NATIONAL INSTITUTE OF ELECTRONICS AND INFORMATION TECHNOLOGY

DEEMED TO BE UNIVERSITY UNDER DISTINCT CATEGORY

(AN AUTONOMOUS INSTITUTION UNDER MINISTRY OF ELECTRONICS & IT, GOVT. OF INDIA)

Curriculum and Syllabi for

Diploma - Electronics and Communication Engineering

(2026-27 Scheme)

रा.इ.सू.प्रौ.सं
NIELIT
Deemed to be University

Main Campus at Ropar and Constituent Units at Aizawl, Agartala, Aurangabad, Calicut, Gorakhpur, Imphal, Itanagar, Kekri, Kohima, Patna and Srinagar

Vision

To emerge as a globally recognized centre of excellence in electronics and communication education and skill development, empowering learners with industry-relevant knowledge, innovation, and ethical values for societal and national development.

Mission

M1: To provide quality technical education in electronics and communication engineering through updated curriculum, effective teaching-learning practices, and a learner-centric environment.

M2: Encourage hands-on learning through practical training, projects, and internships that build real-world skills.

M3: To promote ethical values, environmental responsibility, and entrepreneurial skills for inclusive and sustainable growth.

M4: To collaborate with industry and research institutions for knowledge sharing and continuous improvement in program outcomes.

Program Education Objectives

Graduates of the Diploma in Electronics and Communication Engineering will be able to:

PEO1: Apply fundamental knowledge and modern tools in electronics and communication to solve real-world problems.

PEO2: Build successful careers in the public or private sector or continue their education and professional growth.

PEO3: Work responsibly and effectively in teams, demonstrating good communication and ethical behavior.

PEO4: Adapt to emerging technologies in fields such as IoT, AI/ML, 5G, VLSI, and embedded systems through continuous upskilling.

Program Outcomes

Diploma students will demonstrate the following outcomes by the time of graduation:

PO1-Engineering Knowledge: Apply knowledge of mathematics, science, and electronics fundamentals to practical engineering problems.

PO2-Problem Analysis: Identify, analyze, and solve broadly defined engineering technology problems.

PO3-Design/Development of Solutions: Design systems or components for electronic applications considering health, safety, societal, and environmental aspects.

PO4-Modern Tool Usage: Use appropriate modern hardware/software tools for engineering activities.

PO5-Ethics: Apply ethical principles and commit to professional ethics and responsibilities.

PO6-Communication: Communicate effectively through reports, presentations, and instructions.

PO7-Project Management and Finance: Demonstrate knowledge of engineering and management principles to manage projects.

PO8-Lifelong Learning: Recognize the need for and engage in lifelong learning to adapt to technological changes.

Program Specific Outcomes

PSO1: Apply domain knowledge to build, test, and troubleshoot analog and digital circuits, embedded systems, and communication systems.
PSO2: Demonstrate proficiency in using EDA tools, simulation software, and lab instruments for circuit design, PCB prototyping, and system development.
PSO3:Apply their skills in emerging areas like IoT, VLSI, and wireless communication to solve practical challenges.

CATEGORY WISE CREDIT DISTRIBUTION

Category	Category Code	Credits
Skill / Employment Enhancement Courses (Project/Internship/Seminar/Dissertation/Research)	EE	20
Value Added Courses	VA	4
Ability Enhancement Courses	AE	4
Audit Courses (without grade or credit)	AU	0
Open Elective Courses	OE	8
Professional Elective Courses	PE	16
Program Core Courses	PC	72
Total Credits (Common track)		**124**

EVALUATION AND ASSESSMENT

1. Performance of a student in a semester shall be evaluated through continuous Class assessment, Tutorial/Lab assessment, Mid-Semester Examination (MSE) and End-Semester Examination (ESE). Both the MSE and ESE shall be the University examination and will be conducted as notified by the Controller of Examinations (CoE) of the University.

2. The continuous assessment shall be based on assignments, tutorials, paper presentation / quizzes/ viva-voce / flipped classes, lab work / projects / fieldwork and attendance, etc.

3. The MSE/ESE shall be comprising of written papers.

4. The overall assessment of the students will be done as per the following scheme:

S. No.	Assessment Type	Marks Weightage
1.	Mid Semester Examination	20
2.	End Semester Examination	40
3.	Continuous Assessment - Practical /Lab/ Tutorial	25
4.	Continuous Assessment - Theory	15
Total		**100**

For more details, please refer the applicable ordinance for this programme and Assessment SOPs.

CURRICULUM

Semester 1						
Semester Code	**Course Code**	**Course Title**	**L**	**T**	**P**	**Cr**
PC-DIPECE-101	DASH250006	Applied Mathematics-I	3	1	0	4
PC-DIPECE-102	DASH250005	Applied Science	3	0	2	4
PC-DIPECE-103	DCSE250032	Basic Computer Science and Electronics	2	0	4	4
PE-DIPECE-104	Elective	Program Elective				4
OE-DIPECE-105	Elective	Open Elective				4
AU-DIPECE-106	Elective	Audit Elective				0

Semester 2						
Semester Code	**Course Code**	**Course Title**	**L**	**T**	**P**	**Cr**
PC-DIPECE-201	DASH250007	Applied Mathematics-II	3	1	0	4
PC-DIPECE-202	DCSA250010	Technical Drawing using CAD	2	0	4	4
PC-DIPECE-203	DCSE250036	Basic Programming Concepts	2	0	4	4
AE-DIPECE-204	DASH250016	Communication Skills	1	0	2	2
VA-DIPECE-205	DASH250101	Sports and Yoga	0	0	4	2
EE-DIPECE-206	EE	Internship-1				4

Semester 3						
Semester Code	**Course Code**	**Course Title**	**L**	**T**	**P**	**Cr**
PC-DIPECE-301	DOEE250070	Electrical Circuits & Networking	3	1	0	4
PC-DIPECE-302	DOEE250106	Fundamendals of Electronic Devices and Circuits	3	0	2	4
PC-DIPECE-303	DOEE250160	Digital Logic Design	2	0	4	4
PE-DIPECE-304	Elective	Program Elective				4
OE-DIPECE-305	Elective	Open Elective				4
AU-DIPECE-306	Elective	Audit Elective				0

Semester 4						
Semester Code	**Course Code**	**Course Title**	**L**	**T**	**P**	**Cr**
PC-DIPECE-401	DOEE250164	Linear and Digital IC	2	0	4	4
PC-DIPECE-402	DOEE250166	Fundamentals of Microprocessors and Microcontrollers	2	0	4	4
PC-DIPECE-403	DOEE250186	Basics of Analog and Digital Communication	3	0	2	4
PE-DIPECE-404	Elective	Program Elective				4
AE-DIPECE-405	DASH250091	Professional Values and Ethics	2	0	0	2
VA-DIPECE-406	DASH250052	Environmental Science	2	0	0	2
EE-DIPECE-407	EE	Minor Project				4

Semester 5						
Semester Code	**Course Code**	**Course Title**	**L**	**T**	**P**	**Cr**
PC-DIPECE-501	DOEE250096	Embedded Systems Design	2	1	2	4
PC-DIPECE-502	DOEE250109	Fundamentals of Cellular Technology	3	0	2	4
PC-DIPECE-503	DOEE250050	Control System Engineering	3	1	0	4
PC-DIPECE-504	DOEE250155	Optical Fiber Communication	3	1	0	4
PE-DIPECE-505	Elective	Program Elective				4
EE-DIPECE-506	EE	Summer Internship-II				2
EE-DIPECE-507	EE	Major Project -I				2

Semester 6						
Semester Code	**Course Code**	**Course Title**	**L**	**T**	**P**	**Cr**
PC-DIPECE-601	DOEE250209	PCB Prototyping and Assembly	2	0	4	4
PC-DIPECE-602	DOEE250210	Basic VLSI Technology	2	1	2	4
AU-DIPECE-603	Elective	Audit Elective				0
EE-DIPECE-604	DASH250050	Entrepreneurship and Start-Ups	3	1	0	4
EE-DIPECE-605	EE	Major Project -II				2
EE-DIPECE-606	EE	Technical Seminar				2

Elective Courses

Elective Courses for PE Category						
Course Code	**Course Title**	**L**	**T**	**P**	**Cr**	**For Sem./Code**
DASH250093	Renewable Energy Technologies	3	1	0	4	
DCSA250006	Fundamentals of Blockchain Technology	2	0	4	4	
DCSA250055	Multimedia Technologies	3	0	2	4	
DCSE250022	Introduction to Augmented Reality and Virtual Reality	2	0	4	4	
DCSE250027	Basics of Computer Networking and Cyber Security	2	0	4	4	
DOAI250007	Fundamentals of Artificial Intelligence	2	0	4	4	
DOAI250010	Fundamentals of Deep Learning	2	0	4	4	
DOAI250013	Machine Learning Fundamentals	2	0	4	4	
DOAI250016	Basic Neural Networks and Applications	2	0	4	4	
DOEE250045	Consumer Electronics	3	0	2	4	
DOEE250052	Power Electronics and Electric Vehicles	2	0	4	4	
DOEE250067	Rapid Prototyping and 3D Printing	2	0	4	4	
DOEE250068	Basics of Sensors and Interfaces	2	0	4	4	
DOEE250080	Electronic Measurements and Instrumentation	2	0	4	4	
DOEE250118	Industrial Automation	3	0	2	4	
DOEE250122	Introduction To UAV Electronics	2	0	4	4	
DOEE250126	Introduction to Robotics	2	0	4	4	
DOEE250133	Computer Hardware Servicing	2	0	4	4	
DOEE250138	Medical Electronics	3	0	2	4	
DOEE250143	Basics of Wireless Sensor Networks	2	0	4	4	

Elective Courses for OE Category
Students may opt courses under MOOC, NPTEL, SWAYAM, NSQF/NCVET aligned courses or other relevant technical subjects not included in their core curriculum. The exercise of option shall be subject to the Course Schedule of the respective Constituent Unit, the credit requirements and availability of seats. Guidelines for choosing MOOC/Online courses are given separately and shall have to be adhered to.

Elective Courses for AU (Audit) Category					
Course Code	**Course Title**	**L**	**T**	**P**	**Cr**
DASH240027	Disaster Management	2	0	0	0
DASH240047	English for Research Paper Writing	2	0	0	0
DASH240052	Environmental Science	3	0	0	0
DASH240085	Pedagogy Studies	2	0	0	0
DASH240086	Personality Development through Life Enlightenment Skills	2	0	0	0
DASH240097	Sanskrit for Technical Knowledge	2	0	0	0
DASH240103	Stress Management by Yoga	2	0	0	0
DASH240104	Technical Presentation and Report Writing	0	0	2	0

DASH240106	Value Education	2	0	0	0
DASH240124	Constitution of India - AU	2	0	0	0
DASH250023	Constitution of India	2	1	0	0
DASH250027	Disaster Management	3	0	0	0
DASH250034	Energy and Environmental Engineering	3	0	0	0
DASH250047	English for Research Paper Writing	2	0	0	0
DASH250054	Essence of Indian Knowledge and Tradition	2	0	0	0
DASH250085	Pedagogy Studies	2	0	0	0
DASH250086	Personality Development	2	0	0	0
DASH250097	Sanskrit for Technical Knowledge	3	0	0	0
DASH250103	Stress Management by Yoga	3	0	0	0
DASH250106	Value Education	2	0	0	0
DASH250117	Innovative Thinking and Entrepreneurship Skills	1	0	0	0
DASH250118	Intellectual Property Rights	2	0	0	0
DCSA240080	Training on Computer Networking	0	0	2	0
DCSA240304	Lab Based on Statistical Package	0	0	2	0
Any other Scheduled Course as per the Course Schedule of the respective Constituent Unit can also be chosen, subject to availability of seats. However, there shall be no assessment and grading for the course chosen as Audit Course.					

The choice of all type of Electives available shall be as per the Course Schedule of the respective Constituent Unit.

Guidelines for Massive Open Online Courses (MOOC) / approved Online Courses

1. Relevant Swayam, MOOC, NPTEL, NIELIT NSQF and any other online courses approved by UGC/AICTE shall also be allowed as Open Electives(OE).

2. One credit of MOOC course should be minimum of 30 hours.

3. A student can choose any approved online course as Open Elective, subject to minimum credit requirements.

4. The students willing to opt OE under MOOC in their next semester, will submit their request to the MOOC Coordinator at their respective campus.

5. Once approved, the campus shall display the list of accepted courses.

6. The student has to submit certificate issued by the institution offering the MOOCs course, along with the number of credits and grades, to get credits transferred into his/her marks certificate issued by NDU.

7. The transfer of credits shall be as adopted by NDU.

Detailed Syllabus

Course Code	Course Name	L	T	P	Cr
DASH250006	Applied Mathematics-I	3	1	0	4

Course Outcomes:

CO1: Perform vector operations (dot, cross, scalar triple product) and apply them in simple engineering problems.
CO2: Calculate derivatives of various functions and apply them in real-life rate and change-related problems.
CO3: Solve problems involving complex numbers using algebraic methods and De Moivre's Theorem.
CO4: Evaluate and apply trigonometric and inverse trigonometric identities to triangles and angle-based problems.
CO5: Use combinatorial methods and binomial expansions to solve mathematical and logical problems in computing contexts.

Module 1:

Vector Algebra (9 hrs)

Definition of vector and scalar quantities, addition and subtraction of vectors, Dot and Cross product, Scaler and vector triple product, Angle between two vectors.

Module 2:

Differential Calculus (9 hrs)

Functions and Their Graphs: Definition and types of functions, Graphical representation of functions, Domain and range of functions (elementary cases)
Limits and Continuity: Concept of limit of a function, Left-hand limit (LHL) and Right-hand limit (RHL), Standard limit formulas, Elementary methods for finding limits, Continuity of functions at a point and over an interval, Basic test for continuity and differentiability
Differentiation Techniques: Definition of derivative, Basic rules of differentiation: Sum and difference, Product rule, Quotient rule, Chain rule (function of a function)
Derivatives of Trigonometric functions, Exponential functions, Logarithmic functions, Inverse trigonometric functions.

Module 3:

Complex Numbers and Their Applications (8 hrs)

Complex Numbers: Definition and representation of complex numbers (Cartesian form), Real and imaginary parts
Basic Operations: Addition, subtraction, multiplication, division, modulus, and conjugate
De Moivre's theorem: Statement and simple applications for powers and roots.

Module 4:

Trigonometry (10 hrs)

Revision: Measurement of an angle (degree and radian), Relation Between degree and radian, Trigonometric ratios, Fundamental identities
Inverse trigonometric ratios: Definition of inverse trigonometric ratios, Principal values of Inverse trigonometric ratios, Relation between inverse trigonometric ratios
Properties of Triangle: Sine, Cosine, Projection and tangent rules (without proof), Simple problems.

Module 5:

Permutations, Combinations & Binomial Theorem (9 hrs)

Permutations and Combinations: Factorial notation and basic rules, Permutation and Combination formulas, Application in real-life and computing problems
Binomial Theorem: Expansion for positive integral index (without proof), Expansion for negative index (expansion only).

Labs / Practicals:

N/A

References:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers
2. N.P. Bali and Manish Goyal, A Textbook of Engineering Mathematics (Vol. I & II), Laxmi Publications
3. H.K. Dass, Polytechnic Mathematics, S. Chand Publishing
4. S.S. Sabharwal, Diploma Engineering Mathematics, Unique Publishers
5. R.D. Sharma, Mathematics for Class 11 & 12, Dhanpat Rai Publications
6. M.K. Jain or B.V. Ramana, Engineering Mathematics (Vol. I), S. Chand Publishing / Pearson

Course Code	Course Name	L	T	P	Cr
DASH250005	Applied Science	3	0	2	4

Course Outcomes:

CO1 : Demonstrate understanding of basic measurement principles and physical quantities.
CO2 : Apply laws of mechanics, heat, and material properties in solving engineering problems.
CO3 : Explain atomic structure, electrochemical processes, and corrosion.
CO4 : Identify and classify engineering materials including polymers and alloys.
CO5 : Perform fundamental experiments in Physics and Chemistry relevant to electronics and communication engineering.

