B.Tech. in Electronic Engineering
(Syllabus and Curriculum - 2024 Scheme)

National Institute of Electronics and Information Technology, Aurangabad
A constituent campus of NIELIT Deemed to be University

(An Autonomous Scientific Society of Ministry of Electronics and Information Technology, Government of India)
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B. TECH – ELECTRONIC ENGINEERING

National Institute of Electronics and Information Technology, Aurangabad

Introduction

The B.Tech program in Electronic Engineering is meticulously designed to cultivate a deep understanding of electronic principles, systems, and technologies. This program aims to equip students with the knowledge and skills required to design, analyze, and implement electronic systems that are crucial in today's technologically driven world. With a curriculum that spans fundamental theories to advanced applications, this program prepares students for successful careers in various industries such as telecommunications, robotics, embedded systems, and more. Through a blend of theoretical knowledge and practical experience, students will be capable of innovating and contributing to the evolving landscape of electronics and information technology.

Program Education Objectives (PEO)

- **PEO1: Fundamental Knowledge**
  Graduates will have a strong foundation in mathematics, science, and core electronic engineering principles, enabling them to solve complex engineering problems.
- **PEO2: Technical Proficiency**
  Graduates will develop technical skills in designing and implementing electronic circuits, systems, and applications, with an emphasis on sustainable and ethical practices.
- **PEO3: Industry Preparedness**
  Graduates will be prepared to enter and excel in various roles within the electronics industry, equipped with the ability to adapt to rapidly changing technologies and work effectively in multidisciplinary teams.
- **PEO4: Lifelong Learning**
  Graduates will demonstrate a commitment to continuous learning and professional development, adapting to new challenges and advancing their expertise in electronic engineering and related fields.
- **PEO5: Leadership and Ethics**
  Graduates will possess strong communication, leadership, and ethical decision-making skills, enabling them to take on leadership roles in their professional careers and contribute positively to society.

Program Outcomes (PO)

- **PO1: Engineering Knowledge**
  Apply the knowledge of mathematics, science, engineering fundamentals, and electronic engineering specialization to solve complex engineering problems.

- **PO2: Problem Analysis**
  Identify, formulate, research literature, and analyze complex engineering problems, reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- **PO3: Design and Development**
  Design solutions for complex engineering problems and design system components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.
- **PO4: Modern Tool Usage**
  Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modeling, to complex engineering activities, with an understanding of the limitations.
- **PO5: Ethics and Professionalism**
  Apply ethical principles and commit to professional ethics, responsibilities, and norms of the engineering practice, contributing to the broader societal good.

Course Category Wise Credit Distribution:

Course Category	Category Code	Credits
Humanities and Social Sciences	**HS**	**10**
Basic Science	**BS**	**16**
Engineering Science	**ES**	**08**
Program Core	**PC**	**71**
Professional Elective	**PE**	**16**
Open Elective	**OE**	**06**
Project work, Seminar etc	**EEC**	**38**
Audit	**AU**	**0**
Total Credit		**165**

Semester wise Structure and Curriculum

for

B.Tech. in Electronic Engineering (EE)

Semester I

3-Week Orientation Programme

S.No	Course Code	Course Title	L	T	P	Credits
1.	BS101	Engineering Physics	2	0	2	3
2.	ES101	Engineering Drawing	1	0	4	3
3.	BS102	Engineering Mathematics-I	3	1	0	4
4.	ES102	Electrical Engineering	2	0	2	3
5.	PC101	Python Programming	2	0	4	4
6.	BS103	Engineering Chemistry	2	1	0	3

Total Credits: 20

Semester II

S.No	Course Code	Course Title	L	T	P	Credits
1.	BS201	Engineering mathematics-II	2	1	0	3
2.	PE201	Professional Elective I	2	1	0	3
3.	HS201	Sports and Yoga	0	1	4	3
4.	PC201	Electronic devices and Circuits	2	0	2	3
5.	ES201	Workshop technology	0	1	2	2
6.	HS202	Communication skills	1	1	2	3
7.	HS203	Design Thinking	0	0	2	1

Total Credits: 18

List of Professional Electives are given in Annexure I

Semester III

S.No	Course Code	Course Title	L	T	P	Credits
1.	BS301	Engineering mathematics-III	2	1	0	3
2.	PC301	Power Electronics	2	0	4	4
3.	PC302	Electronic Measurement and Instrumentation	2	0	4	4
4.	PC303	Digital Logic and Circuits	2	1	2	4
5.	PC304	Linear Electrical Networks	2	2	0	4
6.	HS301	Constitution of India	2	1	0	3
						Total Credits: 22

Semester IV

S.No	Course Code	Course Title	L	T	P	Credits
1.	PC401	Control System Engineering	3	1	0	4
2.	PC402	Microprocessor and Microcontroller	2	1	2	4
3.	PC403	Signals and Systems	2	1	2	4
4.	PC404	Analog Electronics	2	1	2	4
5.	PE401	Professional Elective II	2	0	2	3
6.	PE402	Professional Elective III	2	1	0	3
						Total Credits: 22

Semester V						
S.No	**Course Code**	**Course Title**	**L**	**T**	**P**	**Credits**
1.	PC501	Electromagnetics and Field Theory	2	1	0	3
2.	PC502	Analog Communication	2	1	2	4
3.	PC503	Computer Architecture and Organisation	2	0	2	3
4.	PC504	Digital Signal Processing	2	0	2	3
5.	PC505	VLSI Design	2	1	2	4
6	PC506	Computer Networks and Security	2	1	0	3
						Total Credits: 20

Semester VI						
S.No	**Course Code**	**Course Title**	**L**	**T**	**P**	**Credits**
1.	PC601	Digital Communication	2	1	2	4
2.	PC602	Embedded Systems and IOT	2	1	2	4
3.	PC603	Electronic Product Design using EDA Tools	2	1	2	4
4.	PE601	Professional Elective IV	2	0	4	4
5.	PE602	Professional Elective V	2	0	2	3
6.	EEC601	Mini project and Seminar	0	0	16	8
						Total Credits: 27

Semester VII						
S.No	**Course Code**	**Course Title**	**L**	**T**	**P**	**Credits**
1.	OE701	Open Elective 1	--	--	--	3
2.	OE702	Open Elective 2	--	--	--	3
3.	EEC701	Dissertation Phase-I	0	0	20	10
Total						16
Professional Electives and Open Electives may include relevant online courses from platforms such as SWAYAM, MOOC, NPTEL, NIELIT NSQF, or any other UGC/AICTE-approved sources in the field of Computer Science/Electronics/Electrical Engineering, subject to approval by the Dean (Academics) at the time of registration.						

Semester VIII						
S.No	**Course Code**	**Course Title**	**L**	**T**	**P**	**Credits**
1.	EEC801	Dissertation Phase-II	0	0	40	20
Total						20

- ***Main emphasis should be on Project Based Learning / Experiential Learning.***
- ***There should be an option to delay internship semester to $7^{th}/8^{th}$ Semester as per institute convenience and availability of internship slots for different group of students.***

Core Subject Syllabus

Course title:	ENINEERING PHYSICS	Sub code				
		Structure	L	T	P	C
			2	0	2	3

Course Objective:	• To equip the students with an understanding of the "Scientific Methods"so that they can use the training beneficially in their higher pursuits. • This course gives a balance account of the fundamentals of Physics aswell as some of recent developments in this area best suited to the Engineering applications in different branches.
Course Outcome:	• The student will be able to understand many modern devices andtechnologies based on lasers and optical fibres. • Student can also appreciate various material properties which are usedin engineering applications and devices. • Master fundamental principles of physics applicable to engineering. • Apply physics concepts to solve complex engineering problems. • Develop proficiency in experimental techniques and data analysis. • Integrate physics knowledge across engineering disciplines for problem-solving. • Enhance communication and teamwork skills for effective collaboration in engineering projects.

Content	**No. of hours**	**ESE Marks (%)**
Module 1: Interference and Diffraction:	6	16
Interference in thin film of uniform thickness and non-uniform thickness, Newton's rings, Michel son's interferometer, Fabry-Perot interferometer. Fresnel and Fraunhofer diffraction, Fraunhofer diffraction at circular aperture, plane diffraction grating, determination of wavelength using plane diffraction grating, dispersive power of grating, resolving power of grating.		
Module 2: Electrostatics:	6	16
Gauss's law and its applications, Divergence and Curl of Electrostatic fields, Electrostatic Potential, Boundary conditions, Work and Energy, Conductors, Capacitors, Laplace's equation, Method of images, Boundary value problems in Cartesian Coordinate Systems, Dielectrics, Polarization, Bound Charges, Electric displacement, Boundary conditions in dielectrics, Energy in dielectrics, Forces on dielectrics.		
Module 3: Magnetostatics	6	16
Lorentz force, Biot-Savart and Ampere's laws and their applications, Divergence and Curl of Magneto static fields, Magnetic vector Potential, Force and torque on a magnetic dipole,		
Module 4: Dielectrics materials:	8	18
Magnetic materials, Magnetization, Bound currents, Boundary conditions. Diamagnetic materials, Paramagnetic materials, Ferromagnetic materials, origin of magnetization, Types of magnetic materials-hard materials and soft materials. Dielectrics-Introduction, dielectric constant, polarization, induced dipoles, permanent dipoles,polar and non-polar dielectrics, polarization-an atomic view, types of polarization.		
Module 5: Classical Mechanics	6	16
Review of Newtoninan Mechanics in rectilinear coordinate system, motion in plane polar coordinates. Conservation Principles. Collision problems and centre of mass frame. Rotation about fixed axis. Non-inertial frames and pseudo forces, rigid bossy systems.		
Module 6: Quantum Mechanics/ Physics:	8	18
Two−slit experiment. Dual nature of light; Compton Effect; De-Broglie hypothesis; Davisson-Germer Experiment; Phase and group velocities; Uncertainty principle; Wave-function; Schrodinger wave equation; Particle in a finite and infinite potential well; Tunnel effect. Superposition Principle, Continuity Equation for probability density; Normalization . Expectation values .Eigen values and eigen functions Stationary states, Bound states, Applications in one dimension: Particle in a box, 1-D Finite Potential well, Harmonic oscillator.		

Reference Books:

1) Fiber optic Communication-D.C.Agarwal. Wheeler Publication, New Delhi

2) Solid state electronic devices-Streetman, Prentice Hall India, New Delhi
3) Electronic devices and circuits-Allen Mottershade, Prentice Hall India, New Delhi
4) Fiber optic communication-Keiser. Mc Graw Hill Publication
5) A course in Electrical Engineering Materials – S.P.Seth,P.V.Gupta, Dhanpat Rai Publication,New Delhi.
6) Engineering physics-Gaur and Gupta, S.Chand Publication
7) Engineering physics-Avadhanalu and Kshirsagar, S.Chand Publication

List of Experiments:

1) Determination of radius of curvature of Plano- convex lens by Newton's ring
2) Determination of wavelength by diffraction grating.
3) Study of CRO (amplitude, frequency, phase measurement).
4) Experiments on electromagnetic induction and electromagnetic braking;
5) LC circuit and LCR circuit;
6) Resonance phenomena in LCR circuits;
7) Magnetic field from Helmholtz coil;
8) Measurement of Lorentz force in a vacuum tube.
9) To study different types of Optical fibres.

Course title:	**ENGINEERING DRAWING**	**Sub code**				
		Structure	**L**	**T**	**P**	**C**
			1	0	4	3

Course Objective:	• To impart and include proper understanding of the theory of projection. • Improve the visualization skills. • To enable the students with various concepts like dimensioning, conventions and standards related to working drawing in order to become professionally efficient. • To impart the knowledge on understanding and drawing of simple residential/ office building.
Course Outcome:	• Develop proficiency in reading and interpreting engineering drawings and diagrams. • Acquire skills in creating detailed drawings of electronic components, circuits, and systems. • Learn industry-standard drafting techniques and conventions for technical drawings. • Gain knowledge of CAD (Computer-Aided Design) software tools for electronic drafting and modeling. • Enhance visualization and spatial reasoning abilities essential for engineering design and communication.

Content	**No. of hours.**	**ESE Marks (%)**
Module 1 Introduction to engineering drawing:	8	20
Principles of engineering graphics and their significance – drawing instruments and their use – conventions in drawing – lettering – BIS conventions. Dimensioning rules, geometrical construction. Curves used in engineering practice and their constructions: Conic Sections, Special Curves-Cycloids, Epicycloids, Hypocycloids.		
Module 2: Projections of Straight Lines:	8	20

Projections of points in four quadrants, projections of points in reference plane, line parallel to both the plane, line parallel to one plane and perpendicular to the other, line inclined to one plane and parallel to the other, line inclined to both the reference planes, traces of line, use of traces of line in obtaining projections (all four quadrants should be considered).		
Module 3: Projections of planes and solids	8	20
Projections of regular planes, inclined to both planes. Projections of regular solids inclined to both planes. Introduction to solids: prisms, pyramid, cylinder, cone, cube, tetrahedron, sphere, projections of above solids with axis inclined to one plane, projections of above solids with axis inclined to both the planes, projection of composite solids (different arrangement of spheres with above solids).		
Module 4: Development of Surfaces:	8	20
Development of surfaces of right, regular solids – development of prisms, cylinders, pyramids, cones and their parts		
Module 5: Orthographic Projections & Isometric views:	8	20
Principles of orthographic projections – conventions – first and third angle projections. Projections of points and lines inclined to both the planes. Orthographic projections of different machine parts, sectional orthographic projections. Introduction to pictorial views, isometric projections and isometric views (Isometric and non-isometric planes).		
Reference Books:		
1) Bhatt N. D., Panchal V. M., "Engineering Drawing", Charotar Publishing House. 2) Dhabhade M. L., "Engineering Graphics", Vol.-I and Vol.-II, Vision Publications, Pune. 3) Mathur, Laxminarayan, "Elements of Engineering Drawing", Jain Publications, New Delhi.		

List of Experiments:

1) Introduction to BIS SP – 46 – 1988.
2) Explanation of various drawing instruments, symbols, RF, Dimensioning, etc.
3) Conversion of pictorial views to orthographic / profile views.
4) Projection of points and lines.
5) Projections of planes.
6) Projections of lines and planes using Auxiliary planes.
7) Projections of solids.
8) Section and development of solids.
9) Intersection of solids.
10) Isometric views.
11) Practice of scales, Representative Factor and dimensioning on some practical exemplaryfigure.

Course title:	**ENGINEERING METHAMATICS-I**	**Sub code**				
		Structure	**L**	**T**	**P**	**C**
			3	1	0	4
Course Objective:	• To expose student to understand the basic importance of Differential calculus, Integral calculus, Infinite series and Matrix theory in science and engineering.					
Course Outcome:	• The terminal objectives of the course are that, on successfulcompletion of teaching-learning and evaluation activities, a student would be able to identify and analyse the problems by applying the fundamental principles of engineering mathematics. • Develop a strong understanding of calculus and its applications in engineering. • Gain proficiency in differential equations and their relevance to engineering systems. • Apply mathematical methods to analyze and model engineering phenomena. • Acquire problem-solving skills essential for advanced engineering courses and					

	practical applications.

Contents	No. of hours	ESE Marks (%)
Module 1: Differential Calculus:	8	20
Functions of single variable: Limit, continuity and differentiability. Mean value theorems: Rolle's theorem, Lagrange's theorem, Cauchy's theorem, Taylor's theorem with remainders, indeterminate forms, curvature, curve tracing.		
Module 2: Determinants:	8	20
Determinant of a matrix of order one, order two, order three. Properties of determinant, area of triangle, minors and co-factors, adjoint and inverse of a matrix,		
Module 3: Integral Calculus:	8	20
Fundamental theorem of Integral calculus, mean value theorems, evaluation of definite integrals, Applications in Area, length, volumes and surface of solids of revolutions, Improper integrals: Beta and Gamma functions, differentiation under integral sign.		
Module 4: Sequence and Series	8	20
Sequences, Infinite series of real and complex numbers, Cauchy criterion, tests of convergence, absolute and conditional convergence, improper integrals, improper integrals depending on aparameter, uniform convergence, power series, radius of convergence.		
Module 5: Matrices:	8	20
System of linear equations, Augmented matrix, Existence and uniqueness of solution, Gauss elimination method, Elementary row operations, LU decomposition, Row-equivalent systems, Row echelon form, Rank of a matrix, Linear dependence, Consistency of a linear system, Linear combination of solutions, General solution, Types of matrices and their properties, Eigenvalues, Eigen vectors, Eigenvalue problems, Cayley- Hamilton theorem, Similarity of matrices, Diagonalisation, Quadratic form, Reduction to canonical form		

Reference Books:

1) Kreyszig, E., Advanced Engineering Mathematics, John Wiley & Sons
2) Piskunov, N., Differential and Integral calculus, Mir publishers Moscow (Vol. 1, Vol. 2)
3) Thomas, G.B. and Finney, R.L, Calculus and Analytic Geometry, Addison Wesley Longman
4) Michael D. Greenberg, Advanced Engineering Mathematics, Pearson Education Pvt. Ltd
5) Jain R.K., Iyengar S.R.K, Advanced Engineering Mathematics, Narosa Publishers

Course title:	**ELECTRICAL ENGINEERING**	**Sub code**				
		Structure	**L**	**T**	**P**	**C**
			2	0	2	3

Course Objective:	• To enable the students, understand the basic ideas and principles of Electrical Engineering. • To impart knowledge for understanding the details of electrical powersystems, transformers, generators, motors etc.
Course Outcome:	• Acquire the knowledge about circuit analysis by applying KVL KCL and network Theorems. • Analysis of Single Phase AC Circuits, the representation of alternating quantities, and determining the power in these circuits • Understand the different methods for measurement of various electrical quantities. • Acquire knowledge about the constructional details, losses, parameters, and principles of operation of Transformers. • Acquire the knowledge of fundamentals, construction details, working characteristics, and classification of DC motor and induction motor.

Content	No. of hours	ESE Marks (%)
Module 1: Electrical Circuit:	8	20
DC circuits-Ohm's & Kirchoff's laws, mesh and nodal analysis, circuit theorems; Electro-magnetism, Faraday's & Lenz's laws, induced EMF and its uses; Network Theorems: Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer Theorem Voltage Source (Definition, Characteristics of Practical Source, and Equivalent Current Source), and Star-Delta Transformation. Magnetic Circuit, Flux, MMF, Reluctance, Analogy with Electric Circuits. Simple Calculations for Composite Magnetic Circuits		
Module 2: AC Circuits:	8	20
Periodic Function, Average & R.M.S., Values, Steady State Behaviour with Sinusoidal Excitation, Phasor Representation, Reactance & Impedance, Series & Parallel Circuit, Power Factor, Principle of Generation of Single Phase & Three Phase Voltages, Power in Balanced Three Phase AC System		
Module 3: DC Machine:	8	20
DC Machines covering, working principle of DC machine as a generator and a motor; Types and constructional features; EMF equation of generator, relation between EMF induced and terminal voltage enumerating the brush drop and drop due to armature reaction; DC motor working principle; Back EMF and its significance, torque equation; Types of D.C. motors, characteristics and applications; Necessity of a starter for DC motor;		
Module 4: Transformers:	8	20
Introduction, Basic Principles, Construction, Phasor Diagram for Transformer under No Load Condition Transformer on Load, Balance of MMF on Sides, Phasor Diagram, Equivalent Circuit, Open Circuit & Short Circuit Test, Voltage Regulation and Efficiency		
Module 5: Power Systems& Electrical Machines:	8	20
Elementary Idea about Power Generation, Transmission and Distribution. Sources of Electrical Power covering, Introduction to Wind, Solar, Fuel cell, Tidal, Geothermal, Hydroelectric, Thermal-steam, diesel, gas, nuclear power plants; Concept of cogeneration, and distributed generation.		

Reference Books:

1) Hughes, Electrical Technology, Pearson Publishers
2) Theraja B.L., Electrical Technology, S. Chand Publishers
3) Kothari D.P. and NagrathI.J., Theoryand Problems of Basic Electrical Engineering, PrenticeHall India
4) Kulshresta D.C., Basic Electrical Engineering, TMH India
5) Mittle and Mittal, Basic Electrical Engineering, TMH, 2005
6) Tarnekar S.G., and Kharbanda P.K., „A Textbook of Laboratory Course in ElectricalEngineering", Chand S., 2006 (For practical)

List of Experiments:

1) Study and verification of Kirchhoff's laws applied to DC circuits.
2) Verification of Thevenin's Theorem.
3) To Verify Maximum Power Transfer theorem.
4) Study of AC series R-L-C circuit.
5) Determination of B-H curve of a magnetic material.
6) Study of AC parallel R-L-C circuits.
7) Study of balanced 3-phase circuits.
8) Determination of voltage regulation and efficiency of a single-phase transformer by directloading.
9) Study of speed control of a DC motor by field current control and by armature voltage control.
10) Study of reversal of direction of rotation of a 3-phase induction motor.

Course Title:	Python Programming	Sub code:				
		Structure:	L	T	P	C
			2	0	4	4

Course Objective:	• To equip students with the necessary programming skills and proficiency in Python to solve computational problems and develop software applications effectively. • To enhance students' problem-solving abilities by applying Python programming concepts to analyze, design, and implement solutions across various domains including engineering, science, and data analytics.
Course Outcome:	• Understand Python syntax and use of Python flow control and Functions. Develop, run and manipulate program by using core data structures like lists, sets, dictionaries, tuples and use of strings handling methods. Develop, run and manipulate python programs using file operations. • Able to understand Data Wrangling. Manipulate one-dimensional and multi-dimensional Numpy arrays, pandas series and data frames. Perform Data Wrangling, data loading, cleaning, transformation, reshaping, pivoting and merging. • Able to understand Data Aggregation, Group Operations, Time series and various python web scrapping. Design the web Application with the help of python programming for IOT application. • Explore the use Matplot lib package for Data Visualization in python and implement the different techniques for plotting graphs. Comprehend the importance of the exploratory data analysis paradigm, Select appropriate data visualization technique for given data. • Explore the use of python programing for IOT system. Installing OS and Designing Systems using Raspberry pi. Implement Various IoT system using Python Programming and raspberry pi.

