboratory environment, balancing experimental work, data collection, and report writing within specified deadlines.

COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):

Note: 1-Low, 2-Medium, 3-High

CO/PO	PO.1	PO.2	PO.3	PO.4	PO.5	PO.6	PO.7	PO.8	PO.9	PO.10	PO.11	PO.12	PSO.1	PSO.2	PSO.3
CO1	3	2	3	-	-	-	-	-	-	-	-	-	-	3	-
CO2	2	3	1	-	3	-	-	-	-	-	-	-	-	3	-
CO3	2	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO4	2	3	2	-	-	-	-	3	3	2	-	-	-	3	-
CO5	2	2	2	-	-	-	-	3	-	3	3	-	-	3	-

MICROPROCESSOR LABORATORY

[As per Choice Based Credit System (CBCS) Scheme]

SEMESTER-V

Subject Code	18ECL572	CIE Marks	50
Number of Lecture Hour/Week	2P	SEE Marks	50
Total Number of Hours	20	Exam Hours	03

CREDITS-01

Course Objectives: This course will enable students to:

- Get familiarize with 8086 instructions and DOS 21H interrupts and function calls. Develop and test assembly language programs to use instructions of 8086.
- Get familiarize with interfacing of various peripheral devices with 8086 microprocessor for simple applications.

List of Experiments:

1. **Programs involving: Data transfer instructions like**:
   i) Byte and word data transfer indifferent addressing Modes
   ii) Block move (with and without overlap)
   iii) Block interchange
2. **Programs involving: Arithmetic & logical operations like**:
   i) Addition and Subtraction of multi precision no,s.
   ii) Multiplication and Division of signed and unsigned Hexadecimal no,s.
   iii) ASCII adjustment instructions.
   iv) Code conversions.
3. **Programs involving: Bit manipulation instructions like checking**:
   i) Whether given data is positive or negative
   ii) Whether given data is odd or even
   iii) Logical 1‟s and 0‟s in a given data
   iv) 2 out 5code
   v) Bit wise and nibble wise palindrome.
4. **Programs involving: Loop instructions like**
   i) Arrays: addition/subtraction of N nos., Finding largest and smallest nos., Ascending and descending order.
   ii) Two application programs using Procedures and Macros (Subroutines).
5. **Programs involving**
   String manipulation like string transfer, string reversing, searching for a string.
6. **Programs involving**

   Programs to use DOS interrupt INT 21h Function calls for Reading a Character from keyboard, Buffered Keyboard input, Display of character/ String on console.
7. **Interfacing Experiments:**

Experiments on interfacing 8086 with the following interfacing modules through DIO (Digital Input/Output - PCI bus compatible card / 8086 Trainer)

1. Matrix keyboard interfacing
2. Seven segment display interface
3. Logical controller interface
4. Stepper motor interface
5. ADC and DAC Interface (8bit)
6. Light dependent resistor (LDR),Relayand Buzzer Interface to make light operated switches

Course outcomes: On the completion of this laboratory course, the students will be able to:
CO1- Develop a strong foundation in applying theoretical concepts by designing /simulating the experiment.
CO2-Utilize laboratory instruments/simulation tools to Build, and test experiments.
CO3- Analyze experimental data/simulation results and interpret findings to draw meaningful conclusions.
CO4- Learn to work effectively in teams while identifying and correcting faults in electronic circuits/programs.
CO5- Manage time effectively in a simulation/laboratory environment, balancing experimental work, data collection, and report writing within specified deadlines.

COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):
Note: 1-Low, 2-Medium, 3-High

CO/PO	PO.1	PO.2	PO.3	PO.4	PO.5	PO.6	PO.7	PO.8	PO.9	PO.10	PO.11	PO.12	PSO.1	PSO.2	PSO.3
CO1	3	2	3	-	-	-	-	-	-	-	-	-	-	3	-
CO2	2	3	1	-	3	-	-	-	-	-	-	-	-	3	-
CO3	2	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO4	2	3	2	-	-	-	-	3	3	2	-	-	-	3	-
CO5	2	2	2	-	-	-	-	3	-	3	3	-	-	3	-

PROJECT-V [As per, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme] SEMESTER-V			
Subject Code	18PRJ58	CIE Marks	50
Number Lecture Hour/Week	2P	SEE Marks	50
Total Number of Hours	20	Exam Hours	03
CREDITS-01			

Course Objectives: Students will be taught to:

- Get exposure about the electronics hardware and various software tools.
- Design the working model of the open ended problem.
- Understand concepts of Packaging.
- Understand the latest technology trends in the PCB design.
- Prepare technical documentation of the project.

STUDENTS WILL BE GIVEN A OPEN ENDED PROBLEM OF THE SOCIETY AND ASKED TO SOLVE BY DESIGNING AND IMPLEMENTING THE SYSTEM IN TEAM.

Course outcomes: After studying this course, students will be able to:

CO1- Apply the knowledge of electronics hardware and software components to solve the real time problems of the society.

CO2- Analyze the various existing solutions available to solve the real time problem and propose the best solution.

CO3- Design and implement the system to solve the real time problem of the society.

CO4-Conduct investigations on the output and prepare the technical documentation of the designed system in a team.

CO5- Use the modern tool available like advanced hardware and software tools.

COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING(1/2/3):

Note:1-Low, 2-Medium, 3-High

CO/PO	PO.1	PO.2	PO.3	PO.4	PO.5	PO.6	PO.7	PO.8	PO.9	PO.10	PO.11	PO.12	PSO.1	PSO.2	PSO.3
CO1	**3**	**2**	**-**	**-**	**2**	**2**	**-**	**-**	**3**	3	**-**	**3**	**-**	**3**	**-**
CO2	**3**	**3**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**3**	**-**
CO3	**3**	**3**	**3**	**2**	**3**	**2**	**2**	**-**	**3**	**3**	**2**	**3**	**-**	**3**	**-**
CO4	**3**	**3**	**3**	**2**	**-**	**-**	**-**	**3**	**3**	**3**	**3**	**3**	**-**	**3**	**-**
CO5	**-**	**-**	**-**	**-**	**3**	**-**	**-**	**3**	**3**	**3**	**3**	**3**	**-**	**3**	**-**

SOFT SKILLS

[As per Choice Based Credit System (CBCS) Scheme]

SEMESTER-V

Subject Code	18HSM59	CIE Marks	50
Number of Lecture Hour/Week	2L	SEE Marks	50
Total Number of Lecture Hours	20	Exam Hours	03

CREDITS-01

Course Objectives: To enable the students to obtain the basic knowledge about Communication Skills - in the following topics:-

- The Meaning, definition, importance, purpose, process, types, barriers and Essential of communication.
- Develop reading and understanding ability.
- Learn effective writing.
- Learn how to write different types of letter.
- Case method of learning.

Module -1	**Teaching Hours**
INTRODUCTION TO COMMUNICATION: Meaning, Definition, Importance & Purpose of Communication, Process of Communication, Types of Communication, Communication network in an organization, 7c's of communication, Barriers to Communication and Essential of good Communication. **RBT: L1,L2**	04 Hours
Module -2	
READING AND UNDERSTANDING: Reading Comprehension – Reading rate and reading comprehension, Paraphrasing, Interpretations of graphical information, Book reading and summarizing it. **RBT: L1,L2**	04 Hours
Module -3	
EFFECTIVE WRITING: Purpose of Writing, Clarity in Writing, Principle of Effective Writing. Better writing using personal Experiences – Describing a person, situation, memorable events etc…. **RBT: L1,L2**	04 Hours
Module -4	
DRAFTING OF LETTERS: Writing different types of letters – writing for employment, joining letter, complaints & follows up , Enquiries, representation etc. Official Communication – e-mail & Social Media. **RBT: L1,L2**	04 Hours
Module -5	
CASE METHOD OF LEARNING: Understand Case method of learning, different type of cases, overcoming the difficulties of the case method, analyzing the case. Do's & Don'ts for case preparation. **RBT: L1,L2**	04 Hours

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

CO1- Describe the process, types and importance of communication in various contexts.