Module 1:

Unit, Dimension, Measurement and Mechanics
Concept of unit of physical parameters, Fundamental and derived units, S.I. system of units of different physical parameters, Dimension with examples of different physical parameters, measuring devices.
Concept of scalar and vector quantities, Speed, velocity and linear acceleration, Force, inertia, momentum, Conservation of linear momentum, Work, Power and Energy, Rotational Motion.

Module 2:

Properties of matter: Physical and Chemical
Basic crystal structure, States of matter, elasticity, Expansions of solids, liquids and gases, Co-efficient of linear, surface and cubical expansion and relationship amongst them, Simple problems.
Heat and Temperature: Concept and Modes of heat transfer (Conduction, convection and Radiation with examples), Scales of temperatures and their relationship, thermometers and their uses.

Module 3:

Atomic Structure, Chemical Bonding and Solutions
Rutherford, Bohr's atomic model, Pauli's exclusion principle, hydrogen spectrum, periodic table, Planck's constant and Heisenberg uncertainty principle, Quantum numbers, concept of s, p, and d orbitals. Concept of chemical bonding: cause of chemical bonding. Types of bonds: covalent bond, ionic bond and metallic bond, Solution: idea of solute, solvent and solution, methods to express the concentration of solution-molarity (M, molar constant), ppm, mass percentage, volume percentage and mole fraction.

Module 4:

Electrolysis
Process of electrolysis: Equivalent weight and Faraday's laws of electrolysis, ionization, oxidation, reduction, electroplating, Electrolytic refining, Electrometallurgy etc.
Water and its classification, pH value and corrosive effects, total dissolved substance (TDS) acidity and alkalinity estimation.
Chemistry of Electrolytic cells, both during charging and discharging of batteries (Lithium ion, Lithium polymer, lead acid and NMH).

Module 5:

Engineering Materials
Natural occurrence of metals: minerals, ores of iron, aluminum and copper, gangue (matrix), flux, slag, metallurgy: brief account of general principles of metallurgy, Extraction of iron from haematite ore using blast furnace, aluminum from bauxite along with reactions, silicon from silica (sand). Alloys and mixtures: definition, purposes of alloying, ferrous alloys and non-ferrous with suitable examples, properties and applications. General chemical composition, composition-based applications: Polymers: elastomers, thermos plastics and thermosetting polymers, composition and properties of ceramic, PVC, PTFE, Nylon and Bakelite.

Labs / Practicals:

1. Use of Vernier Caliper to measure length, diameter, and depth.
2. Use of Screw Gauge and Spherometer to measure thickness and radius.
3. Determine Young's modulus by Searle's apparatus.
4. Determine surface tension by drop count method.
5. Verify laws of motion using inclined plane or pulley apparatus.
6. Determine coefficient of viscosity by using a viscometer.
7. Determine coefficient of linear expansion using brass or copper rod.
8. Compare specific heats of solids using method of mixtures.
9. Volumetric analysis using acid-base titration (standardization method).
10. Determination of water hardness using EDTA method.
11. Estimation of chloride content in water.
12. Determination of iron content using potassium dichromate.
13. Determination of conductivity of given solution.
14. Preparation of standard solution (Na2CO3 or oxalic acid).
15. Measurement of pH using pH meter or indicator strips.
16. Study of electrochemical cell and verification of Faraday's laws.

References:

1. S.L. Gupta & Sanjeev Gupta, "Engineering Physics", Dhanpat Rai Publications.
2. Engineering Physics by PV Naik, Pearson Education Pvt. Ltd, New Delhi.
3. Jain & Jain, "Engineering Chemistry", Dhanpat Rai Publications.
4. Dr. Vairam, S., Engineering Chemistry, Wiley India Pvt.Ltd., New Delhi.

Course Code	Course Name	L	T	P	Cr
DCSE250032	Basic Computer Science and Electronics	2	0	4	4

Course Outcomes:

CO1. Use relevant diode in electronics circuits.
CO2. Use BJT in electronics circuits.
CO3. Use of BJT as amplifier and switch.
CO4. Use FET and MOSFET in electronics circuits.
CO5. Maintain DC regulated power supply.
CO6. Understand basic computer hardware and software components.
CO7. Operate common operating systems and productivity tools.
CO8. Apply fundamental cyber safety principles and protect digital systems.

Module 1:

Applications of Diode
Different types of diodes and their materials: Construction, Symbol, working principle, applications, Forward and reverse biasing and V-I characteristics of following diodes: P-N junction diode, Zener diode, LED, Photo diode, Schottky diode, Diode as rectifier: Types of Rectifiers, Half wave, Full wave (bridge rectifier and center tapped), circuit operation, Input- output waveform for voltage and current, Parameters of rectifier: Average DC value, value of current and voltage, ripple factor, ripple frequency, PIV of diode, TUF, efficiency of rectifier. Types of Filters: Shunt capacitor, Series inductor, LC and CLC filter. Rectifier IC – KBU 808 IC pin diagram and application .

Module 2:

Bipolar Junction Transistor
Current operating device, Different types of transistors: PNP, NPN, Transistor configurations: CB, CE, CC Transistor characteristics (input, and output) in different transistor configuration. Relation between alpha ,beta, gama. Comparison between CB, CC and C, BJT biasing: Need of DC load Line, Operating point, stabilization, thermal runaway, heat sink. Types of biasing: fixed biasing, base bias with emitter feedback, voltage divider. Classification of amplifier, BJT as an amplifier. Single Stage Amplifier: Working , various currents (Ib, Ic,Ie), Voltage gain of CE amplifier (no derivations required)

Module 3:

Introduction to Computers and Internet:
Basic components: CPU, Memory (types), Display, HDD, SSD, peripherals, Software types, Internet basics: browsers, search engines, types of websites, Digital India portals awareness

Module 4:

Operating Systems, Office Tools, and Information Security
Types and definitions of OS, Windows and Linux installation and procedures, Introduction to MS Office (Word, Excel, PowerPoint) and G-Suite (Drive, Docs, Sheets, Slides, Forms), Basics of cyber security: malware, viruses, anti-virus, firewalls, Best practices for system safety and data privacy

Module 5:

Regulators and Power supply
Need of Regulated power supply . Basic block diagram of DC regulated power supply and function of each block,Load and Line regulation, Zener diode voltage regulator, Fixed voltage IC Regulator: Three terminal Pin diagram, working and application of 78XX and 79xx series, Variable voltage IC Regulator : IC 723 pin diagram , block diagram, working. Low voltage regulator, High voltage regulator, Switch Mode Power supply : Need of SMPS , block diagram and functions of blocks.

Labs / Practicals:

1. Test the performance of PN Junction diode
2. Test the performance of Zener diode
3. Construct and test the Half-Wave Rectifier
4. Construct and test the Full-Wave Rectifier
5. Test and plot input/output characteristics of BJT
6. BJT as a switch and amplifier
7. Assembling and disassembling of computer components
8. Explore features of peripheral devices and install drivers
9. Create email, use browsers, search engines, and cloud storage
10. Browse and report on Digital India portals
11. Install Windows and Linux OS in lab systems
12. Create files using MS Word, Excel, PowerPoint, and G-Suite
13. Install and update antivirus software
14. Demonstrate use of firewall and report common security threats

References:

1.Mehta, V.K. Mehta, Rohit Mehta, Principles of Electronics, S.Chand New Delhi, edition-2008 ISBN-13: 978-8121927833
2. P.Ramesh Babu Electronics Device and Circuits, Scitech Publications (India) Pvt Ltd ,ISBN-13 978-8183712156
3. ITL Education Solutions, Introduction to Computer Science, Pearson Education
4. R.S. Salaria, Computer Fundamentals, Khanna Publishing House

Course Code	Course Name	L	T	P	Cr
DASH250007	Applied Mathematics-II	3	1	0	4

Course Outcomes:

CO1 : Solve systems of equations using determinants and matrix algebra, including Cramer's rule and inverse matrix methods.
CO2: Evaluate definite and indefinite integrals using standard techniques and apply them to solve area and volume problems.
CO3: Calculate statistical measures such as mean, median, mode, variance, and standard deviation, and compare datasets effectively.
CO4: Apply concepts of differentiation to solve problems involving rates of change, tangents, normals, and optimization in technical scenarios.
CO5: Form and solve basic first-order differential equations using standard methods such as variable separation, exact, and linear types.

Module 1:

Determinants and Matrices (9 hrs)
Matrices: Algebra of matrices; inverse of a matrix; solving a system of three linear equations using the matrix inverse method (for non-singular coefficient matrices).
Determinants: Definition and elementary properties of determinants of matrices up to the 3rd order; consistency of linear equations; Cramer's Rule.

Module 2:

Integral Calculus (9 hrs)
Integration as the inverse operation of differentiation; simple integration by substitution, by parts, and by partial fractions (for linear factors only); use of standard formulas for integration of functions of the form x^m (a + b x^n), where m and n are positive integers.
Applications of integration: area bounded by a curve and coordinate axes; volume of a solid formed by the revolution of an area about the coordinate axes.

Module 3:

Statistics (8 hrs)
Measures of central tendency, Mean, median, Mode
Measure of Dispersion mean, Standard deviation, Mean deviation, variance and coefficient of variation comparison of Two sets.

Module 4:

Differential Calculus II (9 hrs)
Higher-order derivatives: concept and computation of second, third, and higher-order derivatives; Leibniz's theorem (statement only, no proof) and simple applications for finding the nth derivatives of basic functions.
Applications of derivatives:
-Geometrical: equation of a tangent and normal to a curve at a point; angle between two curves; finding points of inflection (basic idea only).
-Increasing/decreasing functions: determination of intervals of monotonicity using the first derivative test; finding local maxima and minima using first and second derivative tests.
-Rate of change and motion: derivative as a rate of change; velocity and acceleration in one-dimensional motion.

Module 5:

Differential Equations (10 hrs)

Introduction, Formation of differential equations, Solution of differential equations, Separation of variables, Homogeneous equations, Exact Differential Equations, Integrating factor method, Linear differential equation.

Labs / Practicals:

N/A

References:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
2. H.K. Dass & Er. Rajnish Verma, Mathematical Engineering, S. Chand Publications.
3. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley India (Indian Adapted Edition).
4. R.K. Jain & S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publishing House.
5. S.C. Gupta & V.K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand & Sons.
6. P. Kandasamy, K. Thilagavathy, K. Gunavathi, Engineering Mathematics (Volumes I & II), S. Chand Publications

Course Code	Course Name	L	T	P	Cr
DCSA250010	Technical Drawing using CAD	2	0	4	4

Course Outcomes:

CO1. Explain the basics of AutoCAD software required for building drawing,
CO2. Comprehend the various components of building,
CO3. Design and draft the plan and elevation of a building using AutoCAD,
CO4. Design and draft the plan and sectional views of foundation and columns using AutoCAD
CO5. Design and draft the plan and sectional details of plinth and lintel beam using AutoCAD,
CO6. Develop and design the sectional views of a building using AutoCAD, and
CO7. Develop and design the plan and sectional view of a staircase using AutoCAD

Module 1:

Fundamentals of CAD:
Introduction- CAD/CAM defined- the product cycle and CAD /CAM - automation and CAD/CAM- Computer Technology: Introduction-Central Processing unit-Types of memory-input output-data representation-computer programming languages-operating the computer system
CAD – Concept and Need, Functional Areas of CAD, Specifications of CAD work station, Input- Output devices, Features of CAD software.

Module 2:

Production Drawing
AutoCAD and AutoCAD Mechanical, Requirement of production drawings, Content library, Construction features, Use of layers and Annotations

Module 3:

Parametric Modeling:
Parametric and non-parametric modelling, 2D sketch environment of parametric software and non-parametric software, Parametric software in industries and their features, Sketching and solid modelling tools

Module 4:

Advance Modeling techniques:
Advance tool and basic solid modelling tools. Various advance modelling tools (sweep, loft-blend, helical sweep, pattern, boundary, Standard holes wizard), Error rectification.

Module 5:

Assembly Modeling and Drawing:
Basic Assembly constraints, Mechanical Assembly constraints, 2D production drawing using drawing modules with various orthographic views (may have sectional views), Generation of Bill of Material with balloons, plotting of assembly and drawing details on standard paper with title block mentioning scale of plot.

Labs / Practicals:

Name of the experiment: -
1. Demonstration of AutoCAD Mechanical environment and its commands.
2. Prepare 2D production drawing and plot on paper using AutoCAD Mechanical (At least Four parts)
3. Demonstration of Parametric software environment and its commands.

4. Prepare 2D drawing using parametric software (At least Four parts)
5. Prepare 3D Solid Models using parametric softwares (includes base features like extrude, revolve, cut, shell, chamfer, rib, fillet etc.) (At least Eight parts)
6. Prepare 3D Solid Models using parametric softwares (Includes advance features like sweep, blend (loft), pattern
7. Prepare 2D production drawing of given components prepared in exercise 5 and 6 and take print using plotter. (at least four components)
8. Prepare 3D solid modeling of given Assembly and animate. (must 4 have 4 to 6 components) (at least four assemblies)

References:

1. Tickoo, Sham Creo 2.0 for designer and engineers Dreamtech press, New Delhi
2. Rider, Michel J Designing with Creo Parametric 2.0 SDC Publications, Kansas, USA
3. Tickoo, Sham AutoCAD for engineers and Designers Dreamtech press, New Delhi
4. Narayan, K.L. Production drawing New Age publication, New Delhi

Course Code	Course Name	L	T	P	Cr
DCSE250036	Basic Programming Concepts	2	0	4	4

Course Outcomes:

CO1.Develop script to demonstrate use of basic building blocks of python.
CO2. Implement conditional and looping statements for given problem statement.
CO3. Perform operations on sequence structures in python.
CO4. Implement basics of object oriented programming concepts. Create modules and packages for given purpose.
CO5. Identify and use the syntax rules for constructing programmatic solutions in C.

Module 1:

Introduction to C: Computing Devices, How Computer Stores Data, How Program Works Introduction to 'C' Language: features; applications of C; IDE; Compiler; C Program Structure, Execution of C programs, debugging C code, Data Types & Input/Output: Character set, Variables and Identifiers, Built-in Data Types, Variable Definition, Declaration, C Key Words-Rules & Guidelines for Naming Variables. Constants and Literals. Basic input/output statement (printf() and scanf()

Module 2:

Operators and Expressions: Operators and Arithmetic, Conditions, Relational Operators, Logical Operators. Expressions, Precedence, and Order of Evaluation. Simple assignment statement, Decision Structure and Boolean Logic: if statement, if-else statement, nested if-else, ifelse ladder, Switch, Break, Continue, Arrays: What is an Array? Declaring an Array, Initializing an Array. One dimensional array: Array manipulation; Finding the largest/smallest element in array; Searching & Sorting of element from an array.

Module 3:

Functions: Definition of Function, External Variables, Scope Rules, Header Files, Static Variables, Register Variables, Structures: Basic of Structures, Structures variables, initialization, structure assignment, nested structure, structures and arrays: arrays of structures, Union.

Module 4:

Pre-processors - Introduction, Macro substitution, File inclusion. Includes directives like #include, #define , File Input/Output: File Operations, opening a File, File Opening Modes, reading from a File, writing to a File, Closing the File.

Module 5:

Basic Python's Constructs
Introduction to Python- Python as scripting Language, Programming language Vs Scripting Language (C vs Python), Python's Technical Strength, Application in different domains, Python's building blocks- Identifiers, Keywords, Variables, Constants, Indentation, Comments in python, Python's Data Types – Numbers, Strings, List, Tuples, Dictionaries, Sets, Input and Output statements in python, Operators in Python- Operators as Arithmetic, Assignment, Unary Minus, Relational, Logical, Boolean, Bitwise, Membership, Identity, Operator precedence and Associativity

Labs / Practicals:

1. Write and execute a C program for Transpose of a square matrix
2. Write and execute a C program to demonstrate call by value.
3. Write and execute a C program to declare, and initialize an UNION.
4. Write and execute a C program to demonstrate parameterized Macro substitution
5. Write a program to add the contents at the end of the file.
6. Write simple Python program to calculate equivalent registers connected in series and parallel.
7. Write python programs to define function with arguments. a) Calculate factorial of a number b) Swapping of two

variables.