Content	No. of hours	ESE Marks (%)
Module 1: Introduction to Python	8	20
Installing Python. How a Program Works, Using Python, Program Development Cycle, Input, Processing, and Output, Displaying Output with the Print Function, Comments, Variables, Reading Input from the Keyboard, Performing Calculations, Operators. Type conversions, Expressions, More about Data Output. Decision Structures and Boolean Logic: if, if-else, if-elif-else Statements, Nested Decision Structures, Comparing Strings, Logical Operators, Boolean Variables. Repetition Structures: Introduction, while loop, for loop, Calculating a Running Total, Input Validation Loops, Nested Loops. Data types and Expressions: Strings, Assignment and Comments, Numeric Data Types and Character Sets, Expressions, Functions and Modules.		
Module 2: Control statements	8	20
Definite Iteration, Formatting Text for Output, Selection, Conditional Iteration. File and Exceptions: Introduction to File Input and Output, Using Loops to Process Files, Processing Records, Exceptions. Functions: Introduction, Defining and Calling a Void Function, Designing a Program to Use Functions, Local Variables, Passing Arguments to Functions, Global Variables and Global Constants, Value-Returning Functions-Generating Random Numbers, The math Module, Storing Functions in Modules		
Module 3: Strings and Text Files:	8	20
Accessing Characters and Substrings in a String, Strings and Number System, String Methods, Basic String Operations, String Slicing, Testing, Searching, and Manipulating Strings. Text Files, Data Encryption, Lists, Introduction to Lists, List slicing, Finding Items in Lists with the in Operator, List Methods and Useful Built-in Functions, Copying Lists, Processing Lists, Two-Dimensional Lists, Tuples Sequences, Tuples. Dictionaries and Sets: Dictionaries, Sets, Serializing Objects. Recursion: Introduction, Problem Solving with Recursion, Examples of Recursive Algorithms		
Module 4: – Design with classes	8	20
Classes and Objects, Classes and Functions, Classes and Methods, Working with Instances, Inheritance and Polymorphism. Object-Oriented Programming: Procedural and Object-Oriented Programming, Classes, techniques for Designing Classes.		
Module 5: Graphical User Interface	8	20
Behavior of terminal based programs and GUI-based programs, Coding simple GUI-based programs, other useful GUI resources. GUI Programming: Graphical User Interfaces, Using the tkinter Module, Display text with Label Widgets, Organizing Widgets with Frames, Button Widgets and Info Dialog Boxes, Getting Input with Entry Widget, Using Labels as Output Fields, Radio Buttons, Check Buttons. Simple Graphics and Image Processing: Overview of Turtle Graphics, Two dimensional Shapes, Colors and RBG System, Image Processing.		

Text/Reference Books:	
	1. Mark Lutz, "Learning Python", O'Reilly Media, 5th Edition, 2016. 2. White, "Hadoop: The Definitive Guide", Third Edition - O'Reilly, 2012. 3. Brandon Rhodes and John Goerzen, "Foundations of Python Network Programming: The Comprehensive Guide to Building Network Applications with Python", Apress, Second Edition, 2016.
List of Experiments:	
	1. Installation of Python, and learning interactively at command prompt and writing simple programs. 2. Learning the conditions and iterations in Python by writing and running simple programs. 3. Random number generations, and problems based on random numbers. 4. Handling tuples and exercises based on tuples. 5. Functions and files 6. Linear and binary search 7. Handling tokens 8. Finding unique and duplicate items of a list. 9. Matrix addition, multiplications, and unity matrix. 10. Text processing using python 11. Programs related to python libraries like Numpy, Pandas, Scipy etc

Course title:	**ENGINEERING CHEMISTRY**	**Sub code:**				
		Structure:	**L**	**T**	**P**	**C**
			2	1	0	3

Course Objective:	• To present sound knowledge of chemistry fundamentals, enriching students tounderstand the role of Applied Chemistry in the field of science and engineering. To inculcate habit of scientific reasoning to do the task rationally. • To introduce the students to basic principles of electrochemistry, cell construction and evaluation, electrochemical power sources, the importance of corrosion in metal/alloy and polymer.
Course Outcome:	• Understand the fundamental principles of chemistry and their relevance to engineering applications. • Apply chemical concepts to analyze and design engineering materials and processes. • Gain knowledge of corrosion mechanisms and methods for prevention in engineering materials. • Explore environmental chemistry and its implications for sustainable engineering practices. • Acquire laboratory skills for conducting chemical experiments and analyzing results in engineering contexts.

Content	**No. of hours**	**ESE Marks (%)**
Module 1: Atomic and Molecular Structure	6	18
Schrodinger equation. Particle in a box solutions and their applications for conjugated molecules and nanoparticles. Forms of the hydrogen atom wave functions and the plots of these functions to explore their spatial variations. Molecular orbitals of diatomic molecules and plots of the multicentre orbitals. Equations for atomic and molecular orbitals. Energy level diagrams of diatomic. Pi-molecular orbitals of butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures.		
Module 2: Electrochemistry	8	18

Conductivity of electrolytes- Specific, molar and equivalent conductivity, Nernst equation for electrode potential, EMF series, hydrogen electrode, calomel electrode, glass electrode, Electrolytic and galvanic cells, cell EMF, its measurement and applications, Weston standard cell, reversible and irreversible cells, concentration cell, electrode (hydrogen gas electrode) and electrolyte concentration cell, concentration cell with and without transference.		
Module 3: Intermolecular forces and potential energy surfaces	6	16
Ionic, dipolar and van Der Waals interactions. Equations of state of real gases and critical phenomena. Potential energy surfaces of H3, H2F and HCN and trajectories on these surfaces.		
Module 4: Periodic Properties	6	16
Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries.		
Module 5: Solid State	8	16
Types of solids - close packing of atoms and ions - bcc , fcc structures of rock salt - cesium chloride- spinel -normal and inverse spinel's, Stoichiometric Defect, controlled valency & Chalcogen semiconductors, Non-elemental semiconducting Materials, Preparation of Semiconductors-steps followed during the preparation of highly pure materials and further treatments. Semiconductor Devices-p-n junction diode.		
Module 6: Polymer	6	16
Nomenclature, functionality, classification, methods of polymerization, mechanism of polymerization, molecular weight determination-Viscometry, light scattering methods. Plastics-Moulding constituents of a plastics and moulding of plastics into articles. Important thermoplastics and thermosetting resins- synthesis & applications of PVA, FLUON, PC, Kevlar, ABS polymer, phenolic & amino resins, epoxy resins and polyurethanes. Conductive polymers.		

Reference Books	1. P. C. Jain and M. Jain, Engineering Chemistry, Dhanpat Rai Publishing Company, New Delhi, 2005. 2. B.R. Puri, L.R. Sharma, M.S. Pathania, Principles of Physical Chemistry, Vishal Publishing Company, 2008. 3. J. D. Lee, Concise Inorganic Chemistry, 5th Edn., Chapman and Hall, London, 1996. 4. S. S. Dara, S. S. Umare, A Text Book of Engineering Chemistry, S. Chand Publishing, 2011. 5. F.W. Billmayer. Textbook of Polymer Science, 3rd Edn, Wiley. N.Y. 1991. 6. A.R. West, Basic Solid State Chemistry, 2nd edition, John Wiley and Sons, 1999.

Course title:	**ENGINEERING MATHEMATICS-II**	**Sub code:**				
		Structure:	**L**	**T**	**P**	**C**
			2	**1**	**0**	**3**

Course Objective:	To provide students with a fundamental understanding of importance of multi variable calculus (Differential calculus & Integral calculus), Vector calculus and ordinary differential equations in engineering.
Course Outcome:	• Understand advanced calculus concepts and their applications in engineering. • Master probability and statistics principles relevant to engineering analysis. • Learn differential equations of engineering importance and their solutions. • Apply mathematical tools to model and analyze complex engineering systems.

Content	**No. of hours**	**ESE Marks (%)**
Module 1: Calculus of Functions of Several Variables	8	20
Limit, continuity and differentiability of functions of several variables, partial derivatives and their geometrical interpretation, Tangent plane and normal line. Euler's theorem on homogeneous, functions, Total differentiation, chain rules, Jacobian, Taylor's formula, maxima and minima, Lagrange's method of undetermined multipliers.		

Module 2: Multiple Integrals	8	20
Double and triple integrals, change of order of integration, change of variables, application to area,volumes, Mass, Centre of gravity.		
Module 3: Vector Calculus	8	20
Scalar and vector fields, gradient of scalar point function, directional derivatives, divergence and curl of vector point function, solenoidal and irrotational motion. Vector integration: line, surface and volume integrals, Green's theorem, Stroke's theorem and Gauss divergence theorem (without proof).		
Module 4: Ordinary Differential Equations	8	20
First order differential equations: Exact equation, Integrating factors, Reducible to exact differential equations, Linear and Bernoulli's form, orthogonal trajectories, Existence and Uniqueness of solutions. Picard's theorem, Picard's iteration method of solution (Statements only). Solutions of second and higher order linear equation with constant coefficients, Linear independence and dependence, Method of variation of parameters, Solution of Cauchy's equation, simultaneous linear equations.		
Module 5: Complex Variable-Differentiation	8	20
Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate; elementary analytic functions (exponential, trigonometric, logarithm) and their properties; Conformal mappings, Mobius transformations and their properties.		
Reference Books		
	1. Kreyszig, E., Advanced Engineering Mathematics, John Wiley & Sons 2. Piskunov, N., Differential and Integral calculus, Mir publishers Moscow (Vol. 1,Vol. 2) 3. Thomas, G.B. and Finney, R.L, Calculus and Analytic Geometry, AddisonWesley Longman. 4. Michael D. Greenberg, Advanced Engineering Mathematics, Pearson EducationPvt. Ltd 5. Jain R.K., Iyengar S.R.K, Advanced Engineering Mathematics, NarosaPublishers.	

Course title:	**Sports and Yoga**	**Sub code:**				
		Structure:	**L**	**T**	**P**	**C**
			0	**1**	**4**	**3**

Course Objective:	• To maintain students' mental and physical wellness upright and develop ability in them to cope up with the stress arising in the life. • To create space in the curriculum to nurture the potential of the students in sports/games/yoga etc. • To introduce a practice oriented introductory course on the subject. More involved / advanced course may come up in subsequent years of study.
Course Outcome:	• Enhance physical fitness, stamina, and overall well-being through regular participation in sports activities. • Develop teamwork, leadership, and communication skills through team sports and group exercises. • Cultivate mindfulness, stress management, and relaxation techniques through the practice of yoga. • Promote a healthy lifestyle and balance between academic studies and physical activity. • Understand the importance of sports and yoga in maintaining mental and physical health for optimal performance in academic and professional pursuits.

Content	No. of hours	ESE Marks (%)
Module 1: Introduction to Sports Science and Yoga	8	20
Overview of sports science and its applications in engineering, Introduction to yoga, its history, and benefits, Basic principles of sports training and conditioning, Introduction to various yoga asanas (poses) and their significance		
Module 2: Anatomy and Physiology in Sports and Yoga	8	20
Understanding human anatomy and physiology related to sports performance, Effects of exercise and yoga on various systems of the body, Biomechanics of movement in sports and yoga, Yoga anatomy: Understanding the alignment and engagement of muscles in asanas		
Module 3: Sports Training and Techniques	8	20
Principles of sports training: Strength, endurance, speed, and flexibility, Training methodologies and periodization in sports, Techniques for enhancing athletic performance, Introduction to sports-specific drills and exercises, Application of yoga asanas for improving athletic performance and preventing injuries		
Module 4: Sports Psychology and Mindfulness	8	20
Understanding the psychological aspects of sports performance, Mental preparation and goal setting in sports, Stress management techniques for athletes, Introduction to mindfulness and its application in sports and engineering, Incorporating mindfulness practices into daily routine for improved focus and concentration		
Module 5: Applied Sports Science and Yoga in Engineering	8	20
Integration of sports science principles in engineering design, Biomechanical analysis of sports equipment and technologies, Case studies on the application of sports science in engineering projects, Designing ergonomic workspaces and equipment for athletes and engineers, Practical sessions combining sports activities, yoga, and engineering projects		

Reference Books

1. "Introduction to Sports Science" by Robert Weinberg and Daniel Gould
2. "Essentials of Strength Training and Conditioning" by NSCA - National Strength & Conditioning Association
3. "Biomechanics of Sport and Exercise" by Peter McGinnis
4. "Yoga Anatomy" by Leslie Kaminoff and Amy Matthews
5. "Anatomy and Physiology for Health Professionals" by Jahangir Moini
6. "Sports Training Principles" by Frank Dick
7. "The Psychology of Enhancing Human Performance" by Frank L. Gardner and Zella E. Moore
8. "Mind Gym: An Athlete's Guide to Inner Excellence" by Gary Mack
9. "Mindfulness in Plain English" by Bhante Henepola Gunaratana
10. "Engineering Biomechanics: Mechanics and Design Applications in Musculoskeletal Systems" by D. Gordon E. Robertson and Graham E. Caldwell

list of Experiments

1. Hands-on practice sessions focusing on various yoga asanas such as Sun Salutation, Warrior poses, and balancing poses.
2. Emphasis on correct alignment, breath awareness, and relaxation techniques.
3. Practical training sessions in different sports disciplines like cricket, football, volleyball, or athletics.
4. Focus on improving specific skills such as batting techniques, dribbling skills, or throwing techniques.
5. Conducting fitness assessments including measurements of flexibility, strength, endurance, and cardiovascular fitness using standardized protocols.
6. Analysis of fitness test results to identify areas for improvement and design personalized fitness programs.
7. Interactive sessions exploring the philosophical principles of yoga such as the Eight Limbs of Yoga, Karma Yoga, and Bhakti Yoga.
8. Guided meditation practices to cultivate mindfulness, concentration, and inner peace.
9. Practical sessions on sports nutrition focusing on meal planning, hydration strategies, and nutrient timing for optimal performance and recovery.
10. Hands-on experience in preparing nutritious meals and snacks tailored to athletes' dietary needs.

Course title:	Electronics Devices and Circuits	Sub code:				
		Structure:	L	T	P	C
			2	0	2	3

Course Objective:	• This course aims to provide students with a foundational understanding of basic semiconductor devices, including their operating principles, characteristics, and diverse applications in electronic circuits and systems. • Students will gain proficiency in analyzing and designing simple diode circuits, enabling them to comprehend the behavior of diodes in various configurations and apply this knowledge to practical circuit design scenarios. • Through this course, students will develop a comprehensive understanding of PN junction behavior within the context of circuit-level analysis. They will explore the pivotal role of PN junctions in the operation of diodes and other active semiconductor devices, facilitating deeper insights into electronic device behavior and performance.
Course Outcome:	• Understand the principles and operating characteristics of electronic devices such as diodes, transistors, and integrated circuits. • Analyze and design electronic circuits using various semiconductor devices for different applications. • Gain proficiency in device modeling, simulation, and characterization techniques. • Explore emerging electronic devices and their potential applications in modern technologies. • Develop troubleshooting skills for diagnosing and rectifying electronic device-related problems in circuits and systems.

Content	No. of hours	ESE Marks (%)
Module 1: Basic Understanding of Semiconductor Devices	8	20
Introduction to Quantum Theory of Solids: Basic principles of quantum mechanics, Schrodinger equation and its applications, Atoms and formation of energy bands, electrical conduction in solids, density of tates functions, bonding forces and energy bands in solids. Semiconductor in Equilibrium: charge carriers in semiconductors, carrier concentrations, dopant atoms and energy levels, intrinsic and extrinsic semiconductors; charge neutrality, Fermi energy level.		
Module 2: Power devices & Switching Devices	8	20
Carrier Transport Phenomena: Carrier drift, diffusion, graded impurity distribution, Hall Effect, scattering in semiconductors, velocity- electric field relations, high field transport charge injection and quasi Fermi levels. Non-Equilibrium Excess Carriers in Semiconductors: Carrier generation and recombination, characteristics of excess carriers, excess carrier lifetime, introduction to surface effects.		
Module 3: PN Junction diode and Optoelectronics devices	8	20
PN junction and hetero-structures: basic structure and principle of operation, pn junction under bias, junction capacitance, steady state conditions, transient and ac conditions, reverse bias breakdown, metal semiconductor junctions.Introduction to Optoelectronic Devices, Overview of optoelectronics ,Historical background, IMPORTANCE AND APPLICATIONS: photodiode, LED, Emerging optoelectronics Technology, Photonic Integrated Circuits.		
Module 4: Bipolar junction transistor	8	20
Bipolar Junction Transistors: Fundamental operation, amplification with BJTs, generalized biasing and equivalent circuit models, non-ideal effects, switching.		
Module 5: Field Effect Transistor	8	20
Field – Effect Transistors: Transistor operations. JFET, Metal Semiconductor FET, MISFET, MOSFET and their operations, device characteristics, non-ideal effects, CV characteristics, equivalent circuits, carbon nano tube FET and it's applicationHEMTS.		

Reference Books

	1. Electronic devices and Circuit Theory", "R. Boylestad", "Pearson Education", 9thEdition 2. "Electron devices", "S. Poornachandra, Sasikala", "Scitech", 2nd Edition 3. "Electronic Devices and Circuits", "Millman Halkias", "TMH", 2000 4. "Electronic Devices and Circuits", "DavidA.Bell", "PHI", 4thEdition
List of Experiments	
	1. **Characterization of Semiconductor Materials:** Perform experiments to understand the electrical properties of semiconductor materials such as silicon and germanium. Measure parameters like resistivity, mobility, and carrier concentration. 2. **PN Junction Diode Characteristics:** Study the I-V characteristics of a PN junction diode under forward and reverse bias conditions. Determine parameters like threshold voltage, forward and reverse bias currents, and ideality factor. 3. **Diode Rectifier Circuits:** Construct and analyze various diode rectifier circuits such as half-wave, full-wave bridge, and center-tapped full-wave rectifiers. Measure output voltage, ripple factor, and efficiency. 4. **Zener Diode Characteristics:** Investigate the voltage-regulating properties of Zener diodes. Measure the breakdown voltage and dynamic resistance of Zener diodes under different load conditions. 5. **Bipolar Junction Transistor (BJT) Characteristics:** Study the DC and AC characteristics of NPN and PNP bipolar junction transistors. Measure parameters like DC current gain (β), collector current vs. collector-emitter voltage (IC- VCE) characteristics, and output characteristics. 6. **BJT Amplifier Circuits:** Design and analyze common-emitter and common-base amplifier circuits using bipolar junction transistors. Measure parameters like voltage gain, input/output impedance, and frequency response. 7. **Field Effect Transistor (FET) Characteristics:** Investigate the DC and AC characteristics of both JFET and MOSFET transistors. Measure parameters like drain current vs. drain-source voltage (ID-VDS), transconductance, and output conductance. 8. **FET Amplifier Circuits:** Design and analyze common-source and common-drain amplifier circuits using field-effect transistors. Measure parameters like voltage gain, input/output impedance, and frequency response. 9. **Power Devices & Switching Devices:** Experiment with power semiconductor devices such as thyristors (SCRs), power MOSFETs, and IGBTs. Analyze their switching characteristics, turn-on and turn-off times, and power handling capabilities. 10. **Optoelectronic Devices:** Study the characteristics and applications of optoelectronic devices such as light-emitting diodes (LEDs), photodiodes, and phototransistors. Measure parameters like emission wavelength, forward voltage drop, and responsivity.

Course title:	**WORKSHOP TECHNOLOGY**	**Sub code:**				
		Structure:	**L**	**T**	**P**	**C**
			0	**1**	**2**	**2**
Course Objective:	To develop the technical skills of creating entities from raw materials. To give "hands on" training and practice to students for use of various tools, devices, equipment and machines. To develop ability to understand, plan and implement various processes and operations to be performed on the raw material to create object of desired shape and size.					
Course Outcome:	• Acquire practical skills in using workshop tools and machinery for basic metalworking processes. • Understand safety protocols and practices essential for working in workshop environments. • Learn fabrication techniques including welding, machining, and casting for manufacturing components. • Gain knowledge of different materials, their properties, and selection criteria for engineering applications. • Develop problem-solving abilities through hands-on experience in assembling and disassembling mechanical components and systems.					

Content	No. of hours	ESE Marks (%)
Module 1: Fitting	8	20
Use and setting of fitting tools for chipping, cutting, filing, marking, centre punching, drilling, tapping.Term work to include one job involving following operations: filing to size, drilling and tapping.		
Module 2: Carpentry	8	20
Use and setting of hand tools like hacksaws, jack planes, chisels and gauges for construction of various joints, wood tuning and modern wood turning methods. Term work to include one carpentry job involving ajoint and report on demonstration of a job involving wood tuning.		
Module 3: Electrical and Electronics	8	20
Introduction to basic electrical devices and its measurement. Introduction to basic knowledge of electronics component.		
Module 4: Welding	8	20
Use and setting of tools and equipment's for edge preparation for welding jobs and Arc welding fordifferent job like, Lap welding of two plates, butt welding of plates.		
Module 5: Machining, CNC Machines & Foundry.	8	20
At least one metal tuning job is to be demonstrated. One job on CNC Lathe and CNC Milling machine to bedemonstrated. At least one demonstration of mould making.		
Reference Books		
1. S K Hajra, CHoudhury, A K Hajra, CHoudhury, & Nirjhar Roy, Elements ofWorkshop Technology, Vol. I & II. 2. B S Raghuwanshi, A Course in Workshop Technology, Vol. 1 & II. 3. W A .l Chapman, Workshop Technology, Part I, ll & III		

list of Experiments
1. Wood sizing exercise in planning, marking, sawing, chiselling and grooving to make 1. Half lap joint 2. Cross lap joint
2. Exercise in arc welding for making 1. Lap joint 2. Butt joint
3. Preparation of sand mould for the following 1. Flange 2. Anvil
4. Preparation of joints, markings, cutting and filling for making 1. V-joint 2. T-joint
5. Making of small parts using sheet metal 1. Tray 2. Funnel

Course title:	COMMUNICATION SKILL	Sub code:				
		Structure:	L	T	P	C
			1	1	2	3

Course Objective:	• The primary objective is to develop in the under-graduate students of engineering a level of competence in English required for independent and effective communication for academic and social needs. • To impart to the students the skills that they need in their academic, and later in their professional pursuit. To train the students to adopt an innovative approach to English language teaching and learning.
Course Outcome:	• Understand the principles and technologies behind various communication systems including analog and digital transmission. • Analyze and design communication networks using modulation techniques, multiplexing, and error control coding. • Gain proficiency in using software tools for simulating and analyzing communication systems and protocols. • Explore emerging technologies such as wireless communication, optical communication, and satellite communication. • Develop practical skills in configuring and troubleshooting communication systems and networks.