CO2- Develop the ability to read books or lengthy texts with critical comprehension, effectively identifying and analyzing key themes, arguments, and main ideas.

CO3- Develop writing skills by effectively describing people, situations, and memorable events and demonstrate responsibility, self-management, self-confidence and ethical behavior.
CO4- Develop the ability to draft various professional letters such as employment application, joining letters, complaints, follow ups and representations
CO5- Foster teamwork abilities through collaborative case study discussion and problem-solving exercises

Text Books:

1. Scot ofer, contemporary business communication, Biztantra
2. Chaturvedi P D &Mukeshchaturvedi - Business communication:Concepts, cases & applications- 2/e, pearson education.
3. Essential of Business communication – Rajendra Pal and J.S Korlhall – Sultan Chand & Sons, New Delhi.

Reference Books:

1. Business correspondence & report writing – R.C.Sharma, Krishna Mohan – Tata Megraw Hill Publising Company Ltd, New Delhi.
2. Business Communcation – K.K. Sinha – Galgotio Publishing Company, New Delhi.

COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):

Note: 1-Low, 2-Medium, 3-High

CO/PO	PO.1	PO.2	PO.3	PO.4	PO.5	PO.6	PO.7	PO.8	PO.9	PO.10	PO.11	PO.12	PSO.1	PSO.2	PSO.3
CO1	-	-	-	-	-	3	2	2	2	3	2	3	-	-	3
CO2	-	-	-	-	-	3	2	3	3	3	2	3	-	-	3
CO3	-	-	-	-	-	2	2	3	3	3	3	3	-	-	3
CO4	-	-	-	-	-	3	2	3	3	3	3	3	-	-	3
CO5	-	-	-	-	-	3	3	3	3	3	3	3	-	-	3

VLSI CIRCUITS

[As per Choice Based Credit System (CBCS) Scheme]

SEMESTER-VI

Subject Code	18EC61	CIE Marks	50
Number of Lecture Hour/Week	3L+1T	SEE Marks	50
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS-03

Course Objectives: The objectives of the course is to enable students to:

- Impart knowledge of MOS transistor theory and CMOS technologies
- Impart knowledge on architectural choices and performance tradeoffs involved in designing and realizing the circuits in CMOS technology
- Cultivate the concepts of subsystem design processes
- Demonstrate the concepts of CMOS testing

Module -1	**Teaching Hours**
Introduction: MOS transistors, MOS Transistor Theory, Ideal I-V Characteristics, Non-Ideal I-V Effects, DC Transfer Characteristics, Fabrication Process **(Text 1)** **RBT: L1,L2,L3**	10 Hours
Module -2	
MOS and BiCMOS Circuit Design Process: Layout Design Rules, Gate Layout, Stick Diagram, VLSI Design Flow. **Data Path Subsystems:** Addition/subtraction, Comparators, Counters, coding, Shifters, Multiplication, Division**(Text 1)** **RBT: L1,L2,L3**	10 Hours
Module -3	
Memory: SRAM, DRAM, read only memory, Serial Access Memory, programmable Logic array. Design methodology, Design Flow, Design Economics.**(Text 1)** **RBT: L1,L2,L3**	10 Hours
Module -4	
Single Stage Amplifier: Common Source Stage, Source follower, Source Follower, Common gate Stage, Cascode Stage.**(Text 2)** **RBT: L1,L2,L3**	10 Hours
Module -5	
Differential amplifiers: single Ended and Differential Amplifiers, Basic differential pair, Common Mode Response, Differential Pair with MOS Loads. **Passive and Active Current Mirrors:** Basic Current Mirror, Cascode Current Mirror, Active Current Mirror**(Text 2)** **RBT: L1,L2,L3**	10 Hours

Course outcomes: At the end of the course, the students will be able to:

CO1-Analyze the ideal and non-ideal I-V characteristics of MOS transistors.

CO2-Develop the ability to create and interpret gate layouts and stick diagrams for basic circuits while adhering to design rules, and understand data path subsystems

CO3-Design memory systems for various applications based on system requirements.

CO4- Analyze the performance parameters of a single-stage amplifier, and design and implement a cascode amplifier

CO5- Design and analyze a differential amplifier with MOS loads, focusing on performance improvements, and explore Current Mirrors.

Text Books:

1. "CMOS VLSI Design- A Circuits and Systems Perspective"- Neil H.E. Weste, David Harris, Ayan Banerjee, 3rd Edition, Pearson Education.
2. "Design Of Analog CMOS Integrated Circuits"-Behzad Razavi, McGraw Hill Education (India) Edition 2002

COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):

Note: 1-Low, 2-Medium, 3-High

CO/PO	PO.1	PO.2	PO.3	PO.4	PO.5	PO.6	PO.7	PO.8	PO.9	PO.10	PO.11	PO.12	PSO.1	PSO.2	PSO.3
CO1	3	3	-	-	-	-	1	-	-	-	-	-	3	-	-
CO2	3	3	2	-	-	-	1	-	-	-	-	-	3	-	-
CO3	2	3	3	-	-	-	2	-	-	-	-	-	3	-	-
CO4	2	3	3	-	-	-	2	-	-	-	-	-	3	-	-
CO5	3	3	3	-	-	-	2	-	-	-	-	-	3	-	-

ARM CORTEX M3 & EMBEDDED SYSTEMS

[As per Choice Based Credit System (CBCS) Scheme]

SEMESTER-VI

Subject Code	18EC621	CIE Marks	50
Number of Lecture Hour/Week	3L	SEE Marks	50
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS-03

Course Objectives: This course will enable students to**:**

- Understand the architectural features and instruction set of 32-bit
- microcontroller ARM Cortex M3.
- Program ARM Cortex M3 using the various instructions and C language for
- different applications.
- Understand the basic hardware components and their selection method based on

Module -1	**Teaching Hours**
Embedded System Components: Embedded V/S General computing system, Classification of Embedded systems, Major applications and purpose of ES. Core of an Embedded System including all types of processor/controller, Memory, Sensors, Actuators, LED, 7 segment LED display, Opto coupler, Relay, Piezo buzzer, Push button switch, Communication Interface (onboard and external types), Embedded firmware, Other system components**.(**Text 1: All the Topics from Ch-1 and Ch-2, excluding 2.3.3.4 (stepper motor), 2.3.3.8(keyboard) and 2.3.3.9 (PPI) sections). **RBT: L1,L2**	08 Hours
Module -2	
Embedded System Design Concepts: Characteristics and Quality Attributes of Embedded Systems, Operational and non-operational quality attributes, Embedded Systems-Application and Domain specific, Hardware Software Co-Design and Program Modelling (excluding UML), Embedded firmware design and development (excluding C language).(Text 1: Ch-3, Ch-4, Ch-7 (Sections 7.1, 7.2 only), Ch-9 (Sections 9.1, 9.2, 9.3.1,9.3.2 only). **RBT: L1,L2,L3**	08 Hours
Module -3	
RTOS and IDE for Embedded System Design: Operating System basics, Types of operating systems, Task, process and threads (Only POSIX Threads with an example program), Thread preemption, Preemptive Task scheduling techniques, Task Communication, Task synchronization issues – Racing and Deadlock, How to choose an RTOS, Integration and testing of Embedded hardware and firmware, Embedded system Development Environment – Block diagram (excluding Keil), Disassembler/decompiler, simulator, emulator and debugging(Text 1: Ch-10 (Sections 10.1, 10.2, 10.3, 10.5.2 , 10.7, 10.8.1.1, 10.8.1.2,10.10 only), Ch 12, Ch-13 (a block diagram before 13.1, 13.3, 13.4 only) **RBT: L1,L2,L3**	08 Hours
Module -4	
ARM-32 bit Microcontroller: Thumb-2 technology and applications of ARM, Architecture of ARM Cortex M3, Various Units in the architecture, Debugging support, General Purpose Registers, Special Registers, exceptions, interrupts, stack operation, reset sequence (Text 2: Ch 1, 2, 3) **RBT: L1,L2,L3**	08 Hours
Module -5	
ARM Cortex M3 Instruction Sets and Programming: Assembly basics, Instruction list and description, Useful instructions, Memory mapping, Bit-band operations and CMSIS, Assembly and C language Programming (Text 2: Ch-4, Ch-5, Ch-10 (10.1,10.2, 10.3, 10.5 only) **RBT: L1,L2,L3**	08 Hours

