Sharnbasva University, Kalaburagi
Scheme of Teaching and Examination2022-23
[As per NEP, Outcome Based Education(OBE) and Choice Based Credit System(CBCS) Scheme]
(Effective from the academic year 2022-23)

Programme :B.Tech: Electronics and Communication Engineering

V SEMESTER

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	Total Marks	
					L	T	P					
1	HSS	22HSM51	Management and Entrepreneurship Development	ECE	3			3	50	50	100	03
2	PCC	22EC52	Digital Signal Processing	ECE	3	1		3	50	50	100	04
3	PCC	22EC53	Electromagnetic waves and Antennas	ECE	3			3	50	50	100	03
4	PEC	22EC54X	Professional Elective Course-I	ECE	3			3	50	50	100	03
5	OEC	22XX55X	Open Elective Course-I	ECE	4			3	50	50	100	04
6	PCC	22ECL56	Digital Signal Processing Laboratory	ECE			2	3	50	50	100	01
7	PCC	22ECL57	Electromagnetic waves and Antennas Laboratory	ECE			2	3	50	50	100	01
8	PEC	22ECL58X	Professional Elective Course-I Laboratory	ECE			2	3	50	50	100	01
9	PW	22PRJ59	Project-V	ECE			2	3	50	50	100	01
10	AEC	22AEC510X	Ability Enhancement Course-V	ECE			2	3	50	50	100	01
Total					**16**	**1**	**10**	**30**	**500**	**500**	**1000**	**22**

Note: PCC- Programme Core Course, PEC- Professional Elective Course, PW-Project Work, HSS-Humanity and Social Science, OEC- Open Elective Course, AEC- Ability Enhancement Course, UHV- Universal Human Values.

Project(PRJ): A batch of 4 to 5 students (Same branch or different branches) with a guide, may undertake one project (1 hour of theory/tutorial or two hours of practice /activities.

Professional Elective Course-I			
Course code under 22EC54X	**Course Title**	**Coursecodeunder22ECL58X**	**Course Title**
22EC541	Verilog HDL	22ECL581	Verilog HDL Laboratory
22EC542	Optical Fiber Communication	22ECL582	Optical Fiber Communication laboratory

Open Elective Course-I	
Course code under 22XX55X	**Course Title**
22EC551	Internet of Things
22EC552	Microcontroller and Microprocessor

Ability Enhancement Course-V	
Course code under 22AEC510X	**Course Title**
22AEC510A	Research Article/Report Reading and Writing
22AEC510B	C++ Basics

AICTE Activity Points: In case students fail to earn the prescribed activity points, eighth semester Grade Card shall be issued only after earning the Required activity points. Student shall be admitted for the award of the degree only after the release of the Eighth semester Grade Card.

Sharnbasva University, Kalaburagi

Scheme of Teaching and Examination-2022-23

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

(Effective from the academic year 2022-23)

Programme: B.Tech: Electronics and Communication Engineering

VI SEMESTER

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	Total Marks	
					L	T	P					
1	PCC	22EC61	VLSI Circuits	ECE	3			3	50	50	100	03
2	PCC	22EC62	Control system	ECE	2	1		3	50	50	100	03
3	PEC	22EC63X	Professional Elective Course-II	ECE	3			3	50	50	100	03
4	PEC	22EC64X	Professional Elective Course-III	ECE	3			3	50	50	100	03
5	OEC	22XX65X	Open Elective Course-II	ECE	4			3	50	50	100	04
6	PCC	22ECL66	VLSI Circuits Laboratory	ECE			2	3	50	50	100	01
7	PEC	22ECL67X	Professional Elective Course-II Laboratory	ECE			2	3	50	50	100	01
8	PEC	22ELC68X	Professional Elective Course-III Laboratory	ECE			2	3	50	50	100	01
9	PW	22PRJ69	Project-VI	ECE			2	3	50	50	100	01
10	HSS	22HSM610	Professional Ethics	ECE	1			3	50	50	100	01
11	AEC	22AEC611X	Ability Enhancement Course-VI	ECE			2	3	50	50	100	01
Total					**16**	**1**	**10**	**33**	**550**	**550**	**1000**	**22**

Note: PCC-Professional Core Course, PEC-Professional Elective Course, OEC-Open Elective Course, PW-Project Work, HSS-Humanity and Social Science, AEC-Ability Enhancement Course. UHV- Universal Human Values, OC-Online Course.

Project(PRJ): A batch of 4 to 5 students (Same branch or different branches) with a guide, may undertake one project (1 hour of theory/tutorial or two hours of practice /activities

Professional Elective Course-II			
Course code under 22EC63X	**Course Title**	**Course code under 22ECL67X**	**Course Title**
22EC631	ARM Cortex M3 & Embedded Systems	22ECL671	Embedded Systems Laboratory
22EC632	Tiny Machine Learning	22ECL672	Machine Learning Laboratory

Professional Elective Course-III			
Course code under 22EC64X	**Course Title**	**Course code under 22ECL68X**	**Course Title**
22EC641	Programming using Python	22ECL681	Programming using Python Laboratory
22EC642	IoT Technology	22ECL682	IoT Technology Laboratory

Open Elective Course-II	
Course code under 22EC65X	**Course Title**
22EC651	Embedded Systems
22EC652	Introduction to UAV Electronics

Ability Enhancement Course-VI	
Course code under 22AEC611X	**Course Title**
22AEC611A	Antenna Design Simulation
22AEC611B	Design of VLSI Circuits using LT spice

AICTE Activity Points: In case students fail to earn the prescribed activity points, Eighth semester Grade Card shall be issued only after earning the Required activity points. Student shall be admitted for the award of the degree only after the release of the Eighth semester Grade Card.

MANAGEMENT AND ENTREPRENEURSHIP DEVELOPMENT

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

SEMESTER-V

Subject Code	22HSM51	CIE Marks	50
Number 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:

- 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: Introduction-Meaning-Nature and characteristics of management, Scope and Functional areas of management- Management as art of science, art or profession-Management & Administration-Roles of Management, Levels of Management, Development of Management Thought-Early management approaches-Modern management approaches. **Planning**: Nature, Importance and purpose of planning process objectives-types of plans (meaning only)-decision making, Importance of planning-steps in planning & planning premise- Hierarchy of plans.	08 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 Vs Decentralization of Authority and Responsibility; **Staffing-**Need and Importance, Recruitment and Selection Process. **Directing:** 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;	08 Hours
Module -3	
Coordination: Coordination-Meaning, Types, Techniques of Coordination; **Controlling** – Meaning, Need for Control System, Benefits of Control, Essentials of Effective Control System, Steps in Control Process. **Authority delegation:** Meaning, advantage of effective delegation, barriers to effective delegation, guidelines for effective delegation. Decentralization: Decentralization of authority meaning, distinction between delegation and decentralization, the trade-off of centralization and decentralization.	08 Hours
Module -4	
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.	08 Hours

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) .	
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.	08 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	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

DIGITAL SIGNAL PROCESING

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

SEMESTER-V

Subject Code	22EC52	CIE Marks	50
Number of Lecture Hour/Week	4L	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)**	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)**	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)**	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)**	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)**	10 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.Ganesh Rao, Vineeta P.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	22EC53	CIE Marks	50
Number 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:

- 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.
- Introduce and discuss different types of Antennas, various terminologies, excitations.
- Study different types of Arrays, Pattern-multiplication, design antennas like Yagi-Uda, Helical antennas and other broad band antennas.