Content	No. of hours	ESE Marks (%)
Module 1: Communication & Listening	8	20
An introduction - Its role and importance in the corporate world, Tools of communication, Barriers, Levels of communication, English for Specific purposes and English for technical purposes, Listening process & practice, Exposure to recorded & structured talks, class room lectures, Problems in comprehension & retention, Note-taking practice, Listening tests- Importance of listening in the corporate world.		
Module 2: Reading & Speaking	8	20
Introduction of different kinds of reading materials: technical & non-technical, Different reading strategies: skimming, scanning, inferring, predicting and responding to content, Guessing from context, Note making, Vocabulary extension. Barriers to speaking, Building self-confidence & fluency, Conversation practice, Improving responding capacity, Extempore speech practice, Speech assessment.		
Module 3: Writing	8	20
Effective writing practice, Vocabulary expansion, Effective sentences: role of acceptability, appropriateness, brevity & clarity in writing, Cohesion & coherence in writing, Writing of definitions, descriptions& instructions, Paragraph writing, Introduction to report writing.		
Module 4: Engineering Ethics	8	20
What is profession? Engineering and Professionalism, Models of Professionalism, Types of Ethics or Morality, Engineering Ethics, Variety of moral issues, Responsibility in Engineering, Engineering Standards, The Standard Care, The Positive face of Engineering Ethics, The Negative Face of Engineering Ethics, Blame-Responsibility and Causation types of inquiry moral dilemmas, moral autonomy, The problems of Many Hands, Kohlburg's theory, Gilligan's theory Impediments to Responsible Action.		
Module 5: Safety & problem Framing	8	20
Engineering as social experimentation, Framing the problem, Determining the facts codes of ethics, clarifying Concepts, Application issues, Common Ground, General principles, Utilitarian thinking respect for persons, Engineer's Responsibility for Safety, Social and Value dimensions of Technology, TechnologyPessimism, The Perils of Technological Optimism, The Promise of Technology , Computer, Technology Privacy and Social Policy, Honesty, Integrity & Reliability, Risk, Safety and Liability in Engineering, Risk Benefit Analysis – Collegiality and loyalty.		

Reference Books

1. Krishna Mohan and Meenakshi Raman (2000) Effective English Communication,Tata McGraw Hill, New Delhi.
2. Meenakshi Raman and Sangeetha Sharma (2006) Technical Communication, OxfordUniversity Press, New Delhi.
3. M. Ashraf Rizvi (2005) Effective Technical Communication, Tata McGraw-Hill,New Delhi.
4. Christopher Turk (1985) Effective S peaking, E & FN Spon, London
5. Golding S.R. (1978) Common Errors in English Language, Macmillan.
6. Mike Martin and Roland Schinzinger, "Ethics in Engineering" McGraw Hill
7. Charles E Harris, Micheal J Rabins, "Engineering Ethics, Cengage Learning
8. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists andEngineers, Oxford University Press
9. Caroline Whitback Ethics in Engineering Practice and Research, CambridgsUniversity Press.

List of Experiments

1. Conduct workshops focusing on public speaking techniques, including voice modulation, body language, and speech organization.
2. Organize group discussion sessions on engineering-related topics to improve students' ability to express their ideas articulately and persuasively.
3. Assign students to prepare and deliver technical presentations on engineering topics relevant to their specialization.
4. Conduct mock job interviews to help students develop effective communication skills for professional settings.
5. Assign students to write technical reports on engineering projects or research findings.
6. Provide guidance on writing professional emails for various purposes, such as inquiry, collaboration, and project management.
7. Explore the importance of cross-cultural communication in engineering projects with diverse team members and stakeholders.
8. Conduct negotiation and conflict resolution simulations to help students develop interpersonal communication and problem-solving skills.
9. Organize sessions where students present technical posters summarizing their research projects or engineering designs.
10. Arrange networking events where students can interact with professionals from the engineering industry, academia, and related fields.

Course title:	**Design Thinking**	**Sub code:**	**HS102**			
		Structure:	**L**	**T**	**P**	**C**
			0	**0**	**2**	**1**

COURSE OBJECTIVE(S):

The objective of this Course is to provide the new ways of creative thinking and Learn the innovation cycle of Design Thinking process for developing innovative products which useful for a student in preparing for an engineering career.

Course Outcomes (CO):

Student will able to

1. Compare and classify the various learning styles and memory techniques and Apply them in their engineering education
2. Analyze emotional experience and Inspect emotional expressions to better understand users while designing innovative products
3. Develop new ways of creative thinking and Learn the innovation cycle of Design Thinking process for developing innovative products
4. Propose real-time innovative engineering product designs and Choose appropriate frameworks, strategies, techniques during prototype development
5. Perceive individual differences and its impact on everyday decisions and further Create a better customer experience

Module 1: Foundations of Learning and Memory

An Insight to Learning

- Understanding the Learning Process
- Kolb's Learning Styles
- Assessing and Interpreting

Remembering Memory

- Understanding the Memory Process
- Problems in Retention
- Memory Enhancement Techniques

Module 2: Emotional Intelligence and Individual Differences

Emotions: Experience & Expression

- Understanding Emotions: Experience & Expression
- Assessing Empathy
- Application with Peers

Celebrating the Difference

- Understanding Individual Differences & Uniqueness
- Group Discussion and Activities to Encourage the Understanding, Acceptance, and Appreciation of Individual Differences

Module 3: Introduction to Design Thinking and Creativity

Basics of Design Thinking

- Definition of Design Thinking
- Need for Design Thinking
- Objective of Design Thinking
- Concepts & Brainstorming
- Stages of Design Thinking Process (explain with examples):
    - Empathize
    - Define
    - Ideate
    - Prototype
    - Test

Being Ingenious & Fixing Problem

- Understanding Creative Thinking Process
- Understanding Problem Solving
- Testing Creative Problem Solving

Module 4: Product Design and Prototyping

Process of Product Design

- Process of Engineering Product Design
- Design Thinking Approach
- Stages of Product Design
- Examples of Best Product Designs and Functions
- Assignment – Engineering Product Design

Prototyping & Testing

- What is Prototype?
- Why Prototype?
- Rapid Prototype Development Process
- Testing
- Sample Example
- Test Group Marketing

Module 5: Customer-Centric Innovation and Final Integration

Design Thinking & Customer Centricity

- Practical Examples of Customer Challenges
- Use of Design Thinking to Enhance Customer Experience
- Parameters of Product Experience
- Alignment of Customer Expectations with Product Design

Feedback, Re-Design & Re-Create

- Feedback Loop
- Focus on User Experience
- Address Ergonomic Challenges
- User Focused Design
- Rapid Prototyping & Testing
- Final Product
- Final Presentation – "Solving Practical Engineering Problem through Innovative Product Design & Creative Solution"

List of Practicals

1. Learning Style Assessment using Kolb's Model
2. Memory Retention & Enhancement Exercise
3. Emotion Mapping and Empathy Test
4. Design Thinking Case Study Analysis
5. Group Brainstorming for Creative Problem Solving
6. Mini Product Design Challenge
7. Low-Fidelity Prototyping Workshop
8. Rapid Testing and Feedback Collection
9. Activity on Understanding Individual Differences
10. Customer Persona Development and Journey Mapping

Course title:	**ENGINEERING MATHEMATICS - III**	**Sub code:**			
		Structure:	**L**	**T**	**P**	**C**
			2	**1**	**0**	**3**
Course Objective:	● To Explain the Importance of Numerical Methods in Solving Differential Equations, Integrations, and Algebraic Equations ● To Explain the Significance of Laplace and Z Transforms and Their Use in Solving Differential and Difference Equations. ● To Apply Different Statistical and Curve Fitting Techniques to Gain Insights from Data. ● To Describe the Theory of Complex Variables				

Course Outcome:	• Master advanced mathematical techniques including vector calculus and complex analysis for engineering applications. • Apply Laplace transforms and Numerical methods to solve differential equations arising in engineering problems. • Develop proficiency in numerical methods for solving Complex Variable Integration problems. • Explore probability and statistics concepts relevant to engineering decision-making and data analysis. • Utilize mathematical modeling to analyze and solve real-world engineering problems in various disciplines.

Content	**No. of hours**	**ESE Marks (%)**
Module 1: Numerical Method	8	20
Lagrange's interpolation formula, Numerical differentiation, solution of ordinary differential equation byPicard's method, Taylor 's series method, Euler's modified method and Runge- Kutta method.		
Module 2: Laplace Transform	8	20
Existence theorem - Transform of standard functions – Transform of Unit step function and Dirac delta function – Basic properties - Shifting theorems - Transforms of derivatives and integrals – Transform of periodic functions - Initial and Final value theorem - Inverse Laplace - Convolution theorem– Solving Initial value problems by using Laplace Transform techniques. Solution of LDE by Laplace Transform.		
Module 3: Fourier Series	8	20
Dirichlet's conditions – General Fourier series – Odd and even functions – Half-range Sine and Cosine series – Complex form of Fourier series – Parseval's identity – Harmonic Analysis.		
Module 4: Fourier Transforms	8	20
Fourier integral theorem – Fourier transform pair - Fourier sine and cosine transforms – Properties – Transform of elementary functions - Convolution theorem – Parsevals's identity.		
Module 5: Z transform and difference equations	8	20
Z-transform – Elementary properties – Inverse Z-transform – Convolution theorem – Initial and final value theorems – Formation of difference equation – Solution of difference equation using Z – transform.		

Reference Books

1. P.N. Wartikar and J.N.Wartika, A Text Book of Engineering Mathmatics (Vol. I &II)
2. B.S.Grewal, Higher Engineering Mathematics, Khanna Publicatons, New Delhi
3. Erwin Kreyszing, Advanced Engineering Mathematics, Willey Eastern Ltd.

Course title:	**Power Electronics**	**Sub code:**				
		Structure:	**L**	**T**	**P**	**C**
			2	**0**	**4**	**4**

Course Objective:	• This course aims to explore the fundamental characteristics and operational principles of various semiconductor devices, providing students with a comprehensive understanding of their behavior and applications in electronic circuits and systems. • Students will develop proficiency in analyzing different types of power electronic converters, including their topologies, control strategies, and performance characteristics, enabling them to evaluate their suitability for various power conversion applications • Students will gain practical experience in applying different types of power electronic converters in real-world scenarios, facilitating their ability to design, implement, and troubleshoot power conversion systems effectively.

Course Outcome:	• Understand the principles and characteristics of power semiconductor devices and their applications in electronic power conversion. • Analyze and design power electronic circuits for various applications including rectification, inversion, and conversion. • Gain proficiency in control techniques for regulating voltage, current, and power in power electronic systems. • Explore the integration of power electronics in renewable energy systems, electric vehicles, and industrial applications. • Develop practical skills in simulation, testing, and troubleshooting of power electronic circuits and systems.

Content	**No. of hours**	**ESE Marks(%)**
Module 1: Power Semiconductor Devices and Switching Fundamentals	8	20
Power semiconductor devices: characteristics and operation of power diodes, SCR, TRIAC, DIAC, BJT, MOSFET, and IGBT. Switching characteristics, gate triggering methods, turn-on and turn-off processes, and thermal management. Commutation techniques and protection circuits including snubbers and freewheeling diodes. Comparison and selection of devices based on application requirements.		
Module 2: Power Converters – Rectifiers, Choppers, and Inverters	8	20
AC-DC converters: uncontrolled and controlled rectifiers (single-phase and three-phase), half and full converters, output characteristics, and power factor control. DC-DC converters: step-down (buck), step-up (boost), buck-boost and Cuk converters, operation in continuous and discontinuous modes. DC-AC inverters: single-phase and three-phase, PWM techniques (sine PWM, SVPWM), harmonic reduction and inverter applications.		
Module 3: Power System Design and Protection	8	20
Structure of electrical power systems: generation, transmission, and distribution. Components of power systems: generators, transformers, cables, circuit breakers, and substations. Basics of load estimation, transformer selection, and cable sizing. Earthing and lightning protection. Protective devices: relays, fuses, MCBs, and surge protectors. Introduction to smart grid systems and renewable energy integration.		
Module 4: Power Management in Electronic Systems	8	20
Power supply design: linear voltage regulators (LDOs) and switching mode power supplies (SMPS). Battery management systems: battery types, charging techniques, protection circuits, and SoC estimation. Low-power design strategies in embedded systems: dynamic voltage and frequency scaling (DVFS), sleep modes, and power gating. Energy harvesting techniques using solar, vibration, and RF energy sources for low-power devices.		
Module 5: **Applications of Power Electronics in Modern Systems**	8	20
Applications of power electronics in motor drives: DC motors, induction motors, BLDC and stepper motors. Overview of variable frequency drives (VFDs). Role of power electronics in renewable energy systems such as solar and wind energy converters. Introduction to electric vehicle power electronics: traction inverters, DC-DC converters, and onboard chargers. Design insights into UPS, SMPS, and real-world power management ICs.		

Reference Books

	1	P.C. Sen , " Power Electronics ", Tata McGraw Hill
	2	M. H. Rashid – *Power Electronics: Circuits, Devices and Applications*, Pearson
	3	P. S. Bimbhra – *Power Electronics*, Khanna Publishers
	4	G. K. Dubey, S. R Doradle, "Thyristorised Power Controllers"
	5	J. M. Jalnekar and N. B. Pasalkar, " Power Electronics " Technical Publication
	6	Ned Mohan, T.M. Undeland and W.P. Robbins, " Power Electronics: Converters,Applications and Design", John Wiley, Singapore, 1994
	7	M D Singh and K. B Khanchandani, " Power Electronics ", Tata McGraw Hill
	8	B.K.Bose, "Power Electronics & A.C. Drives", Prentice Hall, 1986.

List of Experiments

	1.	VI Characteristics of Power Semiconductor Devices • Devices: SCR, TRIAC, DIAC, MOSFET, IGBT

		• Objective: Plot static and dynamic characteristics and observe switching behavior.
	2.	Triggering and Commutation of SCR Objective: Study gate triggering circuits and natural/forced commutation methods.
	3.	Study of Single-Phase Controlled Rectifier • Types: Half-wave and full-wave (using SCR) • Objective: Measure output voltage and waveform under resistive and inductive loads.
	4.	Simulation and Hardware of Buck and Boost Converters • Tools: MATLAB/Simulink or hardware prototype • Objective: Observe voltage conversion and continuous/discontinuous conduction modes.
	5.	Design and Testing of a DC-AC PWM Inverter • Objective: Implement single-phase inverter and analyze PWM waveform and harmonics.
	6.	Load Estimation and Cable Sizing for Small Power System • Objective: Perform practical calculation for residential or lab-based loads.
	7.	Earthing, Grounding and Surge Protection Demonstration • Objective: Measure earth resistance, study earthing types and protection device operation.
	8.	Design and Testing of a Linear Voltage Regulator and SMPS • ICs: 7805/LM317 for LDO; flyback/buck converter for SMPS • Objective: Compare efficiency and regulation characteristics.
	9.	Battery Charging & Management System using BMS ICs or Modules • Objective: Monitor battery SoC, charge/discharge control, and protection.
	10	Simulation/Hardware of Electric Vehicle Subsystems (EV Traction Drive / DC-DC Converter) • Objective: Understand role of inverter, traction motor, and DC-DC converter in EV systems.

Course title: Electronic Measurement and Instrumentation	**Subject code:**	**L**	**T**	**P**	**C**
		2	**0**	**4**	**4**

Course Objective:	The primary objective of this course is to provide students with a comprehensive understanding of the fundamental principles underlying various measuring instruments. Through theoretical lectures, practical demonstrations, and hands-on laboratory exercises, students will explore the underlying concepts and operational mechanisms of a wide range of measuring instruments used in electronic engineering.
Course Outcome:	• Understand the principles and operation of electronic measuring instruments used for electrical and electronic parameters. • Learn techniques for accurate measurement, calibration, and error analysis in electronic circuits and systems. • Gain proficiency in the design and implementation of instrumentation systems for various engineering applications. • Explore advanced topics such as sensors, transducers, signal conditioning, and data acquisition systems. • Develop practical skills in laboratory experiments, data acquisition, and analysis using modern instrumentation tools and techniques.

Content	**No. of hours**	**ESE Marks(%)**
Module 1: Fundamentals of Electronic Measurement and Instrumentation	8	20

Necessity of electronic Measurement , Block diagram of electronic measurement system,Types of Measurements, Function of instruments and measurement systems, Applications ofmeasurement system, Elements of measurement system, Types of instruments, Theory of errors ,Accuracy and Precision, Types oferrors, Statistical analysis , probability of errors, Limiting errors,Standards of measurement.		
Module 2: Electromechanical Instruments and AC, DC Bridges	8	20
Construction of Galvanometer, Suspension Galvanometer, Torque and deflection Galvanometer, PMMC mechanism, DC voltmeter; AC voltmeters; Peak, average and true RMS voltmeters; Digital Millimetres; Ammeters, Ohm-meters and their design' AC indicating instruments, Watt-hour meter; Power factor meter. DC Bridges : Wheatstone Bridge, Kelvin Bridge. AC Bridges and their applications: Maxwell's Bridge, Hay's Bridge, Schering Bridge, Desauty's Bridge, Wein Bridge, Detectors for AC bridges.		
Module 3: Transducers and sensors	8	20
Static and dynamic characteristics of Transducer , Classification of transducers, Capacitive transducer, Inductive transducer, Resistive transducer, Displacement Transducer, LVDT, RVDT, Strain Gauge, RTD, Optical Transducers, Hall effect transducer, Piezoelectric transducers, Transducers for measurement of Pressure, Temperature, Level, Displacement, Flow.Sensors and its types. Thermoelectric Sensors: Thermocouples, Piezoelectric Sensors, Pyroelectric Sensors, Electrochemical. Sensors, Acoustic Temperature Sensors, Nuclear Thermometer, Magnetic Thermometer, SemiconductorTypes, Thermal Radiation, Quartz Crystal, NQR, Spectroscopic Noise Thermometry, Heat Flux Sensors. Position Encoders, Resonant Sensors, SAW Sensors, Sensors Based On Semiconductor Junctions, Sensors Based On MOSFET Transistors,Charge-Coupled And CMOS Image Sensors, Fiber-Optic Sensors, Ultrasonic-Based Sensors, Biosensors, Proximity Sensors: Typical Sensor Characteristics, Technologies ForProximity Sensing, Electro-Optical Sensors, Capacitive Sensors, Magnetic Sensors.		
Module 4 Signal generator and Signal Analyzer	8	20
CRO: Types, Dual trace, High frequency, sampling and storage oscilloscopes, Applications of CRO.Signal Generators: Introduction, Sine-wave generator, standard signal generators, Audio frequency signal generation, RF generator, Pulse generator, Function generator. Construction and operation of Signal analyzer, Wave analyzer, Harmonic Distortion analyzer, Spectrumanalyzer and Logic analyzer; Signal conditioning and its necessity, process adopted in		
Module 5: Data Acquisition System	8	20
Signal conditioning,Functions of ,Signal conditioning, AC/DC Conditioning systems, Dataconversion: ADC, DAC, Generalized data acquisition system: single channel and multi-channel DAS.		

Reference Books

1. A.D. Helfrick and W.D. Cooper: "Modern Electronic Instrumentation and MeasurementTechniques", PHI Publications.
2. A.K. Sawhney : "Electrical and Electronic Measurement and Instrumentation", DhanpatRai & Sons Publications
3. S.S. Kalsi : "Electronics Measurements", Mc Graw Hill Publications.
4. B.H. Oliver and J.M Cage : "Electronics Measurement and Instrumentation", Mc GrawHill Publications

List of Experiments

1.	Displacement measurement using LVDT
2.	Force/ Pressure measurement using Strain Gauge
3.	Study of Data Acquisition System
4.	Study of Lab VIEW software
5.	Study of Lab VIEW projects, SubVIs, Block Diagram, Front Panel
6.	Use of Loops, Case Structure, Sequence, Timing, Formula Node, Expression Node
7.	Use of Arrays and Clusters
8.	Study of Lab VIEWs Visual display
9.	Exploring String and File I/O
10	Data Acquisition in Lab VIEW

Course title:	Digital Logic and Circuits	Sub code:				
		Structure:	L	T	P	C
			2	1	2	4

Course Objective:	• Introduce number systems, binary codes, and basic logic gates. • Enable students to simplify Boolean expressions using algebraic methods and Karnaugh Maps. • Teach the design and analysis of combinational logic circuits. • Introduce various types of flip-flops, counters, and shift registers in sequential logic. • Familiarize students with memory elements, logic families, and programmable logic devices
Course Outcome:	**CO1:** Perform conversions between number systems and design logic functions using basic and universal gates. **CO2:** Simplify Boolean expressions using Karnaugh Maps and Boolean algebra for circuit minimization. **CO3:** Design and analyze combinational logic circuits like adders, subtractors, multiplexers, and decoders. **CO4:** Understand and implement sequential circuits such as flip-flops, counters, and shift registers. **CO5:** Understand the architecture and applications of memory units and programmable logic devices.