References:

1. Yashwant Kanetkar,Let Us Python, BPB, ISBN: 978-9391392253
2. Martin C. Brown, Python: The Complete Reference, Tata McGraw Hill ISBN: 9789387572942
3. Y. Kanetkar, Let Us C: Authentic guide to C programming language.
5. E. Balagurusamy, Object Oriented Programming With C++

Course Code	Course Name	L	T	P	Cr
DASH250016	Communication Skills	1	0	2	2

Course Outcomes:

CO1 : Understand the need and importance of English language.
CO2 : Develop proficiency in the language.
CO3 : Able to use technology to enrich communication skills.
CO4 : Gain self-confidence with improved command over English.
CO5 : Apply English communication skills effectively in academic, professional, and social environments.

Module 1:

Communication Fundamentals
Communication ;Meaning, Process and importance of Communication, Types and Channels of communications , Scope and Significance of Listening ,Speaking, Reading, Writing Skills.

Module 2:

Writing Skills
Basics of Grammar: Parts of Speech, Uses of Tenses, Active Passive, Narration.

Module 3:

Vocabulary Building
Word Formation, Synonyms , Antonyms, Words often Confused, One Word Substitutes, Idioms and Phrasal verbs, Abbreviations of Scientific and Technical Words.

Module 4:

Speaking Skills
Introduction to Phonetic Sounds & Articulation, Word Accent, Rhythm and Intonation, Interpersonal Communication, Oral Presentation, Body Language and Voice Modulation (Para linguistics and Non Verbal), Negotiation and Persuasion, Group Discussion, Interview Techniques (Telephonic and Video conferencing).

Module 5:

Technical Writing
Job application, CV writing, Business Letters, Notices, Report Writing, Minutes, E-mail Etiquette, Blog Writing.

Labs / Practicals:

1. Introducing Oneself, Exercise on Parts of Speech & Exercise on Tense.
2. Exercise on Agreement, Narration, Active Passive Voice & Dialogue Conversation.
3. Exercise on Writing Skills and Listening Comprehension.
4. Practice of Phonemes, Word Accent, Intonation, JAM Session.
5. Individual Presentation, Extempore and Picture Interpretation.
6. Vocabulary Building Exercises (One Word Substitute, Synonyms, Antonyms, Words Often Confused etc.) & Group Discussion.

References:

1. "The Essence of Effective Communication”, Ludlow R. and Panton F., Pubs: Prentice Hall.
2. “Effective Communication Skills”, Kulbhushan Kumar, Khanna Publishing House.
3. “A University Grammar of English”, Quirk R. and Sidney G., Pubs: Pearson Education.
4. “High School English Grammar”, Wren and Martin, Pubs: S. Chand & Company Ltd.
5. “Essentials of Business Communication”, Guffrey M.E., Pubs: South-Western College Publishing.
6. “Technical Communication: Principles and Practice”, Raman M. and Sharma S., Pubs: Oxford University Press.
7. “Effective Business Communication”, Rodrigues M.V., Pubs: Concept Publishing Company, Delhi.

8. “English Vocabulary in Use”, McCarthy M. and Felicity O’ Dell.

Course Code	Course Name	L	T	P	Cr
DASH250101	Sports and Yoga	0	0	4	2

Course Outcomes:

CO1: Understand the principles of physical education, fitness, wellness, and positive lifestyle habits essential for maintaining overall health.

CO2: Demonstrate knowledge of basic anatomy, physiology, and posture correction, and apply this understanding to enhance body mechanics and prevent injuries.

CO3: Practice fundamental yoga postures, breathing techniques, and relaxation methods to improve flexibility, concentration, and mental well-being.

CO4: Apply yoga and fitness practices to manage lifestyle-related health conditions and promote physical and psychological balance.

CO5: Participate actively in sports and fitness activities, demonstrating teamwork, discipline, and awareness of safety, nutrition, and lifelong fitness practices.

Module 1:

Foundations of Physical Education and Fitness
Meaning & definition of Physical Education, Aims & Objectives of Physical Education, Changing trends in Physical Education, Meaning & importance of Physical Fitness and Wellness, Components of physical fitness and health-related fitness, Components of wellness, Concept of positive lifestyle, Preventing health threats through lifestyle changes.

Module 2:

Anatomy, Physiology and Posture
Introduction to Anatomy and Physiology, Importance of Anatomy and Physiology in Physical Education, Effects of exercise on circulatory, respiratory, and neuromuscular systems, Meaning & concept of posture, Causes and correction of bad postures, Postural deformities: Knock knee, Flat foot, Lordosis, Kyphosis, etc., Weight training: pros and cons.

Module 3:

Yoga-Theory and Practice
Meaning & importance of Yoga, Elements of Yoga: Asanas, Pranayama, Meditation, Kriyas, Yoga for concentration and related Asanas (Sukhasana, Tadasana, Padmasana, Shashankasana), Relaxation techniques (Yog-Nidra).

Module 4:

Yoga for Lifestyle and Health Conditions
Preventive role of Asanas, Yoga for hypertension, obesity, back pain, diabetes, asthma, Benefits, procedures & contraindications for relevant Asanas (e.g., Bhujangasana, Pavan Muktasana, Tadasana, Chakrasana, etc.).

Module 5:

Games and Sports Fundamentals
Select any one sport: Athletics, Basketball, Kabaddi, etc., History and development of the sport, General rules and regulations, Specifications of playfields and equipment, Major tournaments, venues, and personalities, Importance of proper sports gear.

Labs / Practicals:

1. Practice of Sukhasana, Padmasana, and Tadasana for improving concentration and posture.

2. Shashankasana and Bhujangasana for relaxation and spinal flexibility.
3. Introduction to and practice of basic Pranayama techniques (Anulom-Vilom, Bhramari).
4. Practice of Yog Nidra (deep relaxation technique).
5. Asanas for lifestyle diseases: practice of Pavan Muktasana, Chakrasana, and Tadasana for obesity and diabetes control.
6. Demonstration and correction of bad postures (knock knee, flat foot, lordosis, kyphosis).
7. Light warm-up and stretching routines before yoga or sports activities.
8. Basic fitness tests: measurement of flexibility, endurance, strength, and body composition.
9. Participation in any one selected sport: demonstration of rules, gear, warm-up drills.
10. Practice of the chosen sport (e.g., Athletics, Basketball, Kabaddi) including basic skills and gameplay
11. Group activity: Demonstration of importance of proper sports gear and warm-up before sports.
12. Poster or presentation on a Yoga-based lifestyle for common health issues.
13. Introduction to circuit training and its benefits for physical fitness.
14. Meditation sessions and reflective journaling on mental well-being.
15. Nutritional awareness activity: discussion on diet for fitness and yoga lifestyle.

References:

1. Modern Trends and Physical Education by Prof. Ajmer Singh.
2. Light On Yoga by B.K.S. Iyengar.
3. Health and Physical Education – NCERT (11TH and 12th Classes).
4. Back to health through YOGA by Ramesh Bijlani.

Course Code	Course Name	L	T	P	Cr
DOEE250070	Electrical Circuits & Networking	3	1	0	4

Course Outcomes:

CO1: Apply network theorems (Thevenin, Norton, Superposition, Maximum Power Transfer, Reciprocity) for electrical circuit analysis.
CO2: Analyze electrical networks using graph theory concepts such as incidence matrix, cut-set, tie-set, and duality.
CO3: Solve first and second order RLC circuits in time and frequency domains using differential equations and Laplace transforms.
CO4: Evaluate steady-state response of networks to non-sinusoidal inputs using Fourier series and Fourier transform.
CO5: Determine and interpret two-port network parameters and analyze interconnections of two-port networks.

Module 1:

Basics of Network and Network Theorem: Node and Mesh Analysis, Superposition Theorem, Thevenin Theorem, Norton Theorem Maximum Power transfer theorem, Reciprocity Theorem

Module 2:

Graph Theory: Graph of network, tree, incidence matrix, F- Tie Set Analysis, F-Cut Set Analysis, Analysis of resistive network using cut-set and tie-set, Duality

Module 3:

Time Domain and Frequency Domain Analysis:Solution of first and second order differential equations for Series and parallel R-L, R-C, R-L-C Circuits, Initial and Final conditions in network elements, Forced and Free response, time constants Steady State and Transient State Response, Analysis of electrical circuits using Laplace Transform for standard inputs (unit, Ramp, Step)

Module 4:

Trigonometric and exponential Fourier series:Discrete spectra and symmetry of waveform, Steady state response of a network to non-sinusoidal periodic inputs, power factor, effective Values, Fourier transform and continuous spectra

Module 5:

Two Port Network:Two Port Network, Open Circuit Impedance Parameters, Short Circuit Admittance Parameters, Transmission Parameters, Hybrid Parameters, Interrelationship of Two Port Network, Inter Connection of Two Port Network

Labs / Practicals:

N/A

References:

1. Ashfaq Husain, Networks and Systems, Publication: Khanna Publishing House
2. M. E. Van Valkenburg, Network Analysis, Publication: Prentice Hall of India
3. W. H. Hayt, J. E. Kemmerly and S. M. Durbin, Engineering Circuit Analysis, Publication: McGraw Hill
4. Joseph Edminister, Electrical Circuits, Publication Schaum’s Outline, Tata McGraw Hill

5. 5 Lawrence P. Huelsma, Basic Circuit Theory, Publication: Prentice Hall of India
6. D. Roy Choudhury, Network & Systems, Publication: Wiley Eastern Ltd De Carlo and Lin, Linear Circuit Analysis, Publication: Oxford Press

Course Code	Course Name	L	T	P	Cr
DOEE250106	Fundamendals of Electronic Devices and Circuits	3	0	2	4

Course Outcomes:

CO1. Explain the operation of diodes, BJTs, and FETs.
CO2. Design and analyze rectifier circuits and voltage regulators.
CO3. Construct transistor amplifiers and oscillators.
CO4. Use multimeters and oscilloscopes in component-level diagnostics.
CO5. Simulate and test amplifier circuits using tools like Multisim.

Module 1:

Introduction to Semiconductors, Types of Semiconductors:
Extrinsic and Intrinsic types, Formation of N-type & P-type materials, Introduction to diode, PN Junction Diode, Forward and Reverse Bias Characteristics, Zener Diode—Characteristics, construction, and working; other types of diodes – characteristics and application, Diode as a Rectifier: Construction, working and application of Half Wave, Full Wave and Bridge Rectifiers, Filters: Introduction, Types of filters: C, LC, RLC and Π filters

Module 2:

Introduction to Transistors:
NPN and PNP Transistors, Bipolar Junction Transistors (BJTs)—Operation and characteristics Common Base Configuration—Characteristics and working Common Emitter Configuration – characteristics and working, Common Collector & Common Base Configuration – characteristics and working High frequency model of BJT, Classification of amplifiers, negative feedback

Module 3:

Field Effect Transistors:
FET – Working Principle, Classification, MOSFET Small Signal model, N-Channel/ P-Channel MOSFETs – characteristics, enhancement and depletion mode, MOSFET as a Switch, Common Source Amplifiers, Uni-Junction Transistor – equivalent circuit and operation

Module 4:

SCR, DIAC & TRIAC
SCR – Construction, operation, working, characteristics DIAC - Construction, operation, working, characteristics TRIAC - Construction, operation, working, characteristics SCR and MOSFET as a Switch, DIAC as bidirectional switch Comparison of SCR, DIAC, TRIAC, MOSFET, and IGBT.

Module 5:

Amplifiers and Oscillators
Feedback Amplifiers – Properties of negative Feedback, impact of feedback on Different Parameters Basic Feedback Amplifier Topologies: Voltage Series, Voltage Shunt Current Series, Current Shunt, Oscillator—Basic Principles, Crystal Oscillator, Non-linear/Pulse Oscillator

Labs / Practicals:

1. Construct the circuit and plot the VI characteristics of the PN Junction Diode to find the cut-in voltage
2. Construct the circuit and plot the characteristics of a Zener diode. Find the breakdown voltage
3. Construct a half-wave rectifier and obtain regulation characteristics – Without Filters and with Filters. Compare

the results of the two.
4. Construct a full-wave rectifier and obtain regulation characteristics – Without Filters and with filters. Compare the results of the two.
5. Construct a Bridge Rectifier and obtain regulation characteristics – Without Filters and with Filters
6. Obtain the characteristics of DIAC and TRIAC 3
7. Simulate half wave, full-wave, and bridge rectifier using simulation tool like P Spice/ Orcad/ Multisim.
8. Develop a simulation model for Voltage Series and Voltage Shunt Feedback Amplifiers
9. Develop circuits for voltage series and Voltage Shunt Feedback Amplifiers and obtain output plots. Compare the results with the simulation model.
10. Develop a simulation model for Current Series and Current Shunt Feedback Amplifiers
11. Develop circuits for Current Series and Current Shunt Feedback Amplifiers and obtain output plots. Compare the results with the simulation model.

References:

1. S. Salivahanan & N. Suresh Kumar, Electronic Devices and Circuits, McGraw Hill.
2. Boylestad & Nashelsky, Electronic Devices and Circuit Theory, Pearson Education.
3. A.K. Maini, Analog Circuits, Khanna Publishing House.
4. Albert Malvino, Electronic Principles, McGraw Hill.

Course Code	Course Name	L	T	P	Cr
DOEE250160	Digital Logic Design	2	0	4	4

Course Outcomes:

CO1: Demonstrate understanding of number systems, Boolean algebra, De-Morgan's theorem, and K-map simplification.
CO2: Implement and analyze Boolean expressions and logic functions using basic and universal gates.
CO3: Design and apply combinational circuits including arithmetic units, encoders, decoders, multiplexers, and demultiplexers.
CO4: Analyze and construct sequential circuits using flip-flops, counters, and registers.
CO5: Explain memory organization, types of memories, and data conversion techniques (DAC & ADC).

Module 1:

Number Systems & Boolean Algebra: -
Introduction to different number systems, Binary, Octal, Decimal, Hexadecimal, Conversion from one number system to another, Boolean variables – Rules and laws of Boolean Algebra, De-Morgan's Theorem, Karnaugh Maps and their use for simplification of Boolean expressions.

Module 2:

Logic Gates:
AND, OR, NOT, NAND, NOR, XOR, XNOR: Symbolic representation and truth Table, Implementation of Boolean expressions and Logic Functions using gates, Simplification of expressions

Module 3:

Combinational Logic Circuits:
Arithmetic Circuits – Addition, Subtraction, 1's 2's Complement, Half Adder, Full Adder, Half Subtractor, Full Subtractor, Parallel and Series Adders, Encoder, Decoder, Multiplexer – 2 to 1 MUX, 4 to 1 MUX, 8 to 1 MUX. Applications, Demultiplexer – 1 to 2 DEMUX, 1- 4 DEMUX, 1- 8 DEMUX

Module 4:

Sequential Logic Circuits:
Flip Flops – SR, JK, T, D, FF, JK-MS, Triggering, Counters – 4 bits Up – Down Counters, Asynchronous/ Ripple Counter, Decade Counter- Mod 3, Mod 7 Counter, Johnson Counter, Ring Counter, Registers – 4bit Shift Register: Serial in Serial Out, Serial in Parallel Out, Parallel in Serial Out, Parallel in Parallel Out

Module 5:

Memory Devices:
Classification of Memories – RAM Organization, Address Lines and Memory Size, Static RAM, Bipolar RAM, cell Dynamic RAM, D RAM, DDR RAM, Read Only Memory: ROM organization, Expanding memory, PROM, EPROM, EEPROM, Flash Memory, Data Converters – Digital to Analog converters, Analog to Digital Converters

Labs / Practicals:

List of Experiments:
1. To verify the truth tables for all logic fates – NOT OR AND NAND NOR XOR XNOR using CMOS Logic gates and TTL Logic Gates
2. Implement and realize Boolean Expressions with Logic Gates
3. Implement Half Adder, Full Adder, Half Subtractor, Full subtractor using ICs

4. Implement parallel and serial full-adder using ICs
5. Design and development of Multiplexer and De-multiplexer using multiplexer IC's
6. Verification of the function of SR, D, JK and T Flip Flops
7. Design controlled shift registers
8. Design and Simulate a Simple Digital Lock Circuit.
9. To design a programmable Up-Down Counter with a 7-segment display
10. To study of different memory ICs

References:

1. Digital Principles & Applications – Albert Paul Malvino & Donald P. Leach, Publisher: McGraw Hill Education (8th Edition)
2. Digital Electronics – Roger L. Tokheim, Publisher: McGraw-Hill Education (ISE Editions, International 2nd Revised Edition)
3. Digital Electronics – An Introduction to Theory and Practice – William H. Gothmann, Publisher: Prentice Hall India Learning Private Limited (2nd Edition)
4. Study Digital-to-Analog and Analog-to-Digital Converters.
5. Simulate an Analog-to-Digital Converter using software (such as PSpice).