Course outcomes: At the end of the course, the students will be able to:
CO1- Identify the purpose, application areas, and key components of embedded systems.
CO2- Analyze hardware/software co-design by leveraging the characteristics and attributes of embedded systems.
CO3- Investigate the need of real-time operating system for Embedded system applications.
CO4- Analyze the architectural features of the 32-bit ARM Cortex-M3 and apply them to microcontroller programming.
CO5- Apply the acquired knowledge to program the ARM Cortex-M3 for various applications.

Text Books:

1. Shibu K V, ―Introduction to Embedded Systems‖, Tata McGraw Hill EducationPrivate Limited, 2nd Edition.
2. Joseph Yiu, ―The Definitive Guide to the ARM Cortex-M3‖, 2nd Edition, Newnes,(Elsevier), 2010.

COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):

Note: 1-Low, 2-Medium, 3-High

CO/PO	PO.1	PO.2	PO.3	PO.4	PO.5	PO.6	PO.7	PO.8	PO.9	PO.10	PO.11	PO.12	PSO.1	PSO.2	PSO.3
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	3	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	3	-	-
CO4	2	3	-	-	-	-	-	-	-	-	-	-	3	-	-
CO5	3	3	3	-	-	-	-	-	-	-	-	-	3	-	-

MACHINE LEARNING

[As per Choice Based Credit System (CBCS) Scheme]

SEMESTER-VI

Subject Code	18EC622	CIE Marks	50
Number of Lecture Hour/Week	3L	SEE Marks	50
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS-03

Course Objectives: This course will enable students to:

- Students can identify the problems for machine learning. And select the either supervised, unsupervised or reinforcement learning.
- Students can explain theory of probability and statistics related to machine learning
- Students can investigate concept learning, ANN, Bayes classifier, k nearest neighbor.
- Students have understanding of issues and challenges of Machine Learning.
- Understanding of the strengths and weaknesses of many popular machine learning approaches.

Modules	Teaching Hours
Module -1	
Introduction: Well posed learning problems, Designing a Learning system, Perspective and Issues in Machine Learning. **Concept Learning:** Concept learning task, Concept learning as search, Find-S algorithm**. (Text 1 & Ref 1)** **RBT: L1,L2,L3**	08 Hours
Module -2	
Decision Tree Learning and ANN: Decision tree representation, hypothesis space search in decision tree learning, Inductive bias in decision tree learning, Issues in decision tree learning, Neural Network representation, Appropriate problems, Perceptrons, Backpropagation algorithm.**(Text 1)** **RBT: L1,L2,L3**	08 Hours
Module -3	
Bayesian and Computational Learning: Bayes Theorem, Bayes Theorem Concept Learning, Maximum Likelihood, Minimum Description Length Principle, Bayes Optimal Classifier, Gibbs Algorithm, Naïve Bayes Classifier **(Text 1)** **RBT: L1,L2,L3**	08 Hours
Module -4	
Instant Based Learning and Learning set of rules: K- Nearest Neighbour Learning, Locally Weighted Regression, Radial Basis Functions, Case-Based Reasoning. Sequential Covering Algorithms, Learning Rule Sets, Learning First Order Rules, Learning Sets of First Order Rules. **(Text 1)** **RBT: L1,L2,L3**	08 Hours

Module-5	
Analytical Learning and Reinforced Learning: Perfect Domain Theories, Explanation Based Learning, Inductive-Analytical Approaches, FOCL Algorithm, Reinforcement Learning.**(Text 1)** **RBT: L1,L2,L3**	08 Hours

Course outcomes: After studying this course, students will be able to:

CO1-Identify the characteristics of datasets and compare the trivial data and big data for various applications.

CO2-Explain and analyze machine learning techniques and computing environment that are suitable for the applications under consideration.

CO3-Solve problems associated with batch learning and online learning, and the big data characteristics such as high dimensionality, dynamically growing data and in particular scalability issues.

CO4- Develop scaling up machine learning techniques and associated computing techniques and technologies for various applications.

CO5-Integrate machine learning libraries, and mathematical and statistical tools with modern technologies like distributed file system and mapreduce programming model

Text Books:

1. Tom M. Mitchell, Machine Learning, India Edition 2013, McGraw Hill Education.

Reference Books:

1. Trevor Hastie, Robert Tibshirani, Jerome Friedman, h The Elements of Statistical Learning, 2nd edition, springer series in statistics.
2. EthemAlpaydın, Introduction to machine learning, second edition, MIT press.

COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):

Note: 1-Low, 2-Medium, 3-High

CO/PO	PO.1	PO.2	PO.3	PO.4	PO.5	PO.6	PO.7	PO.8	PO.9	PO.10	PO.11	PO.12	PSO.1	PSO.2	PSO.3
CO1	**3**	-	-	-	-	-	-	-	-	-	-	-	**3**	-	-
CO2	**3**	**3**	-	-	-	-	-	-	-	-	-	-	**3**	-	-
CO3	**3**	-	-	-	-	-	-	-	-	-	-	-	**3**	-	-
CO4	**3**	-	**3**	-	-	-	-	-	-	-	-	-	**3**	-	-
CO5	**3**	-	-	-	**2**	-	-	-	-	-	-	-	**3**	-	-

IOT TECHNOLOGY

[As per Choice Based Credit System (CBCS) Scheme]

SEMESTER-VI

Subject Code	18EC631	CIE Marks	50
Number Lecture Hour/Week	03	SEE Marks	50
Number of Lecture Hours	40	Exam Hours	03

CREDITS-03

Course Objectives: This course will enable students to:

- Understand an overview of IoT, M2M communication and design principles.
- Understand the internet connectivity principles, protocols, data collection, storage and the concept of cloud computing.
- Know about IoT Privacy, Security and Vulnerabilities Solutions.
- Understand the role of IoT in various domains of applications.
- Understand the IoT physical devices and Python programming concept.