Content	No. of hours	ESE Marks(%)
Module 1: Number System, Codes and Boolean Algebra	8	20
Number systems and their inter-conversion, Binary Arithmetic (Addition, Subtraction, Multiplication and Division), BCD codes, Excess-3 code, Gray code, Hamming code, error detection and correction. Boolean Algebra, Basic Theorems and properties of Boolean Algebra, Boolean Functions, Canonical and Standard forms-map method, Two, Three, Four and Five variable K-maps, Sum of products and Product of Sums Simplification. The tabulation method, Determination of Prime implicants, Selection of Essential Prime implicants. Digital Logic Gates, Various Logic Families - DTL, TTL and CMOS.		
Module 2: Introduction to Verilog HDL	8	20
Verilog as HDL, Levels of Design Description, Concurrency, Simulation and Functional Verification. Language Constructs and Conventions: Introduction, Keywords, Identifiers, White Space Characters, Comments, Numbers, Strings, Logic Values, Strengths, Data Types, Scalars and Vectors, Parameters, Operators. Test benches. Modelling and simulation of logic gates and Boolean functions using Verilog HDL. Functional verification using test benches.		
Module 3: Combinational Logic Design	8	20
NAND and NOR implementation of basic gates and Boolean functions. Binary adder and sub tractor, Multiplexers and De-Multiplexers, Decoders and Encoders. Carry Lookahead adder. BCD to 7 segment decoders. An 8 bit-ALU design. Modelling and simulation of combination circuits using Verilog HDL. Writing test cases, Functional verification using test benches. Direct and random verification.		
Module 4: Sequential Logic Design	8	20
Introduction, S-R Flip-flops, JK flip-flop, D flip-flop, T flip-flop, master slave flip-flop. Flip-flop excitation table, Interconversion of flip-flop, Register and Counter circuits. Finite state machines-Mealy and Moore FSMs. FSM encoding techniques-binary, Gray and One hot. Verilog RTL Coding. Modelling and simulation of sequential circuits using Verilog HDL. Writing test cases, Functional verification using test benches. Direct and random verification.		
Module 5: Programmable Logic Devices-Architecture and Programming	8	20
PAL, PLA, PLD, CPLD and FPGA. LUT and CLB architecture. FPGA Architecture-Fine grained and coarse-grained. Verilog RTL coding for synthesis. FPGA Design Flow. Overview of FPGA development tools. Case study-Xilinc-Kintex-7 FPGA Family. Implementation of logic circuits on FPGA. In system Debugging using ILA.		

Reference Books

1. **M. Morris Mano, Michael D. Ciletti** – *Digital Design*, Pearson Education
2. **R.P. Jain** – *Modern Digital Electronics*, McGraw-Hill Education
3. **Thomas L. Floyd** – *Digital Fundamentals*, Pearson Education
4. **John F. Wakerly** – *Digital Design: Principles and Practices*, Pearson
5. **Tokheim** – *Digital Electronics: Principles and Applications*, McGraw-Hill Education

list of Experiments

1. **Verification of Logic Gates:** Implement and verify the truth tables of AND, OR, NOT, NAND, NOR, XOR, and XNOR gates.
2. **Universal Gates Implementation:** Realize basic logic functions using only NAND or NOR gates.
3. **Boolean Expression Simplification:** Simplify given Boolean expressions and implement the minimized circuits using logic gates.
4. **Design of Half Adder and Full Adder:** Construct and test circuits for half and full adders using logic gates.
5. **Design of Half Subtractor and Full Subtractor:** Implement and verify half and full subtractor circuits.
6. **Multiplexer and Demultiplexer:** Design and test 4:1 MUX and 1:4 DEMUX circuits.
7. **Flip-Flop Implementations:** Implement and observe SR, D, T, and JK flip-flops using basic gates or ICs.
8. **Counters:** Design and test asynchronous and synchronous up/down counters (e.g., mod-8, mod-10).
9. **Shift Registers:** Construct and analyze SIPO, SISO, PIPO, and PISO shift registers.
10. **BCD to 7-Segment Display:** Design a decoder to display BCD inputs on a 7-segment LED display.
11. Design and Simulation of 8-bit ALU in Verilog
12. CLA implementation using Verilog.
13. Finite State Machine (FSM) – Design of Sequence Detector using Verilog.
14. Design and Synthesis of Combinational Circuit on FPGA Board (e.g., Basys 3 / Kintex-7)
15. FPGA-based 4-bit Counter with LED Display and On-Chip Debugging using ILA
16. Verilog Implementation of a Small FSM Synthesized on Xilinx FPGA.

Course title:	**Linear Electrical Networks**	**Sub code:**				
		Structure:	**L**	**T**	**P**	**C**
			2	**2**	**0**	**4**

Course Objective:	• This course aims to provide students with a solid foundation in circuit analysis principles, covering essential concepts such as voltage, current, resistance, and basic circuit laws. • Students will learn to analyze and solve DC circuits using Kirchhoff's Voltage Law (KVL) and Kirchhoff's Current Law (KCL), enabling them to determine voltage and current distributions in complex circuits. • Through theoretical study and practical exercises, students will develop proficiency in analyzing AC circuits using KVL and KCL principles, facilitating the analysis of alternating current behavior in electrical circuits. • Students will learn various circuit analysis theorems such as Thevenin's theorem, Norton's theorem, and Superposition theorem, and apply them to solve complex network problems efficiently. • This course will enable students to analyze the frequency response of circuits and establish correlations between time domain and frequency domain responses, providing insights into circuit behavior across different domains. • Through theoretical study and practical design exercises, students will learn to design and implement various types of filter networks including low pass, high pass, band pass, and

	band elimination filters, catering to specific frequency domain requirements in practical applications.
Course Outcome:	• Understand the principles of linear circuit analysis including Ohm's Law, Kirchhoff's Laws, and network theorems. • Analyze and solve linear electrical networks consisting of resistors, capacitors, inductors, and independent sources. • Gain proficiency in analyzing AC circuits using phasor techniques, impedance, and admittance concepts. • Explore the behavior of linear networks under sinusoidal steady-state conditions and transient responses. • Develop problem-solving skills for analyzing and designing linear electrical networks for various engineering applications.

Content	**No. of hours**	**ESE Marks(%)**
Module 1: Basic concept of circuit theory & Network Theorems	8	20
Review of circuit analysis using Kirchoff's laws, nodal and mesh analysis, solution by classical method and Laplace transform, concept of independent and dependent sources, analysis of special signal waveforms, and duality of networks, Brief review of Signals and Systems. Superposition and Reciprocity theorem, Thevenin's and Norton's theorem, Millman's theorem, maximum power transfer theorem, compensation, Tellegan's theorem, analysis of circuits using theorems.		
Module 2: Transient Analysis of Networks	8	20
Network elements, Transient response of R-L, R-C, R-L- C for DC and sinusoidal excitation, Initial condition, Solution using differential equation approach and Laplace transform method. Behaviors of series and parallel resonant circuits		
Module 3: RLC circuit and Resonance	8	20
Laplace transforms and properties: Partial fraction, singularity functions, waveform synthesis, analysis of RC, RL, and RLC networks with and without initial conditions with Laplace. Resonance conditions, quality factor,		
Module 4: Two Port Networks and Graph theory	8	20
Two Port Networks, Graph theoretic analysis for Large scale networks, Formulation and solution of network graph of simple networks, State space representation, Analysis using NGSPICE.		
Module 5: Passive Filter Design	8	20
Butter worth and Chebyshev approximations, Normalized specifications, Frequency transformations, Frequency and impedancede-normalisation, Types of frequency selective filters, Linear phase filters.		

Reference Books

	1	"Network and systems" by D.Roy - Choudhary
	2	"Circuit Analysis - with computer applications to problem solving" by Someshwar C. Gupta, Jon W. Bayless, Behrouz Peikari.
	3	Franklin F. Kuo, "Network Analysis and Synthesis ", John Wiley.
	4	Vanvalkenburg, "Network Analysis ", Printice Hall of India Pvt. Ltd., New Delhi, 1994.
	5	A William Hayt, "Engineering Circuit Analysis," 8th Edition, McGraw-Hill Education.
	6	A. Anand Kumar, "Network Analysis and Synthesis," PHI publication, 2019.

	7	Sudhakar, A., Shyammohan, S. P., "Circuits and Network," Tata McGraw-Hill New Delhi, 1994.

Course title:	**Constitution of India**	**Sub code:**				
		Structure:	**L**	**T**	**P**	**C**
			2	**1**	**0**	**3**

Course Objective:	• To provide students with a comprehensive understanding of the historical context and processes involved in the making of the Indian Constitution. • To examine and analyze the significance and interpretation of the Preamble and the Basic Structure of the Indian Constitution. • To familiarize students with the fundamental rights and duties enshrined in the Indian Constitution and their interpretation in contemporary contexts. • To explore the principles of state policy and their implications for governance and development in India.
Course Outcome:	• Demonstrate a thorough understanding of the historical events and key figures involved in the making of the Indian Constitution. • Analyze and evaluate the significance of the Preamble and the Basic Structure doctrine in shaping Indian constitutional law. • Apply knowledge of fundamental rights and duties to analyze contemporary socio-political issues and debates. • Evaluate the role and powers of various organs of the Indian government, including the President, Prime Minister, and Parliament, in the functioning of the Indian Union. • Assess the functioning of local administrations, including the roles of governors, chief ministers, and local governing bodies, in implementing governance at the grassroots level.

Content

Module 1: The Constitution - Introduction

The History of the Making of the Indian Constitution, Preamble and the Basic Structure, and its interpretation , Fundamental Rights and Duties and their interpretation, State Policy Principles.

Module 2: Union Government

Structure of the Indian Union, President – Role and Power, Prime Minister and Council of Ministers Lok Sabha and Rajya Sabha

Module 3: Local Administration

Governor – Role and Power, Chief Minister and Council of Ministers, State Secretariat

Module 4: Local Administration

District Administration, Municipal Corporation, Zila Panchayat

Module 5: Election Commission

Role and Functioning, Chief Election Commissioner, State Election Commission

Reference Books

	1	Ethics and Politics of the Indian Constitution by Rajeev Bhargava Oxford University Press, New Delhi, 2008
	2	The Constitution of India by B.L. Fadia Sahitya Bhawan; New edition (2017)
	3	Introduction to the Constitution of India by DD Basu Lexis Nexis; Twenty-Third 2018 edition

Course title:	Control System Engineering	Sub code:				
		Structure:	L	T	P	C
			3	1	0	4

Course Objective:	• To introduce different types of system and identify a set of algebraic equations to represent and model a complicated system into a more simplified form to interpret different physical and mechanical systems in terms of electrical system to construct equivalent electrical models for analysis. • To employ time domain analysis to predict and diagnose transient performance parameters of the system for standard input functions and identify the needs of different types of controllers and compensator toascertain the required dynamic response from the system. • Formulate different types of analysis in frequency domain to explain the nature of stability of the system.
Course Outcome:	Understand the principles and concepts of control systems including feedback, stability, and performance criteria. Analyze and design control systems using various techniques such as root locus, frequency response, and state-space methods. Gain proficiency in modeling dynamic systems and obtaining transfer functions for control system design. Explore the application of control systems in engineering disciplines such as robotics, aerospace, and industrial automation. Develop practical skills in implementing control algorithms, tuning controllers, and analyzing system responses through simulations and experiments.

Content	**No. of hours**	**ESE Marks(%)**
Module 1: Introduction to Control Systems	8	20
Types of Control Systems, Effect of Feedback Systems, Differential equation of Physical Systems –Mechanical Systems, Electrical Systems, Analogous Systems. Block diagrams and signal flow graphs: Transfer functions, Block diagram algebra and Signal Flow graphs.		
Module 2: Time Response of feedback control systems	8	20
Standard test signals, Unit step response of First and Second order Systems. Time response specifications, Time response specifications of second order systems, steady state errors and error constants. Introduction to PI, PD and PID Controllers (excluding design).		
Module 3: Stability analysis	8	20
Concepts of stability, Necessary conditions for Stability, Routh stability criterion, Relative stability analysis: more on the Routh stability criterion, Introduction to Root-Locus Techniques, The root locus concepts, Construction of root loci.		
Module 4: Frequency domain analysis and stability	8	20
Correlation between time and frequency response, Bode Plots, Experimental determination of transfer function. Introduction to Polar Plots, (Inverse Polar Plots excluded) Mathematical preliminaries, Nyquist Stability criterion, (Systems with transportation lag excluded) Introduction to lead, lag and lead-lag compensating networks (excluding design).		
Module 5: Introduction to Digital Control System	8	20
Introduction, Spectrum Analysis of Sampling process, Signal reconstruction, Difference equations. Introduction to State variable analysis: Introduction, Concept of State, State variables & State model, State model for Linear Continuous & Discrete time systems, Diagonalization.		

Reference Books

	2	Control systems, K.R. Varmah, McGraw hill
	3	Control System Engineering, D. Roy Chowdhuri, PHI
	4	Digital Control system, B.C. Kuo, Oxford University Press.

	5	Control System Engineering, I. J. Nagrath& M. Gopal. New AgeInternational Publication
	6	Modern Control Engineering, K. Ogata, 4th Edition, Pearson Education

Course title:	**Microprocessor and Microcontroller**	**Sub code:**				
		Structure:	**L**	**T**	**P**	**C**
			2	**1**	**2**	**4**

Course Objective:	This subject deals about the basic 16-bit (8086) processor and an 8-bit (8051) controllers, their architecture, internal organization and their functions, interfacing an external device with the processors/ controllers.
Course Outcome:	• Understand the architecture, instruction set, and operation of microprocessors and microcontrollers. • Analyze and design digital systems using assembly language programming for microprocessors. • Gain proficiency in interfacing peripheral devices and implementing input/output operations. • Explore embedded system design concepts including real-time operating systems and software development tools. • Develop practical skills in programming, debugging, and testing microcontroller-based systems for various applications.

Content	**No. of hours**	**ESE Marks(%)**
Module 1: 8086 Architecture	8	20
Introduction to advanced microprocessors, 8086 internal architecture, Memory, Organization, Addressing modes, Accessing immediate & Register data, Memory accessing. 8086 minimum/maximum mode system, Real and Protected modes of operation, Address translation, Memory organization, Paging.		
Module 2: 8086 Instruction Set	8	20
8086 data transfer instructions, Arithmetic instructions, Bit manipulation instructions, String instructions, Conditional & Unconditional branch instructions, Processor control instructions, Overview of 8086 interrupts responses, 8086 interrupt types, Examples, Hardware interrupt applications, Multiple interrupts, 8259 a interrupt controller, Examples using 8259 A with 8088.		
Module 3: Keyboard & Display interfacing	8	20
Keyboard interfacing, interfacing LED displays, 8279 keyboard/ display controller, Block diagram, Pin description, Functional description, Software operation, Interface considerations, Circuit connections with 8086.		
Module 4: Advanced Microprocessors	8	20
Introduction to Pentium and Pentium pro architectures: RISC concepts, BUS operation, Super scalararchitecture, Pipelining Introduction to Pentium II, Pentium III and Pentium 4 processors. RISC Architecture : Properties of RISC Systems Comparison with CISC architecture.		
Module 5: Introduction to Microcontrollers	8	20
Study of micro controller (MCS 51 family- 8051) - Architecture - Comparison of various families of 8 bit micro controllers. System design techniques interfacing of LCD, Stepper motor, Keyboard and ADC /DAC using microcontrollers. Study of micro controller 8096 - Architecture, Typical application in automotive and other industries, Introduction to super pipelined super scalar architectures of microcontrollers.		

Reference Books

	1	D. Hall, " Microprocessor and Interfacing (8086), 2nd ed, TMH
	2	Gibson, " Microprocessor and Interfacing", 2nd edition, PHI
	3	Triebel and Singh, " The 8088 and 8086 Microprocessors : Programming, Interfacing,software, Hardware and Applications ", PHI

	4	Brey, " Intel Microprocessors, 8086 to Pentium and Pentium pro processor:Architecture, Programming and interfacing", 4th edition, PHI / Pearson
	5	Ajay Deshmukh, "Microcontrollers (Theory and Applications) –TMH
	6	M.A. Mazidi&J.G.Mazidi, The 8051 Microcontroller and Embedded systems 3rdIndian reprint, Pearson Education.
list of Experiments		
	1	Microprocessor 8086 based development system
	2	Simple arithmetic programs
	3	Array manipulation programs
	4	Code conversion programs
	5	LED Bank interface
	6	ADC ,DAC interface
	7	Stepper Motor interface
	8	Programming exercises in c and assembly language covering program and data memory
	9	i/o port, Peripheral and external interrupt, power saving modes
	10	Interfacing of devices like keys, relays, leads, seven segment, LCD Module, Matrix keyboard etc.

Course title:	**Signals and Systems**	**Sub code:**				
		Structure:	**L**	**T**	**P**	**C**
			2	**1**	**2**	**4**

Course Objective:	• This course aims to provide students with a comprehensive understanding of signals and systems, covering fundamental concepts such as signal classification, system properties, and mathematical representations. • Students will learn to analyze signals and systems in both continuous and discrete domains using time domain and frequency domain methods, including techniques such as convolution, Fourier analysis, and Laplace transforms, enabling them to characterize and manipulate signals and systems effectively. • Through theoretical study and practical exercises, students will gain insight into the stability of systems by examining the concept of Region of Convergence (ROC) in the context of signal and system analysis, enabling them to assess system stability and robustness. • This course will familiarize students with various transform techniques used in the analysis of signals and systems, including Fourier transforms, Laplace transforms, and Z-transforms, providing them with versatile tools for signal representation, analysis, and manipulation across different domains.
Course Outcome:	• Understand the fundamentals of signals, systems, and their mathematical representations. • Analyze linear time-invariant (LTI) systems using convolution, Fourier analysis, and Laplace transforms. • Gain proficiency in analyzing signals and systems in both time and frequency domains. • Explore applications of signal and system theory in communication, control, and signal processing. • Develop problem-solving skills for designing and analyzing linear systems and filters for various engineering applications.

Content	**No. of hours**	**ESE Marks(%)**
Module 1: Vector spaces	8	20
Field-definition-Finite field arithmetic. Vector Spaces – Subspaces – Linear Combinations - Linear Span – Linear Dependence - Linear Independence – Bases and Dimensions. Linear Transformations. Matrix representation of linear transformation.		

Module 2: Classification of signals and systems	8	20
Continuous time signals (CT signals)- Discrete time signals (DT signals) – Step, Ramp, Pulse, Impulse, Exponential - classification of CT and DT signals – periodic and aperiodic signals, random signals, Energy & Power signals - CT and DT systems, Classification of systems. LINEAR TIME INVARIANT SYSTEMS.		
Module 3: Spectral analysis of continuous time signals	8	20
Representation of a periodic Signals by continuous FT, FT of periodic signals, convolution and multiplication property of continuous FT, systems characterized by Linear Constant Coefficient Differential Equations. Magnitude and phase representation of FT, Magnitude and phase response of LTI systems, Time domain and Frequency domain aspects of ideal and non-ideal filters. Fourier Series representation of periodic signals.		
Module 4: Sampling	8	20
Sampling theorem. Effect of under sampling. DTFT and Spectral analysis of sampled signal. DFT. Properties of DTFT and DFT, convolution property, multiplication property, Duality, Systems characterized by Linear Constant Coefficient Difference Equations.		
Module 5: Characterization of continuous time and discreate time LTI Systems	8	20
Definition-ROC-Properties-Inverse Laplace transforms-the S-plane and BIBO stability-Transfer functions-System Response to standard signals-Solution of differential equations with initial conditions. Application in continuous time signal and system analysis. Z-transform, Region of convergence and its properties, Inverse Z transform, properties of ZT, Analysis andcharacterization of LTI systems using ZT, LTI Systems, System function algebra and block diagram representations. Application in discreate time system analysis.		

Reference Books

	1	Alan V. Oppenheim, Alan S. Willsky, S. Hamid Nawab, Signals and Systems PrenticeHall India, 2nd Edition, 2009.
	2	John G. Proakis, Dimitris G. Manolakis, Digital Signal Processing, Principles,Algorithms, and Applications, 4th Edition, PHI, 2007.
	3	B.P. Lathi, ―Signals, Systems & Communications‖, 2009,BS Publications.
	4	Simon Hykin , " Signals and Systems", John Wiley
	5	Robert A. Gable, Richard A. Roberts, Signals & Linear Systems, 3rd Edition, JohnWiley, 1995.
	6	Harish Parthasarathy,"Signals and Systems" JK International Second Edition.
	7	HWEI P.HSU Schaum's, " Signals and Systems" TMH
	8	M.J.Roberts,"Signals and Systems" TMH Ed 2003

List of Experiments (10 Practicals)

Module 1: Signal Basics and LTI Systems

1. **Generation and Visualization of Standard Signals**
   Objective: Generate and plot continuous-time and discrete-time signals: step, ramp, exponential, sinusoidal, and impulse.
   Tools: MATLAB/Scilab/Python
2. **Operations on Signals**
   Objective: Perform and plot operations like scaling, shifting, folding, and addition on signals.
3. **Verification of Linearity and Time Invariance of Systems**
   Objective: Test whether a given discrete-time system is linear and time-invariant using example inputs and outputs.

Module 2 & 3: Fourier Series and Fourier Transform

4. **Fourier Series Representation of Periodic Signals**
   Objective: Compute and plot the Fourier series coefficients of a square/triangular waveform and reconstruct the waveform using limited harmonics.
5. **Computation and plotting of Fourier Transform**
   Objective: Find the Fourier Transform of a given time-domain signal (e.g., rectangular pulse) and plot its magnitude and phase spectrum.

Module 4: Laplace Transform

6. **System Response using Laplace Transform**
   Objective: Use Laplace transform to find system response to standard inputs (step, impulse) and compare time-domain and Laplace-domain results.

Module 5: DTFT and DFT, Z transform

7. **Sampling and Reconstruction of Signals**
   Objective: Demonstrate the effect of sampling and reconstruction using sinc interpolation. Analyze aliasing with under-sampling.
8. **Compute and Plot DTFT and DFT of Discrete-Time Signals**
   Objective: Use MATLAB/Python to compute DTFT and DFT, and visualize the spectral content of a discrete-time signal.

9. **Computation and Plotting of Z-Transform and Inverse Z-Transform**
   Objective: Determine and plot the Z-transform of basic sequences. Find inverse Z-transform using partial fractions.

Integrated Application

10. **Analysis of LTI System using Convolution and Z-Transform**
    Objective: Implement an LTI system described by a difference equation. Use convolution and Z-transform to compute and verify the system's response.