Course Code	Course Name	L	T	P	Cr
DOEE250164	Linear and Digital IC	2	0	4	4

Course Outcomes:

CO1. Understand the operation of op-amps and their applications.
CO2. Design and test op-amp-based circuits such as filters, amplifiers, and oscillators.
CO3. Apply concepts of voltage regulators and timers.
CO4. Build analog signal processing circuits using ICs like 741, 555 and 723.
CO5. Perform practical tasks using IC-based configurations.

Module 1:

IC Fabrication and Circuit Configuration for Linear IC:
Advantages of ICs over discrete components – Manufacturing process of monolithic ICs Construction of monolithic bipolar transistor – Monolithic diodes – Integrated Resistors Monolithic Capacitors
– Inductors. Current mirror and current sources, Current sources as active loads, Voltage sources, Voltage References, BJT Differential amplifier with active loads, General operational amplifier stages -and internal circuit diagrams of IC 741, DC and AC performance characteristics, slew rate, Open and closed loop configurations.

Module 2:

Applications Of Operational Amplifiers:
Sign Changer, Scale Changer, Phase Shift Circuits, Voltage Follower, V-to-I and I-to-V converters, adder, subtractor, Instrumentation amplifier, Integrator, Differentiator, Logarithmic amplifier, Antilogarithmic amplifier, Comparators, Schmitt trigger, Precision rectifier, peak detector, clipper and clamper,
Low-pass, high-pass and band-pass Butterworth filters.

Module 3:

Analog Multiplier and PLL:
Analog Multiplier using Emitter Coupled Transistor Pair - Gilbert Multiplier cell – Variable trans-conductance technique, analog multiplier ICs and their applications, Operation of the basic PLL, Closed loop analysis, Voltage controlled oscillator, Monolithic PLL IC 565, application of PLL for AM detection, FM detection, FSK modulation and demodulation and Frequency synthesizing.

Module 4:

Analog to digital and digital to analog converters:
Analog and Digital Data Conversions, D/A converter – specifications - weighted resistor type, R-2R Ladder type, Voltage Mode and Current-Mode R2R Ladder types switches for D/A converters, high speed sample-and-hold circuits, A/D Converters specifications - Flash type - Successive Approximation type - Single Slope type – Dual Slope type - A/D Converter using Voltage-to-Time Conversion - Over-sampling A/D Converters.

Module 5:

Waveform generators and special function ICs:
Sine-wave generators, Multivibrators and Triangular wave generator, Saw-tooth wave generator, ICL8038 function generator, Timer IC 555, IC Voltage regulators – Three terminal fixed and adjustable voltage regulators - IC 723 general purpose regulator Monolithic switching regulator, Switched capacitor filter IC MF10, Frequency to Voltage and Voltage to Frequency converters, Audio Power amplifier, Video Amplifier, Isolation Amplifier, Opto-couplers and fibre optic IC.

Labs / Practicals:

1. Design and testing of Inverting, non-inverting, Differential amplifiers and voltage follower.
2. Design and testing of Integrator and Differentiator.
3. Design and testing of Instrumentation amplifier
4. Design and testing of Active low-pass, High-pass and band-pass filters.
5. Design and testing of a stable & Mono-stable multivibrators and Schmitt Trigger using op-amp.
6. Design and testing of Phase shift and Wein bridge oscillators using op-amp.
7. Design and testing of A stable and mono-stable multivibrators using NE555 Timer.
8. Design and testing of PLL characteristics and its use as Frequency Multiplier.
9. Design and testing of DC power supply using LM317 and LM723, IC Voltage Regulators.
10. Design and testing of Study of SMPS.
11. Design and testing of Waveform generators: using op-amp.
12. Design and testing of Waveform generators: using 555 Timer.
13. Design and testing of R -2R ladder DAC.
14. Design and testing of Simulation experiments using EDA Tools.
15. Design and testing of Flash Type ADC. SIMULATION USING SPICE
16. Design and testing of D/A and A/D converters (Successive approximation)
17. Design and testing of Analog multiplier

References:

1. Sergio Franco, Design with operational amplifiers and analogue integrated circuits, 3rd Edition (Publication: Tata McGraw-Hill, 2007)
2. D.Roy Choudhry, Shail Jain, Linear Integrated Circuits (Publication: New Age International Pvt.Ltd)
3. B.S.Sonde, System design using Integrated Circuits (Publication: New Age Pub, 2nd Edition, 2001)
4. Gray and Meyer, Analysis and Design of Analogue Integrated Circuits (Publication: Wiley International, 2005)
5. Ramakant A.Gayakwad, OP-AMP and Linear ICs Publication: Prentice Hall / Pearson Education, 4th Edition, 2001)
6. K Lal Kishore, Operational Amplifier and Linear Integrated Circuits (Publication: Pearson Education, 2006)

Course Code	Course Name	L	T	P	Cr
DOEE250166	Fundamentals of Microprocessors and Microcontrollers	2	0	4	4

Course Outcomes:

CO1. Understand the basic working of the 8085 microprocessor and write simple assembly programs.
CO2. Explain the internal architecture and functioning of the 8051 microcontroller.
CO3. Develop embedded C and assembly programs for microcontroller applications.
CO4. Interface I/O devices, ADC/DAC, and communication modules with 8051.
CO5. Explore the fundamentals of ARM microcontrollers for embedded system design.

Module 1:

Introduction to Microprocessors and 8085 Architecture
8085 microprocessor architecture, pin configuration, addressing modes, memory and I/O interfacing basics, instruction cycle, timing diagram.
Basic 8085 instructions and simple assembly programs (addition, subtraction, loop, jump).

Module 2:

8051 Microcontroller Architecture and Programming
8051 architecture, registers, memory organization, addressing modes, I/O programming, instruction set, timer/counter operations, interrupt handling, stack operations.

Module 3:

Interfacing Techniques
Interfacing 8051 with input/output devices: LEDs, LCD, keypad, switches, ADC, DAC, stepper motors, RS232 communication.

Module 4:

Embedded C Programming with 8051
Data types, control structures, port manipulation, timer/counter programming, serial communication, interrupt programming using C.

Module 5:

ARM Processor Fundamentals
Introduction to RISC architecture, ARM core concepts, LPC214x microcontroller features, GPIO, ADC/DAC, timer and serial communication modules.

Labs / Practicals:

8085 Microprocessor Experiments: -
1. Addition of two 8-bit numbers
2. Subtraction of two 8-bit numbers
3. Block transfer and memory copy operations
4. Finding the largest/smallest number in an array
5. Sorting an array in ascending order

8051 Microcontroller Experiments: -
1. Programming 8051 Micro controller using ASM and C, and implementation in flash 8051 microcontroller.

2. Programming with Arithmetic logic instructions [Assembly]
3. Program using constructs (Sorting an array) [Assembly]
4. Programming using Ports [Assembly and C]
5. Delay generation using Timer [Assembly and C]
6. Programming Interrupts [Assembly and C]
7. Implementation of standard UART communication (using hyper terminal) [Assembly and C].
8. Interfacing LCD Display. [Assembly and C]
9. Interfacing with Keypad [Assembly and C]
10. Programming ADC/DAC [Assembly and C]
11. Interfacing with stepper motor. [Assembly and C]
12. Pulse Width Modulation. [Assembly and C]
13. Programming ARM Micro controller using ASM and C using simulator.
14. Programming with Arithmetic logic instructions[Assembly]

References:

1. Muhammad Ali Mazidi & Janice Gilli Mazidi, R.D.Kinely, The 8051 Micro Controller and Embedded Systems, PHI Pearson Education
2. Krishna Kant, Microprocessor and Microcontrollers, Eastern Company Edition, Prentice Hall of India, New Delhi
3. Soumitra Kumar Mandal, Microprocessor & Microcontroller Architecture: Programming & Interfacing using 8085, 8086, 8051, McGraw Hill Edu
4. Tabak Daniel, Hintz Kenneth j, Microcontrollers: Architecture implementation and Programming, Tata McGraw Hill, 2007
5. Andrew N.Sloss, Dominic Symes, Chris Wright, ARM Developer's Guide.UM10139 LPC214X User manual – Rev., User manual – Rev.4
6. Douglas V. Hall, Microprocessors and interfacing: programming and hardware, Tata Mc.Graw Hill, 2editon, 2007
7. Valder – Perez, "Microcontroller – Fundamentals and Applications with Pic, Yeesdee Publishers, Tayler & Francis

Course Code	Course Name	L	T	P	Cr
DOEE250186	Basics of Analog and Digital Communication	3	0	2	4

Course Outcomes:

CO1. Analyze and compare analog modulation schemes for bandwidth and efficiency.
CO2. Understand and evaluate FM and PM systems with respect to performance and bandwidth.
CO3. Implement pulse modulation techniques and multiplexing strategies.
CO4. Design and interpret PCM, delta modulation, and companding systems.
CO5. Demonstrate and compare various digital modulation techniques and their practical implications.

Module 1:

Introduction to Communication Systems:
Elements of Electrical Communication Systems, Frequency Domain Representation, Need and Types of Modulation, Amplitude Modulation – DSBFC, DSBSC, SSB – Generation & Detection, VSB, Frequency Translation, FDM, Nonlinear Distortion.

Module 2:

Angle Modulation Techniques:
Phase and Frequency Modulation, NBFM, WBFM, Multitone FM, Transmission Bandwidth, Generation and Detection of FM, Nonlinear Effects, Comparison with AM.

Module 3:

Pulse Analog Modulation:
Pulse Modulation Techniques: PAM, PWM, PPM – Generation and Demodulation, Time Division Multiplexing (TDM).

Module 4:

Pulse Digital Modulation:
Digital Communication System Overview, Sampling, Quantization, PCM, DPCM, Delta Modulation, Adaptive Delta Modulation, Companding, Comparison and Noise Performance in PCM/DM.

Module 5:

Digital Modulation Techniques:
BPSK, DPSK, QPSK, M-ary PSK, ASK, FSK, MSK, Duobinary Encoding, Comparison of Digital Modulation Techniques, Partial Response Signaling.

Labs / Practicals:

1. Generation and detection of Amplitude Modulation (AM) using DSB-SC and SSB techniques.
2. Generation and demodulation of Frequency Modulated (FM) signals.
3. Implementation and demodulation of Pulse Amplitude Modulation (PAM).
4. Study and implementation of Pulse Code Modulation (PCM) and reconstruction.
5. Delta Modulation and Adaptive Delta Modulation implementation and analysis.
6. Simulation of BPSK and QPSK digital modulation schemes using software tools.
7. Demonstration of Time Division Multiplexing (TDM) using discrete-time signals.
8. Measurement of Signal-to-Noise Ratio (SNR) for AM and FM under different noise conditions.

References:

1. Simon Haykin, Communication Systems, 4th Edition, Wiley.
2. H. Taub & D. Schilling, Gautam Sahe, Principles of Communication Systems, 3rd Edition, TMH.

Course Code	Course Name	L	T	P	Cr
DASH250091	Professional Values and Ethics	2	0	0	2

Course Outcomes:

CO1: Describe profession, professionalism, its challenges, effective communication, and the role of regulatory bodies and professional organizations related to engineering.
CO2: Analyze professional values such as integrity, responsibility, respect, fairness, and accountability, and demonstrate their application in professional practice.
CO3: Apply knowledge of ethics and bioethics in ethical decision-making in collaboration with professional teams.
CO4: Evaluate responsibilities related to safety, risk management, and intellectual property in professional practice.
CO5: Examine global ethical issues and professional responsibilities in technological and research contexts.

Module 1:

Values
Definition and characteristics of values, value clarification, personal and professional values, professional socialization: integration of professional and personal values, importance of professional values in engineering and technology, core values – integrity, honesty, trust, respect, responsibility, fairness, accountability, ethical conduct in workplace relationships and decision-making.

Module 2:

Engineering Ethics
Senses of engineering ethics, variety of moral issues, types of inquiry, moral dilemmas, moral autonomy, Kohlberg's theory, Gilligan's theory, consensus and controversy, models of professional roles, theories about right action – self-interest, customs and religion, application of ethical theories, valuing time, cooperation, commitment, case studies.

Module 3:

Engineering as Social Experimentation
Engineering as social experimentation, framing the problem, determining the facts, codes of ethics, clarifying concepts, application issues, common ground, general principles – utilitarian thinking and respect for persons, case studies.

Module 4:

Engineers Responsibility for Safety and Risk
Safety and risk, assessment of safety and risk, risk-benefit analysis, reducing risk, safety and the engineer – designing for safety, Intellectual Property Rights (IPR).

Module 5:

Global issues
Globalization, cross-cultural issues, environmental ethics, computer ethics, computers as instruments of unethical behavior, computers as objects of unethical acts, autonomous systems, computer codes of ethics, weapons development, ethics and research, analyzing ethical problems in research, case studies.

Labs / Practicals:

N/A

References:

1. M. Govindarajan, S. Natarajan, V.S. Senthil Kumar – Engineering Ethics Includes Human Values, PHI Learning Pvt. Ltd.
2. Charles E. Harris, Michael S. Pritchard, Michael J. Rabins – Engineering Ethics, Cengage Learning.
3. Mike W. Martin, Roland Schinzinger – Ethics in Engineering, Tata McGraw Hill.

4. A.R. Aryasri, Dharanikota Suyodhana – Professional Ethics and Morals, Maruthi Publications.
5. A. Alavudeen, R. Kalil Rahman, M. Jayakumaran – Professional Ethics and Human Values, Laxmi Publications.
6. D.R. Kiran – Professional Ethics and Human Values.
7. P.S.R. Murthy – Indian Culture, Values and Professional Ethics, BS Publications

Course Code	Course Name	L	T	P	Cr
DASH250052	Environmental Science	2	0	0	2

Course Outcomes:

CO1: Understand the importance and dimension of a healthy environment, become environmentally conscious, skilled and responsible in all their actions with a concern for sustainable development.
CO2: Comprehend the significance and issues related to ecosystems, natural resources and bio-diversity and become aware of the need and ways to protect/ preserve them.
CO3: Grasp the issues related to environmental pollution, solid waste management and climate change, and become conscious and proactive in the discharge of their responsibilities towards the environment.
CO4: Become aware and appreciate the values and concerns of environmental movements and policies and the role of communities, and act responsibly on environment-related issues.
CO5: Understand environmental policies, ethics, and community roles in sustainable development.

Module 1:

Introduction to Environmental Studies and Ecosystems:
Environmental Studies: Importance and scope, Multidisciplinary nature, Concept of sustainability and sustainable development, Ecosystems: Concept, Structure and Function, Pond and forest ecosystems, Food chains and food webs, Concept of ecological succession, Bio-geographical zones of India, Levels of biological diversity: Genetic, Species, and Ecosystem.

Module 2:

Biodiversity and Conservation:
Biodiversity Hotspots with special reference to India, Threats to biodiversity, Conservation of biodiversity: In-situ and Ex-situ, Endangered and endemic species: Concept Afforestation: Social forestry, Agroforestry, Green belt.

Module 3:

Pollution and Waste Management:
Air, water, and noise pollution: Causes, effects, and control measures, Climate change, global warming, ozone depletion, acid rain: Impact on humans and agriculture, Solid waste management: biodegradable and non-biodegradable waste.
- Segregation of domestic waste at source
- Impact of plastic on human and animal health

Module 4:

Natural Resources and Disaster Management:
Land resources and land-use changes, Land degradation, soil erosion, and desertification, Water: Use and over-exploitation, Water conservation : Rainwater harvesting, Watershed management : Meaning and importance, Energy resources: Renewable and non-renewable, Alternate energy sources, Disaster management – Types and self-protection during disasters Environmental Policy, 2006 : Provisions and importance; Environmental Impact Assessment – Concept; Swachh Bharat Mission Objectives; International agreements , Montreal and Kyoto protocols.