Module -1	**Teaching Hours**
Internet of Things: An overview Internet of Things, IoT Conceptual Framework, IoT Architectural View, Technology Behind IoT, Sources of IoT, M2M Communication, Examples of IoT. **Design Principles for Connected Devices:** Introduction, IoT/M2M Systems Layers and Design Standardization, Data Enrichment, Data Consolidation and Device Management at Gateway. **Design Principles for Web Connectivity:** Web Communication Protocols for Connected Devices, Message Communication Protocols for connected devices.(Chapter 1,2 &3 from Textbook 1) **RBT: L1,L2**	08 Hours
Module -2	
Internet Connectivity Principles: Internet Connectivity, Internet-Based Communication, IP Addressing in the IoT, Application Layer Protocols: HTTP, HTTPS, FTP, Telnet and Others. **Data Collection, Storage and Computing Using a Colud Platform:** Introduction, Cloud Computing Paradigm for Data Collection, Storage and Computing. Everything as a Service and Cloud Service Models. IoT Cloud-Based Services Using the Xively, Nimbits and Other Platforms. (Chapter 4 & 6 from textbook 1) **RBT: L1,L2**	08 Hours
Module -3	
IoT Privacy, Security and Vulnerabilities Solutions: Introduction, Vulnerabilities, Security Requirements and Threat Analysis, Use Cases and Misuse Cases, IoT Security Tomography and Layered Attacker Model, Identity Management and Establishment, Access Control and Secure Message Communication. Security Models, Profiles and Protocols for IoT. (Chapter 10 from Textbook 1) **RBT: L1,L2**	08 Hours
Module -4	
IoT applications for smart and connected cities-Driverless vehicles, Crowd sensing, Smart buildings, Smart campuses, Smart grid. Internet of things for connected homes-Smart connected home stack holders, Smart home connected systems. IoT in Smart Ambulance and Emergency Medicine-IoT in Emergency medicine. (Textbook 2) **RBT: L1,L2,L3**	08 Hours

Module -5	
IoT Systems- Logical Design using Python: Introduction, Installing Python, Python Data Types and Data Structures, Control Flow, Functions, Modules, Packages, File handling, date/ Time operations, Classes, Python Packages of Interest for IoT. **IoT Physical Devices & Endpoints:** Exemplary Device: Raspberry Pi, About the Board, Linux on Raspberry Pi, Raspberry Pi Interfaces. Programming Raspberry Pi with Python, Arduino, About the board.(Chapter 6&7 of Textbook 3) **RBT: L1,L2,L3**	08 Hours
Course outcomes: After studying this course, students will be able to: CO1- Gain a foundational understanding of IoT concepts, architecture, and analyze the data collection and processing mechanisms. CO2- Analyze IoT communication protocols and application layer protocols, focusing on data collection, storage, and computing using cloud platforms. CO3- Identify security concerns and analyze the vulnerabilities encountered in IoT applications. CO4 Analyze the real-time applications of IoT in various scenarios. CO5- Apply Python programming skills to develop IoT applications.	
Text Books: 1. Raj Kamal, "Internet of Things- Architecture and Design Principles", McGraw Hill Education. **2.** Qusay F. Hassan, Internet of Things A to Z Technologies and Applications, IEEE press, WILEY, ISBN:978-1-111-945674-2. **3.** ArshdeepBahaga and Vijay Madisetti, "Internet of Things – A Hands-on Approach 2014.	
Reference Book: 1. Srinivasa K G, "Internet of Things", CENGAGE Leaning India, 2017. 2. Peter Waher, Learning Internet of Things, Packet Publishing Limited, Jan 2015.	

COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):

Note: 1-Low, 2-Medium, 3-High

CO/PO	PO.1	PO.2	PO.3	PO.4	PO.5	PO.6	PO.7	PO.8	PO.9	PO.10	PO.11	PO.12	PSO.1	PSO.2	PSO.3
CO1	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**
CO2	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**
CO3	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**
CO4	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**
CO5	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

WIRELSESS SENSOR NETWORKS

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – VI

Subject Code	18EC632	CIE Marks	50
Number Lecture Hour/Week	3L	SEE Marks	50
Number of Lecture Hours	40	Exam Hours	03

CREDITS-03

Course Objectives: This course will enable students to:

- Architect sensor networks for various application setups.
- Explore the design space and conduct trade-off analysis between performance and resources.
- Devise appropriate data dissemination protocols and model links cost.
- Determine suitable medium access protocols and radio hardware.
- Applications of wireless sensor networks in commercial components.

Modules	Teaching Hours
Module -1	
Introduction, Basic overview of the Technology, Applications of Wireless Sensor Networks: Introduction, Background, Range of Applications, Examples of Category 2 WSN Applications, Examples of Category 1 WSN Applications, Another Taxonomy of WSN Technology. **RBT:L1, L2**	08 Hours
Module -2	
Basic Wireless Sensor Technology and Systems: Introduction, Sensor Node Technology, Sensor Taxonomy, WN Operating Environment, WN Trends, Wireless Transmission Technology and Systems: Introduction, Radio Technology Primer, Available Wireless Technologies.**RBT:L1, L2**	08 Hours
Module -3	
MAC and Routing Protocols for Wireless Sensor Networks: Introduction, Background, Fundamentals of MAC Protocols, MAC Protocols for WSNs, Sensor-MAC case Study, IEEE 802.15.4 LR-WPANs Standard Case Study. **RBT:L1, L2,L3**	08 Hours
Module -4	
Routing Protocols for Wireless Sensor Networks: Introduction, Background, Data Dissemination and Gathering, Routing Challenges and Design Issues in WSNs, Routing Strategies in WSNs. **RBT:L1, L2,L3**	08 Hours
Module -5	
Applications Of WSN: WSN Applications - Home Control - Building Automation - Industrial Automation - Medical Applications - Reconfigurable Sensor Networks - Highway Monitoring - Military Applications - Civil and Environmental Engineering Applications - Wildfire Instrumentation - Habitat Monitoring - Nanoscopic Sensor Applications – Case Study: IEEE 802.15.4 LR-WPANs Standard - Target detection and tracking - Contour/edge detection - Field sampling. **RBT:L1, L2**	08 Hours

Course outcomes: After studying this course, students will be able to:

CO1-Explain and Demonstrate Applications of Wireless Sensor Networks.

CO2-Develop applications of wireless sensor actuator networks.

CO3-Analyze various routing protocols for wireless sensor networks.

CO4- Analyze various design issues in wireless sensor networks.

CO5-Apply the WSN in applications like, building automation, industrial automation, medical applications, military applications, etc.

Text Book:

1. 1. KAZEM SOHRABY, DANIEL MINOLI, TAIEB ZNATI, "Wireless Sensor Networks: Technology, Protocols and Applications:, WILEY , Second Edition (Indian) , 2014.
2. 2.KazemSohraby, Daniel Minoli and TaiebZnati, " Wireless Sensor Networks Technology, Protocols, and Applications", John Wiley & Sons, 2007.
3. 3.Holger Karl and Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks", John Wiley & Sons, Ltd, 2005.

Reference Books:

1. .K. Akkaya and M. Younis, "A survey of routing protocols in wireless sensor networks", Elsevier Ad Hoc Network Journal, Vol. 3, no. 3, pp. 325--349
2. Anna Ha´c, "Wireless Sensor Network Designs", John Wiley & Sons Ltd.
3. Feng Zhao & Leonidas J. Guibas, "Wireless Sensor Networks- An Information Processing Approach", Elsevier, 2007.

COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):

Note: 1-Low, 2-Medium, 3-High

CO/PO	PO.1	PO.2	PO.3	PO.4	PO.5	PO.6	PO.7	PO.8	PO.9	PO.10	PO.11	PO.12	PSO.1	PSO.2	PSO3
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	3	-	3	-	-	-	-	-	-	-	-	-	3	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	3	-	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	3	-	-
CO5	3	-	-	-	-	-	-	-	-	-	-	-	3	-	-

CONTROL SYSTEMS

[As per Choice Based Credit System (CBCS) Scheme]

SEMESTER-VI

Subject Code	18EC641	CIE Marks	50
Number of Lecture Hour/Week	3L	SEE Marks	50
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS-04

Course Objectives: This course will enable students to:

- To introduce the components and their representation of control systems
- Learn how to find a mathematical model of electrical, mechanical and electromechanical systems.
- Find the transfer function via Masons'rule and various approach for the state variable analysis.
- Know how to find time response and analyze the stability of a system from the transfer function.
- To learn various methods for analyzing the time response, frequency response andstability of the systems.