Course title:	ANALOG ELECTRONICS	Sub code:				
		Structure:	L	T	P	C
			2	1	2	4

Course Objective:	• To impart foundational knowledge and understanding of electronic circuits and devices operating in continuous time domain, emphasizing analysis, design, and application of analog circuits. • To equip students with skills to analyze, design, and troubleshoot analog electronic circuits commonly used in various engineering disciplines, fostering critical thinking and problem-solving abilities.
Course Outcome:	• Understand the principles and characteristics of analog electronic devices such as diodes, BJTs, and FETs. • Analyze and design analog electronic circuits including amplifiers, oscillators, and filters. • Gain proficiency in biasing techniques, small-signal analysis, and frequency response of analog circuits. • Explore advanced topics such as feedback amplifiers, operational amplifiers, and voltage regulators. • Develop practical skills in circuit simulation, prototyping, and testing of analog electronic circuits for various applications.

Content	No. of hours	ESE Marks(%)
Module-1: BJT Characteristics and Biasing Techniques	8	20
Overview of BJT operation: active, cut-off, and saturation regions, Input and output characteristics of CE, CB, and CC configurations, DC load line, operating point, Biasing techniques: Fixed bias, Collector-to-base bias, Voltage divider bias, Stability factors and thermal runaway, Design of BJT biasing circuits.		
Module 2: BJT Small Signal Models and Amplifiers	8	20
Small signal equivalent models (hybrid-π and r_e models), CE, CB, CC amplifier analysis: voltage gain, input/output impedance, Multistage amplifier concepts: cascade and cascode configurations, Frequency response of BJT amplifiers: low and high-frequency analysis, Miller effect and bandwidth estimation.		
Module 3: Feedback Amplifiers and Oscillators	8	20
Concept of negative and positive feedback in amplifiers, Voltage series, voltage shunt, current series and current shunt feedback configurations, Oscillators: Barkhausen criterion, RC phase shift oscillator, Wien bridge oscillator, LC oscillators: Colpitts and Hartley.		
Module 4: MOSFET Characteristics and Amplifier Configurations	8	20
Overview of MOSFET types (Enhancement and Depletion), MOSFET characteristics: output and transfer characteristics, Biasing techniques for MOSFETs, Small signal analysis of common source, common drain, and common gate configurations. MOSFET as an amplifier and switch, Frequency response of MOSFET amplifiers, Comparison with BJT amplifier performance. Introduction to CMOS inverter and digital logic applications. Analog applications: active loads, current sources, analog switches		
Module 5: Power Amplifiers and Linear Regulators Classification of power amplifiers: Class A, B, AB, and C, Class A power amplifier with resistive and transformer load, Class B push-pull amplifier and crossover distortion, Class AB operation and efficiency. **Linear Voltage Regulators:** Types of voltage regulators-series and shut. Working and design. Load and line regulation. Short circuit protection and fold back protection.	8	20

Reference Books

	1	**Sedra, Adel S. and Smith, Kenneth C.** *Microelectronic Circuits*

		Oxford University Press, India
	2	**Millman, Jacob and Halkias, Christos C.** *Electronic Devices and Circuits* McGraw-Hill Education (India)
	3	**Boylestad, Robert L. and Nashelsky, Louis** *Electronic Devices and Circuit Theory* Pearson Education, India
	4	**Mottershead, Allen** *Electronic Devices and Circuits: An Introduction* Pearson Education, India
	5	**Salivahanan, S. and Kumar, N. Suresh** *Electronic Devices and Circuits* McGraw-Hill Education (India)
list of Experiments		
	1	**Design and Implementation of Voltage Divider Biasing Circuit** *To design a voltage divider bias circuit for a BJT and determine its operating point (Q-point).*
	2	**Single Stage CE Amplifier – Gain and Impedance Measurement** *To design and implement a CE amplifier and measure voltage gain, input/output impedance.*
	3	**Two-Stage RC Coupled Amplifier** *To design and analyze a two-stage RC coupled amplifier and determine overall gain and bandwidth.*
	4	**Frequency Response of CE Amplifier** *To study low-frequency and high-frequency response and determine bandwidth and cutoff frequencies.*
	5	**RC Phase Shift Oscillator using BJT** *To design and implement a phase shift oscillator and verify frequency of oscillation using Barkhausen criterion.*
	6	**Wien Bridge Oscillator using Op-Amp or BJT** *To construct a Wien bridge oscillator and analyze output waveform and frequency.*
	7	**Colpitts Oscillator using BJT** *To design and implement a Colpitts oscillator circuit and verify its frequency of oscillation.*
	8	**MOSFET Output and Transfer Characteristics** *To obtain the output and transfer characteristics of an enhancement-type MOSFET and extract threshold voltage.*
	9	**Common Source MOSFET Amplifier** *To implement and analyze a common source amplifier and measure voltage gain and frequency response.*
	10	**MOSFET as a Switch** *To demonstrate the switching behavior of a MOSFET for digital signal interfacing.*
	11	**Class A Power Amplifier with Transformer Coupling** *To design and analyze a Class A power amplifier and determine efficiency.*
	12	**Design and Testing of Linear Voltage Regulator Circuit** *To design and implement a series-type voltage regulator and measure line/load regulation and short-circuit protection.*

Course title:	**Electromagnetics and Field Theory**	**Sub code:**				
		Structure:	**L**	**T**	**P**	**C**
			2	**1**	**0**	**3**

Course Objective:	• To provide basic skill required to understand and develop applications relatedto Signals. • To enrich strong foundation on systems in modern communication • To develop an understanding on Electromagnetic waves and radiating systems • To develop a strong understanding on Antennas
Course Outcome:	• Understand the fundamental principles of electromagnetic fields and their interactions in various mediums. • Analyze and solve electromagnetic problems using Maxwell's equations and boundary conditions. • Gain proficiency in understanding wave propagation, transmission lines, and antenna theory. • Explore applications of electromagnetic theory in wireless communication, microwave engineering, and photonics. • Develop problem-solving skills for designing and analyzing electromagnetic devices and systems.

Content	**No. of hours**	**ESE Marks(%)**
Module 1: Vector calculus	2	5
Orthogonal Coordinate System, Transformations of coordinate systems; Del operator; Gradient,Divergence, Curl - their physical interpretations; Laplacian operator.		
Module 2: Electrostatics	8	20
Coulomb's Law, Electric Field Intensity – Fields due to Different Charge Distributions, Electric Flux Density, Gauss Law and Applications, Electric Potential, Relations Between E and V, Maxwell's Two Equations for Electrostatic Fields, Electric dipole, Energy Density, Convection and Conduction Currents, Dielectric Constant, Isotropic and Homogeneous Dielectrics, Continuity Equation, Relaxation Time, Poisson's and Laplace's Equations, Capacitance – Parallel Plate, Coaxial, Spherical Capacitors, Illustrative Problems.		
Module 3: Magneto statics & Maxwell's Equations	10	25
Biot-Savart Law, Ampere's Circuital Law and Applications, Magnetic Flux Density, Maxwell's Two Equations for Magneto static Fields, Magnetic Scalar and Vector Potentials, Forces due to Magnetic Fields,Magnetic torque and moment, Magnetic dipole, Inductances and Magnetic Energy, Illustrative Problems. Inconsistency of Ampere's Law and Displacement Current Density, Maxwell's Equations in Different Final Forms and Word Statements. Boundary Conditions of Electromagnetic fields: Dielectric-Dielectric and Dielectric-Conductor Interfaces, Illustrative Problems.		
Module 4: EM Wave Characteristics	10	25
Wave Equations for Conducting and Perfect Dielectric Media, Uniform Plane Waves – Definition, All Relations between E & H, Sinusoidal Variations, Wave Propagation in Lossless and Conducting Media, Conductors & Dielectrics – Characterization, Wave Propagation in Good Conductors and Good Dielectrics,Polarization,Reflection and Refraction of Plane Waves – Normal and Oblique Incidences, for both Perfect Conductor and Perfect Dielectrics, Brewster Angle, Critical Angle and Total Internal Reflection, Surface Impedance, Pointing Vector, and Pointing Theorem – Applications, Power Loss in a Plane Conductor, Illustrative Problems		
Module 5: **Transmission Lines & Antennas**	10	25
Transmission Lines: Types, Transmission line parameters (Primary and Secondary), Transmission line equations, Input impedance, Standing wave ratio & power, Smith chart & its applications, Applications oftransmission lines of various lengths, Micro- strip transmission lines – input impedance, Illustrative Problems. Antenna Concepts, Antenna Characteristic; Hertzian dipole (Radiation Fields, Radiation Resistance, Radiation patterns, Directive Gain); Properties and typical applications of Half-wavedipole, Loop antenna, parabolic reflector anteena Horn antenna, Yagi-Uda array, Array Antennas: End fire and Broadside array		

Reference Books

1	Principles of Electromagnetics, 4th Edition, Matthew O H Sadiku, Oxford University Press.
2	Electromagnetic Field Theory & Transmission Lines, G.S.N. Raju, Pearson Education
3	Electromagnetic Waves Shevgaonkar, Tata-McGaw-Hillr –R K

	4	Engineering Electromagnetics, 2ed Edition - Nathan Ida, Springer India
	5	Fields & Waves in Communication Electronics, S. Ramo, J. R. Whinnery& T. VanDuzer, John Wiley
	6	Electromagnetic Theory & Applications, A. K. Saxena, Narosa Publishing House Pvt. Ltd.
	7	Electromagnetics, 2ed Edition – J. A. Edminister, Tata-McGraw-Hill.
	8	Engineering Electromagnetics, 7th Edition-W.H.Hayt& J. A. Buck, Tata-McGraw-Hill

Course title:	**Analog Communication**	**Sub code:**				
		Structure:	**L**	**T**	**P**	**C**
			2	**1**	**2**	**4**

Course Objective:

- This course aims to provide students with a comprehensive understanding of the fundamental principles and components of analog communication systems, covering topics such as modulation, demodulation, and transmission techniques.
- Students will learn to analyze and evaluate different analog modulation and demodulation techniques, including amplitude modulation (AM), frequency modulation (FM), and phase modulation (PM), enabling them to comprehend their applications and performance characteristics.
- Through theoretical study and practical demonstrations, students will gain insight into the operation of various transmitters and receivers used in analog communication systems, facilitating their understanding of signal generation, transmission, reception, and signal processing techniques.
- This course will enable students to understand the effects of noise on analog communication systems and its impact on signal quality, signal-to-noise ratio (SNR), and system performance, empowering them to mitigate noise-induced distortions and enhance system reliability.
- Students will acquire knowledge about information theory and capacity concepts in analog communication systems, including channel capacity, bandwidth considerations, and transmission efficiency, enabling them to optimize system design and performance for efficient information transmission.

Course Outcome:

- Understand the principles of analog modulation techniques including amplitude modulation (AM), frequency modulation (FM), and phase modulation (PM).
- Analyze the performance of analog communication systems in terms of signal-to-noise ratio, bandwidth, and distortion.
- Gain proficiency in designing and implementing analog communication systems including transmitters, receivers, and transmission lines.
- Explore advanced topics such as frequency synthesis, phase-locked loops, and noise reduction techniques in analog communication.
- Develop practical skills in laboratory experiments, simulation, and testing of analog communication systems using modern instruments and tools.

Content	**No. of hours**	**ESE Marks(%)**
Module 1: Basics of Amplitude Modulation	8	20

Elements of communication systems, Information, Messages and Signals, Modulation, Modulation Methods, Modulation Benefits and Applications. Amplitude Modulation & Demodulation: Baseband and carrier communication, Amplitude Modulation (AM), Rectifier detector, Envelope detector, Double sideband suppressed carrier (DSB-SC) modulation & its demodulation, Switching modulators, Ring modulator, Balanced modulator, Frequency mixer, sideband and carrier power of AM, Generation of AM signals, Quadrature amplitude modulation (QAM), Single sideband (SSB) transmission, Time domain representation of SSB signals & their demodulation schemes (with carrier, and suppressed carrier), Generation of SSB signals, Vestigial sideband (VSB) modulator & demodulator, Illustrative Problems.

Module 2: Angle Modulation &Demodulation	8	20

Concept of instantaneous frequency, Generalized concept of angle modulation, Bandwidth of angle modulated waves – Narrow band frequency modulation (NBFM); and Wide band FM (WBFM), Phase modulation, Verification of Frequency modulation bandwidth relationship, Features of angle modulation, Generation of FM waves – Indirect method, Direct generation; Demodulation of FM, Band pass limiter, Practical frequency demodulators, Small error analysis,		
Module 3: Noise in Communication Systems	8	20
Types of noise, Time domain representation of narrowband noise, Filtered white noise, Quadrature representation of narrowband noise, Envelope of narrowband noise plus sine wave, Signal to noise ratio & probability of error, Noise equivalent bandwidth, Effective noise temperature, and Noise figure, Baseband systems with channel noise, Performance analysis (i.e. finding SNR expression) of AM, DSB-SC, SSB-SC,FM, PM in the presence of noise, Illustrative Problems.		
Module 4: Analog pulse modulation schemes	8	20
Pulse amplitude modulation – Natural sampling, flat top sampling and Pulse amplitude modulation (PAM)& demodulation, Pulse-Time Modulation – Pulse Duration and Pulse Position modulations, and demodulation schemes, PPM spectral analysis, Illustrative		
Module 5: Radio Receivers	8	20
Pre-emphasis, & De-emphasis filters, FM receiver, FM Capture Effect,. Carrier Acquisition- phased locked loop (PLL), Costas loop, Frequency division multiplexing (FDM), and Super-heterodyne AM receiver, Sensitivity and selectivity , selection of IF ,Illustrative Problems.		

Reference Books		
	1	B. P. Lathi, "Modern Digital and Analog Communication Systems," Oxford Univ. press, 3rd Edition, 2006
	2	Sham Shanmugam, "Digital and Analog Communication Systems", WileyIndia edition, 2006.
	3	A. Bruce Carlson, & Paul B. Crilly, "Communication Systems – An Introduction toSignals & Noise in Electrical Communication", McGraw-Hill International Edition, 5th Edition, 2010.
	4	Simon Haykin, "Communication Systems", Wiley-India edition, 3 rd edition, 2010.
	5	Herbert Taub& Donald L Schilling, "Principles of Communication Systems", Tata McGraw-Hill, 3rd Edition, 2009.
	6	George Kennedy and Bernard Davis, "Electronics & Communication System", TMH,2004.
list of Experiments		
	1	Amplitude modulation and demodulation
	2	Frequency modulation and demodulation.
	3	Characteristics of Mixer
	4	Pre-emphasis & de-emphasis.
	5	Pulse Amplitude Modulation and demodulation
	6	Pulse Width Modulation and demodulation
	7	Pulse Position Modulation and demodulation
	8	Radio Receiver measurements – Sensitivity, Selectivity, & Fidelity
	9	Sampling Theorem – verification
	10	Time division multiplexing.

Course Title:	Computer Architecture and Organization	Sub code:				
		Structure:	L	T	P	C
			2	0	2	3

Course Objective:	• This course aims to familiarize students with fundamental concepts related to computer organization, covering hardware and software aspects such as CPU architecture, memory organization, input/output systems, and operating system functionality. • Students will gain an overview of the design principles underlying digital computing systems, including topics such as instruction set architecture, processor microarchitecture, pipelining, memory hierarchy, and input/output interfaces. • Through theoretical study and practical exercises, students will learn how data is represented at the machine level, including binary representation of numbers, character encoding schemes, floating-point representation, and memory organization, enabling them to understand how information is processed within a computer system. • Students will gain insight into the execution of computations at the machine level, including arithmetic and logic operations, control flow mechanisms, instruction execution cycle, and addressing modes, enabling them to comprehend the underlying mechanisms of program execution and data manipulation within a computer system
Course Outcome:	• Understand the fundamental principles and components of computer architecture including CPU, memory, and I/O devices. • Analyze and design the organization of computer systems at both hardware and software levels. • Gain proficiency in understanding the instruction set architecture (ISA) and its implications on system design. • Explore advanced topics such as pipelining, memory hierarchy, and parallel processing architectures. • Develop practical skills in designing and evaluating computer systems through simulation, prototyping, and performance analysis.

Content	No. of hours	ESE Marks (%)
Module 1: Introduction of Processor	8	20
Introduction, Technologies for building Processors and Memory, Performance, The Power Wall, Operations of the Computer Hardware, Operands Signed and Unsigned numbers, Representing Instructions, Logical Operations, Instructions for Making Decisions		
Module 2: Instructions Set	8	20
MIPS Addressing for 32-Bit Immediate and Addresses, Parallelism and Instructions: Synchronization,Translating and Starting a Program, Addition and Subtraction, Multiplication, Division, Floating Point, Parallelism and Computer Arithmetic: Sub word Parallelism, Streaming SIMD Extensions and Advanced Vector Extensions in x86.		
Module 3: Architecture Building Block	8	20
Logic Design Conventions, building a Datapath, A Simple Implementation Scheme, overview of Pipelining, Pipelined Datapath, Data Hazards: Forwarding versus Stalling, Control Hazards, Exceptions, Parallelism via Instructions, The ARM Cortex – A8 and Intel Core i7 Pipelines, Instruction –Level Parallelism and Matrix Multiply Hardware Design language.		
Module 4: Memory Mapping	8	20
Memory Technologies, Basics of Caches, Measuring and Improving Cache Performance, dependable memory hierarchy, Virtual Machines, Virtual Memory, Using FSM to Control a Simple Cache, Parallelism and Memory Hierarchy: Redundant Arrays of Inexpensive Disks, Advanced Material: Implementing Cache Controllers.		
Module 5: Memory Management	8	20
Disk Storage and Dependability, RAID levels, performance of storage systems, Introduction to multi-threading clusters, message passing multiprocessors.		

Text/Reference Books:

	1. David A. Patterson and John L. Hennessey, "Computer organization and design, The Hardware/Software interface", Morgan Kauffman / Elsevier, Fifth edition, 2014 2. V. Carl Hamacher, Zvonko G. Varanesic, and Safat G. Zaky, "Computer Organization", 6 th edition, McGraw-Hill Inc, 2012. 3. William Stallings, "Computer Organization and Architecture", 8th Edition, PearsonEducation, 2010

List of 10 Practical Experiments

Module 1 & 2: Processor Basics and Instruction Set

1. **Simulation of Basic Arithmetic Operations in MIPS Assembly**
   - Objective: Write MIPS assembly code to perform addition, subtraction, multiplication, and division of two integers.
   - Tool: MIPS Simulator (e.g., QtSpim, MARS)
2. **Binary and Hexadecimal Conversion & Representation**
   - Objective: Implement a program (in C or Assembly) to convert between binary, hexadecimal, and decimal formats; demonstrate signed and unsigned number representations.
3. **Instruction Encoding and Decoding**
   - Objective: Manually encode and decode sample MIPS instructions and verify using a simulator.

Module 3: Datapath and Pipelining

4. **Design a Basic Arithmetic Logic Unit (ALU) Using VHDL/Verilog**
   - Objective: Implement an ALU capable of performing AND, OR, ADD, SUB, and SLT operations.
   - Tool: Xilinx Vivado / ModelSim / Logisim
5. **Simulate Single-Cycle and Multi-Cycle Datapaths**
   - Objective: Model a simplified processor datapath (single-cycle and pipelined) and compare performance.
   - Tool: Digital Simulator / Logisim / Ripes (RISC-V simulator)
6. **Pipeline Hazard Detection and Resolution**
   - Objective: Simulate and analyze data and control hazards in a pipelined processor; demonstrate stalling and forwarding.

Module 4 & 5: Memory Mapping and Management

7. **Cache Memory Simulation**
   - Objective: Simulate direct-mapped, fully-associative, and set-associative caches; compute hit/miss ratio.
   - Tool: Custom Python/C program or existing cache simulator tools.
8. **Implementation of Virtual Memory using Paging**
   - Objective: Simulate address translation using page tables; demonstrate page faults and TLBs.
   - Tool: Python or Java-based simulation
9. **Disk Scheduling Algorithm Simulation**
   - Objective: Implement and compare performance of FCFS, SSTF, SCAN, and LOOK disk scheduling algorithms.
10. **RAID Level Simulation and Performance Comparison**

- Objective: Simulate different RAID levels (RAID 0, 1, 5) and evaluate redundancy, speed, and fault tolerance.

Course Title:	Digital Signal Processing	Sub code:				
		Structure:	L	T	P	C
			2	0	2	3

Course Objective:	• Learning about discrete time systems and to learn about FFT algorithms. • Learning the design techniques for FIR and IIR digital filters. • Learning about Realization of Digital systems.
Course Outcome:	Understand the principles and techniques of digital signal representation and processing. Analyze and design digital filters for various signal processing applications. Gain proficiency in time-domain and frequency-domain analysis of discrete-time signals and systems. Explore advanced topics such as spectral analysis, adaptive filtering, and multirate signal processing. Develop practical skills in implementing signal processing algorithms using software tools and programming languages.

Content	No. of hours	ESE Marks(%)
Module 1: Introduction to discrete time signals and systems	8	20
Overview of convolution and correlation. Discrete Fourier Transform (DFT) and linear filtering techniques using the DFT. Methods for filtering long sequences. Direct computation of the DFT and its optimization using the divide-and-conquer strategy, including the Radix-2 Fast Fourier Transform (FFT) algorithm. Analysis of quantization effects in DFT computation.		
Module 2: Implementation of the Discrete time systems	8	20
Structure for the realization of discrete time FIR and IIR systems, Direct Form, cascade form, Data broad case structure, State space system analysis and structures. Round-off effects in digital filter.		
Module 3: Design of FIR Digital Filters	8	20
Magnitude and phase response of digital filter, frequency response of Linear phase FIR filters, Design Techniques for FIR (Low pass, high pass, band pass and band reject) filters. Design of Optimal Linear phase FIR Filters, Design of Minimum phase FIR Filters.		
Module 4: Design of IIR Digital Filters	8	20
IIR filter design by approximation of derivatives, impulse invariant approach and bilinear transformation. Butterworth filters, Chebyshev filters, Inverse Chebychev filter and elliptic filters, Design of Low pass, high pass, band pass and band reject IIR filters. Effects of Finite word length indigital filters.		
Module 5: Spectral Estimation methods	8	20
Spectral estimation, Energy Density Spectrum, Estimation of autocorrelation and power spectrum, DFT inspectral estimation, Parameteric and nonparametric method for power spectrum estimation.		