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)	08 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)	08 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(8.5,8.6,10.1,10.2,10.3,10.4,12.1,12.2,12.3of Text1)	08 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)	08 Hours
Module -5	
Antenna Types: Helical Antenna, Yagi-Uda antenna, corner reflectors, parabolic reflectors, log periodic antenna, lens antenna, antenna for special applications – sleeve antenna, turnstile antenna, omni directional antennas, antennas for satellite, antennas for ground penetrating radars, embedded antennas, ultra wide band antennas, plasma antenna. Patch or Microstrip Antennas (8.1-8.3,9.3,9.9,10.115.6,15.7,15.9,15.26-15.29 ,16-12 of Text 2)	08 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 NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]

SEMESTER-V

Course Code	22EC541	CIE Marks	50
Number of Lecture Hours/Week	3L	SEE Marks	50
Total Number of Lecture Hours	40	Exam Hours	03hrs

CREDITS–03

Course Learning Objectives:

- Learn different Verilog HDL constructs.
- Understand the basic concepts and internals of module.
- Understand different aspects of gate level design and constructs.
- Understand behavioral statements, Verilog Tasks, Functions and Directives.
- 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. (Text1: CH. 1, 2)	**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. (Text1: CH. 3, 4)	**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, Examples. **Dataflow Modeling:** Continuous assignments, delay specification, expressions, operators, operands, operator types. (Text1: CH. 5, 6.1, 6.2, 6.3, 6.4, 6.5)	**08 Hours**
Module 4	
Behavioral Modeling: Structured procedures, initial and always, blocking and non-blocking statements, regular delay control, event based timing control, conditional statements, Multiway branching-case statement, loops, Examples. **Tasks and functions:** differences between tasks and functions, tasks and functions with examples. (Text1: CH. 7.1-7.6, 7.9.1, 7.9.2, 8.1, 8.2, 8.3.1, 8.3.2)	**08 Hours**
Module 5	
Switch level modeling: switch modeling elements: MOS switches, CMOS switches, bidirectional switches, power & ground, 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. (Text1: CH. 11, 14.1, 14.2, 14.3, 14.4, 14.6)	**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 Book:

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**	**-**	**-**

OPTICAL FIBER COMMUNICATION

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

SEMESTER-V

Subject Code	22EC542	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:

- Learn the basic principle of optical fiber communication with different modes of light propagation.
- Understand the transmission characteristics and losses in optical fiber.
- Study of optical components and its applications in optical communication networks.
- Learn the network standards in optical fiber and understand the network architectures along with its functionalities.

Modules	Teaching Hours
Module-1	
Optical fiber Communications: Historical development, The general system, Advantages of optical fiber communication, Optical fiber wave guides :Ray theory transmission, Modes in planar guide, Phase and group velocity, Cylindrical fiber: Modes, Step index fibers, Graded index fibers, Single mode fibers, Cutoff wavelength ,Mode field diameter, effective refractive index. Fiber Materials, Photonic crystal fibers. Text book 2: Chapter 1 and 2	**08Hours**
Module-2	
Transmission characteristics of optical fiber: Attenuation, Material absorption losses, Linear scattering losses, Nonlinear scattering losses, Fiber bend loss, Dispersion, Chromatic dispersion, Intermodal dispersion: Multimode step index fiber. Optical Fiber Connectors: Fiber alignment and joint loss, Fiber splices: Fusion Splices, Mechanical splices, Fiber connector, Cylindrical ferrule connectors, Duplex and Multiple fiber connectors. Fiber couplers: three and four port couplers, star couplers, Optical Isolators and Circulators. Text book 2: Chapter 3 and 5	**08Hours**
Module-3	
Optical sources: Light Emitting diodes: LED Structures, Light Source Materials, Quantum Efficiency and LED Power, Modulation. **Laser Diodes:** Modes and Threshold conditions, Rate equation, External Quantum Efficiency, Resonant Frequencies. **Photo-detectors**: Physical principles of Photodiodes, Photo detector noise, Detector response time. **Optical Receiver:** Optical Receiver Operation: Error Sources, Front End Amplifiers. Text book 1: Chapter 4:4.2,4.3, Chapter 6:6.1,6.2,6.3,Chapter 7:7.1	**08Hours**
Module-4	
WDM Concepts and Components: Overview of WDM: Operational Principles of WDM,WDM standards. **Optical amplifiers:** Basic application and Types, Semiconductor optical amplifiers, Erbium Doped Fiber Amplifiers, Raman Amplifiers, Wideband Optical Amplifiers. Text book 1: Chapter 10:10.1,10.8,Chapter 11:11.1,11.2,11.3	**08 Hours**

Module-5	
OPTICAL AMPLIFIERS AND NETWORKS: optical amplifiers, basic applications and types, semiconductor optical amplifiers, EDFA. Optical Networks: Introduction, SONET / SDH, Optical Interfaces, SONET/SDH rings, High – speed light – waveguides. Text book 1: Chapter 13:13.1,13.2,13.3.	**08 Hours**

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

CO1-Comprahend the construction and working principle of optical connectors, multiplexers, amplifiers, Optical sources, and detectors.

CO2-Analyze the Applications of Semiconductor optical amplifiers, Erbium Doped Fiber Amplifiers, Raman Amplifiers, and Wide band Optical Amplifiers.

CO3-Analyze the various transmission losses in the optical fiber.

CO4-Analyzethenetworkingaspectsofopticalfiberanddescribevariousstandardsassociatedwithit.

CO5-Design and interface issues of SONET/SDH optical networks.

Text Books:

1. Gerd Keiser, Optical Fiber Communication, 4th Edition, Mc Graw Hill Education (India) Private Limited, 2015. ISBN:1-25-900687-5.
2. John M Senior, Optical Fiber Communications, Principles and Practice, 3rd Edition, Pearson Education, 2010, ISBN:978-81-317-3266-3.

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**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**
CO4	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**
CO5	**3**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

INTERNET OF THINGS
[As per Choice Based Credit System (CBCS) Scheme]
SEMESTER-V

Subject Code	22EC551	CIE Marks	50
Number Lecture Hour/Week	4L	SEE Marks	50
Number of Lecture Hours	50	Exam Hours	03

CREDITS-04

Course Objectives: This course will enable students to:

- Understand the overview of IoT, Physical and Logical Design of IoT.
- Studying the similarity between M2M & IoT and its system management.
- Understand IoT platform design methodology.
- Know the IoT physical devices and Python programming concept.
- Understand the role of IoT in various domains of applications.