Module -1	**Teaching Hours**
INTRODUCTION TO CONTROL SYSTEMS: Basic control system and its classifications, Servo mechanics, Differential Equation Of Physical Systems: Mechanical Systems, Electrical Systems, Analogous Systems (mentioned system numerical's)(Text 1: 1.1,1.2, 2.2) **(Text1& Ref 1)** **RBT: L1,L2,L3**	08 Hours
Module -2	
SIGNAL FLOW GRAPHS & STATE VARIABLES: Transfer functions, Block diagram algebra and Signal Flow graphs. Introduction to State variable analysis: Introduction, Concept of State, State variables & State model, State model for Linear Continuous & Discrete time systems, Diaganolisation.(Text 1: 2.4,2.5, 2.6, 12.1 to 12.5) **(Text1& Ref 1)** **RBT: L1,L2,L3**	08 Hours
Module -3	
TIME RESPONSE ANALYSIS OF CONTROL SYSTEMS: Standard test signals, Unit step & ramp step response of First order Systems , Unit step response of second order System, Time response specifications of second order systems, steady state errors and error constants. Introduction to PI, PD and PID Controllers (excluding design).(Text 1: 5.1to 5.5,5.7) **(Text1& Ref 1)** **RBT: L1,L2,L3**	08 Hours
Module -4	
STABILITY ANALYSIS AND ROOT LOCUS: Concepts of stability, Necessary conditions for Stability, Routh stability criterion, Relative stability analysis, more on the Routh stability criterion, Introduction to Root-Locus Techniques ,The root locus concepts, Construction of root loci. Text 1: (6.1,6.2,6.4,6.5,6.6,7.1 to 7.3) **(Text1& Ref 1)** **RBT: L1,L2,L3**	08 Hours
Module -5	
FREQUENCY DOMAIN ANALYSIS AND STABILITY: Correlation between time and frequency response, Polar Plots, (Inverse Polar Plots excluded) , Bode Plots, Experimental determination of transfer function Mathematical preliminaries, Nyquist Stability criterion, Introduction to lead, lag and lead-lag compensating networks (excluding design).Text 1: (8.1 TO 8.4,9.2,9.3,10.3) **(Text1 & Ref 1)** **RBT: L1,L2,L3**	08 Hours

Course Outcomes: At the end of the course, the students will be able to
CO1-Develop the mathematical model of mechanical and electrical systems
CO2-Develop transfer function for a given control system using block diagram reduction techniques and signal flow graph method.
CO3-Analyze the time response specification, steady state errors, and error constants second order system.
CO4-Construction of Root Locus and determine stability.
CO5- Construction of Nyquist and bode plots to determine the stability of the system in frequency domain.

Text Books:

1. J.Nagarath and M.Gopal, ―Control Systems Engineering‖, New Age International (P) Limited, Publishers, Fifth edition-2005, ISBN: 81-224-2008-7.

Reference Books:

1. Control Systems,‖ A Anand Kumar ,Second Edition.
2. Modern Control Engineering,‖K.Ogata, Pearson Education Asia/PHI, 4th Edition, 2002. ISBN 978-81-203-4010-7.

COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):
Note: 1-Low, 2-Medium, 3-High

CO/PO	PO.1	PO.2	PO.3	PO.4	PO.5	PO.6	PO.7	PO.8	PO.9	PO.10	PO.11	PO.12	PSO.1	PSO.2	PSO.3
CO1	**3**	**3**	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	**3**	**3**	**3**	-	-	-	-	-	-	-	-	-	3	-	-
CO3	**3**	**3**	-	-	-	-	-	-	-	-	-	-	3	-	-
CO4	**3**	**3**	**3**	-	-	-	-	-	-	-	-	-	3	-	-
CO5	**3**	**3**	**3**	-	-	-	-	-	-	-	-	-	3	-	-

AUTOMOTIVEELECTRONICS

[As per Choice Based Credit System (CBCS) Scheme]

SEMESTER-VI

Subject Code	18EC642	CIE Marks	50
Number of Lecture Hour/Week	03	SEE Marks	50
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS-03

Course Objectives: This course will enable students to:

- Understand the basics of automobile dynamics and design electronics to complement those features.
- Design and implement the electronics that attribute the reliability, safety, and smartness to the automobiles, providing add-on comforts.

Module -1	**Teaching Hours**
Automotive Fundamentals Overview: Evolution of Automotive Electronics, Automobile Physical Configuration, Survey of Major Automotive Systems, The Engine – Engine Block, Cylinder Head, Four Stroke Cycle, Engine Control, Ignition System - Spark plug, High voltage circuit and distribution, Spark pulse generation, Ignition Timing, Diesel Engine, Drive Train - Transmission, Drive Shaft, Differential, Suspension, Brakes, Steering System. **The Basics of Electronic Engine Control:**Motivation for Electronic Engine Control – Exhaust Emissions, Fuel Economy, Concept of an Electronic Engine control system, Definition of General terms, Definition of Engine performance terms, Engine mapping, Effect of Air/Fuel ratio, spark timing and EGR on performance, Control Strategy, Electronic Fuel control system, Analysis of intake manifold pressure, Electronic Ignition. **(Text 1)** **RBT: L1,L2,L3**	08 Hours
Module -2	
Automotive Control System applications of Sensors and Actuators: Typical Electronic Engine Control System, Variables to be measured. **Automotive Sensors –**Airflow rate sensor, Strain Gauge MAP sensor, Engine Crankshaft Angular Position Sensor, Magnetic Reluctance Position Sensor, Hall effect Position Sensor, Shielded Field Sensor, Optical Crankshaft Position Sensor, Throttle Angle Sensor (TAS), Engine Coolant Temperature (ECT) Sensor, Exhaust Gas Oxygen (O2/EGO) Lambda Sensors, Piezoelectric Knock Sensor.**(Text 1)** \ **RBT: L1,L2,L3**	08 Hours
Module -3	
Digital Engine Control Systems – Digital Engine control features, Control modes for fuel Control (Seven Modes), EGR Control, Electronic Ignition Control - Closed loop Ignition timing, Spark Advance Correction Scheme, Integrated Engine Control System - Secondary Air Management, Evaporative Emissions Canister Purge, Automatic System Adjustment, System Diagnostics.**(Text 1)** **RBT: L1,L2,L3**	08 Hours
Module -4	
Vehicle Motion Control– Typical Cruise Control System, Digital Cruise Control System, Digital Speed Sensor, Throttle Actuator, Digital Cruise Control configuration, Cruise Control Electronics (Digital only), Antilock Brake System (ABS). **Automotive Diagnostics–** Timing Light, Engine Analyzer, Onboard diagnostics, Off-board diagnostics, Expert Systems, Occupant Protection Systems – Accelerometer based Air Bag systems.**(Text 1)** **RBT: L1,L2,L3**	08 Hours

Module -5	
Future Automotive Electronic Systems – Alternative Fuel Engines, Electric and Hybrid vehicles, Fuel cell powered cars, Collision Avoidance Radar warning Systems, Low tire pressure warning system, Heads Up display, Speech Synthesis, Navigation – Navigation Sensors - Radio Navigation, Signpost navigation, dead reckoning navigation, Voice Recognition Cell Phone dialing, Advanced Cruise Control, Stability Augmentation, Automatic driving Control. **(Text 1)** **RBT: L1,L2,L3**	08 Hours
Course outcomes: After studying this course, students will be able to: CO1-Understand and implement various control requirements in the automotive system. CO2-Apply the various control automotive sensors in the vehicle control. CO3-Analysis of various physical parameters that are to be sensed and monitored for maintaining the stability of the vehicle under dynamic conditions. CO4-Apply the controls and actuator system pertaining to the comfort and safety of commuters. CO5-Design and implement sensor network for mechanical fault diagnostics in an automotive vehicle.	
Text Books: 1. William B. Ribbens, "Understanding Automotive Electronics", 6th Edition, Elsevier Publishing.	
Reference Books: 1. Robert Bosch Gmbh (Ed.) Bosch Automotive Electrics and Automotive Electronics Systems and Components, Networking and Hybrid Drive, 5th edition, John Wiley& Sons Inc., 2007.	

COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING(1/2/3):

Note:1-Low, 2-Medium, 3-High

CO/PO	PO.1	PO.2	PO.3	PO.4	PO.5	PO.6	PO.7	PO.8	PO.9	PO.10	PO.11	PO.12	PSO.1	PSO.2	PSO.3
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	3	-	-
CO4	3	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO5	3	-	3	-	-	-	-	-	-	-	-	-	3	-	-

VLSI CIRCUITS LAB

[As per Choice Based Credit System (CBCS) Scheme]

SEMESTER-VI

Subject Code	18ECL65	CIE Marks	50
Number of Lecture Hour/Week	2P	SEE Marks	50
Total Number of Hours	20	Exam Hours	03

CREDITS-01

Course Objectives: This course will enable students to:

- Explore the CAD tool and understand the flow of the Full Custom IC design cycle.
- Learn DRC, LVS and Parasitic Extraction of the various designs.
- Design and simulate the various basic CMOS analog circuits and use them in higher circuits like data converters using design abstraction concepts.
- Design and simulate the various basic CMOS digital circuits and use them in higher circuits like adders and shift registers using design abstraction concepts.

List of Experiments:

Following Experiments to be done using MATLAB / SCILAB / OCTAVE or equivalent:

PART A
ASIC DIGITAL DESIGN

1. Write Verilog Code for the following circuits and their Test Bench for verification, observe the waveform and synthesize the code with technological library with given constraints*. Do the initial timing verification with gate level simulation.
   i. An inverter
   ii. A Buffer

iii. Transmission Gate
iv. Basic/universal gates
v. Flip flop -RS, D, JK, MS, T
vi. Serial & Parallel adder
vii. 4-bit counter [Synchronous and Asynchronous counter]
viii. Successive approximation register [SAR]

PART B
ANALOG DESIGN

1. Design an Inverter with given specifications**, completing the design flow mentioned below:
   a. Draw the schematic and verify the following
   i) DC Analysis
   ii) Transient Analysis
   b. Draw the Layout and verify the DRC, ERC
   c. Check for LVS
   d. Extract RC and back annotate the same and verify the Design
   e. Verify & Optimize for Time, Power and Area to the given constraint*

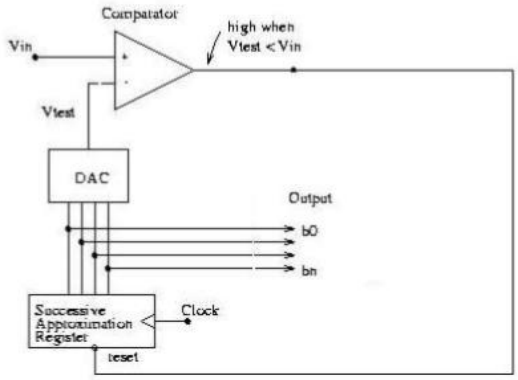
2. Design the (i) Common source and Common Drain amplifier and
   (ii) A Single Stage differential amplifier, with give specifications**, completing the design flow mentioned below:
   a. Draw the schematic and verify the following
   i) DC Analysis
   ii) AC Analysis
   iii) Transient Analysis
   b. Draw the Layout and verify the DRC, ERC

c. Check for LVS
d. Extract RC and back annotate the same and verify the Design.

3. Design an op-amp with given specification** using given differential amplifier Common source and Common Drain amplifier in library*** and completing the design flow mentioned below:
   a. Draw the schematic and verify the following
   i) DC Analysis
   ii). AC Analysis iii) Transient Analysis
   b. Draw the Layout and verify the DRC, ERC
   c. Check for LVS d. Extract RC and back annotate the same and verify the Design.

4. Design a 4 bit R-2R based DAC for the given specification and completing the design flow mentioned using given op-amp in the library***.
   a. Draw the schematic and verify the following
   i) DC Analysis
   ii) AC Analysis
   iii) Transient Analysis
   b. Draw the Layout and verify the DRC, ERC

5. For the SAR based ADC mentioned in the figure below draw the mixed signal schematic and verify the functionality by completing ASIC Design FLOW. [Specifications to GDS-II]



* An appropriate constraint should be given.
** Appropriate specification should be given.
*** Applicable Library should be added & information should be given to the Designer.

Course Outcomes: On the completion of this laboratory course, the students will be able to:
CO1- Develop a strong foundation in applying theoretical concepts by designing /simulating the experiment.
CO2-Utilize laboratory instruments/simulation tools to Build, and test experiments.
CO3- Analyze experimental data/simulation results and interpret findings to draw meaningful conclusions.
CO4- Learn to work effectively in teams while identifying and correcting faults in electronic circuits/programs.
CO5- Manage time effectively in a simulation/laboratory environment, balancing experimental work, data collection, and report writing within specified deadlines.

COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING(1/2/3):

Note:1-Low, 2-Medium, 3-High

CO/PO	PO.1	PO.2	PO.3	PO.4	PO.5	PO.6	PO.7	PO.8	PO.9	PO.10	PO.11	PO.12	PSO.1	PSO.2	PSO.3
CO1	3	2	3	-	-	-	-	-	-	-	-	-	-	3	-
CO2	2	3	1	-	3	-	-	-	-	-	-	-	-	3	-
CO3	2	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO4	2	3	2	-	-	-	-	3	3	2	-	-	-	3	-
CO5	2	2	2	-	-	-	-	3	-	3	3	-	-	3	-

EMBEDDED SYSTEM LAB

[As per Choice Based Credit System (CBCS) Scheme]

SEMESTER-VI

Subject Code	18ECL661	CIE Marks	50
Number of Lecture Hour/Week	2P	SEE Marks	50
Total Number of Hours	20	Exam Hours	03

CREDITS-01

Course Objectives: This course will enable students to:

- Understand the instruction set of ARM Cortex M3, a 32 bit microcontroller and the software tool required for programming in Assembly and C language.
- Program ARM Cortex M3 using the various instructions in assembly level language for different applications.
- Interface external devices and I/O with ARM Cortex M3.
- Develop C language programs and library functions for embedded system applications.

List of Experiments:

PART-A: Conduct the following Study experiments to learn ALP using ARM Cortex M3 Registers using an Evaluation board and the required software tool.

1. ALP to multiply two 16 bit binary numbers.
2. ALP to find the sum of first 10 integer numbers.

PART-B: Conduct the following experiments on an ARM CORTEX M3 evaluation board using evaluation version of Embedded 'C' & Keil uVision-4 tool/compiler.