Module 5:

Environmental Policies and Human Role
Population growth: Impact on environment, health, and welfare, Environmental ethics : Religion and cultural role, Environmental movements: Chipko, Narmada Bachao, Silent Valley, Bishnoi's, Community initiatives:
Salu Marada Thimmakka, Sacred Groves (Devarakadu), Environment Protection Act, Biodiversity Act (2002), National Environmental Policy (2006), Environmental Impact Assessment, Swachh Bharat Mission, International agreements: Montreal and Kyoto Protocols.

Labs / Practicals:

NA

References:

1. Asthana, D. K. .Text Book of Environmental Studies. S. Chand Publishing.
2. Basu, M., Xavier, S. . Fundamentals of Environmental Studies, Cambridge University Press, India
3. Basu, R. N. Environment. University of Calcutta, Kolkata
4. Bharucha, E. Textbook of Environmental Studies for Undergraduate Courses. Universities Press, India.
5. De, A.K. Environmental Chemistry, New Age International, .
6. Mahapatra, R., Jeevan, S.S., Das, S. (Eds) . Environment Reader for Universities, Centre for Science and Environment.
7. Masters, G. M., &Ela, W. P. .Introduction to environmental engineering and science. Englewood Cliffs, NJ: Prentice Hall.
8. Odum, E. P., Odum, H. T., & Andrews, J. Fundamentals of ecology. Philadelphia: Saunders.
9. Sharma, P. D., & Sharma, P. D. .Ecology and environment. Rastogi Publications.

Course Code	Course Name	L	T	P	Cr
DOEE250096	Embedded Systems Design	2	1	2	4

Course Outcomes:

CO1: Describe the application domains, characteristics, classification, and trends of embedded systems.
CO2: Apply Embedded C programming constructs, operators, and control structures for embedded applications.
CO3: Explain RTOS concepts, architecture, scheduling, and interrupt handling in real-time systems.
CO4: Interface sensors and actuators with microcontrollers for embedded applications.
CO5: Utilize development tools and platforms like 8051 and Arduino Mega for programming and hardware interfacing.

Module 1:

Introduction to embedded systems:
Application domain of embedded systems, desirable features and general characteristics of embedded systems, model of an embedded system, microprocessor Vs microcontroller, example of a simple embedded system, figure of merit for an embedded system, classification of MCUs: 4/8/16/32 bits, history of embedded systems, current trends

Module 2:

Embedded C basic:
Understanding of the code with Boolean operations, pointer access operations, bitwise, operations, compounded operations, Difference between the C language and Embedded C language, Embedded C control structure blocks, looping mechanism – for, do and while. The branching operations based on conditions expression

Module 3:

Real - time Operating Systems (RTOS):
Definition of real- time systems and their importance, Characteristics of Real -time Operating Systems, RTOS Architecture and Components, Task Scheduling in RTOS, Interrupt Handling in RTOS

Module 4:

Sensors and Actuator:
Introduction to Sensors and Actuators, Types of Sensors, Sensor Interfacing with Microcontrollers, Types of Actuators, Actuator Interfacing with Microcontrollers

Module 5:

Embedded Systems Development Tools
Introduction to Embedded Systems Development Tools, Introduction to 8051 Microcontroller, Development Environment Setup for 8051, Programming in C for 8051, 8051 Assembly Language Programming, 8051 Development Board and Hardware Interfacing, Introduction to Arduino Mega, Arduino Mega specifications including power ratings, digital and analogue peripherals., Arduino Mega Ports, Pins, Digital and Analog Peripherals, Arduino IDE., Sketch designing for Arduino, Communication interface using serial port

Labs / Practicals:

1. Built-in LED state control by push button sketch implementation
2. Built-in LED blinking sketch implementation
3. Built-in LED blinking by toggling states based on binary operation
4. Built-in LED state control by user interface through serial port
5. User interface for boolean operation and bit wise operation through serial port
6. User interface for compounded operation through serial port

7. Looping mechanism to check the state of pin and if change print its status on serial port
8. Controlling multiple LEDs with a loop and an array
9. Use a potentiometer to control the blinking of an LED
10. Uses an analog output (PWM pin) to fade an LED
11. Servo Motor Control using PWM
12. Temperature sensor interfacing and sending its reading over serial port
13. light sensor interfacing and sending its reading over serial port

References:

1. Shibu, K.V., Introduction to Embedded Systems, 1st Ed., TMH, 2009
2. Kanta Rao B, Embedded Systems, 1st Ed., PHI 3. Frank Vahid & Tony Givargis, Embedded System Design, 2nd Edition, John Wiley,
2. Arduino Projects For Dummies (For Dummies Series), Kennedy George; Davis Bernard; Prasanna SRM, Wiley (5 July 2013) ISBN: 978-1118551479.
3. Make: Getting Started with Arduino - The Open-Source Electronics Prototyping Platform, Massimo Banzi and Michael Shiloh, Shroff/Maker Media; (Dec 2014) ISBN : 978-9351109075

Course Code	Course Name	L	T	P	Cr
DOEE250109	Fundamentals of Cellular Technology	3	0	2	4

Course Outcomes:

CO1: Explain the evolution of mobile communication technologies, cell concepts, frequency reuse, and regulatory aspects.
CO2: Describe the structure of cellular systems, channels, traffic parameters, and grade of service.
CO3: Analyze cellular capacity improvement methods and interference types with their mitigation techniques.
CO4: Explain channel assignment strategies, hand-off mechanisms, and their practical considerations.
CO5: Compare multiple access techniques, propagation models, fading phenomena, and link budget analysis.

Module 1:

Introduction to mobile communication, Brief overview of evolution of technology from 1G, 2G, 3G, 4G, 5G etc., Concept of Service Provider, Cell, Cluster, Shape of Cell and Frequency re-use, Regulatory Authority and Frequency bands used for mobile communication in India.

Module 2:

Basic structure of a Cellular System with relevant figure. Explanation of each part (Mobile Unit, BTS, MSC & PSTN + Radio Interface), Concept of Voice channels, Control channels and Guard bands, Definition of Set-up time, blocked call, holding time, request rate, traffic intensity, grade of service.

Module 3:

Capacity of a Cellular System, methods for improving Cellular Capacity: Cell Splitting, Cell Sectoring using directional antennas and Microcell Zone Approach, Interference, Type of interferences (Adjacent Channel Interference & Co-Channel Interference) and their remedies/control

Module 4:

Channel Assignment Strategies: Fixed Channel Assignment (FCA) and Dynamic Channel Assignment (DCA), Introduction to Hand-off, Hand-off Initiation, Types of hand-offs, Hand-off Prioritization and Practical considerations.

Module 5:

Concept of Multiple Access, Multiple Access Techniques: Salient features of TDMA, FDMA & CDMA, Concept of Large scale and small-scale propagation models, Propagation Mechanisms: Reflection, Diffraction and Scattering, Basic Traffic theory, Link Budget, Fading and its types, Free space path loss

Labs / Practicals:

1. To write a programme to implement concept of frequency reuse when given size of geographical.
2. Study and Analysis of wired and wireless network.
3. Study of CDMA Call Setup and Handoff Process (Simulation-Based)
4. Hands-on with LTE Network Scanner Tools
5. To Implement Code Division Multiple Access (CDMA).
6. To implement mobile network using open source softwares like NS2
7. Study of Mobile Communication System Architecture (2G/3G/4G/5G)
8. Study and Analysis of GSM Network Parameters
9. Simulation of OFDM Transmission Used in LTE/5G
10. Measurement of Antenna Radiation Pattern using Omni-directional antenna with VNA/Spectrum Analyzer.
11. Study of IMEI and Security Features in Mobile Devices.
12. Hands-on with SIM Card Reader/Writer Tools.

References:

1. Wireless Communications – Principles and Practice, T. S. Rappaport, (2nd edition) Pearson ISBN 9788131731864
2. Modern Wireless Communications, Haykin & Moher, Pearson 2011 (Indian Edition) ISBN: 978-8131704431
3. Wireless Communications and Networking, Jon. W. Mark & Weihua Zhuang, PHI learning Pvt. Ltd.
4. Wireless Communications, Stallings, Pearson Prentice Hall

Course Code	Course Name	L	T	P	Cr
DOEE250050	Control System Engineering	3	1	0	4

Course Outcomes:

CO1. Understand the principles and concepts of control systems including feedback, stability, and performance criteria.
CO2. Analyze and design control systems using various techniques such as root locus, frequency response, and state-space methods.
CO3. Gain proficiency in modeling dynamic systems and obtaining transfer functions for control system design.
CO4. Explore the application of control systems in engineering disciplines such as robotics, aerospace, and industrial automation.
CO5. Develop practical skills in implementing control algorithms, tuning controllers, and analyzing system responses through simulations and experiments.

Module 1:

Introduction to Control Systems: 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: 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: 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: 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: 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.

Labs / Practicals:

NA

References:

Control systems, K.R. Varmah, McGraw hill
Control System Engineering, D. Roy Chowdhuri, PHI
Digital Control system, B.C. Kuo, Oxford University Press.
Control System Engineering, I. J. Nagrath& M. Gopal. New AgeInternational
Publication
Modern Control Engineering, K. Ogata, 4th Edition, Pearson Education

Course Code	Course Name	L	T	P	Cr
DOEE250155	Optical Fiber Communication	3	1	0	4

Course Outcomes:

CO1: Explain the optical spectrum, safety considerations, and maximum exposure limits in fiber optics.
CO2: Analyze photon properties, optical link parameters, and WDM/DWDM techniques in communication systems.
CO3: Apply principles of linear and non-linear optics, Snell's law, dispersion, and polarization to fiber communication.
CO4: Describe the working of optical transmitters, LEDs, lasers, and their role in fiber optic systems.
CO5: Evaluate optical components such as fibers, connectors, couplers, detectors, and receivers for efficient communication.

Module 1:

Spectrum and Safety
Spectrum of optical and quasi-optical electromagnetic waves. The common wave lengths used in fiber optics-850 nm, 1330 nm and 1550 nm, Optical LED and LASER safety. Maximum exposure limits.

Module 2:

Quantities
Representation of photons as wave and particle, photon size, photon energy. Characteristic Impedance in free space and photon speed. Photon energy-carrier, Radiant flux, Radiant Intensity, Solid Angle, Numerical. Aperture, Optical Links:Principles of Wave Division Multiplexing and DWDM. Examples of WDM System using Grin Lens. WDM Demultiplexing. Fibre optic links. Fibre BW, Bit Rate, Fibre Loss, BW-Length Product, Power Ratings, Optical. Noise, Interference.

Module 3:

Physics
Linear and non-linear optics. Reflection, Refraction, Refraction Index, Diffraction. Snell's Law. Dispersion, Surface Fields, Evanescent Wave, Total Internal Reflection and Polarization. Simple calculation involving Snell's Law Calculating wavelength and Frequency

Module 4:

Optical Transmitters
Principles of Light Radiation. Population Inversion. Stimulated Radiation. Light Sources radiation Characteristics. LEDS. LASER fundamentals. LASER diodes. Transmitter Circuits.Optical System: Typical fibre Optic Communication System Using TDM and WDM

Module 5:

Optical Components
Optical Waveguides. Characteristics and Construction of SM, MMSI and MMGI Fibers. Propagation Modes. Numerical Aperture, Acceptance cone, Launching of light attenuation and Dispersion Characteristics VS Wavelength. Connectors and Surface inspection. Optical Couplers, Grin Lenses, Optical Stitches, Optical Detectors/Receivers: Principles of light Detection. Light Detectors. PIN Detectors. APD Detectors. Receiver Circuits.

Labs / Practicals:

1. Study the preparation procedure of Plastic Fiber assembly with the latching connector.
2. Study the procedure for setting up a fiber optic analog link.
3. Study the procedure for setting up a fiber optic digital link.
4. Study the losses in optical fiber
5. Measurement of the Numerical aperture.
6. Study Time Division Multiplexing of Signals.
7. Study framing in TDM.
8 Study of Marker in TDM
9. Study the method of voice Digitization
10. Study the Electromagnetic / Radio Frequency Interference.
11. Study the Pulse broadening in Fiber optic Communications.

References:

1. Fiber Optics and Optoelectronics; K. Hare; Oxford
2. Optical Fiber communication System; William D., Jones Jr.
3. Optical fiber Communication, Principles and Practice; John M. Senior
4. Fiber Optic Systems for Telecommunications; Roger L. Freeman,

Course Code	Course Name	L	T	P	Cr
DOEE250209	PCB Prototyping and Assembly	2	0	4	4

Course Outcomes:

CO1: Explain PCB fundamentals, classifications, materials, EDA tools, and electronic components.
CO2: Identify active and passive electronic components with their package types and applications.
CO3: Design schematic diagrams and PCB layouts considering electrical, mechanical, and thermal constraints.
CO4: Apply PCB design processes including schematic entry, net listing, layout, fabrication, soldering, and testing.
CO5: Demonstrate PCB prototyping, auto-routing, and analyze recent trends and environmental aspects of PCB technology.

Module 1:

Introduction to PCB designing concepts:
What is PCB, Difference between PWB and PCB, Classification of PCBs: Single Sided (Single Layer), Multi-Layer (Double Layer), flexible boards PCB Materials, Electronic design Automation (EDA), Brief History of EDA, PCB Advantages, components of PCB, Electronic components, Microprocessors and Microcontrollers, IC ‘s, Surface Mount Devices (SMD).

Module 2:

Component introduction and their categories:
Active Components, Diode, Transistor, MOSFET, LED, SCR, Integrated Circuits (ICs), Passive Components, Resistor, Capacitor, Inductor, Transformer, Speaker/Buzzer
Component Package Types -Through Hole Packages, Axial lead, Radial Lead, Single Inline Package (SIP), Dual Inline Package (DIP), Transistor Outline (TO), Pin Grid Array (PGA), Through Hole Packages, Metal Electrode Face (MELF), Leadless Chip Carrier (LCC), Small Outline Integrated Circuit (SOIC), Quad Flat Pack (QPF) and Thin QFP (TQFP), Ball Grid Array (BGA), Plastic Leaded Chip Carrier (PLCC).

Module 3:

Schematic & Layout Design:
Schematic diagram, General, Mechanical, and Electrical design considerations, Placing and Mounting of components, Conductor spacing, routing guidelines, heat sinks and package density, Net list, creating components for a library, Tracks, Pads, Vias, power plane, grounding.