Module -1	**Teaching Hours**
Introduction to Internet of Things **Introduction:** Definition, and Characteristics of IoT, **Physical Design of IoT**: Things in IoT, IoT Protocols **Logical Design of IoT**: IoT Functional Blocks, IoT Communication Models, IoT communication APIs **IoT Enabling Technologies:** Wireless sensor networks, Cloud computing, Big data analytics, communication protocol, Embedded systems **IoT levels and Deployment Templates:** IoT level1 to Level 6 (Chapter 1)	10 Hours
Module -2	
IoT and M2M: M2M, Difference between IoT and M2M, Software defined networking and network function virtualization **IoT System Management with NETCONF-YANG:** Need for IoT System Management, SNMP, Network operator requirements, NETCONF, YANG,IoT System Management with NETCONF-YANG. (Chapter 3 & 4)	10 Hours
Module -3	
IoT Platforms Design Methodology: Introduction, IoT Design Methodology, Purpose and Requirements Specification, Process Specification, Domain model Specification, Information Model specification, service specifications, IoT level Specifications, Functional view specifications, operational view specifications, Device and component Integration, Application Development, Motivation for Using Python(chapter-5)	10 Hours
Module -4	
IoT Systems- Logical Design using Python: Introduction, Installing Python, Python Data Types and Data Structures, Control Flow, Functions, Modules, Packages, File handling, Python Packages. **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)	10 Hours
Module -5	
Domain Specific IoTs and its Applications: Home automation, Cities, Environment Energy, Retail, logistics, Agriculture, Industry, Health and life style **IoT applications:** Smart lighting, smart parking, whether monitoring system, air pollution monitoring, forest fire detection, smart irrigation. (Chapter-2 & 9)	10 Hours

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

CO1-Define and illustrate architectural view of IoT and analyze all the six levels of IoT deployment templets.

CO2-Compare M2M & IOT and applications of NETCONF-YANG in IoT system management.

CO3-Analyse various IoT design methodology specifications.

CO4-Logical and physical design of IoT system using Python and Respberry Pi.

CO5-Design IoT system for Home automation, cities, energy, environment, retail, logistic, agriculture, industry, health and life style.

Text Books:

1. Arshdeep Bhaga and Vijay Madisetti, "Internet of Things – A Hands-on Approach 2014

Reference Book:

3. Raj Kamal, "Internet of Things- Architecture and Design Principles", McGraw Hill Education.
4. Qusay F. Hassan, Internet of Things A to Z Technologies and Applications, IEEE press, WILEY, ISBN:978-1-111-945674-2.

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**	**-**	**-**

MICROCONTROLLER AND MICROPROCESSOR

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

SEMESTER-V

Subject Code	22EC552	CIE Marks	50
Number of Lecture Hours/Week	4L	SEE Marks	50
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS-04

Course objectives: Students will be taught to:

- Understand the basics of microcontroller, Embedded systems and architecture of 8051microcontrollers.
- Explain and analyze the instruction sets of 8051microcontrollers and also to write the Assembly Level Programs using8051 Instruction set.
- Understand and write peripheral programming for timers, serial port and Interrupt system of 8051.
- Analyze the Application and Interfacing of 8051MicrocontrollertoI/O devices.
- To develop an Understand the basics of microprocessors. Architecture of 8086 microprocessors.
- Analyze and write the Assembly language programs of 8086

Module -1	Teaching Hours
8051 Microcontroller: Microprocessor Vs Microcontroller, Embedded Systems, Embedded Microcontrollers, 8051 Architecture- Registers, Pin diagram, I/O ports functions, Internal Memory organization. External Memory (ROM & RAM) interfacing.	**08 Hours**
Module -2	
8051 Instruction Set: Addressing Modes, Data Transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, Bit manipulation instructions. Simple Assembly language program examples (without loops) to use these instructions.	**08 Hours**
Module -3	
8051 Interrupts and Interfacing Applications: 8051 Interrupts. 8051 Assembly language programming to generate an external interrupt using a switch, 8051 C programming to generate a square waveform on a port pin using a Timer interrupt. Interfacing 8051 to ADC-0804, DAC, LCD and Stepper motor and their 8051 Assembly language interfacing programming	**08 Hours**
Module -4	
8086 Architecture: 8086 Architecture-Functional diagram, Register Organization, Memory Segmentation, Programming Model, Memory addresses, Physical Memory Organization, Architecture of 8086, Signal descriptions of 8086, interrupts of 8086.	**08 Hours**
Module -5	
Instruction Set and Assembly Language Programming of 8086: Instruction formats, Addressing modes, Instruction Set, Assembler Directives, Macros, and Simple Programs involving Logical, Branch and Call Instructions, Sorting, String Manipulations.	**08 Hours**

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

CO1-Understand and analyze basics of microcontroller and microprocessor.

CO2- Develop 8051 application specific programs using 8051 instructions set.

CO3-Analyze the interfacing of 8051microcontroller to various I/O devices.

CO4- Apply the 8086 instruction set to write the programs.

CO5- Investigate the performance of all the microprocessors starting from Pentium-IV to i7 and submit a report.

Text Books:

1. "The 8051 Microcontroller and Embedded Systems – using Assembly and C", Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D. McKinlay; PHI, 2006 / Pearson, 2006.
2. "The 8051 Microcontroller", Kenneth. J Ayala,3rd Edition, Thomson /Cengage Learning.
3. Advanced Microprocessors and Peripherals – A. K. Ray and K.M. Bhurchandani, MHE, 2nd Edition 2006.

Reference Book:

1. "The 8051 Microcontroller Based Embedded Systems", Manish K Patel, McGraw Hill, 2014, ISBN:978-93-329-0125-4.
2. "Microcontrollers: Architecture, Programming, Interfacing and System Design", Raj Kamal, Pearson Education,2005.
3. Microprocessors and Interfacing, D. V. Hall, MGH, 2nd Edition 2006.

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	-	-	-	-	-	-	-	-	-	3	-	-
CO3	2	3	-	-	-	-	-	-	-	-	-	-	3	-	-
CO4	3	2	3	-	-	-	-	-	-	-	-	-	3	-	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-	3	-	-

DIGITAL SIGNAL PROCESING LABORATORY

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

SEMESTER-V

Subject Code	22ECL56	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:

- 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 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- Analyse 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 LABORATORY

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

SEMESTER-V

Subject Code	22ECL57	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 of microstrip dipole
3. Measurement of gain of microstrip dipole
4. Measurement of directivity of Yagi antennas.
5. Measurement of gain of Yagi antennas.
6. Measurement of directivity of horn antennas
7. Measurement of gain of horn antennas.
8. Impedance measurements of Horn/Yagi/dipole/Parabolic antennas
9. Determination of Coupling and isolation characteristics of microstrip directional coupler.
10. Resonance characteristics of microstrip ring resonator and computation of dielectric constant of the substrate.
11. Power division and isolation of microstrip power divider.
12. Measurement of cross and co-polarisation of an antenna.

Course Outcomes: After studying this 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-Analyse 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	-

VERILOG HDL LABORATORY

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

SEMESTER-V

Laboratory Code	22ECL581	CIE Marks	50
Number of Lecture Hours/Week	2P	SEE Marks	50
Total Number of Lecture Hours	24	Exam Hours	03

CREDITS – 01

Course Learning 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.
- Use Verilog 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.

Laboratory 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. Multiplexer, de-multiplexer.
3. Write a Verilog code to describe the functions of a Full Adder using three modeling styles.
4. Develop the Verilog code for 4 bit ripple carry adder.
5. Develop the Verilog code for 4 bit parallel multiplier.
6. Develop the Verilog code for the following flip-flops, SR, D, JK and T.
7. Design a 4 bit binary counters (Synchronous reset and Asynchronous reset).
8. Design 4 bit ALU and write a Verilog Code.
9. Write Verilog HDL code to control speed, direction of DC and Stepper motor.
10. Write Verilog HDL code to generate different waveforms (Sine, Square, Triangle, Ramp etc.,) using DAC - change the frequency.