1. Display ―Hello World‖ message using Internal UART.
2. Interface and Control a DC Motor.
3. Interface a Stepper motor and rotate it in clockwise and anti-clockwise direction.
4. Interface a DAC and generate Triangular and Square waveforms.
5. Interface a 4x4 keyboard and display the key code on an LCD.
6. Using the Internal PWM module of ARM controller generate PWM and vary its duty cycle.
7. Demonstrate the use of an external interrupt to toggle an LED On/Off.
8. Display the Hex digits 0 to F on a 7-segment LED interface, with an appropriate delay in between.
9. Interface a simple Switch and display its status through Relay, Buzzer and LED.
10. Measure Ambient temperature using a sensor and SPI ADC IC.

Course Outcomes: On the completion of this laboratory course, the students will be able to:

CO1- Develop a strong foundation in applying theoretical concepts by designing /simulating the experiment.

CO2-Utilize laboratory instruments/simulation tools to Build, and test experiments.

CO3- Analyze experimental data/simulation results and interpret findings to draw meaningful conclusions.

CO4- Learn to work effectively in teams while identifying and correcting faults in electronic circuits/programs.

CO5- Manage time effectively in a simulation/laboratory environment, balancing experimental work, data collection, and report writing within specified deadlines.

COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING(1/2/3):

Note:1-Low, 2-Medium, 3-High

CO/PO	PO.1	PO.2	PO.3	PO.4	PO.5	PO.6	PO.7	PO.8	PO.9	PO.10	PO.11	PO.12	PSO.1	PSO.2	PSO.3
CO1	3	2	3	-	-	-	-	-	-	-	-	-	-	3	-
CO2	2	3	1	-	3	-	-	-	-	-	-	-	-	3	-
CO3	2	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO4	2	3	2	-	-	-	-	3	3	2	-	-	-	3	-
CO5	2	2	2	-	-	-	-	3	-	3	3	-	-	3	-

MACHINE LEARNING LABORATORY

[As per NEP, Outcome based Education (OBE), and Choice Based Credit System (CBCS) Scheme]

SEMESTER-VI

Subject Code	22ECL672	CIE Marks	50
Number of Lecture Hour/Week	2P	SEE Marks	50
Total Number of Hours	24	Exam Hours	03

CREDITS-01

Course Objectives: This course will enable students to:

- Understand the Integrated development environments and deploying the code to specific microcontrollers
- Analyse the code written in platforms like C, C++, Python, Tensor flow, Google's Colab
- Understand microcontrollers like Arduino Nano, Sparkfun Edge and ST Microelectronics STM32F746G discovery kit for various applications
- Design Tiny ML applications
- Design model architecture, train, convert, run interface evaluate and troubleshoot

List of Experiments:

1. Build an application and deploy it to a microcontroller for turning LEDs on and off
2. Build an application for wake word detection and deploy it to a microcontroller
3. Build an application for person detection and deploy it to a microcontroller
4. Build an application for Magic Wand and deploy it to a microcontroller
5. For a given model optimize latency
6. Estimate, measure and improve the power usage for a model
7. Optimize the given model in terms of its binary size
8. Port a model from tensor flow to tensor flow lite

Course Outcomes: On the completion of this laboratory course, the students will be able to:

CO1-Understand and apply various Integrated development environments and deploying the code to specific microcontrollers.

CO2-Analyse the code written in platforms like C, C++, Python, Tensor flow, Google's Colab and make suitable changes for new applications

CO3-Evaluate and perform the optimization to achieve a certain goal and design Tiny ML applications.

CO4-Conduct experiments as individual, or teams by using modern tools.

CO5-Make an effective report based on experiment conducted.

COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):

Note: 1-Low, 2-Medium, 3-High

CO/PO	PO.1	PO.2	PO.3	PO.4	PO.5	PO.6	PO.7	PO.8	PO.9	PO.10	PO.11	PO.12	PSO.1	PSO.2	PSO.3
CO1	3	2	3	-	-	-	-	-	-	-	-	-	-	3	-
CO2	2	3	1	-	3	-	-	-	-	-	-	-	-	3	-
CO3	2	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO4	2	3	2	-	-	-	-	3	3	2	-	-	-	3	-
CO5	2	2	2	-	-	-	-	3	-	3	3	-	-	3	-

IOT TECHNOLOGY LAB

[As per Choice Based Credit System (CBCS) Scheme]

SEMESTER-VI

Subject Code	18ECL671	CIE Marks	50
Number of Lecture Hour/Week	2P	SEE Marks	50
Total Number of Hours	20	Exam Hours	03

CREDITS-01

Course Objectives: This course will enable students to:

- Understand the use of Raspberry Pi.
- Study the Interfacing of Gas, Soil Moisture, Ultrasonic sensor, Temperature sensor, and Humidity sensor to the Raspiberry Pi.
- Understand the use of Things speaks or xtrans cloud storage.
- Study the design of IoT application.

List of Experiments:

Following Experiments to be done using Python Application software

PART-A

1) Getting started with raspberry Pi 3B+- down loading OS, connecting to PC monitor and initial setup.
2) Study of various sensors- i) GAS Sensor ii) Soil Moisture Sensor iii) Light Sensor iv) Ultrasonic Distance Sensor v) Temperature and Humidity Sensor.
3) Interfacing GAS sensor to the Raspberry pi and test the working of GAS sensor and make the buzzer on.
4) Interfacing Soil moisture sensor to the Raspberry pi and test the working of soil moisture sensor and send the data to cloud.
5) Interfacing light sensor to the Raspberry pi and test the working of light sensor and send the data to cloud.
6) Interfacing Ultrasonic distance to the Raspberry pi and test the working of ultrasonic distance senor.
7) Interfacing Temperature & Humidity sensor to the Raspberry pi and test the working of Temperature & Humidity sensor.

PART-B

1) Live weather broadcasting using DHT11 and Things speak cloud/xtrans cloud.
2) Smart gas leakage email alerts using Things speak or xtrans alerts.
3) Weather display system using DHT11 and LCD display.
4) Object distance display using 7-segment display and Ultrasonic sensor.
5) Read the sensor data when specified key is pressed.

Course outcomes: After studying this course, students will be able to:.

CO1- Develop a strong foundation in applying theoretical concepts by designing /simulating the experiment.

CO2-Utilize laboratory instruments/simulation tools to Build, and test experiments.

CO3- Analyze experimental data/simulation results and interpret findings to draw meaningful conclusions.

CO4- Learn to work effectively in teams while identifying and correcting faults in electronic circuits/programs.

CO5- Manage time effectively in a simulation/laboratory environment, balancing experimental work, data collection, and report writing within specified deadlines.

COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING(1/2/3):

Note:1-Low, 2-Medium, 3-High

CO/PO	PO.1	PO.2	PO.3	PO.4	PO.5	PO.6	PO.7	PO.8	PO.9	PO.10	PO.11	PO.12	PSO.1	PSO.2	PSO.3
CO1	3	2	3	-	-	-	-	-	-	-	-	-	-	3	-
CO2	2	3	1	-	3	-	-	-	-	-	-	-	-	3	-
CO3	2	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO4	2	3	2	-	-	-	-	3	3	2	-	-	-	3	-
CO5	2	2	2	-	-	-	-	3	-	3	3	-	-	3	-

WIRELESS SENSOR NETWORK LAB

[As per Choice Based Credit System (CBCS) Scheme]

SEMESTER-VI

Subject Code	18ECL672	CIE Marks	50
Number Lab practice Hour/Week	02	SEE Marks	50
Total Number of Hours	20	Exam Hours	03
CREDITS-01			

Course Objectives:

This course will enable students to:

- Choose suitable tools to model a network and understand the protocols.
- Design a suitable network and simulate using a Network simulator tool.
- Simulate the Sensor networking concepts and protocols using C/C++ programming.
- List various applications of wireless and for solving wireless sensor network design issues.