Text/Reference Books :

1	Discrete Time Signal Processing, Oppenheim & Schafer, PHI Ltd, Third Edition
2	Digital Signal Processing: Principles Algorithms and Applications, Proakis Johnand Manolakis.
3	Digital Signal Processing- A computer based approach, Sanjit K. Mitra, McGrawHill Education.

List of Experiments

1	Compute linear convolution, circular convolution and cross correlation of twosequences.
2	Implementation of configurable DFT and IDFT and spectral analysis.
3	Verify different properties of Discrete Fourier Transform.

	4	Implement Radix-2 8-point FFT algorithm.
	5	Linear filtering of signals using FFT and Overlap-Add and Overlap-Save methods.
	6	Design and implementation of low pass, high pass, band pass and band reject FIRfilters.
	7	Design and implementation of low pass, high pass, band pass and band reject IIR filters of different types.
	8	Realization of IIR and FIR systems using direct form-I, II, and cascade form structures.
	9	Spectral estimation using Periodogram and Welch methods.
	10	Autocorrelation and power spectral density estimation using DFT.

Course title:	**VLSI Design**	**Sub code:**				
		Structure:	**L**	**T**	**P**	**C**
			2	**1**	**2**	**4**

Course Objective:	• To provide students with a comprehensive understanding of VLSI design fundamentals, covering CMOS logic, fabrication processes, layout representations, design flow, and verification techniques, preparing them for practical VLSI design projects. • Students will learn to model MOS transistors, analyze their characteristics, and design CMOS logic circuits. They will understand the principles behind CMOS logic design, including transistor sizing, noise margin, and static and switching characteristics. • Through theoretical study and practical exercises, students will gain proficiency in analyzing delay and power characteristics in VLSI circuits. • Students will explore various circuit families and design techniques used in VLSI design, including static CMOS, ratioed circuits, dynamic circuits, and pass-transistor circuits. • This module aims to familiarize students with subsystem design principles and FPGA technology.
Course Outcome:	• Understand the concepts of Verilog Language. • Design the digital systems as an activity in a larger system design context. • Study the design and operation of semiconductor memories frequently usedin application specific digital system. • Inspect how effectively ICs are embedded in package and assembled in PCBsfor different application. • Design and diagnosis of processors and I/O controllers used in embeddedsystems.

Content	**No. of hours**	**ESE Marks (%)**
Module 1: Introduction To VLSI	8	20
Basics of VLSI design CMOS Logic: Combinational and sequential circuits, CMOS fabrication and layouts, Layout representations, Stick diagrams, Design partitioning, Logic design, Circuit design, Physical design, Design verification, fabrication, packaging and testing, Design Flow		
Module 2: MOS and CMOS	8	20
Modelling of MOS transistor, Capacitance voltage characteristics, non-ideal effects DC transfer characteristics, MOS Inverter, MOS Transistor Switches, CMOS Logic design, Circuit and System Representations, Design Equations, Static Load MOS Inverters, Transistor Sizing, Static and Switching Characteristics; Body Effect, Noise Margin.		
Module 3: Delay Power	8	20

Transient Response, RC Delay Model, Effective Resistance, Gate and Diffusion Capacitance, Equivalent RC Circuits, Transient Response, Elmore Delay, Layout Dependence of Capacitance, Determining Effective Resistance, Linear Delay Model Logical Effort, Parasitic Delay, Delay in a Logic Gate, Drive, Extracting Logical Effort from Datasheets, Limitations to the Linear Delay Model, Logical Effort of Paths, Delay in Multistage Logic Networks, Choosing the Best Number of Stages, Sources of power dissipation, dynamic power , static power, Wire Geometry, Example of Metal Stacks, Interconnect Modelling, Resistance, Capacitance Inductance, Skin Effect, Temperature Dependence, Interconnect Impact, Delay, Energy, Crosstalk, Inductive Effects,		
Module 4: Circuit Design	8	20
Circuit Families, Static CMOS, Ratioed Circuits, Cascode Voltage Switch Logic, Dynamic Circuits, Pass-Transistor Circuits, Sequencing Static Circuits, Sequencing Methods, Max Delay Constraints, Min-Delay Constraints, Time Borrowing, Clock Skew, Circuit Design of Latches and Flip-Flops, Conventional CMOS Latches, Conventional CMOS Flip-Flops, Pulsed Latches, Resettable Latches and Flip-Flops, Enabled Latches and Flip-Flops, Incorporating Logic into Latches		
Module 5: Subsystem Design FPGA	8	20
Adders, zero one detectors, comparators, counters, Memory subsystems SRAM, Read and write operation, DRAM, sense amplifiers Field Programmable gate arrays- Logic blocks, routing architecture, design flow technology mapping for FPGAs, Case studies Xilinx-Virtex-7 and Kintex-7 FPGAs.		

Reference Books:	
	1. C. Mead and L. Conway, Introduction to VLSI Systems, Addison Wesley,1979. 2. S. M. Kang and Y. Leblebici, CMOS Digital Integrated Circuits : Analysis and Design, Third Edition, MH, 2002 3. J. M. Rabaey, A. P. Chandrakasan and B. Nikolic, Digital Integrated Circuits : A Design Perspective, Second Edition, PHI /Pearson, 2003. 4. J. P. Uyemura, CMOS Logic Circuit Design, Springer; 2001,. 5. J. P. Uyemura, Introduction to VLSI Circuits and System, Wiley, 2002. 6. R. J. Baker, H. W. Li and D. E. Boyce, CMOS Circuit Design, Layout and Simulation, PH, 1997
List of Experiments:	
	1. Based on VHDL (Xilinx) platform and implementation on FPGA boards: Logic expression s, modulo synchronous and asynchronous up down counters. Multiplexers/ decoders, arithmetic logic unit, priority encoder,62 models based on Moore's law, mealy model etc. 2. CADENCE CAD tool-based experiments: Design of MOS transistor circuits, DC characteristics, AC small signal analysis and extraction of parameters, design of sample and hold circuits, measurement of switching times, design of PLL and measurement of all characteristic's parameters, design of 3-8 decoder using MOS technology.

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Course title:	**Computer Network and security**	**Sub code:**				
		Structure:	**L**	**T**	**P**	**C**
			2	**1**	**0**	**3**
Course Objective:	• This course aims to teach the basic concept of networks like network classification, network topologies network devices. • This course deal with the important concepts and techniques related to data communication and enable students to have an insight in to technology involved to make the network communication possible.					

Course Outcome:	• Understand the fundamentals of computer networks, including protocols, architectures, and networking technologies. • Analyze and design network architectures for efficient data transmission, routing, and switching. • Gain proficiency in network security concepts, including cryptography, authentication, and access control. • Explore advanced topics such as wireless networks, network management, and cloud computing. • Develop practical skills in configuring and securing network devices, conducting vulnerability assessments, and implementing security measures to protect against cyber threats.

Content	**No. of hours**	**ESE Marks (%)**
Module 1: Introduction	6	14
Data Communications, Networks, The Internet, Protocols and Standards, Network Models, Layered Tasks, The OSI Model, Layers in the OSI Model, TCP/IP Protocol Suite, Addressing, Physical Layer and Media, Data and Signals, Analog and Digital, Periodic Analog Signals, Digital Signals, Transmission impairment, Data Rate Limits, Performance, Network topologies.		
Module 2: Physical and Data Link Layer	8	20
Bandwidth utilization: Multiplexing and Spreading, Multiplexing, Spread Spectrum, Transmission Media, Guided Media, Unguided Media: Wireless, Switching, Circuit-Switched Networks, Datagram Networks, Virtual-Circuit Networks, Structure of a Switch, Introduction, Block Coding, Liner Block Codes, Cyclic Codes, Checksum, Data Link Control, Framing, Flow and Error Control, Protocols, Noiseless Channels, HDLC, Point-to-Point Protocol, Multiple Access, Random Access, Aloha, Controlled Access, Channelization, IEEE Standards, Standard Ethernet, Changes in the Standard, Fast Ethernet, Gigabit Ethernet, IEEE 802.11, Bluetooth, Connecting LANs, Backbone Networks, and Virtual LANs, Connecting Devices, Backbone Networks, Virtual LANs, Sonet Networks, Virtual Tributaries, Virtual- Circuit Networks: Frame Relay and ATM, Frame Relay, ATM, ATM LANs.		
Module 3: Network Layer and Transport layer	8	20
Logical Addressing, IPv4 Addresses, IPv6 Addresses, Network Layer: Internet Protocol, Internetworking, IPv4, IPv6, Transition from IPv4 to IPv6, Network Layer: Address Mapping, Error Reporting and Multicasting, Address Mapping, ICMP, IGMP, ICMPv6, Network Layer: Delivery, Forwarding and Routing, Delivery, Forwarding, Unicast Routing Protocols, Multicast Routing Protocols. Process-Process Delivery: UDP, TCP and SCTP, Process-to-Process Delivery, User Datagram Protocol (UDP), TCP, SCTP, Congestion Control and Quality of Service, Data Traffic, Congestion, Congestion Control, Two Examples, Quality Service, Techniques to improve QoS, Integrated Services, Differentiated Services, QoS in Switched Networks.		
Module 4: Application Layer	6	16
Domain Name System, Name Space, Domain Name Space, Distribution of Name Space, DNS in the Internet, Resolution, DNS Messages, Types of Records, Registrars, Dynamic Domain Name System (DDNS), Encapsulation, Remote Logging, Electronic Mail and File Transfer, Remote Logging, Telnet, Electronic Mail, File Transfer, WWW and HTTP: Architecture, Web Documents, HTTP, Network Management: SNMP, Network Management System, Simple Network Management Protocol (SNMP), Multimedia, Digitizing Audio and Video, Audio and Video Compression, Streaming Stored Audio/Video, Streaming Live Audio/Video, Real-Time Interactive Audio/Video, RTP, RTCP, Voice over IP.		
Module 5: Network Security and Introduction to Wireless Sensor Networks	12	30
Security concepts and terminology TCP/IP and OSI network security access control issues (packet filters, firewalls) communication security (OSI layer security protocols) security tools cryptography- Public Key Cryptography And Its Application, Cyber Security and its application Introduction to Wireless Sensor Networks, Sensor Node Architecture and Characteristics, Communication Protocols for Wireless Sensor Networks, Energy-Efficient Protocols and Algorithms, Applications and Challenges of Wireless Sensor Networks		
Reference Books:		

1. Data Communications and Networking, Fourth Edition by Behrouza A. Forouzan,TMH.
2. Computer Networks, A.S. Tanenbaum,4th edition, Pearson education.
3. Introduction to Data communications and Networking, W. Tomasi, Pearsoneducation.
4. Data and Computer Communications, G.S. Hura and M. Singhal, CRC Press,Taylor and Francis Group.
5. An Engineering Approach to Computer Networks-S. Keshav,2nd Edition, Pearson Education
6. Understanding communications and Networks,3rd Edition, W. A. Shay, Cengage Learning.
7. "Modern Cryptography, Theory & Practice", Pearson Education. Wenbo Mao
8. "Computer Security", Pearson Education. Matt Bishop

Course title:	**Digital Communication**	**Sub code:**				
		Structure:	**L**	**T**	**P**	**C**
			2	**1**	**2**	**4**

Course Objective:	• Understanding the Key Modules of Digital Communication Systems with Emphasis on Digital Modulation Techniques • Designing Systems Involving Randomness Using Mathematical Analysis and Computer Simulations. • Learning about Theoretical Bounds on the Rates of Digital Communication Systems and Representing Digital Signals Using Several Modulation Methods • Drawing Signal Space Diagrams, Computing Spectra of Modulated Signals, and Applying Redundancy for Reliable Communication.
Course Outcome:	• Understand the principles and techniques of digital modulation and demodulation schemes. • Analyze and design digital communication systems using modulation techniques such as ASK, FSK, PSK, and QAM. • Gain proficiency in error detection and correction codes for reliable digital communication. • Explore advanced topics including spread spectrum communication and multiple access techniques. • Develop practical skills in simulation, implementation, and performance analysis of digital communication systems using software tools and laboratory experiments.

Content	**No. of hours**	**ESE Marks (%)**
Module 1: Random Variables and Random Process	8	20
Deterministic and Random Signal: Types of random variables, cumulative distribution function and probability density functions, Standard distributions: Gaussian, exponential, Rayleigh, uniform, Bernoulli, binominal, Poisson, discrete uniform and conditional distributions. Functions of one random variable: distribution, mean, variance, moments and characteristics functions. Random Processes: Random processes, stationary processes, mean and covariance functions, periodicity, linear filtering of random processes, power spectral density, examples of random processes: white noise process and white noise sequence, Gaussian process, Poisson process, Markov process.		
Module 2: Digital communication and modulation basics	8	20
Band pass and Low pass signal, Introduction to Digital communication systems, Pulse code modulation , differential pulse code modulation, delta modulation, adaptive delta modulation, PSD of Line Codingschemes, Pulse shaping, Scrambling, Eye diagram, Gram-Schmidt orthogonalization scheme.		
Module 3: Digital Modulation Techniques	8	20
Modulation and Demodulation of Digital modulation schemes-ASK, FSK, PSK, DPSK, QPSK andConstellation diagram. Introduction to M-ary communication.		

Module 4: Digital Communication Through Band LimitedChannels and Digital Receiver	8	20
Characteristic and signal Design of band Limited Channels. Optimum Receiver for Channel with ISI and AWGN. Linear Equalization, Decision Equalization, Adaptive Equalization. Introduction of Multichannel and Multicarrier System. Optimum threshold detection, Concept of Matched Filters, BER analysis of BASK, BFSK, BPSK, Modelof Spread Spectrum Digital Communication. Direct Sequence Spread Spectrum Signal (DS-SS), Frequency Hopped Spread Spectrum Signal (FH-SS).		
Module 5: Information theory and Coding	8	20
Discrete Source models – Memoryless and Stationary, Mutual Information, Self-Information, Conditional Information, Average Mutual Information, Entropy, Entropy of the block, Conditional Entropy, Information Measures for Analog Sources. Review of probability theory Entropy Mutual information Data compression Huffman coding Asymptotic equipartition property Universal source coding Channel capacity Differential entropy Block codes and Convolutional codes.		

Reference Books		
	1	John G. Proakis & Masoud Salehi, “Digital Communications”, 5th Edition, McGraw Hill
	2	B.P. Lathi, “Modern Digital and Analog Communication Systems”, 4th Edition,Oxford University Press
	3	H. Taub, D L Schilling, Gautam Saha, “Principles of Communication”, 4th Edition, McGraw Hill
	4	Singh & Sapre, Analog & Digital Communication Systems, 3th Edition, McGraw Hill
	5	John G. Proakis,"Communication Systems Engineering 2nd Edition, Pearson Education, 2015
	6	(Schaum's Outline Series) H P HSU & D Mitra, “Analog and Digital Communications”, McGraw Hill 3rd Edition
	7	Bernard Sklar, Digital Communications, Pearson Education
	8	Simon Haykin, “Communication Systems”, 5th Edition, Wiley India
list of Experiments		
	1	Design and Generation of random binary signals
	2	Study of impairments of signals generated in experiment 1 on passing through a simulated channel by observing Eye Pattern.
	3	Generation Unipolar NRZ, Polar NRZ, Unipolar RZ and Polar RZ line codes.
	4	Generation Manchester and AMI line codes
	5	Conversion of analogue signal into PCM format and its study
	6	Design and implementation of Delta Modulator for analogue signals
	7	Design, implementation and study of BASK Modulator and demodulator
	8	.Design, implementation and study of BPSK Modulator and demodulator
	9	Design, implementation and study of BFSK Modulator and demodulator
	10	Design, implementation and study of multiplexer and de-multiplexer of digital signals using TDM.
	11	study of spread spectrum signal

Course Title:	Embedded system and IOT	Sub code:				
		Structure:	L	T	P	C
			2	1	2	4

Course Objective:	• Leanring the Discipline of Embedded Systems and IoT and Its Application to Real-Time Embedded System Development • Learning Basic Embedded Microcontroller Principles and Practices and Their Appropriate Applications. • Understanding the Principles of Analysis and Design for IoT Development. • Applying IoT Applications to Construct Embedded Systems of High Quality.
Course Outcome:	• Understand the principles and design methodologies of embedded systems and IoT devices. • Analyze and implement real-time operating systems, communication protocols, and sensor interfacing for embedded systems. • Gain proficiency in designing and developing embedded software for controlling and monitoring IoT devices. • Explore the integration of IoT technologies for smart applications in various domains such as healthcare, agriculture, and smart cities. • Develop practical skills in hardware-software co-design, system integration, and deployment of embedded systems and IoT solutions.

Content	**No. of hours**	**ESE Marks(%)**
Module 1: Introduction to Processor Architecture	8	20
Architecture of Intel processors from 80286 to Pentium-Microarchitectural techniques of advanced processors –pipelining-superscalar concept –Out of order execution –Speculative execution – branch prediction –register renaming -Multicore processors-Processors beyond Pentium- Architecture of ARM Cortex-M – NVIC – WIC--Sleep modes – peripheral programming of a Cortex-M processor.		
Module 2: Robotics Design And Application Instruction Set And Thumb Instruction Set	8	20
Robotics – Designing robotics applications using ARM cortex-M in MSP 432 Robotics kit GPU Processing. Instruction Set: Data Processing Instructions, Addressing Modes, Branch, Load, Store Instructions, PSR Instructions, Conditional Instructions Thumb Instruction Set: Register Usage, Other Branch Instructions, Data Processing Instructions, Single-Register and Multi Register Load-Store Instructions, Stack, Software Interrupt Instructions.		
Module 3: Communication and Networking in IoT	8	20
Review of Communication Networks, Challenges in Networking of IoT Nodes, range, bandwidth Machine-to-Machine (M2M) and IoT Technology Fundamentals, Medium Access Control (MAC) Protocols for M2M Communications Standards for the IoT Basics of 5G Cellular Networks and 5G IoT Communications, Low-Power Wide Area networks (LPWAN)Wireless communication for IoT: channel models, power budgets, data rates.Networking and communication aspects: IPv6, 6LoWPAN, COAP, MQTT, Operating Systems need and requirements for IoT..		
Module 4: IoT Protocols	8	20
Low power, low range protocols –Zigbee –BLE – 6LoWPAN. Applications for IoT-Smart home, city,agriculture etc, - IoT services Project work on Design and development of an IoT product.		
Module 5: Modern Networking	8	20
Cloud computing: Introduction to the Cloud Computing, History of cloud computing, Cloud service options, Cloud Deployment models, Business concerns in the cloud, Hypervisors, Comparison of Cloud providers, Cloud and Fog Ecosystem for IoT Review of architecture IoT Data analytics and Security: OLAP and OLTP, NoSQL databases, Row and column Oriented databases, Introduction to Columnar DBMS CStore , Run :Length and Bit vector Encoding, IoT Data Analytics. Cryptographic algorithms, Analysis of Light weight Cryptographic solutions IoT security, Key exchange using Elliptical Curve Cryptography, Comparative analysis of Cryptographic Library for IoT		

Text/Reference Books :		
	1	Lyla B. Das, The x86 Microprocessors: 8086 to Pentium,, Multicores, Atom , and the

		8051 Microcontroller : Architecture ,Programming and Interfacing, Second Edition , Pearson Education ,India 2014
	2	Lyla B. Das, Architecture, Programming, and Interfacing of Low-power Processors – ARM7, Cortex-M, Cengage, 2017
	3	Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence, 1 st Edition, Academic Press, 2014.
	4	ArshdeepBagha, Vijay Madisetti , Internet of Things ,A hands on approach,2015
	5	Daniel P. Bovet, Marco Cesati, Understanding the Linux Kernel, 3rd Edition, O'Reilly,2005

List of Experiments

1. Display Hello WORD message using UART
2. Using mobile hotspot network communicate server and Client
3. Display Temperature Sensor reading on Putty using UART
4. Interface Receiver and transmitter to send data
5. Interface LMT86 with ADC to get readings on the UART
6. Blink LED using suitable pattern
7. Display light intensity on the UART

Course title:	**Electronic Product Design Using EDA tools**	**Sub code:**				
		Structure	**L**	**T**	**P**	**C**
			2	**1**	**2**	**4**

Course Objective:

- Develop proficiency in utilizing EDA tools for schematic capture, simulation, synthesis, and layout design.
- Enhance design skills to optimize electronic products for performance, reliability, and manufacturability through practical EDA tool applications.

Course Outcome:

- Ability to independently carry out research /investigation and developmentwork to solve practical problems
- Ability to write and present a substantial technical report/document
- Demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program
- Inculcate the ability to understand clearly the steps in designing electronic systems which are in tune with current technology and adaptable for future changes
- Create an environment such that graduates develop a passion for hardware and software design and be part of the electronic design industry to become leaders in indigenous product development

Content	**No. of hours**	**ESE Marks (%)**
Module 1: Introduction to Electronic Design Automation (EDA) Tools	8	20

Overview of EDA tools for electronic product design, Introduction to popular EDA software suites (e.g., Cadence, Synopsys, Mentor Graphics), Basic concepts of schematic capture, simulation, synthesis, and layout design.

Module 2: Schematic Design and Simulation	8	20

Schematic capture techniques using EDA tools, Component selection, placement, and connectivity considerations, Introduction to simulation methodologies (e.g., transient, DC, AC, and transient analysis), Verifying circuit functionality, performance, and signal integrity through simulation.

Module 3: Synthesis and Optimization	8	20

Principles of logic synthesis and optimization, Utilizing EDA tools for RTL (Register Transfer Level) synthesis, Optimization techniques for area, power, and timing constraints, Timing analysis and constraints setup for synchronous digital designs.