Course Outcomes: After studying this 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- Analyse 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	-

OPTICAL FIBER COMMUNICATION LABORATORY

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

SEMESTER-V

Subject Code	22ECL582	CIE Marks	50
Number of Lecture Hour/Week	2P	SEE Marks	50
Total Number of Lecture Hours	24	Exam Hours	03

CREDITS-01

Course Objectives: This course will enable students to:

- Performance comparison of optical link using LED and LASER for specific distance.
- Performance Evaluation of Point to point optical link at different distances and for different transmitter powers.
- Performance comparison of optical link receivers and for different fibers.
- Impact of optical amplifiers on link performance.

Experiments

1. To study the VI & PI characteristics of the FO-LED.
2. To study the VI & PI characteristics of the Laser Diode.
3. Real time Temperature sensor data transfer using fiber optic
4. To study the transfer Characteristics between the DETECTOR and SOURCE with simplex cable.
5. To study the VOICE communication over the fiber optic cable.
6. To study Voice communication using CODEC.
7. To study PWM signal communication using fiber optic.
8. To study digital data transmission with LED and switch.
9. To set up Fiber Optic Analog and fiber Optic Digital link.
10. Measurement of Propagation loss and numerical aperture.
11. Measurement of optical power bending loss in a plastic optical fiber.
12. Study and measure characteristics of fiber optic LED's, LDR and Laser diode.

Course Outcomes: After studying this 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- Analyse 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 Books:

1.GerdKeiser,"OpticalFiberCommunication"McGraw–HillInternational,4th Edition 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	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 NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme] SEMESTER-V			
Subject Code	22PRJ59	CIE Marks	50
Number Lecture Hour/Week	2P	SEE Marks	50
Total Number of Lecture Hours	24	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**	**-**

RESEARCH ARTICLE/REPORT READING AND WRITING [As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme] SEMESTER-V			
Subject Code	22AEC510A	CIE Marks	50
Number Lecture Hour/Week	2P	SEE Marks	50
Total Number of Lecture Hours	24	Exam Hours	03
CREDITS-01			

Course Objectives: Students will be taught to:

- Download the research articles from the digital platforms and read it.
- Understand the various sections of the research article.
- How to review the literature?
- How to formulate the research problem statement?
- How to design the methodology, represent the result, write the research article and publish it.

EVERY WEEK STUDENTS WILL BE GIVEN ONE RESEARCH ARTICLE AND MAKE THEM TO READ UNDERSTAND AND ANALYZE IT.

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

CO1-Independently down load the research articles of their interested domain and read it.
CO2-Analize the various sections of the research paper and present it using power point/chart.
CO3- Do the proper literature survey and submit the report individual/ group.
CO4-Design various sections of the research paper like introduction, literature review, methodology, result and conclusions.
CO5- Write the research article and publish in indexed journals/ submit report.

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**	**-**

C++ BASICS

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

SEMESTER-V

Course Code	22AECL510B	CIE Marks	50
Number of Lecture Hour/Week	2P	SEE Marks	50
Number of Lecture Hours	24	Exam hours	03

CREDITS-01

Course Objectives: Students will be taught to:

- Introduces object-oriented programming concepts using the C++ language.
- Introduces the principles of data abstraction, inheritance and polymorphism;
- Introduces the principles of virtual functions and polymorphism
- Introduces handling formatted I/O and unformatted I/O
- Introduces exception handling

Module -1

1. Write a C++ Program to display Names, Roll No., and grades of 3 students who have appeared in the examination. Declare the class of name, Roll No. and grade. Create an array of class objects. Read and display the contents of the array.
2. Write a C++ program to declare Struct. Initialize and display contents of member variables.
3. Write a C++ program to declare a class. Declare pointer to class. Initialize and display the contents of the class member.
4. Given that an EMPLOYEE class contains following members: data members: Employee number, Employee name, Basic, DA, IT, Net Salary and print data members.
5. Write a C++ program to read the data of N employee and compute Net salary of each employee (DA=52% of Basic and Income Tax (IT) =30% of the gross salary).
6. Write a C++ to illustrate the concepts of console I/O operations.
7. Write a C++ program to use scope resolution operator. Display the various values of the same variables declared at different scope levels.
8. Write a C++ program to allocate memory using new operator.
9. Write a C++ program to create multilevel inheritance. (Hint: Classes A1, A2, A3)
10. Write a C++ program to create an array of pointers. Invoke functions using array objects.
11. Write a C++ program to use pointer for both base and derived classes and call the member function. Use Virtual keyword.

Course Outcomes: After studying this 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-Analyse 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	-

VLSI CIRCUITS

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

SEMESTER-VI

Subject Code	22EC61	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: 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 trade-offs involved indesigning and realizing the circuits in CMOS technology
- Cultivate the concepts of Memory and subsystem design processes.
- Exemplify single-stage amplifiers
- Describe Differential amplifier and Current Mirrors.

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)**	08 Hours
Module -2	
MOS and BiCMOS Circuit Design Process: MOS Layers, Stick Diagrams, Design Rules and Layout, VLSI Design Flow. **(Text 3)** Sheet Resistance, Area Capacitance of Layers, Standard Unit of Capacitance, Scaling Models and Scaling factors, Scaling Factors for Device Parameters. **(Text 3)**	08 Hours
Module -3	
Memory: SRAM, DRAM, read only memory, Serial Access Memory, programmable Logic array. **(Text 1)** **Subsystem Design:** Some architectural issues, Pseudo nMOS logic, Dynamic CMOS Logic, C^2MOS logic, CMOS Domino logic**(Text 3)**	08 Hours
Module -4	
Single Stage Amplifier: Common Source Stage, Source Follower,Common gate Stage, Cascode Stage. **(Text 2)**	08 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)**	08 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 transistor.

CO2- Develop the ability to create and interpret gate layouts and stick diagrams for basic circuits while adhering to design rules, and analyze and apply scaling models to predict the impact of device miniaturization.

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

CO4- Design and analyze the performance parameters of a single-stage and cascode amplifier.

CO5-Design and analyze a differential amplifier 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
3. " Basic VLSI Design ", Douglass A. Pucknell & Kamran Eshraghian,PHI 3rd Edition(orginal edition 1994)2005.

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	-	-

CONTROL SYSTEM

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

SEMESTER-VI

Subject Code	22EC62	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:

- 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 .
- Know how to find time response and analyze the stability of a system from the transfer function.
- 5. To learn various methods for analyzing the time response, frequency response and stability of the systems

Module -1	Teaching Hours
INTRODUCTION TO CONTROL SYSTEMS: Basic control system and its classifications, Servomechanics, Differential Equation Of Physical Systems: Mechanical Systems, Electrical Systems, Analogous Systems (mentioned system numerical's) (Text1& Ref 1)	**08 Hours**
Module -2	
MODELING A CONTROL SYSTEM: Transfer functions, Block diagram algebra and Signal Flow graphs.	**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. (Text1& Ref 1)	**08 Hours**
Module -4	
STABILITY ANALYSIS AND ROOT LOCUS: Concepts of stability, Necessary conditions for Stability, Routh stability criterion, Introduction to Root Locus Techniques ,The root locus concepts, Construction of root loci.(Text1& Ref 1)	**08 Hours**
Module -5	
FREQUENCY DOMAIN ANALYSIS AND STABILITY: Correlation between time and frequency response, Bode Plots, Nyquist Stability criterion.(Text1 & Ref 1)	**08 Hours**

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

CO1- Derive and analyze Mechanical and Electrical Systems using analogous system.