Laboratory Experiments

Following Programs can be done using C/C++.

1) Write a program for first come first serve data transmission in WSN.
2) Write a program for congestion control for a network using leakage bucket algorithm.
3) Write a program for RSA Algorithm to encrypt and decrypt the confidential data for transmission across the network.
4) Write a program for Distance vector Hop algorithm to find the shortest path between the sensor nodes.
5) Write a program to obtain the CRC code for the given data and the generator polynomial. Verify the program without error.
6) Write a program to obtain the CRC code for the given data and the generator polynomial. Verify the program with error.

PART-B

Simulation experiments using NS2/ NS3/ OPNET/ NCTUNS/ NetSim/ QualNet or any other equivalent tool.

Analyze the sensor network by Implementing a point to point network with four nodes and duplex links between them. set the queue size and varying the bandwidth.

7) Implement a four node point to point Sensor network with links n0-n2, n1-n2 and n2-n3. Apply TCP agent between n0-n3 and UDP between n1-n3. determine the number of packets sent by TCP/UDP.
8) Implementation and create links between the source and destination using both FTP and TCP protocol for WSN.
9) create data transmission between the nodes using TCP
10) To simulate and study the Distance Vector routing algorithm using simulation.

Course outcomes: After studying this course, students will be able to:

CO1- Develop a strong foundation in applying theoretical concepts by designing /simulating the experiment.
CO2-Utilize laboratory instruments/simulation tools toBuild, and test experiments.
CO3- Analyze experimental data/simulation results and interpret findings to draw meaningful conclusions.
CO4- Learn to work effectively in teams while identifying and correcting faults in electronic circuits/programs.
CO5- Manage time effectively in a simulation/laboratory environment, balancing experimental work, data collection, and report writing within specified deadlines.

Reference Book

1.WIRELESS SENSOR NETWORKS Technology, Protocols, and Applications By kazemsohrabydanielminolitaiebznati.

COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING(1/2/3):

Note:1-Low, 2-Medium, 3-High

CO/PO	PO.1	PO.2	PO.3	PO.4	PO.5	PO.6	PO.7	PO.8	PO.9	PO.10	PO.11	PO.12	PSO.1	PSO.2	PSO.3
CO1	3	2	3	-	-	-	-	-	-	-	-	-	-	3	-
CO2	2	3	1	-	3	-	-	-	-	-	-	-	-	3	-
CO3	2	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO4	2	3	2	-	-	-	-	3	3	2	-	-	-	3	-
CO5	2	2	2	-	-	-	-	3	-	3	3	-	-	3	-

PROJECT-VI [As per, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme] SEMESTER-VI			
Subject Code	18PRJ68	CIE Marks	50
Number Lecture Hour/Week	2P	SEE Marks	50
Total Number of Hours	20	Exam Hours	03
CREDITS-01			

Course Objectives: Students will be taught to:

- Get exposure about the electronics hardware and various software tools.
- Design the working model of the open ended problem.
- Understand concepts of Packaging.
- Understand the latest technology trends in the PCB design.
- Prepare technical documentation of the project.

Students Will Be Given A Open Ended Problem Of The Society And Asked To Solve By Designing And Implementing The System In Team.

Course outcomes: After studying this course, students will be able to:

CO1- Apply the knowledge of electronics hardware and software components to solve the real time problems of the society.

CO2- Analyze the various existing solutions available to solve the real time problem and propose the best solution.

CO3- Design and implement the system to solve the real time problem of the society.

CO4- Conduct investigations on the output and prepare the technical documentation of the designed system in a team.

CO5- Use the modern tool available like advanced hardware and software tools.

COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING(1/2/3):

Note:1-Low, 2-Medium, 3-High

CO/PO	PO.1	PO.2	PO.3	PO.4	PO.5	PO.6	PO.7	PO.8	PO.9	PO.10	PO.11	PO.12	PSO.1	PSO.2	PSO.3
CO1	**3**	**2**	**-**	**-**	**2**	**2**	**-**	**-**	**3**	3	**-**	**3**	**-**	**3**	**-**
CO2	**3**	**3**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	-	**-**	**3**	**-**	**3**	**-**
CO3	**3**	**3**	**3**	**2**	**3**	**2**	**2**	**-**	**3**	**3**	**2**	**3**	**-**	**3**	**-**
CO4	**3**	**3**	**3**	**2**	**-**	**-**	**-**	**3**	**3**	**3**	**3**	**3**	**-**	**3**	**-**
CO5	**-**	**-**	**-**	**-**	**3**	**-**	**-**	**3**	**3**	**3**	**3**	**3**	**-**	**3**	**-**

PROFESSIONAL ETHICS

[As per Choice Based Credit System (CBCS) Scheme]

SEMESTER-VI

Subject Code	18HSM69	CIE Marks	50
Number of Lecture Hour/Week	1L	SEE Marks	50
Total Number of Lecture Hours	20	Exam Hours	03

CREDITS-01

Course Objectives:

- To enable the students to create an awareness on Engineering Ethics and Human Values,
- To instill Moral and Social Values and Loyalty and to appreciate the rights of others.

Module -1	**Teaching Hours**
HUMAN VALUES : Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management **RBT: L1,L2**	04 Hours
Module -2	
ENGINEERING ETHICS: Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories **RBT: L1,L2**	04 Hours
Module -3	
ENGINEERING AS SOCIAL EXPERIMENTATION: Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law. **RBT: L1,L2**	04 Hours
Module -4	
SAFETY, RESPONSIBILITIES AND RIGHTS: Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination **RBT: L1,L2**	04 Hours
Module -5	
GLOBAL ISSUES: Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership –Code of Conduct – Corporate Social Responsibility **RBT: L1,L2**	04 Hours

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

CO1-Incorporate morals, values, ethics, and personal development in the workplace to create a positive culture and contribute to societal advancement.

CO2- Apply engineering ethics and theories to tackle moral issues and foster moral development.

CO3- Follow ethical guidelines as responsible experimenters, ensuring accountability through codes of ethics and legal duties.

CO4- Understand the safety, responsibilities and rights associated with professional ethics in both the workplace and society.

CO5- Understand and apply professional ethics to effectively navigate and address the complex challenges in modern engineering environments.

Text Books:

1. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2003.

2. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.

Reference Books:

1. Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.
2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics – Concepts and Cases", Cengage Learning, 2009.
3. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003
4. Edmund G Seebauer and Robert L Barry, "Fundametals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001
5. Laura P. Hartman and Joe Desjardins, "Business Ethics: Decision Making for Personal Integrity and Social Responsibility" Mc Graw Hill education, India Pvt. Ltd.,New Delhi 2013.
6. World Community Service Centre, " Value Education", Vethathiri publications, Erode, 2011

COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING(1/2/3):

Note:1-Low, 2-Medium, 3-High

CO/PO	PO.1	PO.2	PO.3	PO.4	PO.5	PO.6	PO.7	PO.8	PO.9	PO.10	PO.11	PO.12	PSO.1	PSO.2	PSO.3
CO1	-	-	-	-	-	3	2	2	2	3	2	3	-	-	3
CO2	-	-	-	-	-	3	2	3	3	3	2	3	-	-	3
CO3	-	-	-	-	-	2	2	3	3	3	3	3	-	-	3
CO4	-	-	-	-	-	3	2	3	3	3	3	3	-	-	3
CO5	-	-	-	-	-	3	3	3	3	3	3	3	-	-	3