Module 4:

PCB Design Processes
Design automation, Drill and Gerber Files; Drills; Footprints and Libraries Adding and Editing Pins, copper-clad laminates materials of copperclad laminates, properties of laminates (electrical & physical), types of laminates, soldering techniques. Film master preparation, Image transfer, photo printing, Screen Printing, Plating techniques, Etching techniques, Mechanical Machining operations, Lead cutting and Soldering Techniques, Testing, and quality controls.
PCB Designing Flow Chart
Schematic Entry, Net listing, PCB Layout Designing, Prototype Designing, Design Rule Check (DRC), Design for Manufacturing (DFM), PCB Making, Printing, Etching, Drilling, Assembly of components,
Description of PCB Layers Electrical Layers, Top Layer, Mid Layer, Bottom Layer, Mechanical Layers, Board Outlines and Cutouts, Drill Details, Documentation Layers, Components Outlines, Reference Designation,
Text Keywords & Their Description: Footprint, Pad stacks, Vias, Tracks, Color of Layers, PCB Track Size Calculation Formula PCB Materials, Standard FR-4 Epoxy Glass, Multifunctional FR-4, Tetra Functional FR-4, NelcoN400-6, GETEK, BT Epoxy Glass, Cyanate Aster, Plyimide Glass, Teflon Rules for Track, Track Length,

Track Angle, Rack Joints, Track Size

Module 5:

PCB Technology:
Introduction of PCB prototyping machines, Schematic Entry, PCB Parts creation, Auto Routing, Post Design, Brief overview of various models available, Recent Trends, and environmental concerns in the PCB industry. Screen printing and thermal toner transfer

Labs / Practicals:

1. Designing of Centre tapped full wave rectifier – without and with shunt capacitance filter.
2. Simple circuit to glow an LED
3. Design, fabrication, and testing of a 9 V power supply with Zener regulator
4. Synthesize the PCB Layout of given analog or digital IC based electronic circuit with manual and auto routing technique using PCB design software
5. Regulator circuit using 7805.
6. Design, fabrication, and testing Full-wave Rectifier
7. Design an 8051 Development board having, Power section consisting of IC7805, capacitor, resistor, headers, LED, Capacitors, DB9 connector, Jumper, LEDs, Reset & Input/ output sections, consisting of 89C51 Microcontroller, Electrolytic Capacitor, Resistor, Jumper, Crystal Oscillator, Capacitors
8. Design a PCB board for Automatic Water Pump controller with Level indicator.
9. Design a PCB board for Clap Switch using 555 timer IC
10. Synthesize complete PCB for a given electronic circuit (mini project)

References:

PCB Design Software recommended:
1. KiCAD (Open-Source Electronics Design Automation Suite) https://www.kicad.org/
2. EasyEDA (Online PCB Design Tool) https://easyeda.com/
3. PADS - Siemens EDA (PCB Design Software) https://eda.sw.siemens.com/enUS/pcb/pads/
4. Any other similar PCB designing software

REFERENCES
1. Printed Circuit Board – Design & Technology, Walter C. Bosshart, Tata McGraw Hill, 2008.
2. Printed Circuit Board –Design, Fabrication, Assembly & Testing, R.S. Khandpur, First Edition, Tata Mcgraw-Hill Education Pvt. Ltd., 2005.
3. Printed Circuit Board Design Using Autocad, Chris Schroeder, Newnes Publisher, 1998.
4. Printed Circuits Handbook, Clyde F. Coombs, Jr, Happy T. Holden, Sixth Edition,
Publisher: McGraw-Hill Education, 2016.

Course Code	Course Name	L	T	P	Cr
DOEE250210	Basic VLSI Technology	2	1	2	4

Course Outcomes:

CO1. Understand the VLSI design flow and abstraction levels.
CO2. Develop and simulate Verilog code for digital circuits.
CO3. Design and implement combinational and sequential circuits using Verilog.
CO4. Use FPGA kits for prototyping and testing.
CO5. Explain the architecture and usage of various programmable logic devices

Module 1:

Introduction to VLSI Design:
Overview of VLSI and CAD tools for digital systems, Levels of abstraction, VLSI design steps: Design Entry, Simulation, Synthesis, Placement & Routing, CMOS logic design using NMOS and CMOS gates.

Module 2:

Introduction to Verilog HDL:
Types of HDL, modeling styles, Verilog modules, data types, operators, assignment statements, control and timing constructs.

Module 3:

Combinational Circuit Design:
Verilog programs for Half/Full Adders, Subtractors, MUX/DEMUX, Encoder/Decoder.

Module 4:

Sequential Circuit Design:
Verilog for Flip-Flops, Counters, Shift Registers.

Module 5:

Programmable Logic Devices:
PROM, PAL, PLA, CPLD, FPGA basics. Implementation with PROM, PAL, PLA (3-variable).

Labs / Practicals:

1. Simulate Verilog code for basic gates (AND, OR).
2. Simulate Verilog code for Half Adder.
3. Simulate Verilog code for Full Adder.
4. Simulate Verilog code for Half Subtractor.
5. Simulate Verilog code for Full Subtractor.
6. Simulate and implement 4-to-1 MUX in FPGA.
7. Simulate and implement 1-to-4 DEMUX in FPGA.
8. Simulate and implement 4-to-2 Encoder in FPGA.
9. Simulate and implement 2-to-4 Decoder in FPGA.
10. Simulate and implement D Flip-Flop and T Flip-Flop in FPGA.
11. Simulate and implement JK Flip-Flop in FPGA.
12. Simulate and implement 3-bit Shift Register.
13. Simulate and implement 3-bit Up Counter.
14. Simulate and implement 3-bit Down Counter.
15. Simulate Verilog code for simple RAM/ROM design.

References:

Recommended Software:
1. Xilinx Synthesis Software (web pack) freely available on internet.
2. On Xilinx.com VLSI System Design is wind software for designing (System Designing).
3. VLSI Learning Resource like Ex-VLSI 155

References
1. M. Morris Mano and Michael D. Ciletti, Digital Design, 6th ed., Pearson, 2018.
2. J. Bhasker, A Verilog Primer, 3rd ed., Prentice Hall India, 2005.
3. Neil H.E. Weste and Kamran Eshraghian, Principles of CMOS VLSI Design, 2nd ed., Addison Wesley, 2005.

Course Code	Course Name	L	T	P	Cr
DASH250050	Entrepreneurship and Start-Ups	3	1	0	4

Course Outcomes:

CO1: Understand the fundamental concepts of entrepreneurship, including traits, motivation, business structures, and the role of entrepreneurs in economic development.

CO2: Identify, evaluate, and visualize innovative business ideas through effective market analysis and opportunity recognition.

CO3: Develop and implement business strategies related to marketing, competition analysis, risk management, and organizational structure.

CO4: Demonstrate knowledge of financial planning, start-up funding sources, investor relations, and intellectual property rights essential for small business management.

CO5: Design a comprehensive business plan that integrates strategic, financial, operational, and marketing perspectives for a successful start-up venture.

Module 1:

Introduction to Entrepreneurship and Business Foundations
Definitions, Traits of an entrepreneur, Intrapreneurship, Motivation,Types of Business Structures, Similarities/differences between entrepreneurs and managers, Exit strategies for entrepreneurs, Bankruptcy, and Succession and harvesting strategy.

Module 2:

Business Ideas and Visualization
Discovering ideas and visualizing the business, Activity map, Market Analysis: Identifying the target market.

Module 3:

Business Strategy and Implementation
Competition evaluation and Strategy Development, Marketing and accounting, Risk analysis.

Module 4:

Organizational and Financial Management
Company’s Organization Structure, Recruitment and management of talent, Financial organization and management.

Module 5:

Start-up Financing, Investor Relations and IPR
Financing methods available for start-ups in India, Communication of Ideas to potential investors: Investor Pitch, Patenting and Licenses.

Labs / Practicals:

N/A

References:

1. The Startup Owner’s Manual: The Step-by-Step Guide for Building a Great Company, Steve Blank and Bob Dorf, K & S Ranch.
2. The Lean Startup: How Today’s Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses, Eric Ries Penguin, .
3. Demand: Creating What People Love Before They Know They Want It, Adrian J. Slywotzky with Karl Weber,

Headline Book Publishing .
4. The Innovator’s Dilemma: The Revolutionary Book That Will Change the Way You Do Business, Clayton M. Christensen, Harvard business .

Course Code	Course Name	L	T	P	Cr
DASH250093	Renewable Energy Technologies	3	1	0	4

Course Outcomes:

CO1 : Explain the global and national scenario of energy demand, environmental impacts, and the role of renewable energy technologies in sustainable development.
CO2 : Analyze the principles of solar radiation, solar thermal, and photovoltaic systems, and assess their applications for energy conversion and utilization.
CO3 : Evaluate wind energy potential, select appropriate sites, and describe the working and performance of wind turbine systems with regard to safety and efficiency.
CO4 : Identify various forms of bioenergy and describe the functioning of biomass-based technologies such as gasifiers, biogas plants, and biofuels production systems.
CO5 : Describe the working principles and applications of other renewable sources including tidal, wave, geothermal, ocean thermal energy, hydrogen fuel cells, and hybrid systems.

Module 1:

Introduction
World Energy Use; Reserves of Energy Resources, Environmental Aspects of Energy Utilization, Renewable Energy Scenario in India and around the World, Potentials, Achievements / Applications, Economics of renewable energy systems.

Module 2:

Solar energy
Solar Radiation, Measurements of Solar Radiation, Flat Plate and Concentrating Collectors, Solar direct Thermal Applications, Solar thermal Power Generation Fundamentals of Solar Photo Voltaic Conversion, Solar Cells, Solar PV Power Generation, Solar PV Applications.

Module 3:

Wind Energy
Wind Data and Energy Estimation, Types of Wind Energy Systems, Performance, Site Selection, Details of Wind Turbine Generator, Safety and Environmental Aspects.

Module 4:

Bio-Energy
Biomass direct combustion, Biomass gasifiers, Biogas plants, Digesters, Ethanol production, Bio diesel, Cogeneration, Biomass Applications.

Module 5:

Other Renewable Energy Sources
Tidal energy, Wave Energy, Open and Closed OTEC Cycles, Small Hydro-Geothermal Energy, Hydrogen and Storage, Fuel Cell Systems, Hybrid Systems.

Labs / Practicals:

N/A

References:

1. O.P. Gupta, Energy Technology, Khanna Publishing House.
2. Renewable Energy Sources, Twidell, J.W. & Weir, A., EFN Spon Ltd.
3. Solar Energy, Sukhatme. S.P., Tata McGraw Hill Publishing Company Ltd.
4. Renewable Energy, Power for a Sustainable Future, Godfrey Boyle, Oxford University Press.
5. Fundamental of Renewable Energy Sources, GN Tiwari and MK Ghoshal, Narosa.

Course Code	Course Name	L	T	P	Cr
DCSA250006	Fundamentals of Blockchain Technology	2	0	4	4

Course Outcomes:

CO1. Understand the types, benefits and limitation of block chain.
CO2. Explore the block chain decentralization and cryptography concepts.
CO3. Enumerate the Bitcoin features and its alternative options.
CO4. Describe and deploy the smart contracts
CO5. Summarize the block chain features outside of currencies

Module 1:

What is Block chain, Block chain Technology Mechanisms & Networks, Block chain Origins, Objective of Block chain, Block chain Challenges, Transactions And Blocks

Module 2:

P2P Systems, Keys As Identity, Digital Signatures, Hashing, and public key cryptosystems, private vs. public Blockchain.CAP theorem and block chain, Block chain Network, Mining Mechanism,

Module 3:

Distributed Consensus, Merkle Patricia Tree,Gas Limit, Transactions and Fee, Anonymity, Reward, Chain Policy, Life of Block chain application, Soft & Hard Fork, Private and Public block chain. Benefits and limitations of block chain.

Module 4:

Nakamoto consensus, Proof of Work, Proof of Stake, Proof of Burn, Difficulty Level, Sybil Attack, Energy utilization and alternate

Module 5:

Decentralization Decentralization using block chain, Methods of decentralization, Routes to decentralization, Decentralized organizations.

Labs / Practicals:

1. Creating Merkle tree
2. Creation of Block
3. Block chain Implementation Programming code
4. Creating ERC20 token
5. Python code to implement blockchain in Merkle Trees
6. Python Code to implement Mining using block chain
7. Python Code to implement peer-to-peer using block chain
8. Creating a Crypto-currency Wallet

References:

1.Decentralization Decentralization using block chain, Methods of decentralization, Routes to decentralization, Decentralized organizations.
2. A Non-Technical Introduction in 25 Steps, Author- Daniel Drescher, Apress, First Edition, 2017.

Course Code	Course Name	L	T	P	Cr
DCSA250055	Multimedia Technologies	3	0	2	4

Course Outcomes:

CO1. Analyze multimedia components such as text, graphics, audio, video, and animation.
CO2. Create and design video and audio effects using multimedia tools.
CO3. Understand multimedia formats, standards, and their properties.
CO4. Develop animated sequences and apply basic principles of animation.
CO5. Design multimedia applications using appropriate tools for practical scenarios.

Module 1:

Introduction to Multimedia:
Definition, basics, elements, applications, multimedia workstation architecture. Hypermedia documents, hypertext, hyperspeech, 3D technologies, holography (definitions only). Overview of multimedia software tools, open-source replacements, multimedia OS.

Module 2:

Defining Objects for Multimedia Systems:
Text, images, audio, video; multimedia data interface and processing standards. Bitmaps, vector graphics, rendering, color palettes, digital audio, MIDI, sound integration, animation principles and techniques, video formats and converters.

Module 3:

Multimedia Data and Standards:
Compression: lossy/lossless concepts, JPEG, video and audio standards. File format standards: RTF, RIFF, GIF, PNG, TIFF, MIDI, JPEG, AVI, WAV, BMP, WMF, MPEG (list only).

Module 4:

Multimedia Devices and Making Multimedia:
Input/output technologies, multimedia project stages. Text editing, OCR, painting, 3D modeling, sound/video editing, authoring systems and tools.

Module 5:

Multimedia and Internet:
Internet bandwidth bottleneck, multimedia services, plug-ins, delivery vehicles. Wireless and mobile multimedia networks, streaming architecture, webcasting, on-demand services, video conferencing.

Labs / Practicals:

1. Use HTML to play audio/video formats on desktop/mobile browsers
2. Import and manipulate images on a workspace
3. Create a notebook wrapper or invitation using suitable software
4. Use a scanner and stitch images into a panorama
5. Edit video clips using software (trim, rotate, merge, add effects)
6. Create a 2D animation using motion guide layer and masking
7. Animate a moving cloud using animation software
8. Develop an animated web page with sound using HTML editor

9. Compress/decompress audio/video and convert file formats
10. Create a pencil sketch from an image using software
11. Morph and overlap two pictures using editing tools
12. Design a certificate using different text effects
13. Record, edit, split, and merge audio from different sources
14. Create 3D metallic text using animation tools
15. Design an innovative institute logo incorporating key features

References:

1. Ze-Nian Li and M. S. Drew, Fundamentals of Multimedia, 2nd Edition, Pearson Education, 2014
2. Tay Vaughan, Multimedia: Making It Work, 8th Edition, Tata McGraw-Hill, 2017
3. Ralf Steinmetz and Klara Nahrstedt, Multimedia Computing, Communication and Applications, Pearson Education, 2012

Course Code	Course Name	L	T	P	Cr
DCSE250022	Introduction to Augmented Reality and Virtual Reality	2	0	4	4

Course Outcomes:

CO1. Understand the foundational techniques in computer vision, graphics, and human-computer interaction relevant to AR/VR.
CO2. Explain the physical and perceptual principles behind VR environments.
CO3. Demonstrate motion tracking, simulation, and object dynamics in virtual systems.
CO4. Develop immersive VR applications using Unity and other toolkits.
CO5. Understand human vision and perception to apply correct rendering and interaction strategies in AR/VR development.

Module 1:

Introduction to Virtual Reality (VR):
Definition of VR, history and key elements; Virtual environment, real-time graphics, flight simulation; Benefits and scientific developments of VR.

Module 2:

Computer Graphics and Geometric Modelling:
Virtual world space, projection and human vision, color theory; 2D to 3D modeling, shading, clipping; Transformations, instances, collision detection.

Module 3:

Virtual Environment:
Input/Output devices for VR; Generic VR system architecture; Animation of virtual environments and physical simulation (e.g., projectiles, pendulum, flight dynamics).

Module 4:

Augmented Reality (AR):
Fundamentals and taxonomy; AR vs VR; AR systems, challenges, methods, visualization and interactivity techniques.

Module 5:

Development Tools and Frameworks:
Human factors: sensory systems; Hardware: sensors, displays; Software: simulation, toolkits, VRML introduction.

Labs / Practicals:

1. Install Unity and Visual Studio; set up Unity for VR development
2. Implement basic video or feature viewing in VR
3. Implement a virtual tool interaction
4. Demonstrate working of HTC Vive, Google Cardboard, Daydream, Samsung Gear VR
5. Explore 2D and 3D Unity projects
6. Create immersive static environment (e.g., living room, battlefield)
7. Create Unity scene with cube, plane, sphere and apply transformations, video/audio
8. Create Unity scene with a pendulum and apply transformations
9. Simulate flight dynamics of an aircraft in Unity

10. Create Unity scene with sphere and plane using rigid body, material, box collider
11. Apply visualization techniques to any Unity object
12. Implement interaction techniques on Unity objects
13. Create immersive environment with static 3D objects using Blender or available models
14. Write basic VRML code to create a red sphere
15. Case study: develop and present a VR + AR application

References:

Textbooks
1. D. Schmalstieg and T. Höllerer, Augmented Reality: Principles & Practice, Pearson, 2016
2. K. Norman and J. Kirakowski, Wiley Handbook of Human Computer Interaction, Wiley-Blackwell, 2018
3. A. E. Hassanien et al., Virtual and Augmented Reality for Automobile Industry, Springer, 2022

Web-based / Online Resources:
1. NPTEL Course: Virtual Reality Engineering, IIT Madras – https://nptel.ac.in/courses/121106013

Course Code	Course Name	L	T	P	Cr
DCSE250027	Basics of Computer Networking and Cyber Security	2	0	4	4

Course Outcomes:

CO1. Understand the fundamentals of computer networking and its components.
CO2. Apply knowledge of network models and identify appropriate protocols.
CO3. Configure IP addressing and perform subnetting.
CO4. Recognize basic cyber threats and implement security measures.
CO5. Practice safe computing habits and basic protective techniques.