CO2- Analyze the transfer functions of block diagram algebra, and signal flow graphs for system analysis.

CO3- Analyze the time response specification and evaluate steady state errors and error constants for different types of input signals.

CO4- Develop root locus diagrams and analyze the system dynamics for stability assessment.

CO5- Assess the stability of control systems in frequency domain using the Nyquist and Bode plots.

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	2	3	3	-	-	-	-	-	-	-	-	-	3	-	-
CO5	2	3	3	-	-	-	-	-	-	-	-	-	3	-	-

ARM CORTEX-M3 & EMBEDDED SYSTEMS

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

SEMESTER-VI

Subject Code	22EC631	CIE Marks	50
Number Lecture Hour/Week	3L	SEE Marks	50
Number of Lecture Hours	40 Hours	Exam Hours	03

CREDITS-03

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

- Understand the basic hardware components and their selection method based on the characteristics and attributes of an embedded system.
- Develop the hardware software co-design and firmware design approaches.
- Explain the need of real time operating system for embedded system applications
- 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.

Modules	Teaching Hours
Module -1	
Embedded System Components: Embedded Vs General computing system, Classification of Embedded systems, Major applications and purpose of ES. Elements of an Embedded System (Block diagram and explanation), Differences between RISC and CISC, Harvard and Von-neumann, Big and Little Endian formats, Memory (ROM and RAM types), Sensors, Actuators, Optocoupler, Communication Interfaces (I2C, SPI, IrDA, Bluetooth, Wi-Fi, Zigbee only) **(Text 1: All the Topics from Ch-1 and Ch-2 (Fig and explanation before 2.1) 2.1.1.6 to 2.1.1.8, 2.2 to 2.2.2.3, 2.3 to 2.3.2, 2.3.3.3, selected topics of 2.4.1 and 2.4.2 only).**	**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 Modeling (excluding UML), Embedded firmware design and development (excluding C language). **(Text 1: Ch-3, Ch-4 (4.1, 4.2.1 and 4.2.2 only), Ch-7 (Sections 7.1, 7.2 only), Ch-9 (Sections 9.1, 9.2, 9.3.1, 9.3.2 only))**	**08 Hours**
Module -3	
RTOS and The Embedded product development life cycle(EDLC): Operating System basics, Types of operating systems, Task, process and threads (Only POSIX Threads with an example program), Thread preemption, Preemptive scheduling techniques, How to choose an RTOS, The Embedded product development life cycle (EDLC): What is EDLC?,Why EDLC?, objectives of EDLC, Different phases of EDLC,EDLC approaches(Modeling the EDLC) **(Text 1: Ch-10 (Sections 10.1, 10.2, 10.3, 10.5.2 , 10.10 only), ch-15**	**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)**	**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(4.1,4,2,4.3.1 to 4.3.5,4,3.8,4.4only),Ch-5(5.1,5.2,5.3,5.5only), Ch-10 (10.1,10.2, 10.3, 10.4 only))**	**08 Hours**

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

CO1-Indentify the purpose, core of embedded systems and area of applications.

CO2-Analyze the hardware /software co-design and firmware design approaches.

CO3-Investigate the need of real time operating system for embedded system applications.

CO4-Analyze the architectural features of ARM Cortex M3 and apply for embedded system applications.

CO5- Apply the knowledge gained for programming ARM Cortex M3 for applications, interface external devices and I/O with ARM microcontroller.

Text Book:

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

Reference Book:

4. James K. Peckol, "Embedded systems- A contemporary design tool", John Wiley, 2008, ISBN: 978-0- 471-72180-2.
5. Yifeng Zhu, “Embedded Systems with Arm Cortex-M Microcontrollers in Assembly Language and C”, 2nd E -Man Press LLC ©2015 ISBN:0982692633 9780982692639.
6. Embedded real time systems by K.V. K. K Prasad, Dreamtech publications, 2003.
7. Embedded Systems by Rajkamal, 2nd Edition, McGraw hill Publications, 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	-	-	-	-	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	-	-

TINY MACHINE LEARNING

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

SEMESTER-VI

Subject Code	22EC632	CIE Marks	50
Number 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:

- Work with Arduino and ultra-low-power microcontrollers
- Learn the essentials of ML and how to train models
- Train models to understand audio, image, and accelerometer data
- Explore Tensor Flow Lite for Microcontrollers, Google's toolkit for TinyML
- Debug applications and provide safeguards for privacy and security

Module -1	**Teaching Hours**
Getting up to speed on ML: What machine learning actually is, Deep learning workflow, decide on a goal, collect dataset, design model architecture, train the model, convert model, run interface, Evaluate and troubleshoot, wrapping up, Machine learning tool chain, Python and Jupyter notebooks, Google co laboratory, tensor flow and keras building model, importing dependencies, generating data, splitting data, defining basic model, Training model, training metrics, graphing the history, improving model, testing, converting model to tensor flowlite, converting to C file. **Hello world of TinyML: Building an application**, walking through tests, including the dependencies, setting up test, getting ready to log data, mapping model, creating allopsresolver, defining tensor arena, creating interpreter, inspecting input, running interface, reading output, running tests, project file structure, walking through source. **Hello world of TinyML: Deploying to Microcontrollers,** Arduino, sparkfun edge, ST Microelectronics, handling output, running example, making own changes. (Chapter 3, 4, 5 & 6 of Text1)	08 Hours
Module -2	
Wake-word detection: Building an application, application architecture, introducing model , all moving parts, walking through the tests, basicflow, audio provider, feature provider, command recognizer, command responder, listening for wake words, running application, deploying to microcontrollers. **Wake-word detection: Training a Model**, Training in co lab, using model, replacing model, updating labels, updating command responder, other ways to run scripts, model working, visualizing inputs, understanding model architecture, model output, training data, speech commands dataset, training dataset, data augmentation, model architectures. **Person detection: Building an application**, application architecture, introducing model, all moving parts, walking through the tests, basic flow, image provider, detection responder, detecting people, deploying to microcontrollers, wrapping up**.** **Person detection: Training model,** picking a machine, setting google cloud platform instance, training framework choice, building dataset, training model, tensorboard, evaluating model, exporting to tensorflow lite, training other categories, understanding architecture. (Chapter, 7, 8 9 & 10, of Text1)	08 Hours