Module 4: Layout Design and Physical Verification	8	20

Introduction to layout design principles and methodologies, Floor planning, placement, and routing techniques using EDA tools, Understanding Design Rule Checks (DRC) and Layout vs. Schematic (LVS) verification, Physical verification techniques to ensure design manufacturability and reliability.

Module 5: Advanced Topics and Project Work	8	20

Advanced concepts such as analog/mixed-signal design, power analysis, and formal verification, Integration of EDA tools into a complete electronic product design flow, Hands-on project work involving the design, simulation, synthesis, layout, and verification of a complex electronic product using EDA tools, Presentation and documentation of project outcomes.

Reference Books:

1. **"EDA for IC Implementation, Circuit Design, and Process Technology"** by Luciano Lavagno, Igor L. Markov, and Louis K. Scheffer
2. **"Digital Integrated Circuits: A Design Perspective"** by Jan M. Rabaey, Anantha Chandrakasan, and Borivoje Nikolić
3. **"Introduction to VLSI Circuits and Systems"** by John P. Uyemura
4. **"SystemVerilog for Design"** by Stuart Sutherland, Simon Davidmann, and Peter Flake
5. **"ASIC Design in the Silicon Sandbox: A Complete Guide to Building Mixed-Signal Integrated Circuits"** by Keith Barr

List of Experiments:

1. **Schematic Design Exercise:**
   - Create a schematic diagram for a simple digital circuit using EDA software, ensuring proper component selection and connectivity.
2. **Simulation Analysis:**
   - Conduct transient analysis on the designed circuit to verify its functionality and transient response using EDA simulation tools.
3. **Logic Synthesis and Optimization Task:**
   - Perform RTL synthesis and optimization for a given digital design, optimizing for area, power, and timing constraints.
4. **Timing Constraints Setup:**
   - Set up timing constraints and perform timing analysis for synchronous digital designs to ensure proper operation within specified timing requirements.
5. **Layout Design Challenge:**
   - Design the layout for the synthesized digital circuit, considering floor planning, placement, and routing techniques to optimize layout area and signal integrity.
6. **Design Rule Checks (DRC) Evaluation:**
   - Conduct DRC checks on the layout design to identify and rectify violations, ensuring compliance with manufacturing rules and constraints.
7. **Layout vs. Schematic (LVS) Verification Task:**
   - Perform LVS verification to ensure consistency and accuracy between the schematic and layout designs, resolving any mismatches or discrepancies.
8. **Physical Verification Assignment:**
   - Perform physical verification tasks including DRC, LVS, and other checks to ensure design manufacturability and reliability.
9. **Advanced Design Exploration Project:**
   - Explore advanced design concepts such as analog/mixed-signal design or power analysis, implementing a small-scale project using EDA tools.
10. **Comprehensive Project Presentation:**
11. Present and document a comprehensive project involving the entire electronic product design flow, demonstrating proficiency in using EDA tools for design, simulation, synthesis, layout, and verification.

Course title:	Dissertation Phase-II	Sub code:	8P43			
		Structure:	L	T	P	C
			0	0	40	20

Course Objective:	Final Year Projects represent the culmination of study towards the Bachelor of Engineering degree. Projects offer the opportunity to apply and extend material learned throughout the program. Assessment is by means of a seminarpresentation, submission of a thesis, and a public demonstration of work undertaken. The projects undertaken span a diverse range of topics, including theoretical, simulation and experimental studies. The emphasis is necessarily on facilitating student learning in technical, project management and presentation spheres.
Course outcome:	• Apply knowledge and skills acquired throughout the program to solve real-world engineering problems. • Gain hands-on experience in designing, implementing, and testing innovative engineering solutions. • Develop project management skills including planning, scheduling, and resource allocation. • Enhance communication and presentation skills through the documentation and presentation of project outcomes. • Prepare for transition into the workforce or further academic pursuits by demonstrating competency in a specialized area of electronics engineering.

Content	No. of hours	ESE Marks (%)
Module 1: Term Work		
Dissertation Phase-II, is in continuation of Project Part-I undertaken by the candidates in first term. The term workshall consist of a typed report of about 70 pages or more, on the work carried out by the batch of students inrespect of the project assigned, during first term and second term. It should be in the proper format.		
Module 2: Practical Examination:		
It shall consist of demonstration of designed, fabricated project and oral based on it. The said examination will be conducted by a panel of two examiners; one of them will be a guide and another will be an externalexaminer. The external examiner will be either from the allied industry or a senior faculty member from another institute.		

Annexure-I
List of Professional Electives

Sl No.	Elective	Course Name	Credit
1	Professional Elective I (PE201A/PE201B)	1. Energy and Environment Engineering 2. Smart Grids and Energy Management	3
2	Professional Elective II (PE401A/PE401B)	1. C/C++ Programming 2. Data Structure and Algorithm	3
3	Professional Elective III (PE402A/PE402B)	1. Management Principles and Practices 2. Employability skill	3
4	Professional Elective IV (PE601A/PE601B)	1. Transmission Lines and PCB Technology 2. SOC Design and Verification	4
5	Professional Elective V (PE602A/PE602B)	1. Artificial Intelligence and Machine Learning 2. Database Management System	3

Course title:	**ENERGY AND ENVIRONMENTAL ENGINEERING**	**Sub code**				
		Structure	**L**	**T**	**P**	**C**
			2	1	0	3

Course Objective:	• To provide students with a fundamental understanding of energy systems and their environmental impact, fostering awareness of sustainable practices and solutions. • To analyze environmental challenges arising from energy utilization and explore engineering solutions to mitigate environmental impacts, promoting a holistic approach to energy and environmental management.
Course Outcome:	• Principal renewable energy systems • Explore the environmental impact of various energy sources and also theeffects of different types of pollutants. • An understanding the problems of energy distribution, design, plan and execute • To make a thought in terms of scientific and technological advancement in the spirit of a sustainable energy greenhouse • Understand the relationships between natural resources, consumption, population, economics of consumerism, etc in an environmental context

Content

Module 1: Introduction:

Present Energy resources in India and its sustainability - Different type of conventional Power Plant-
-Energy Demand Scenario in India-Advantage and Disadvantage of conventional Power Plants –Conventional Vs Non-conventional power generation.

Module 2: Basics of Solar Energy:

Basics of Solar Energy- Solar Thermal Energy- Solar Photovoltaic- Advantages and Disadvantages-Environmental impacts and safety.

Module 3: Wind, Biomass, Geothermal conversions and resources:

Power and energy from wind turbines- India's wind energy potential- Types of wind turbines- Offshore Wind energy- Environmental benefits and impacts.
Biomass resources-Biomass conversion Technologies- Feedstock pre-processing and treatmentmethods- Bioenergy program in India-Environmental benefits and impacts.
Geothermal Energy resources –Ocean Thermal Energy Conversion – Tidal.

Module 4: Air Pollution and Greenhouse gases :

Air pollution- Sources, effects, control, air quality standards, air pollution act, air pollution measurement. Water pollution-Sources and impacts, Soil Pollution-Sources and impacts, disposal of solid waste.
Greenhouse gas effect, acid rain. Noise pollution. Pollution aspects of various power plants. Fossilfuels and impacts, Industrial and transport emissions- impacts.

Module 5: Social Issues related to Environment:

From Unsustainable to Sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management, Resettlement and rehabilitation of people; its problems and concerns. Climate change, global warming, acid rain, ozone layer depletion and Eutrophication, Wasteland reclamation. Consumerism and waste products. Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act.

Reference Books:

1) Boyle, G. 2004. Renewable energy: Power for a sustainable future, Oxford University press.
2) B H Khan, Non-Conventional Energy Resources-The McGraw –Hill Second edition.
3) G. D. Rai, Non-conventional energy sources, Khanna Publishers, New Delhi, 2006.
4) Gilbert M. Masters, Introduction to Environmental Engineering and Science, 2nd Edition, Prentice Hall, 2003.

Course title:	**Smart Grids and Energy Management**	**Sub code:**	**PE201B**			
		Structure	**L**	**T**	**P**	**C**
			2	**1**	**0**	**3**

Course Objective:

- To introduce the fundamental concepts of smart grids and the technologies enabling modern energy management systems.
- To develop an understanding of demand-side management and its role in energy conservation and load balancing.
- To explore the integration of Internet of Things (IoT) in energy management for monitoring, control, and automation.
- To provide students with knowledge of energy auditing practices and standards in assessing and optimizing energy use.
- To analyze data analytics and machine learning techniques in optimizing energy management and predictive maintenance within smart grids.

Course Outcome:

- Explain the architecture, components, and functioning of smart grids and their significance in modern power systems.
- Apply demand-side management strategies to optimize energy consumption and improve grid reliability.
- Implement IoT-based solutions for energy monitoring, control, and automation in smart grid applications.
- Perform energy audits and assessments, understanding various energy performance metrics and their relevance.
- Utilize data analytics and machine learning tools to enhance energy efficiency, predict failures, and support decision-making in energy management.

Content

Module 1: Introduction to Smart Grids and Energy Management

- Evolution of traditional grids to smart grids, features, benefits, and architecture of smart grids.
- Key components of smart grids: Advanced Metering Infrastructure (AMI), Phasor Measurement Units (PMUs), and communication networks.
- Role of smart grids in integrating renewable energy sources and managing distributed generation.
- Cybersecurity challenges in smart grids and potential solutions.

Module 2: Demand-Side Management and Energy Efficiency

- Concept and importance of demand-side management (DSM), demand response (DR), and load forecasting.
- Energy conservation techniques and energy efficiency measures.
- Techniques for load shifting, peak shaving, and balancing energy supply and demand.

- Economic incentives for DSM and DR programs, and their impact on consumers and utilities.

Module 3: IoT in Smart Grids and Energy Management

- Overview of IoT architecture and protocols for smart grids.
- IoT-enabled devices and sensors for real-time monitoring, data collection, and remote control of energy systems.
- Smart meters, smart appliances, and home energy management systems (HEMS).
- Communication technologies in IoT-enabled smart grids: Zigbee, LoRa, NB-IoT, and 5G.

Module 4: Energy Auditing and Standards

- Basics of energy auditing: types of audits, objectives, and methodologies.
- Key energy performance indicators (KPIs), energy consumption analysis, and benchmarking.
- Standards and protocols in energy auditing (ISO 50001, ASHRAE standards).
- Role of energy audits in industry, buildings, and residential applications, case studies of successful energy audits.

Module 5: Data Analytics and Machine Learning in Energy Management

- Introduction to data analytics and machine learning techniques in energy management.
- Applications of machine learning for load forecasting, anomaly detection, and predictive maintenance.
- Case studies on using analytics for energy optimization and fault detection in smart grids.
- Overview of tools and platforms (MATLAB, Python, R) for energy data analysis and visualization.

Reference Books:

1. **James Momoh**, *Smart Grid: Fundamentals of Design and Analysis*, IEEE Press, Wiley.
2. **Gil Masters**, *Renewable and Efficient Electric Power Systems*, 2nd Edition, Wiley.
3. **Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama**, *Smart Grid: Technology and Applications*, Wiley.
4. **Fereidoon P. Sioshansi**, *Smart Grid: Integrating Renewable, Distributed & Efficient Energy*, Academic Press.
5. **Ali Keyhani**, *Design of Smart Power Grid Renewable Energy Systems*, Wiley-IEEE Press.

Course title:	**C/C++ PROGRAMMING**	**Sub code**				
		Structure	**L**	**T**	**P**	**C**
			2	0	2	3

Course Objective:	• To introduce basics of programming and develop logical thinking ofstudents. • To help students understand how to model real world problems into the software and develop practical programming skills of students. • To implement mathematical statistical, applications into programming.
Course Outcome:	• Master the syntax, semantics, and basic programming constructs of the C/C++ languages. • Develop problem-solving skills through algorithmic thinking and programming exercises. • Understand memory management, pointers, and data structures for efficient programming. • Gain proficiency in modular programming, debugging, and testing techniques. • Apply object-oriented programming principles to design and implement software solutions for engineering problems.

Content		**No. of hours**	**ESE Marks(%)**
Module 1: Introduction:		8	20

Flow charts, data types and storage classes, scope of variables, arithmetic operators, assignment, conditional, arithmetic expressions, enumerated data types, decision making, branching, looping, Switch concept, function and parameter passing, recursive functions, macros.		
Module 2: Basic programming algorithms:	8	20
Programs to illustrate basic language constructs in C like - Factorial, Sine/cosine and other mathematical series, Fibonacci series, calculating square-root of a number, calculating GCD of 2 integers (Euclid's method and otherwise), Calculating LCM of 2 integers and similar such programs.		
Module 3: Arrays and applications in C language:	8	20
Introduction to one dimensional and 2-D array with examples. Representing a polynomial using 1-D array and polynomial operations, use of 2-D array to represent a matrix and matrix operations. Character arrays (strings): String related functions (strlen, strcpy, strcat, strcmp, atoi, itoa, reverse, strstr etc) and their function definitions. Searching and Sorting methods: Selection sort, Bubble sort,Insertion sort, Linear and binary search, partitioning an array, merging of 2 sorted arrays. Introduction to "Divide and Conquer" via Mergesort and Quicksort.		
Module 4: Structures, Unions and Pointers in C language:	8	20
Basic concept, array of structures and its applications. Introduction (declaration and initialization), pointers and arrays, concept of dynamic memory allocation, use of pointers to represent variable- sized 1-D and 2-D arrays, pointers to structures.		
Module 5: C++ programming concepts	8	20
Introduction to Object Oriented Concepts, Features of Object-oriented programming (OOP). Classes and Objects: Creating a Class, The Self Variable, Constructor, Types of Variables, Namespaces, Types of Methods, Encapsulation, Module Packages. Inheritance and Polymorphism: Constructors in Inheritance, The Super Function, Types of Inheritance, Polymorphism, Abstract classes and Interfaces.		

Reference Books:

1) Kerninghan; Ritchie, "C programming Language", PHI
2) Theraja B.L., Electrical Technology, S. Chand Publishers
3) Balguruswamy, "Programming in ANSI C", Tata Mcgraw Hill Publishing
4) Kakde and Deshpande, "C and data Structure", Charles River Media Publisher
5) Dromey R G, "How to Solve it by Computer", PHI
6) "Programming in C++ (A Practical Approach)", C. S. Sharma Publisher, Oxford University Press

List of Experiments:

1) Write a Program to calculate and display the volume of a CUBE having its height (h=10cm),width (w=12cm) and depth (8cm).
2) Write a program to take input of name, roll no and marks obtained by a student in 5 subjectseach have its 100 full marks and display the name, roll no with percentage score secured.
3) Simple Arithmetic Operation.
4) Write a C program to check whether a number is even or odd using ternary operator.
5) Write a C program to find the sum of individual digits of a positive integer.
6) Write a C program to print the numbers in triangular form.
7) Write a C program to find the second largest integer in a list of integers.
8) Write C programs that use both recursive and non-recursive functions.
9) Write a C program to perform arithmetic using Switch Statement.
10) Write a C program to perform factorial.
11) Write a C program to print Fibonacci no.
12) Write a Simple Calculator Program using C++
13) Write a student database management Program using C++

Course title:	Data Structure and Algorithms	Sub code:				
		Structure:	L	T	P	C
			2	0	2	3

Course Objective:	• Master fundamental data structures and algorithms to efficiently solve computational problems. • Develop critical thinking and problem-solving skills through the analysis and implementation of algorithms. • Understand the principles behind various data structures and their applications in real-world scenarios. • Enhance coding proficiency by practicing algorithmic problem-solving techniques..
Course Outcome:	• Apply various data structures and algorithms to efficiently solve computational problems. • Analyze the time and space complexity of algorithms to make informed design choices. • Design and implement algorithms for sorting, searching, and manipulating data effectively. • Utilize data structures such as arrays, linked lists, trees, and graphs to model and solve real-world problems.

Content

Module 1: Introduction and basic terminology

Notion of data structures and algorithms, $lllllll$, nn, $2nn$: understanding growth of these functions, and applications (binary search and extensions to similar problems), Worst-case, averagecase time/space complexity and their relative merits, Asymptotic Notation: $OO( )$,$\Omega\Omega( )$

Module 2: Abstract Data-types, Arrays, Linked Lists, Stacks, Queues Dictionary ADT, Trees, Binary Trees

Abstract data-type (ADTs): arrays and linked list ADTs, Stacks, Queues: ADTs and implementations using arrays, linked lists, Doubly linked lists: ADT and implementation, Dictionary ADT: implementation using array, linked lists, binary search, Tree ADT and examples, Implementation of trees and basic traversal algorithms, Binary trees and in order traversal

Module 3: Priority Queues and Heaps

Priority Queue ADT, Definition of heaps, Implementation of Priority Queues using heaps and running time analysis, Implementation of heaps using arrays, Heap-sort

Module 4: Binary Search Trees, AVL Trees, 2-4 trees

Binary Search Trees: definition and some basic algorithms, Implementation of Dictionary ADTs using Binary Search trees and running time analysis, AVL trees: height balance condition, rotations, and implementation of dictionary ADT, 2-4 Trees: Multi-way search trees, implementation of dictionary ADT, Informal discussion of extension to B-trees.

Module 5: **Hash tables, tries**

Map ADT , Hash Tables and implementation of Map using Hash Tables , Design of hash functions , Collision resolution schemes: chaining, open addressing schemes like linear probing, quadratic probing, double hashing, Applications of Hashing: finding duplicates, set intersection, etc. ,Tries: implementation of Map ADT using tries,Compressed tries and suffix tries.

Reference Books

	1	"Data Structures and Algorithms in Java", by Michael T. Goodrich and Roberto Tamassia, John Wiley & Sons; 3rd Edition.
	2	"Data Structures and Algorithms in Python", by Michael T. Goodrich and Robert, Tamassia, Wiley, 1st Edition.
	3	In case any other programming language is used for this course, some other suitable text book may be chosen.
	4	NPTEL video series, Data-structures and Algorithms, Instructor: Naveen Garg
	5	Introduction to Algorithms, 4th Edition, Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, MIT Press/McGraw-Hill.

Experiment List

	1. Measure the time complexity of linear search versus binary search on arrays of varying sizes to understand their growth patterns. 2. Implement a stack using arrays and compare its performance with a linked list-based implementation. 3. Explore the efficiency of different collision resolution schemes (chaining, linear probing, quadratic probing) in hash tables. 4. Construct a priority queue using a heap and analyze its time complexity during various operations. 5. Implement a binary search tree and measure its efficiency in comparison to other dictionary ADTs. 6. Study the balance conditions in AVL trees by implementing insertion and deletion operations and analyzing their effects on the tree's height. 7. Compare the efficiency of different traversal algorithms (in-order, pre-order, post-order) on binary trees. 8. Experiment with various hash functions and observe their impact on hash table performance. 9. Implement a trie data structure and explore its efficiency in storing and retrieving data compared to hash tables. 10. Construct a 2-4 tree and analyze its space and time complexity for dictionary operations.

Course title:	**Management Principles and Practices**	**Sub code:**	**PE402A**			
		Structure:	**L**	**T**	**P**	**C**
			2	**1**	**0**	**3**

Course Objective:	• Understand the fundamental principles and functions of management in the context of technology-driven organizations. • Develop skills in planning, decision-making, organizing, leading, controlling, and monitoring within the tech industry. • Analyze and apply management theories and practices to address challenges specific to the field of computer science engineering. • Explore the role of human resource management in nurturing talent and fostering innovation in tech teams.
Course Outcome:	• Demonstrate proficiency in applying management principles to solve real-world problems in technology-driven environments. • Develop effective planning, decision-making, and organizational skills relevant to computer science engineering projects. • Exhibit leadership qualities and the ability to motivate and engage tech teams towards achieving organizational goals. • Implement quality management and project management methodologies to ensure the success of tech projects. • Apply human resource management strategies to recruit, train, and retain talent, fostering a productive and collaborative work culture in technology organizations.

Content

Module 1: Introduction to Management

Overview of management principles and functions. Evolution of management theories. Managerial roles and responsibilities. Importance of management in organizations. Case studies on successful management practices

Module 2: Planning and Decision Making

Understanding the planning process: setting goals, objectives, and strategies. Types of plans: strategic, tactical, operational. Decision-making models and techniques. Risk management and contingency planning. Case studies on effective planning and decision-making in tech companies

Module 3: Organizing and Leading

Principles of organizational structure and design. Delegation of authority and responsibility. Leadership styles and theories. Motivation and employee engagement strategies. Case studies on leadership and organizational effectiveness in tech teams.

Module 4: Controlling and Monitoring

Techniques for performance measurement and control. Quality management principles and practices. Project management methodologies (e.g., Agile, Waterfall). Monitoring and evaluating project progress. Case studies on successful project management and quality control in tech projects

Module 5: Human Resource Management

Recruitment and selection processes for tech roles. Training and development programs for tech professionals. Performance appraisal systems and feedback mechanisms. Employee relations and conflict resolution strategies. Case studies on HRM practices in tech companies.

Reference Books

1. "Management: Principles and Practices for Engineering and Construction" by Alan C. Twort and J. Gordon Rees
2. "Introduction to Management Science" by Bernard W. Taylor III
3. "Management Information Systems: Managing the Digital Firm" by Kenneth C. Laudon and Jane P. Laudon
4. "Human Resource Management" by Gary Dessler
5. "Project Management for Engineering, Business, and Technology" by John M. Nicholas and Herman Steyn

Course title:	**Employability skill**	**Sub code:**	**PE402B**			
		Structure:	**L**	**T**	**P**	**C**
			2	**1**	**0**	**3**

Course Objective:

- To enhance students' soft skills, communication, and interpersonal skills, which are essential for career development.
- To develop critical thinking, problem-solving, and decision-making skills required in the workplace.
- To improve students' writing skills, including technical reports, resumes, and business communication.
- To build teamwork, leadership, and time-management skills for effective collaboration in a professional setting.
- To prepare students for interviews, presentations, and group discussions, helping them become industry-ready professionals.

Course Outcome:

- Demonstrate effective verbal and written communication skills for professional contexts.
- Exhibit enhanced problem-solving abilities and the capability to think critically under different scenarios.
- Write clear and concise technical reports, resumes, and professional emails, adhering to standard formats.
- Collaborate effectively in teams, demonstrating leadership and managing time efficiently in project work.
- Show readiness for job interviews and perform well in group discussions, technical rounds, and HR interviews.