Module 1:

Introduction to Networking:
Definition and need for computer networks; Types of networks – LAN, MAN, WAN; Network topologies – Bus, Star, Ring, Mesh; Line configurations; Network devices – Hub, Switch, Router, Repeater, Bridge.

Module 2:

Network Models and Protocols:
OSI and TCP/IP reference models; Functions and protocols of each layer; Comparison of OSI and TCP/IP; Introduction to HTTP, FTP, SMTP, DNS, DHCP.

Module 3:

IP Addressing and Subnetting:
IPv4 and IPv6; IP address classes; Subnet mask and subnetting; Network utilities – ping, tracert, ipconfig, nslookup.

Module 4:

Introduction to Cyber Security:
Concepts of Confidentiality, Integrity, Availability (CIA); Types of security threats – Virus, Worms, Trojans, Ransomware, Phishing; Basics of Firewalls and Antivirus.

Module 5:

Safe Computing Practices and Protection Techniques:
Password protection; Social engineering; Email and browser security; Basic security settings in OS; Cyber hygiene practices.

Labs / Practicals:

1. Identify various types of network devices (Hub, Switch, Router, Repeater, Bridge).
2. Create a peer-to-peer network using LAN cables.
3. Setup a wired LAN with at least 3 systems using a switch.
4. Assign static IP addresses and check connectivity using ping and tracert.
5. Demonstrate IP address class detection and subnetting calculation.
6. Use ipconfig and nslookup to retrieve network configurations.
7. Simulate OSI and TCP/IP communication using open-source tools.
8. Setup and configure a Wi-Fi router.
9. Identify and test common protocols like HTTP, FTP, DNS using browser and command-line.
10. Install and demonstrate basic antivirus scanning and quarantine process.
11. Configure basic firewall settings in Windows/Linux.
12. Demonstrate phishing attack awareness and detection techniques.
13. Set up strong passwords and demonstrate password management practices.
14. Configure browser settings for safe browsing and blocking pop-ups.
15. Use network monitoring tools like Wireshark for simple packet capture and analysis.

References:

Textbooks
1. Behrouz A. Forouzan, Data Communications and Networking, 5th Edition, McGraw-Hill.
2. William Stallings, Computer Networking with Internet Protocols and Technology, Pearson Education.
3. Joseph Migga Kizza, Guide to Computer Network Security, Springer, 5th Edition.

Course Code	Course Name	L	T	P	Cr
DOAI250007	Fundamentals of Artificial Intelligence	2	0	4	4

Course Outcomes:

CO1. Understand the fundamentals of Artificial Intelligence and review Python programming concepts.
CO2. Apply AI search algorithms such as uninformed, informed, heuristic, and adversarial search.
CO3. Demonstrate knowledge of various machine learning techniques and implement relevant algorithms.
CO4. Employ text processing and NLP techniques in real-world tasks.
CO5. Build basic AI applications for domains such as education, healthcare, and automation.

Module 1:

Fundamentals of AI & Python Basics
Introduction to AI, Evolution & Revolution of AI, Structure of AI, Intelligent Agents & Environments.

Python: Introduction, Basic Syntax, Data Types, Variables, Operators, Input/output, Flow of Control (If, If-else, Nested if-else), Loops (For, While, Nested loops, Pass), Strings, List, Dictionary & Tuples Comparison, OOPs Concepts.

Module 2:

Problem Solving by Search:
Searching for solution, Uninformed Search, Breadth First Search, Informed Search (Heuristic & Meta-heuristics), Alpha-beta pruning.

Module 3:

Learning: The Brain and the Neuron, Machine Learning types (Supervised, Unsupervised, Reinforcement), Find S Algorithm, Classification, Linear Regression.

Module 4:

Natural Language Processing
Basics of Text Processing, Tokenization, Word Types, Morphology, Lemmatization, Morphemes, Stemming, POS Tagging.

Module 5:

Applications of Artificial Intelligence
Applications in Education, Healthcare, Transportation, Robotics, Data Analysis, Autonomous Vehicles, Agriculture, Gaming.

Labs / Practicals:

1. Familiarization with Python libraries used in machine learning
2. Write a Python program to check if a number is even or odd
3. Generate random numbers using Python
4. Extract data from a database using Python
5. Implement Breadth First Search using Python
6. Solve a simple knapsack problem using heuristic algorithm
7. Implement Alpha-beta pruning game-playing algorithm
8. Implement Find S algorithm using Python

9. Perform K-means clustering on synthetic GPS data
10. Implement regression model (y = mx + c) using dataset
11. Remove stop words from text using Python
12. Perform tokenization on input text
13. Implement noise removal in text using Python
14. Generate an image from text using an AI image generator
15. Create a speedometer using TK dial in Python
16. Analyze smartwatch data using Python

References:

Textbooks:
1. Stuart J. Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, 3rd Edition, Prentice Hall, 2010.
2. Rupinder Singh, Introduction to Artificial Intelligence, 1st Edition, Notion Press, 2021.
3. T.R. Sharika and P.S. Archana, Introduction to Artificial Intelligence, 1st Edition, Sharika T.R. Publisher, 2023.

Course Code	Course Name	L	T	P	Cr
DOAI250010	Fundamentals of Deep Learning	2	0	4	4

Course Outcomes:

CO1. Understand the basics of artificial intelligence, machine learning, and deep learning.
CO2. Implement neural network training and explore various machine learning models.
CO3. Utilize modern frameworks such as Keras, TensorFlow, and PyTorch for DL tasks.
CO4. Design and build CNN and RNN architectures.
CO5. Apply deep learning in real-world applications like vision, NLP, and generative modeling.

Module 1:

Fundamentals of Deep Learning:
Artificial Intelligence; History of Machine Learning: Probabilistic Modeling, Early Neural Networks, Kernel Methods, Decision Trees, Random Forests, Gradient Boosting Machines; Fundamentals of Machine Learning: Four Branches of ML, Model Evaluation, Overfitting and Underfitting.

Module 2:

Introducing Deep Learning:
Biological and Machine Vision; Human and Machine Language; Artificial Neural Networks; Training Deep Networks; Improving Deep Networks.

Module 3:

Neural Networks and Tools:
Anatomy of Neural Networks; Introduction to Keras, TensorFlow, Theano, CNTK; Setting up Deep Learning Workstation; Binary Classification with Movie Reviews; Multiclass Classification with Newswires.

Module 4:

Convolutional and Recurrent Neural Networks:
Representation Learning; Convolutional Layers and Multichannel Operations; Introduction to RNNs; Implementing RNN and CNN with PyTorch; Understanding PyTorch Tensors.

Module 5:

Interactive Applications and Research Trends:
Machine Vision; NLP; GANs; Deep Reinforcement Learning; Deep Generative Models: Autoencoders, Boltzmann Machines, Restricted Boltzmann Machines, Deep Belief Networks.

Labs / Practicals:

1. Install and configure a deep learning environment using TensorFlow and Keras
2. Implement a basic perceptron model for binary classification
3. Develop a multi-layer neural network for MNIST digit classification
4. Train and evaluate a CNN on a small image dataset (e.g., CIFAR-10)
5. Perform text classification using LSTM or GRU
6. Use pre-trained models like VGG or ResNet for image classification
7. Visualize feature maps in CNN to understand layer activations
8. Build a sentiment analysis model for movie reviews using Keras
9. Implement transfer learning with a pre-trained model on custom images
10. Create and train a basic GAN to generate handwritten digits
11. Implement an autoencoder for image compression and reconstruction
12. Compare training performance using TensorFlow vs PyTorch
13. Use TensorBoard to visualize training metrics and model graphs

14. Apply dropout and batch normalization for regularization
15. Implement a deep reinforcement learning agent in a simple environment

References:

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning, MIT Press, 2016
2. Francois Chollet, Deep Learning with Python, Manning Publications, 2017
3. Jon Krohn, Grant Beyleveld, Aglaé Bassens, Deep Learning Illustrated, Addison-Wesley, 2019
4. Seth Weidman, Deep Learning from Scratch, O'Reilly Media, 2019
5. Yegnanarayana B., Artificial Neural Networks, PHI Learning Pvt. Ltd., 2009
6. Swayam NPTEL: Deep Learning : https://onlinecourses.nptel.ac.in/noc22_cs22/preview

Course Code	Course Name	L	T	P	Cr
DOAI250013	Machine Learning Fundamentals	2	0	4	4

Course Outcomes:

CO1. Understand and differentiate types of learning in machine learning.
CO2. Apply simple regression and classification techniques to practical problems.
CO3. Analyze and cluster data using unsupervised learning models.
CO4. Understand and implement Naive Bayes and basic sequence models.
CO5. Describe the structure of a neural network and use simple deep learning ideas.
CO6. Use basic ML libraries such as Scikit-learn for implementation.

Module 1:

Introduction to Machine Learning:
Definition of ML, Applications and Use Cases, Types of Machine Learning (Supervised, Unsupervised, Reinforcement), Basic Learning Concepts, Concept and Hypothesis Space, Introduction to Learning Models

Module 2:

Supervised Learning Methods:
Linear Regression, Overfitting and Underfitting, Cross Validation, Logistic Regression, K-Nearest Neighbors (KNN), Decision Trees, Random Forest, Model Evaluation Metrics (Accuracy, Precision, Recall)

Module 3:

Unsupervised Learning Methods:
Clustering Algorithms: K-Means and Hierarchical Clustering, Dimensionality Reduction using PCA, Basics of Recommendation Systems

Module 4:

Probability-Based Models:
Naïve Bayes Classifier, Maximum Likelihood, Basics of Bayesian Networks, Introduction to Hidden Markov Models (HMM) and Sequence Modeling

Module 5:

Introduction to Neural Networks & Deep Learning:
Perceptron, Feedforward Networks, Activation Functions, Concept of Backpropagation, Limitations of Classical ML, Introduction to Deep Learning and Use Cases

Labs / Practicals:

1. Introduction to Python libraries for ML (NumPy, Pandas, Matplotlib, Scikit-learn).
2. Build and test a Linear Regression model for house price prediction.
3. Apply Logistic Regression to binary classification (e.g., email spam detection).
4. Implement and compare K-Nearest Neighbors (KNN) with different k-values.
5. Train and evaluate a Decision Tree Classifier on a basic dataset.
6. Implement K-Means clustering on a synthetic dataset and visualize the clusters.
7. Apply Principal Component Analysis (PCA) on an image dataset for dimensionality reduction.
8. Use Naive Bayes Classifier for text classification (e.g., sentiment analysis).

9. Introduction to training a simple neural network using TensorFlow/Keras.

References:

1. Aurelien Geron, Hands-On Machine Learning with Scikit-Learn and TensorFlow, O'Reilly, 2nd Ed.
2. Stephen Marsland, "Machine Learning: An Algorithmic Perspective", Chapman & Hall/CRC, 2nd Edition, 2014.

3. Kevin Murphy, Machine Learning: A Probabilistic Perspective, MIT Press.

Online Resources
1. https://scikit-learn.org
2. https://www.kaggle.com/learn/intro-to-machine-learning

Course Code	Course Name	L	T	P	Cr
DOAI250016	Basic Neural Networks and Applications	2	0	4	4

Course Outcomes:

CO1. Understand the basic models and working principles of artificial neurons.
CO2. Train and implement simple feedforward neural networks.
CO3. Explore feedback and Hopfield networks for pattern stability.
CO4. Understand and apply memory-based neural models.
CO5. Build basic applications like digit recognition or simple diagnostic systems.
CO6. Use open-source tools to simulate and test simple neural networks.

Module 1:

Introduction to Neural Networks:
History and Development of Neural Systems; Biological Neurons vs. Artificial Neurons; Structure and Function of Neural Networks; Learning and Adaptation; Single-Layer Perceptron Models; Basic Learning Rules

Module 2:

Multilayer Perceptron and Learning Algorithms:
Linear vs. Non-linear Pattern Classification; Delta Learning Rule; Backpropagation Algorithm; Feedforward Networks; Learning Rate and Epochs; Functional Link Networks

Module 3:

Feedback Neural Networks and Hopfield Models:
Dynamical Systems Overview; Discrete-Time and Continuous-Time Hopfield Networks; Relaxation Modeling; Energy Function and Convergence

Module 4:

Associative Memory and Recurrent Networks:
Linear Associators; Auto-Associative and Bi-directional Associative Memories; Spatio-temporal Memory; Storage and Recall Mechanisms

Module 5:

Applications of Neural Networks:
Character Recognition, Robotics Kinematics, Medical Diagnosis, Self-Organizing Maps, Control Systems, Pattern Matching, Animation and Simulation Concepts

Labs / Practicals:

1. Implement a basic single-layer perceptron for OR and AND logic gates.
2. Train and test a simple feedforward neural network for handwritten digit recognition using Python (e.g., MNIST subset).
3. Visualize neuron activation using sigmoid and ReLU activation functions.
4. Implement and observe learning in a simple Hopfield network.
5. Build a character recognition model using a small set of images and MLP.
6. Simulate backpropagation learning algorithm using a Python-based toolkit (TensorFlow or Keras).
7. Design and visualize a self-organizing map (SOM) using a simple dataset.
8. Apply ANN for classifying diseases (using toy datasets for diagnosis).
9. Use Scikit-learn to classify IRIS dataset using neural networks.

10. Design a small ANN model (2–3 layers) for binary classification and evaluate its accuracy.

References:

1. Jacek M. Zuarda, Introduction to Artificial Neural Networks, West Publishing Company, 1994
2. Simon Haykin, Neural Networks & Learning Machines, 3rd Edition, Pearson, 2009

Course Code	Course Name	L	T	P	Cr
DOEE250045	Consumer Electronics	3	0	2	4

Course Outcomes:

CO1. Understand the working of electronic appliances like TV, audio systems, and microwave ovens.
CO2. Explain the use of electronics in day-to-day life.
CO3. Repair and troubleshoot common consumer electronic equipment.
CO4. Analyze different types of electronic displays and sensors used in home appliances.