Module -3	
Magic Wand: Building an application, application architecture, introducing model, all moving parts, walking through the tests, basic flow, accelerometer handler, gesture predictor, output handler, detecting gestures, deploying to microcontrollers. **Magic Wand: Training model**, training in Colab, other ways to run the scripts, model working, visualizing input, understanding model architecture, training data, capturing data, modifying training scripts, using new model. **TensorFlow lite for Microcontrollers**, tensorflow, tensorflow lite, tensorflow lite for microcontrollers, requirements, model interpretation, project generation, building systems, specializing code, makefiles, writing tests, supporting a new hardware platform, supporting a new IDE, integrating code changes, contributing back to open source, supporting new hardware accelerators, understanding file format, porting tensorflow lite mobile Ops to micro. **Designing own TinyML applications**, design process, need a microcontroller or larger device, understanding possibilities, find similar models to train, look data, wizard of Oz-ing, get it working on desktop. (Chapter 11, 12, 13 & 14 of Text1)	10 Hours
Module -4	
Optimizing Latency, first make sure it matters, hardware changes, model improvements. quantization, product design, code optimizations, optimizing operations, contributing back to opensource. **Optimizing energy usage,** developing intuition, typical component power usage, hardware choice, measuring real power usage, estimating power usage for model, improving power usage for model, duty cycling, cascading design. **Optimizing model and binary size,** understanding system's limits, estimating memory usage, flash usage, RAM usage, ballpark figures for model accuracy and size on different problems, model choice, reducing size of executables, truly tiny models. (Chapter 15, 16 & 17 of Text1	10 Hours
Module -5	
Debugging, accuracy loss between training and deployment, preprocessing differences, debugging preprocessing, On-device evaluation, Numerical differences, are the differences problem, establish a metric, compare against baseline, swap out implementation, mysterious crashes and hangs, desktop debugging, log tracing, shotgun debugging, memory corruption, **Porting models from tensor flow to tensor flow lite,** understand Ops need, look existing Op coverage in tensor flow lite, move preprocessing and post processing into application code, implement and optimize Ops, **Privacy, security and deployment,** privacy design document, using a PDD, protecting models, moving from a development board to a product (Chapter 18, 19 & 20 of Text1)	10 Hours
Course Outcomes: After studying this course, students will be able to: CO1-Make use concepts in Tiny ML. CO2-Build an application and deploy to the microcontroller CO3-Analyze a Tensor flow lite for microcontroller and Design a Tiny ML application. CO4- Experiment with Latency, Energy usage, model and binary size parameter. CO5- Analyze accuracy loss between training and deployment, Privacy, security and deployment	
Text Books: 3. Pete warden and Daniel Situnayake, TinyML: Machine Learning with TensorFlow Lite on Arduino and UltraLow-Power Microcontrollers, O'Reilly Media, 1st edition, 2020. ISBN-10: 1492052043.	

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	-	-	-	-	-	-		-	-	-	1	-	2	-
CO2	3	-	-	-	-	-	-	-	-	-	-	2	-	2	-
CO3	1	1	3	-	-	-	-	-	-	-	-	2	-	3	-
CO4	3	-	-	-	-	-	-	-	-	-	-	2	-	3	-
CO5	3	-	-	-	-	-	-	-	-	-	-	2	-	3	-

PROGRAMMING USING PYTHON

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

SEMESTER – VI

Subject Code	22EC641	IA Marks	50
Number of Lecture Hours/Week	3L	Exam Marks	50
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 03

Course objectives: This course will enable students to

- Learn Syntax and Semantics and create Functions in Python.
- Handle Strings and Files in Python.
- Understand Lists, Dictionaries and Regular expressions in Python.
- Implement Object Oriented Programming concepts in Python
- Build Web Services and introduction to Network and Database Programming inPython.

Module – 1	TeachingHours
The way of the program, Variables, expressions and statements, Functions, conditionals and recursions	8 Hours
Module – 2	
Iteration, Strings, lists	8 Hours
Module – 3	
Dictionaries, Tuples, Files, Regular Expressions	8 Hours
Module – 4	
Classes and objects, Classes and functions, Classes and methods	8 Hours
Module – 5	
Networked programs, Using Web Services, Using databases and SQL	8 Hours

Course outcomes: The students should be able to:

CO1- Understand Python syntax and semantics, and be fluent in the use of Python flow control and Functions.
CO2- Develop, run, and manipulate Python programs using Core data structures like Lists, Dictionaries, and string handling methods.
CO3- Develop, run, and manipulate Python programs using File Operations and searching patterns using regular expressions.
CO4- Interpret the concepts of object-oriented programming using Python.
CO5- Implement exemplary applications related to Network Programming, Web Services, and Databases in Python.

Text Books:

1.Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd Edition,GreenTeaPress,2015.(http://greenteapress.com/thinkpython2/thinkpython2.pdf)(Chapters 1-3,5,7,8,10-12,14-17) (Download pdf files from the above links)

2.Charles R. Severance, "Python for Everybody: Exploring Data Using Python 3", 1st Edition, CreateSpace Independent Publishing Platform, 2016. (http://do1.dr-chuck.com/pythonlearn/EN_us/pythonlearn.pdf) (Chapters 11 –13, 15)

Reference Books:

1. Charles Dierbach, "Introduction to Computer Science Using Python", 1st Edition, Wiley India Pvt Ltd. ISBN-13: 978-8126556014
2. Mark Lutz, "Programming Python", 4th Edition, O'Reilly Media, 2011.ISBN-13: 978-9350232873
3. Wesley J Chun, "Core Python Applications Programming", 3rd Edition,Pearson Education India, 2015. ISBN-13: 978-9332555365

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	3	3	3	-	2	-	-	-	-	-	-	-	3	-	-
CO3	3	3	3	-	2	-	-	-	-	-	-	-	3	-	-
CO4	3	2	2	-	2	-	-	-	-	-	-	-	3	-	-
CO5	3	3	3	-	3	-	-	-	-	-	-	-	3	-	-

IOT & ITS APPLICATIONS

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

SEMESTER-VI

Subject Code	22EC642	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:

- Understand the overview of IoT, Physical and Logical Design of IoT.
- Studying the similarity between M2M & IoT and its system management.
- Understand IoT platform design methodology.
- Know the IoT physical devices and Python programming concept.
- Understand the role of IoT in various domains of applications.

Module -1	**Teaching Hours**
Introduction to Internet of Things Introduction: Definition, and Characteristics of IoT, Physical Design of IoT: Things in IoT, IoT Protocols Logical Design of IoT: IoT Functional Blocks, IoT Communication Models, IoT communication APIs IoT Enabling Technologies: Wireless sensor networks, Cloud computing, Big data analytics, communication protocol, Embedded systems IoT levels and Deployment Templates: IoT level1 to Level 6 (Chapter 1)	8 Hours
Module -2	
IoT and M2M:M2M, Difference between IoT and M2M, Software defined networking and network function virtualization **IoT System Management with NETCONF-YANG:** Need for IoT System Management, SNMP, Network operator requirements, NETCONF, YANG, IoT System Management with NETCONF-YANG. (Chapter 3 & 4)	8 Hours
Module -3	
IoT Platforms Design Methodology: Introduction, IoT Design Methodology, Purpose and Requirements Specification, Process Specification, Domain model Specification, Information Model specification, service specifications, IoT level Specifications, Functional view specifications, operational view specifications, Device and component Integration, Application Development, Motivation for Using Python(chapter-5)	8 Hours
Module -4	
IoT Systems- Logical Design using Python: Introduction, Installing Python, Python Data Types and Data Structures, Control Flow, Functions, Modules, Packages, File handling, Python Packages. **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)	8 Hours
Module -5	
Domain Specific IoTs and its Applications: Home automation, Cities, Environment Energy, Retail, logistics, Agriculture, Industry, Health and life style **IoT applications:** Smart lighting, smart parking, whether monitoring system, air pollution monitoring, forest fire detection, smart irrigation. (Chapter-2 & 9)	8 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. Arshdeep Bhaga and Vijay Madisetti, "Internet of Things – A Hands-on Approach 2014

Reference Book:

5. Raj Kamal, "Internet of Things- Architecture and Design Principles", McGraw Hill Education.
6. Qusay F. Hassan, Internet of Things A to Z Technologies and Applications, IEEE press, WILEY, ISBN:978-1-111-945674-2.