Content

Module 1: Communication Skills and Professional Writing

- **Verbal Communication**: Importance of clear and concise communication, effective listening, and presentation skills.
- **Written Communication**: Email etiquette, technical report writing, formal letters, and memos.
- **Resume Building**: Structure of a professional resume, creating an impactful resume that highlights skills and achievements.
- **Cover Letters**: Writing personalized cover letters to accompany job applications.
- **Business Communication**: Effective use of communication in meetings, conferences, and business correspondence.

Module 2: Critical Thinking, Problem-Solving, and Decision Making

- **Critical Thinking**: Analyzing information objectively, logical reasoning, and evaluating arguments.
- **Problem-Solving**: Techniques for solving complex problems, identifying root causes, and finding solutions.
- **Decision-Making Models**: Understanding various decision-making models like SWOT analysis and cost-benefit analysis.
- **Creativity in Problem Solving**: Techniques for fostering creativity and innovation in finding solutions.
- **Case Studies**: Analyzing real-life industry problems and providing solutions using critical thinking.

Module 3: Teamwork, Leadership, and Collaboration

- **Teamwork Skills**: Importance of teamwork, roles within a team, and conflict resolution techniques.
- **Leadership Styles**: Different leadership styles (e.g., transformational, transactional, and situational leadership) and their applications.
- **Effective Collaboration**: Techniques for improving collaboration in a diverse work environment.
- **Project Management**: Basics of project management, resource allocation, scheduling, and tracking progress.
- **Group Dynamics**: Understanding group roles, managing group conflict, and enhancing group performance.

Module 4: Time Management and Organizational Skills

- **Time Management**: Techniques like the Pomodoro technique, Eisenhower Matrix, and setting SMART goals.
- **Prioritization**: How to prioritize tasks based on urgency and importance.
- **Stress Management**: Techniques for managing stress and maintaining productivity during peak workloads.
- **Work-Life Balance**: Strategies for achieving a balance between professional responsibilities and personal life.
- **Organizational Skills**: Managing resources, organizing workspaces, and using tools for scheduling and tracking progress.

Module 5: Interview Preparation, Group Discussions, and Public Speaking

- **Interview Techniques**: Preparation for technical, HR, and behavioral interviews. Mock interviews and interview etiquette.
- **Group Discussions**: Approaches to participating effectively in group discussions, including listening skills, argument presentation, and summarizing.
- **Public Speaking**: Overcoming stage fear, techniques for effective public speaking, and making impactful presentations.
- **Communication in Interviews**: Handling difficult questions, body language, and personal branding.
- **Personality Development**: Confidence-building, self-awareness, and maintaining a positive attitude in professional settings.

Reference Books

1. **Meenakshi Raman and Sangeeta Sharma**, *Technical Communication: Principles and Practice*, 3rd Edition, Oxford University Press.
2. **P. K. Sinha**, *Employability Skills for Engineers*, Cengage Learning.
3. **Rajendra Pal and J.S. Korlahalli**, *Essentials of Business Communication*, 8th Edition, Sultan Chand & Sons.
4. **K. K. Sinha**, *Soft Skills: Know Yourself and Know the World*, 2nd Edition, Cengage Learning.
5. **Stephen P. Robbins**, *Organizational Behavior*, 12th Edition, Pearson Education.

Course Title:	**Transmission Lines and PCB Technology**	**Sub code:**				
		Structure:	**L**	**T**	**P**	**C**
			2	**0**	**4**	**4**

Course Objective:	• Learning PCB Fundamentals, Types, and Classifications. • Learning the design rules for Analog, digital and mixed signal electronic circuits. • Learning about Transient, AC Sweep, DC Sweep and operation point simulation for various electronic circuits. • Learning about PCB design and manufacturing process flow for SSB (Single sides boards) & DSB(Double sided Boards).
Course Outcome:	• Able to do analysis of various electronic circuits. • Design the Schematics and PCB layout for SSB(Single sides boards) &DSB(Double sided boards). • Perform Artwork generation using Film master equipment. • Generate various PCB Manufacturing files and drill files required for PCBfabrication.

Content	**No. of hours**	**ESE Marks(%)**
Module 1: Transmission Lines	8	20

Introduction to Transmission Lines: Definition and importance of transmission lines, Classification of transmission lines (open-wire, coaxial, microstrip, etc.), Parameters of transmission lines: resistance, inductance, capacitance, and conductance. Basics of Transmission Line Equations: Derivation of Telegrapher's equations. Characteristics of transmission lines: velocity of propagation, characteristic impedance, attenuation constant, and phase constant. RC Transmission Lines: Analysis of RC transmission lines, Determination of characteristic impedance and propagation constant for RC lines, Reflection and transmission coefficients for RC lines. RCC Transmission Lines: Introduction to RCC transmission lines, Analysis of RCC transmission lines considering resistive, capacitive, and conductive effects, Calculation of characteristic impedance and propagation constant for RCC lines. Infinite Transmission Lines and Control Impedance: Infinite transmission lines: reflectionless lines, matched lines, and quarter-wavelength lines, Design considerations for control impedance, Applications and examples of transmission line designs, Problem-solving sessions and review of key concepts.

Module 2: Introduction to PCB Design, tools and techniques	12	30

Overview of PCB technology and its applications. Introduction to PCB design software (e.g., Cadence Allegro / Orcad / Altium Designer) ,Understanding PCB design considerations: size, shape, layers, and component placement ,Basics of schematic capture and PCB layout design ,Design rules and constraints for signal integrity, power distribution, and thermal management, In-depth exploration of PCB design software features and tools,Practical exercises in schematic design and PCB layout using industry-standard software ,Advanced techniques for component placement, routing, and copper pour ,Designing for manufacturability (DFM) and assembly (DFA) ,Introduction to Design for Testability (DFT) principles.

Module 3: PCB Manufacturing process	8	20

Overview of PCB manufacturing processes: substrate selection, imaging, etching, and drilling Understanding PCB fabrication technologies: subtractive, additive, and semi-additive processes ,Quality control and inspection techniques during manufacturing ,Environmental considerations in PCB manufacturing ,Case studies and real-world examples of PCB manufacturing challenges and solutions

Module 4: PCB assembly techniques.	6	20

Introduction to surface-mount technology (SMT) and through-hole technology (THT) ,Component selection, procurement, and inventory management Soldering techniques: hand soldering, reflow soldering, wave soldering PCB assembly equipment and machinery: pick-and-place machines, solder paste printers, reflow ovens ,Testing and inspection methods during PCB assembly: visual inspection, automated optical inspection (AOI), in-circuit testing (ICT)

Module 5: PCB testing and quality assurance	6	10

Introduction to PCB testing methodologies: functional testing, boundary scan testing, flying probe testing Designing and implementing test fixtures and procedures Reliability testing and failure analysis techniques Quality assurance standards and certifications for PCBs Continuous improvement strategies in PCB testing and quality management

Text/Reference Books :

	1	Printed Circuit Boards: Design and Technology, Walter C Bosshart ,Tata McGraw-hill publication
	2	Printed Circuit Boards: Design, Fabrication, Assembly & Testing, R S Khandpur,Tata McGraw-hill publication
	3	Printed Circuit Boards, Coombs Clyde F., Tata McGraw-hill publication
	4	The Design & Drafting of Analog Printed Circuit boards, Darryl Lindsey, BishopGraphics Inc
	5	Printed Circuit Boards: Design Techniques For EMC Compliance, Montrose Mark I,IEEE Press Series of Electronics Technology
List of Experiments		
	1	Design the current mirror circuit in schematic editor using Autodesk Eagle softwareand Run the operating point analysis simulation.
	2	Design the basic diode circuit in schematic editor using Autodesk Eagle software andRun the Transient Analysis simulation.
	3	Design the basic MOSFET circuit in schematic editor using Autodesk Eagle software
		and Run the DC Sweep Analysis simulation.
	4	Design the BJT Oscillator circuit in schematic editor using Autodesk Eagle software and Run the Transient Analysis simulation.
	5	Create the library component resistor with the following dimensions and specifications using Autodesk Eagle software.
	6	Create the library component for 555 timer IC with the given dimensions and specifications using Autodesk EAGLE Software.
	7	Create the library component for G5LE OMRON RELAY with the given dimensions and specifications using Autodesk EAGLE Software.
	8	Create the library component for NCP716B LDO with the given dimensions and specifications Autodesk EAGLE Software.
	9	Design the USB TO TTL/CMOS Programmer circuit using FTDI232 IC into schematic editor and draw the PCB layout for the same in Autodesk EAGLE software, run the Electrical Rule Check(ERC) in schematic editor.
	10	Design the Astable Multivibrator circuit using 555 timer ic into schematic editor and draw the PCB layout for the same in Autodesk EAGLE software, generate BOM, netlist and run design rule check.
	11	Design the DC TO DC 5V Voltage regulator circuit using LM317 IC into schematic editor and draw the PCB layout for the same in Autodesk EAGLE software, generate gerber files for top electrical and bottom electrical.
	12	To learn the process of generating files(HPGL, ISEL, Excellon) for CNC drilling and milling machine.
	13	To learn the process of generating 3D files format and observe the DXF view.
	14	Study the various format settings done in photoplotter machine. Learn about artwork generation software, the concept of importing PCB Gerber file and converting files to photoplotter format.
	15	To learn the process of generating legends(silkscreen) for Top electrical/ bottom electrical (SSB) Or both (DSB).

Course title:	SoC Design and Verification	Sub code:				
		Structure:	L	T	P	C
			2	0	4	4

Course Objective:	• Understand the fundamentals of System-on-Chip (SoC) design and verification methodologies to develop complex integrated circuits. • Gain proficiency in hardware description languages (HDLs) for SoC modeling and simulation. • Learn advanced techniques for designing and verifying digital and analog components within SoCs, including IP integration and system-level validation. • Explore industry-standard tools and methodologies for SoC design, verification, and testing, enhancing employability in the semiconductor industry. • Develop practical skills through hands-on projects and case studies, culminating in the design and verification of a custom SoC, preparing students for real-world engineering challenges.
Course Outcome:	• Demonstrate proficiency in designing and verifying complex System-on-Chip (SoC) architectures, adhering to industry standards and best practices. • Acquire hands-on experience in hardware description languages (HDLs) and industry-standard tools for SoC modeling, simulation, and synthesis. • Possess the skills to integrate and verify digital and analog components within SoCs, ensuring functional correctness and performance optimization. • Students will be capable of analyzing and resolving design challenges in SoC projects, considering factors such as power consumption, area utilization, and timing constraints. • Prepare students for careers in semiconductor companies, research institutions, or further studies in advanced topics related to SoC design and verification.

Content	No. of hours	ESE Marks (%)
Module 1: Introduction to SoC Design	8	20
Overview of System-on-Chip (SoC) architecture and design methodologies, Introduction to hardware description languages (HDLs) such as Verilog and VHDL, SoC design flow and the role of simulation and verification		
Module 2: Digital Design and Verification	8	20
Combinational and sequential logic design techniques, Finite State Machine (FSM) design and implementation, RTL (Register Transfer Level) coding using Verilog/VHDL for digital SoC components, Functional verification techniques including testbench development and simulation		
Module 3: System Verilog And Universal Verification Methodology	8	20
Overview of System Verilog as an extension of Verilog with enhanced features for design and verification, Utilizing System Verilog for RTL (Register Transfer Level) design of SOC components including modules, interfaces, and hierarchical structures, Introduction to UVM as a standardized methodology for verification in System Verilog, Designing modular and reusable verification components using the UVM methodology, Developing verification plans to ensure comprehensive verification coverage of SOC designs.		
Module 4: SoC Integration and Verification	8	20
IP (Intellectual Property) integration strategies and standards,SoC bus architectures (e.g., AMBA) and interconnect design, System-level verification methodologies including constrained random testing and assertion-based verification, SoC debug techniques and tools		
Module 5: Advanced Topics and Project Work	8	20
Advanced SoC design concepts such as low-power design techniques and security considerations, Case studies and industry applications of SoC design and verification, Group projects involving the design, verification, and testing of a custom SoC, Presentation and discussion of project outcomes		

Reference Books:

	1. "Digital Design and Computer Architecture" by David Harris and Sarah Harris 2. "SystemVerilog for Verification: A Guide to Learning the Testbench Language Features" by Chris Spear 3. "Analog Design Essentials" by Willy M. C. Sansen4. J. P. Uyemura, CMOS Logic Circuit Design, Springer; 2001,. 4. "Principles of CMOS VLSI Design: A Systems Perspective" by Neil H. E. Weste and David Harris 5. "System-on-Chip Verification: Methodology and Techniques" by Prakash Rashinkar, et al.
List of Experiments:	
	1. Introduction to SoC Design: o Experiment 1: FPGA Programming for Basic Logic Circuits. 2. Digital Design and Verification: o Experiment 2: Design and Verification of Basic Logic Gates in Verilog. 3. System Verilog and Universal Verification Methodology (UVM): o Experiment 3: Introduction to System Verilog Constructs. o Experiment 4: Development of a UVM Testbench for SOC Verification. 4. SoC Integration and Verification: o Experiment 5: Integration and Verification of Peripherals in an SoC. 5. Advanced Topics: o Experiment 6: Design and Verification of Advanced SoC Components. 6. Project Work: o Experiment 7-10: SoC Design Project: Full SoC Development with Peripherals and Advanced Components.

Course title:	**Artificial Intelligence and Machine Learning**	**Sub code:**				
		Structure:	**L**	**T**	**P**	**C**
			2	**0**	**2**	**3**

Course Objective:	• This course aims to introduce students to fundamental concepts, theories, and advanced techniques in artificial intelligence (AI), providing a comprehensive understanding of AI principles and methodologies. • Students will be introduced to the foundational concepts and practical applications of machine learning, including supervised, unsupervised, and reinforcement learning algorithms, enabling them to understand the principles behind machine learning and its diverse applications. • Through practical examples and case studies, students will learn how to apply machine learning and AI algorithms in diverse fields such as science, medicine, finance, and others.
Course Outcome:	• Understand the principles and techniques of artificial intelligence and machine learning algorithms. • Analyze and apply supervised, unsupervised, and reinforcement learning techniques to solve engineering problems. • Gain proficiency in designing and implementing machine learning models for pattern recognition, classification, and regression tasks. • Explore advanced topics such as deep learning, neural networks, and natural language processing. • Develop practical skills in programming, data analysis, and model evaluation using machine learning libraries and frameworks.

Content	**No. of hours**	**ESE Marks (%)**
Module 1: Introduction to Artificial Intelligence	8	20
Overview of Artificial Intelligence (AI) and its applications, History and evolution of AI, Foundations of AI: Logic, reasoning, and problem-solving, AI techniques: Search algorithms, knowledge representation, and expert systems,Ethical considerations and societal impact of AI		
Module 2: Machine Learning Fundamentals	8	20
Introduction to Machine Learning (ML) and its types (supervised, unsupervised, reinforcement learning), Basic concepts: Feature representation, training, and evaluation, Supervised learning algorithms: Linear regression, logistic regression, decision trees, and support vector machines,Unsupervised learning algorithms: Clustering, dimensionality reduction, and association rule learning		

Model evaluation and validation techniques		
Module 3: Deep Learning and Neural Networks	8	20
Introduction to Deep Learning and neural networks, Basics of artificial neurons and activation functions, Fundamentals of feedforward neural networks, Training neural networks: Backpropagation algorithm, gradient descent optimization, Deep learning architectures: Convolutional Neural Networks (CNNs), Recurrent Neural Networks (RNNs), and their applications		
Module 4: Advanced Topics in Machine Learning	8	20
Ensemble learning techniques: Bagging, boosting, and stacking, Support Vector Machine (SVM) extensions: Kernel methods, multi-class classification, Introduction to reinforcement learning: Markov Decision Processes (MDPs), Q-learning, and policy gradients, Introduction to natural language processing (NLP): Text preprocessing, sentiment analysis, and language modeling, Time series analysis and forecasting using machine learning techniques		
Module 5: Applications of Artificial Intelligence and Machine Learning	8	20
AI applications in various domains: Healthcare, finance, robotics, autonomous vehicles, etc., Case studies and real-world examples of AI and ML implementations, Ethical considerations in AI and ML applications, Future trends and emerging technologies in AI and ML, Hands-on projects and practical applications of AI and ML concepts		

Reference Books:

1. Stuart Russell, Peter Norvig, "Artificial Intelligence – A Modern Approach", PearsonEducation
2. Elaine Rich and Kevin Knight, "Artificial Intelligence", McGraw-Hill
3. E Charniak and D McDermott, "Introduction to Artificial Intelligence", PearsonEducation
4. Dan W. Patterson, "Artificial Intelligence and Expert Systems", Prentice Hall of India
5. Tom M. Mitchell, ―Machine Learning, McGraw-Hill Education (India) Private Limited,2013.
6. Ethem Alpaydin, ―Introduction to Machine Learning (Adaptive Computation andMachine Learning), The MIT Press 2004.

Experiments

1. Search Algorithm Simulation: Simulate depth-first search and breadth-first search algorithms to solve a simple maze problem.
2. Expert System Development: Create a rule-based expert system using a decision tree to diagnose common medical conditions.
3. Linear Regression Model Implementation: Build a linear regression model to predict house prices based on features like size and number of bedrooms.
4. K-Means Clustering Exercise: Apply the k-means clustering algorithm to segment customer data into distinct groups for targeted marketing strategies.
5. Convolutional Neural Network (CNN) Training: Train a CNN model to classify images of handwritten digits (MNIST dataset) into their respective classes.
6. Ensemble Learning Experiment: Compare the performance of different ensemble methods (e.g., random forests, gradient boosting) on a classification task using a benchmark dataset.
7. Reinforcement Learning Simulation: Implement a simple grid-world environment and train an agent using Q-learning to navigate and find optimal paths.
8. Sentiment Analysis with NLP: Perform sentiment analysis on movie reviews dataset to classify reviews as positive or negative using natural language processing techniques.
9. Time Series Forecasting: Use historical stock price data to forecast future prices using time series analysis techniques like ARIMA or LSTM networks.
10. AI and ML Project: Choose a domain of interest (e.g., healthcare, finance) and develop a mini-project applying machine learning techniques to solve a relevant problem, such as disease prediction or stock price prediction.

Course title:	Database Management Systems	Sub code:	PC404			
		Structure:	L	T	P	C
			2	0	2	3

Course Objective:	• To understand the role and functions of a database management system and its impact on the overall performance of a computer system. • To understand the concepts and techniques involved in ER modeling. • To understand the SQL commands and relational algebraic expressions for query processing. • To gain hands-on experience with designing and implementing database management systems through programming projects and case studies.
Course Outcome:	• Learn the basic concepts of Database Systems • Model the real-world systems using Entity Relationship Diagrams and convert the ER model into a relational logical schema using various mapping algorithms • Make use of SQL commands and relational algebraic expressions for query processing • Simplify databases using normalization process based on identified keys and functional dependencies and solve the atomicity, consistency, isolation, durability, transaction, and concurrency related issues of databases

Content

Module 1: Introduction

- General introduction to database systems; Database - DBMS disctinction, approaches to building a database, data models, database management system, threeschema architecture of a database, challenges in building a DBMS, various components of a DBMS.

Module 2: Database design and ER Model

Overview, ER-Model, Constraints, ER-Diagrams, ERD Issues, weak entity sets, Codd's rules, Relational Schemas, Introduction to UML Relational database model: Logical view of data, keys, integrity rules. Relational Database design: features of good relational database design, atomic domain and Normalization (1NF, 2NF, 3NF, BCNF).

Module 3: Relational algebra

Introduction, Selection and projection, set operations, renaming, Joins, Division, syntax, semantics. Operators, grouping and ungrouping, relational comparison. Calculus: Tuple relational calculus, Domain relational Calculus, calculus vs algebra, computational capabilities.

Module 4: SQL

Introduction, data definition in SQL, table, and key and foreign key definitions, update behaviors. Querying in SQL - basic select-from-where block and its semantics, nested queries- correlated and uncorrelated, notion of aggregation, aggregation functions group by and having clauses, embedded SQL. Data Storage and Indexes - file organizations, primary, secondary index structures, various index structures - hashbased, dynamic hashing techniques, multi-level indexes, and B+ trees.

Module 5: Transaction management and Concurrency control

Transaction processing and Error recovery - concepts of transaction processing, ACID properties, and serializability concurrency control, Lock based concurrency control (2PL, Deadlocks), Time stamping methods, optimistic methods, and database recovery management. Error recovery and logging, undo, redo, undo-redo logging and recovery methods.

Reference Books

	1	Fundamentals of Database Systems Author R. Elmasri and S.B. Navathe Publisher Pearson Edition 2016
	2	Database Systems Concepts Author H.f.Korth and Silberschatz Publisher McGraw Hill
	3	Database System Author Hector Garcia-Molina, Jeff Ullman, and Jennifer Widom Publisher Pearson Edition 2nd Edition
	4	Data Base Design Author C.J. Date Publisher Addison Wesley.

	5	DBM and Design Author Hansen and Hansen Publisher PHI
	6	"Database System Concepts" Authors: Abraham Silberschatz, Henry F. Korth, S. Sudarshan Publisher: McGraw-Hill Education Year: 2020 (7th edition).
list of Experiments		
	1	Library Management system (File Handling)
	2	Introduction to SQL ● Installation of SQL-Server ● SQL data definition ● Constraints in SQL ● Schema change Statement
	3	Basic SQL Queries
	4	Complex SQL Queries-1 ● Nested Queries ● Correlated Nested Queries ● EXISTS Function in SQL ● Aggregation Function
	5	Complex SQL Queries-2 ● Joined Tables ● Aggregate Functions
	6	Complex SQL Queries-3 ● Grouping ● EXISTS and UNIQUE functions ● Aggregate Functions
	7	Entity-Relationship Diagram from Case Study
	8	Normalization of the Case Study
	9	Webpage Connectivity with SQL Server Using XAMPP- 1
	10	Webpage Connectivity with SQL Server Using XAMPP- 2