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	-	-

EMBEDDED SYSTEMS

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

Course Code	22EC651	CIE Marks	50
Number of Lecture Hours/Week	4L	SEE Marks	50
Total Number of Lecture Hours	50	Exam Hours	03hrs

CREDITS– 04

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

- Understand the basic hardware components and their selection method based of the characteristics and attributes of an embedded system.
- Understand typical Embedded system with its components.
- Develop the hardware software co-design and firmware design approaches.
- Explain the need of real time operating system for embedded system applications
- Understand the integration, testing of Embedded hardware and firmware and Embedded development Life cycle.

Module 1	**Teaching Hours**
Introduction To Embedded Systems: History of embedded systems, Classification of embedded systems based on generation and complexity, Purpose of embedded system, characteristics of embedded systems and quality attributes of an embedded system, Embedded system-Application specific and Domain specific. **(Text 1:Chapter-1,chapter-3 and chapter-4)**	**10Hrs**
Module 2	
Typical Embedded System: Core of the embedded system-general purpose and domain specific processors, ASICs, PLDs, COTs; Memory-ROM, RAM, memory according to the type of interface, memory shadowing, memory selection for embedded systems, Sensors, actuators, I/O components: seven segment LED, relay, piezo buzzer, push button switch, Onboard communication interfaces, External communication interfaces, other sub-systems: reset circuit, brownout protection circuit, oscillator circuit real time clock, watch dog timer. **(Text 1:Chapter-2)**	**10 Hrs**
Module 3	
Hardware Software Co-Design and Program Modeling: Fundamental issues in hardware software co-design and Computational models in Embedded design. **Embedded Firmware Design And Development:** Embedded firmware design approaches-super loop based approach, operating system based approach; embedded firmware development languages-assembly language based development, high level language based development. **(Text1:Chapter 7.1,7.2,chapter 9.1 and 9.2)**	**10 Hrs**
Module 4	
RTOS Based Embedded System Design: Operating system basics, types of operating systems, tasks, process and threads, multiprocessing and multitasking, task scheduling: non-pre-emptive and pre-emptive scheduling; task communication-shared memory, message passing, Remote Procedure Call and Sockets, Task Synchronization: Task Communication/ Synchronization Issues, Task Synchronization Techniques and How to choose an RTOS.(**Text1:Chapter 10)**	**10 Hrs**

Module 5	
Integration and testing of Embedded hardware and firmware. **Embedded system Development Environment** – Block diagram (excluding Keil), Disassembler/decompiler, simulator, emulator and debugging techniques. **The Embedded product development life cycle (EDLC):** What is EDLC?,Why EDLC?, objectives of EDLC, Different phases of EDLC,EDLC approaches(Modeling the EDLC) **(Chapter 12,13,15)**	**10 Hrs**

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

CO1-Describe the differences between the general computing system and the embedded system, also recognize the classification of embedded systems and its applications

CO2-Apply the knowledge of Microcontrollers to understand the basics of typical embedded system and its design components.

CO3-Analyze the typical embedded system components.

CO4-Develop the hardware /software co-design and firmware design approaches.

CO5-Investigate the process of embedded product development life cycle.

Text Book:

1. Shibu K V, ―Introduction to Embedded Systems‖, Tata McGraw Hill Education Private Limited, 2nd Edition.

Reference Books:

1. James K. Peckol, "Embedded systems- A contemporary design tool", John Wiley, 2008, ISBN: 978-0-471-72180-2.
2. Yifeng Zhu, “Embedded Systems with Arm Cortex-M Microcontrollers in Assembly Language and C”, 2nd E -Man Press LLC ©2015 ISBN:0982692633 9780982692639.
3. Embedded real time systems by K.V. K. K Prasad, Dreamtech publications, 2003.
4. Embedded Systems by Rajkamal, 2nd Edition, McGraw hill Publications, 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	2	-	-	-	-	-		-	-	-	-	3	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	3	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	3	-	-
CO5	3	2	2	-	-	-	-	-	-	-	-	-	3	-	-

INTRODUCTION TO UAV ELECTRONICS

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

SEMESTER-VI

Course Code	22EC652	CIE Marks	50
Number of Lecture Hour/Week	4L	SEE Marks	50
Number of Lecture Hours	50	Exam Hours	03

CREDITS-04

Course Objectives: Students will be taught to:

- To introduce the basic concepts of comparator, converter and interfacing circuits.
- To give exposure on the construction and working of digital circuits.
- To get introduce about the basics of signal generators.
- To make familiarize with the microprocessor and its applications.
- To make familiarize with the microprocessor and its applications.

Module -1	**Teaching Hours**
Linear IC's: OP-AMP specifications, applications, voltage comparator, A/D and D/A converter, sample and hold circuit, timer, VCO, PLL, interfacing circuits.	10 Hours
Module -2	
Digital Systems**:** Review of TTL, ECL, CMOS- Logic gates, Flip Flops, Shift Register, Counter, Multiplexer, Demultiplexer / Decoder, Encoder, Adder, Arithmetic functions, analysis and design of clocked sequential circuits, Asynchronous sequential circuits.	10 Hours
Module -3	
Signal Generators: Monostable, Astable and Bistable muti-vibrators. Schmitt Trigger. Conditions for oscillation, RC phase shift oscillator, Wien bridge oscillator, Crystal oscillator. LC oscillators. Relaxation oscillators.	10 Hours
Module -4	
Microprocessor Based Systems:The 8085 microprocessor, interfacing with Alpha numeric displays, LCD panels, Stepper motor controller, Analog interfacing and industrial control.	10 Hours
Module -5	
Microcontroller Based Systems: 8031/8051 Micro controllers:– Architecture- Assembly language Programming-Timer and Counter Programming- External Memory interfacing – D/A and A/D conversions – Multiple Interrupts . Introduction to 16 bit Microcontrollers.	10 Hours

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

CO1-The Students will be able to understand and apply the basic concepts of Electronic Systems for UAV.

CO2-The students will be able to get exposure in the construction and analyze the working of digital circuits.

CO3-The students will be able to understand/ analyze/design various signal generators used in the avionics.

CO4-The students will get familiarize with microprocessors/ microcontrollers and will be able to deploy these skills effectively in designing avionics subsystems.

CO5-The students will develop ability to conduct independent study and investigations on microprocessors/ microcontrollers based designs.

Text Books:

1. Jacob Millman, Christos C Halkias, SatyabrataJit, Millman's, “Electronic Devices and Circuits”, Second Edition, Tata McGraw Hill,New Delhi, 2007.
2. Donald P Leach, Albert Paul Malvino, GoutamSaha, “Digital Principles and Applications”, 6th Edition Tata McGraw Hill, New Delhi, 2006.
3. Gayakwad, Ramakant A., “Op-Amps And Linear Integrated Circuits”, Prentice Hall/ Pearson Higher Education, New Delhi, 1999.

Reference Books / Web links:

1. John Crisp, “Inroduction to Microprocessor and Microcontroller”, Newnes Publication, London. 2004.
2. William Kleitz, “Microprocessor and Microcontroller Fundamentals: The 8085 and 8051 Hardware and Software”, Prentice Hall Inc, New York, 1997.

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	-	-	-	-	-	-	-	-	-	3	-	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	3	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-	3	-	-

VLSI CIRCUITS LABORATORY

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

SEMESTER-VI

Subject Code	22ECL66	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:

- 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 circuitslike data converters using design abstraction concepts.
- Design and simulate the various basic CMOS digital circuits and use them in higher circuitslike 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. CMOS flip flop
   ii. Transmission Gate
   iii. Edge triggered D Flip flop
   iv. 4 bit Ripple Carry Adder, Carry Look Ahead Adder
   v. Serial Adder
   vi. 32 bit ALU
   vii. Ripple Counter using T- Flop Flop
   viii. 4-bit counter [Synchronous and Asynchronous counter]

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

Course Outcomes: After studying this 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-Analyse 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 LABORATORY

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

SEMESTER-VI

Subject Code	22ECL671	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 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: After studying this 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- Analyse 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 tensorflow to tensorflow lite

Course Outcomes: After studying this 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-Analyse 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	-

PROGRAMMING USING PYTHON LABORATORY

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

SEMESTER-VI

Subject Code	22ECL681	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:

- Learn Syntax and Semantics and create Functions in Python.
- Handle Strings and Files in Python.
- Understand Lists, Dictionaries and Regular expressions in Python.
- Implement Object Oriented Programming concepts in Python
- Build Web Services and introduction to Network and Database Programming inPython.

List of Experiments:

1.write a program to demonstrate different number data types in python(script.py)

2. Create a list and perform the following methods

    1) insert() 2) remove() 3) append() 4) len() 5) pop() 6)clear()

3.write a program to perform different arithmetic operations on numbers in Python.

4.write a program to demonstrate working with tuples in python.

5.write a program to create, concatenate and print a string and accessing sub-string from given string

6. Create a dictionary and apply the following methods

    1) Print the dictionary items 2) access items 3) useget() 4)change values 5) use len()

7. Write a python program to find largest number among three numbers.

8. Write a python program to check whether the given string is palindrome or not.

9. Program to convert temperature in Celsius to Fahrenheit

10.write a python program to construct the following pattern, using a nested for loop

11.write a python script that prints prime numbers less than 20

12.write a python program to find the factorial of a number using recursion

13.Write a program to do the following operations:

    i. Create a empty dictionary with dict() method
    ii. Add elements one at a time
    iii. Update existing key‟s value
    iv. Access an element using a key and also get() method
    v. Deleting a key value using del() method

14. Write a program to create a dictionary and apply the following methods:

    i. pop() method
    ii. popitem() method
    iii. clear() method

15. Given a dictionary, write a program to find the sum of all items in the dictionary.

16. Write a program to merge two dictionaries using update() method.

17.write a program that input a text file .the program should print all of the unique words in the file in alphabetical order.

18.write a python class to convert an integer to Roman numeral.

19.write a python class to implement pow(x, n).

20.write a python class to reverse a string word by word.

Course Outcomes: After studying this 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-Analyse 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	-

IOT & ITS APPLICATION LABORATORY

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

SEMESTER-VI

Subject Code	22ECL682	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 use of Respberry Pi.
- Study the Interfacing of Gas, Soil Moisture, Ultrasonic sensor, Temperature sensor, and Humidity sensor to the Respiberry 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 Respberry pi and test the working of GAS sensor and make the buzzer on.
4) Interfacing Soil moisture sensor to the Respberry pi and test the working of soil moisture sensor and send the data to cloud.
5) Interfacing light sensor to the Respberry pi and test the working of light sensor and send the data to cloud.
6) Interfacing Ultrasonic distance to the Respberry pi and test the working of ultrasonic distance senor.
7) Interfacing Temperature & Humidity sensor to the Respberry 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, 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- Analyse 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-VI [As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme] SEMESTER-VI			
Subject Code	22PRJ69	CIE Marks	50
Number Lecture Hour/Week	2P	SEE Marks	50
Total Number of Lecture Hours	24	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 NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]

SEMESTER-VI

Subject Code	22HSM610	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 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	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	04 Hours
Module -3	
ENGINEERING AS SOCIAL EXPERIMENTATION Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.	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	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	04 Hours

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

CO1-Understand the human values required to live peaceful in the society.

CO2-Apply ethics in society, discuss the ethical issues related to engineering

CO3-Realize the responsibilities and rights of an engineer in the society

CO4-Understand the role and responsibility of an engineer in maintaining the safety of society.

CO5-Understand the global issues related to product development.

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

ANTENNAS DESIGN SIMULATION

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

SEMESTER-VI

Subject Code	22AEC611A	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:

- Students will be able to understand the working principle of different antennas
- Students will be able to microstrip antennas using 3DEM of Mentorgraphics.
- Students will be able to understand the different feeding techniques
- Students will be able to design, Microstrip antennas for various wireless applications

List of Experiments:

1. Design and simulation of rectangular microstrip patch antenna with a particular operating frequency, dielectric constant and substrate thickness
2. Design of microstrip patch antenna using microstrip line feeding technique
3. Design of microstrip patch antenna using a coaxial feeding technique
4. Design and simulation of dual-band patch antenna
5. Design and simulation of compact patch antenna
6. Design and simulation of wide band patch antenna
7. Design and simulation of compact and wide band patch antenna
8. Design and simulation of circular polarized patch antenna

Course Outcomes: After studying this 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-Analyse 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.

Text book:

1. C A Balanis, Antenna Theory: Analysis and Design, John Wiley & Sons, 2nd. Edn.

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	-

DESIGN OF VLSI CIRCUIT USING LT SPICE LABORATORY

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

SEMESTER-IV

Subject Code	22AEC610B	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:

- To provide practical exposure on designing, setting up, executing and debugging various electronic circuits.
- Draw the schematic diagram some digital circuits like few combinational and sequential circuits and verify their functionality.
- Draw the schematic diagram some analog circuits and verify their functionality.
- Use open source simulation software to analyze the circuits.

List of Experiments:

Design Analyze and simulate using LT-SPICE

1. Inverter
2. NAND Gate
3. NOR Gate
4. 2:1 MUX
5. RS-Flip flop
6. D-Flip flop
7. T- Flip flop
8. Half adder
9. Common source with resistive load
10. Ring oscillator

Course Outcomes: After studying this 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-Analyse 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 REVISED BLOOM'S TAXONOMY LEVEL MAPPING						
COURSE OUTCOME	**Remember L1**	**Understand L2**	**Apply L3**	**Analyze L4**	**Evaluate L5**	**Create L6**
CO1	Y	Y	Y	N	N	N
CO2	Y	Y	Y	N	N	Y
CO3	Y	Y	N	Y	N	N
CO4	Y	Y	N	N	N	N
CO5	Y	Y	N	N	N	N

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**	**-**