Module 1:

Audio Fundamentals
Basic characteristics of sound signal : Intensity and loudness, pitch, frequency response, fidelity, sensitivity and selectivity, Audio Amplifiers: Mono, stereo, quadraphonic, block diagram of Hi- Fi amplifier and its working, use of bass, treble tone controls 1.3 Microphone: Working principle and Types condenser, crystal, electret, laser, Speakers: Working principle and types- electrostatic, dynamic, plasma arc, Bluetooth, Multi-speaker system: Definition, Crossover Networks, Impedance matching, Public Address System (PA system) and Home theatre : Block diagram and working principle

Module 2:

Video Systems:
Closed circuit television (CCTV): functional block diagram, working ,installation of CCTV, Liquid crystal display (LCD) television: Principle, Block diagram and working, Block diagram and working principle: Light emitting diode(LED) TV, Organic light emitting diode(OLED) TV, Quantum dot light emitting diode (QLED) television, Direct to Home (DTH) television : Block diagram and working principle, Smart interactive TV : Features and applications

Module 3:

Consumer Electronic Appliances
Photocopier: Block diagram and working principle, Microwave Oven: Block diagram, single chip controllers, types, wiring diagram, safety instructions, electrical specifications, Washing Machine: Block diagram, electrical specifications, types and features of (Automatic, Semiautomatic and Fuzzy Logic) washing machine, Digital Camera and Camcorder: Working principle, picture processing, picture storage, electrical specification, Scanner: Working principle, Specifications, types of scanners (Handheld ,Flatbed, Sheet fed ,Portable Scanners), interface cables, ports and connectors, Bar code reader: Working principle , applications

Module 4:

Smart appliances
Wearable antenna: Construction, Working principle and applications, Smart Wrist bands :Construction, applications and functional units (sensors ,signal conditioning, microcontrollers, wireless connectivity , power management, firmware, storage), Virtual Reality (VR) Headset: Functional block diagram and functional units (tracking unit, processing unit, display unit, sensors, pixel resolution, field of view),virtual reality supported platforms such as Windows Mixed Reality(WMR), Augmented Reality(AR) devices: Functional block diagram, working principle, examples, Recycling of electronic appliances :Regulations and procedures

Module 5:

Office Automation appliances
Laser Printer: Working principle, features, specifications, functional block diagram, control unit and troubleshooting procedure, Smart Interactive Board: Working procedure, features and specifications, LED Projector: Working principle, features, specifications, functional block diagram, control unit and troubleshooting procedure, Biometric Attendance system: Hardware and software components , working procedure, Video conferencing system: Components and working procedure, Paper shredding mach

Labs / Practicals:

1. Test and measure the various parameters of a microphone.
2. Test the given speaker and plot its frequency response.
3. Measure voltages at different sections of Hi-Fi amplifier.
4. Measure the voltages for various components of CCTV unit.
5. Connect CCTV Cameras to DVR/IVR, record and replay.
6.Measure voltage of Power supply , Audio section and Video section of LCD TV. Compare the above measured voltage with standard voltage.
7. Troubleshoot the faults in a LCD TV- a) No picture, No Audio b) No Audio but proper picture. c) Complete dead TV.
8. Test the performance of various sections of given LED TV - a) Power supply b) Driver LED section c) Audio section d) Video section.
10.Detect and rectify faults in microwave oven - a) Oven not starting b) Oven not heating c) Error display.
11. Sketch the wiring diagram of washing machine and locate its main components.
12. Interface and configure the LED projector using various controls.
13.Demonstrate and study of DTH system

References:

1. Consumer Electronics by Bali S.P. (Publisher-Person Education India, 2010, latest edition)
2. Audio video system: Principle practices & troubleshooting by Bali R and Bali S.P. (Publisher-Khanna Book Publishing Co.(P)Ltd., 2010 Delhi, India, Latest edition)
3. Modern Television Practices by Gulati R.R. (Publisher-New Age International Publication-P Ltd. New Delhi)
4. Audio Video System by Gupta R.G. (Publisher-Tata Mcgraw Hill)
5. Mastering Digital Television by Whitaker Jerry & Benson Blair (Publisher- Mcgraw Hill)

Course Code	Course Name	L	T	P	Cr
DOEE250052	Power Electronics and Electric Vehicles	2	0	4	4

Course Outcomes:

CO1. Understand construction & working of power transistor & IGBT
CO2. Understand construction & working of thyristor family devices
CO3. Understand and simulate turn on and turn off circuits of thyristor family devices
CO4. Understand and simulate operation of pulse controlled rectifiers.
CO5. Understand and design industrial control circuits using power electronics devices

Module 1:

Power Electronics Devices
Introduction,Power transistor-Construction,Working, V-I characteristics, Uses. IGBT- Construction, Working, V-I characteristics, Uses. Concept of nanotechnology in the field of power electronics

Module 2:

Thyristor Family
SCR- Construction, Working, V-I characteristics, Uses, Mounting & Cooling, Types of thyristor- SCR, LASCR, SCS, GTO, UJT, PUT, DIAC & TRIAC, Thyristor family devices- Construction, Working, V-I characteristics, Uses, Protection circuits using thyristor family devices- Over voltage, over current, snubber, crow bar

Module 3:

Phase controlled rectifiers
Concept of firing angle & conduction angle, Single phase half controlled, full controlled rectifier with R & RL load: Circuit diagram, working, input output waveforms, equations for DC output & effect of freewheeling diode. Different configurations of bridge rectifiers: Full bridge, Half bridge with common anode, common cathode, SCRs in one arm and diodes in other arms

Module 4:

INTRODUCTION TO ELECTRIC VEHICLES History of electric vehicles, social and environmental importance of electric vehicles, impact of modern drive-trains on energy supplies. CASE STUDY Comparison by efficiency of Conventional, Hybrid, Electric and Fuel cell Vehicles. Introduction to electric components used in electric vehicles, Control of Induction Motor Drive, Permanent Magnet (PM) motor Drive & Switched Reluctance Motor (SRM) Drive.

Module 5:

ENERGY STORAGE
Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery-based energy storage and its modeling, SOC, Different Types of Batteries, Super Capacitor based energy storage and its analysis, Hybridization of different energy storage devices,Introduction to energy management strategies used in electric vehicles, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy management strategies, Types of EV charging Infrastructure & Standardized Communication protocols for EV charging.

Labs / Practicals:

1. To Plot the characteristics of Semiconductor Diode And To plot the characteristics of Transistor
2. To draw the output characteristics of IGBT.
3. Obtain the V-I characteristics of DIAC and TRIAC and take the print out of waveforms
4. To plot the V-I characteristics of S.C.R. And verify using DSO
5. Study of 1 – Phase Half wave and full wave Bridge rectifier
6. To verify the UJT as a relaxation oscillator
7. To Study a 3-phase full wave controlled rectifier with R - Load.

8. Check the results of DC Shunt Motor Speed Control with Unijunction Transistor Firing Circuit
9. Activity based Practical 1: Create Burglar alarm system using bread board.
10. Activity based Practical 2: Create Illumination / fan control using TRIAC using bread board

References:

1. Fundamentals of Power electronics by S.K. Bhattacharya, Vikas Publishing House, Noida.
2. Power Electronics Circuits Devices and applications by M.H. Rashid, Pearson Publication
3. Power Electronics by MD Singh & KB Khanchandani, Tata Mcgraw Hill Publishing Co. Ltd.
4. Power Electronics & Its Applications by Alok Jain, Penram International Publishing (India) Pvt. Ltd., Mumbai
5 James Larminie, John Lowry, “Electric Vehicle Technology Explained”, Wiley, 2nd Edition 2012

Course Code	Course Name	L	T	P	Cr
DOEE250067	Rapid Prototyping and 3D Printing	2	0	4	4

Course Outcomes:

CO1. Understand the construction of basic 3D Printing machines
CO2. Understand the Energy delivery, Material delivery, Nozzle and Heating Systems
CO3. Know the Optical & Optoelectronic components in 3D Printing
CO4. Know the environmental control systems
CO5. Understand the Pre-processing & Post processing techniques in 3D printing

Module 1:

INTRODUCTION TO 3D PRINTING MACHINES & PROCESSES
Introduction to 3D Printing Machines: Historical Perspectives, Rapid Prototyping - An Integral Part of Time Compression Engineering, RP Information Workflow. Rapid Prototyping Processes: Classification of Rapid Prototyping Processes, Processes Involving a Liquid - Solidification of a Liquid Polymer, Solidification of an Electroset Fluid: Electrosetting (ES), Solidification of Molten Material, Processes Involving Discrete Particles, Processes Involving Solid Sheets.

Module 2:

Fundamentals of Fused Deposition Modeling (FDM) printing
Principle of FDM/FFF printing, Basic steps to perform FDM printing, Significant process parameters of FDM printing, layer height, raster angle, raster width, build temperature, Nozzle temperature, orientation, printing speed etc, Types of FDM printer Cartesian, Polar, delta, Robotic (SCARA), continuous FDM Materials PLA, ABS, PETG, Nylon, PVA, PC, TPU, Carbon reinforced nylon, ceramics, metals, Dual and multi material etc,

Module 3:

Main Parts and Construction of FDM printer Frame, Linear rods, Linear motion bearings, Slider/Carriage, V slot extrusion, Pulley, belt, Lead screw Arduino processor, Controller board, Limit Switch, Hot end, Extrusion system: Direct Drive, Bowden type, Power Supply, Heat Beds etc, Applications of FDM printer in AM, Applications of AM: Aerospace, Biomedical, Automotive, Bio-printing, Tissue & Organ Engineering, Architectural Engineering, Surgical simulation, Art, Health care

Module 4:

Additive Manufacturing
ntroduction and Basic Principles, What is Additive Manufacturing? What Are AM Parts Used For The Generic AM Process Step 1: CAD Step 2: Conversion to STL Step 3: Transfer to AM Machine and STL File Manipulation Step 4: Machine Setup Step 5: Build Step 6: Removal Step 7: Postprocessing Step 8: Application Why Use the Term Additive Manufacturing? 1 Automated Fabrication (Autofab) 2 Freeform Fabrication or Solid Freeform Fabrication 3 Additive Manufacturing or Layer-based Manufacturing 4 Stereolithography or 3D Printing 5 Rapid Prototyping, The Benefits of AM

Module 5:

Comparison of Additive Manufacturing with Conventional Manufacturing Processes Introduction, Comparison between AM and Conventional Manufacturing: Comparison between AM and Deformation Process, Comparison between AM and Primary or Shaping Processes; Pros and Cons of AM with Respect to conventional Manufacturing: Part flexibility, Waste prevention, Production flexibility, Process Running cost, Probability of change, Start-up investment Mass production, Raw material.

Labs / Practicals:

1. Introduction to 3D Printer Components (Frame, Nozzle, Motors, Extruder, etc.)
2. Safety Training and Basic Maintenance of a 3D Printer
3. Installation and Setup of Open-source 3D Printing Software (e.g., Cura, PrusaSlicer)

4. Preparing STL Models for Printing
5. Calibration of the 3D Printer Bed
6. Printing a Basic 3D Object (Cube/Keychain)
7. Changing and Loading Filament
8. Printing with Different Infill Settings and Supports
9. Exploring Layer Height and Print Speed Impacts
10. Dual Material Printing Demonstration (if applicable)
11. Post-processing Techniques: Cleaning, Sanding, and Polishing Printed Objects
12. Print Failure Troubleshooting and Solutions
13. Design and Print a Custom Part Using Tinkercad/Fusion 360
14. Case Study: Biomedical or Automotive Part Printed Using FDM
15. Group Project: Design and Print a Functional Assembly (e.g., Gear Mechanism)

References:

1. Ian Gibson, Ian Gibson. "Additive manufacturing technologies 3D printing, rapid prototyping, and direct digital manufacturing." Springer International Publishing
2. Harshit K. Dave, J. Paulo Davim Fused Deposition Modeling Based 3D Printing, Springer International Publishing
3. Manu Srivastava, Sandeep Rathee, Sachin Maheshwari, TK Kundra Additive Manufacturing Fundamentals and Advancements CRC press
4. The 3D Printing Handbook: Technologies, design and applications by Ben Redwood. Fielmon

Course Code	Course Name	L	T	P	Cr
DOEE250068	Basics of Sensors and Interfaces	2	0	4	4

Course Outcomes:

CO1. Analyze the basics and design the resistive sensors.
CO2. Identify the materials and designing of inductive and Capacitive Sensors.
CO3. Analyze various types of Actuators.
CO4. Design Micro sensors and Micro Actuators for various applications.
CO5. Implement fabrication process and technologies and compare various Micro machining processes.

Module 1:

FUNDAMENTALS AND TEMPERATURE SENSORS
Difference between sensor, transducer and Actuators- Classification of sensors: Proprioceptive and Exteroceptive – Active and Passive– Contact and Non-contact, selection and characteristics: Range; resolution, Sensitivity, error, repeatability, linearity and accuracy, Primary sensing elements. Temperature sensors: Principle of operation, construction details, characteristics and applications of Bimetallic thermometer, Resistance thermometer, Thermistor, Thermocouples and Total radiation Pyrometers

Module 2:

STRAIN, FORCE, TORQUE AND PRESSURE SENSORS
Strain gauges, strain gauge beam force sensor, piezoelectric force sensor, load cell, torque sensor, Piezoresistive and capacitive pressure sensor, Manometer, vacuum sensors, Pirani gauge.

Module 3:

DISPLACEMENT, LEVEL AND FLOW SENSORS
Displacement Sensors: LVDT, RVDT, eddy current, transverse inductive, Hall Effect, magneto resistive, magnetostrictive sensors. Liquid level sensor: Fabry Perot sensor, ultrasonic sensor, capacitive liquid level sensor. Flow sensors: pressure gradient technique, ultrasonic, electromagnetic sensors and Hot wire anemometer. Micro flow sensor, Coriolis mass flow and drag flow sensor.

Module 4:

ACTUATORS
Definition,types and selection of Actuators; linear; rotary; Logical and Continuous Actuators, Pneumatic actuator, Hydraulic actuator - Control valves and cylinders Electrical actuating systems: Solenoids, Electric Motors- D.C motors - AC motors - Three Phase Induction Motor, Stepper motors -Piezoelectric Actuator.

Module 5:

Interfaced with Microcontroller:
HC-SR04 Ultrasonic Sensor: Measures distance to objects using ultrasonic sound waves, DHT22 Temperature Sensor: Measures temperature using a digital interface, MPU6050 Accelerometer and Gyroscope: Measures acceleration and rotational motion, Soil Moisture Sensor: Measures the moisture content of soil, PIR (Passive Infrared) Sensor (HC-SR501): Detects motion by sensing infrared light emitted by objects, BME280: Measures temperature, humidity, and pressure, LM75 I2C Temperature Sensor: Measures temperature using the I2C communication protocol, Rain Sensor (YL-85): Detects rain or moisture, IR Sensor: Detects infrared light, often used for remote control or obstacle detection, LDR (Light Dependent Resistor): Detects light intensity, GPS Module: Receives location data from satellites, Gas Sensor: Detects the presence and concentration of various gases, Relay Module: Controls high-voltage or high-current devices with low-voltage signals from the Arduino, Touch Sensor: Detects physical touch, Flex Sensor: Detects bending or flexing, Color Sensor: Detects the color of objects, Water Flow Sensor: Measures the flow rate of liquids, Sound Sensor: Detects sound intensity, RFID Reader: Reads data from RFID tags, Thermistor: Measures temperature using resistance changes, Potentiometer: A variable resistor used to control voltage or current.

Labs / Practicals:

1. To interface an LM35 / Thermistor with a microcontroller (e.g., Arduino/8051) and Display temperature on LCD or Serial Monitor.
2. To interface a Light Dependent Resistor (LDR) and measure light intensity, control an LED/streetlight based on ambient light.
3. To measure distance using ultrasonic sensor, Display distance on LCD/Serial monitor.
4. To detect the presence of an object using IR sensor, Trigger a buzzer or LED upon detection.
5. To detect human motion, Light an LED or sound buzzer on motion detection.
6. To design a Hardware based Home Automation System using relay and nodeMCU development board.
7. To design a Automatic multilevel Car Parking System.
8. To communicate with sensor over I2C/SPI and Acquire data (e.g., from MPU6050 or BMP180).
9. To design a Hardware based Line Follower Robot

References:

[1]. Patranabis.D, Sensors and Transducers, Wheeler publisher, 1994.
[2]. Sergej Fatikow and Ulrich Rembold, " Microsystem Technology and Microbotics" First edition, Springer –Verlag NEwyork, Inc, 1997.
[3]. Jacob Fraden, "Hand Book of Modern Sensors: Physics, Designs and Application" Fourth edition, Springer, 2010.
[4]. Robert H Bishop, "The Mechatronics Hand Book", CRC Press, 2002.
[5]. Thomas. G. Bekwith and Lewis Buck.N, "Mechanical Measurements", Oxford and IBH publishing Co. Pvt. Ltd.,
[6]. Massood Tabib and Azar, "Microactuators Electrical, Magnetic, thermal, optical, mechanical, chemical and smart structures", First edition, Kluwer academic publishers, Springer, 1999.
[7]. Manfred Kohl, Shape Memory Actuators, first edition, Springer.

Course Code	Course Name	L	T	P	Cr
DOEE250080	Electronic Measurements and Instrumentation	2	0	4	4

Course Outcomes:

CO1.Understand the principles and operation of electronic measuring instruments used for electrical and electronic parameters.
CO2.Learn techniques for accurate measurement, calibration, and error analysis in electronic circuits and systems.
CO3.Gain proficiency in the design and implementation of instrumentation systems for various engineering applications.
CO4.Explore advanced topics such as sensors, transducers, signal conditioning, and data acquisition systems.
CO5.Develop practical skills in laboratory experiments, data acquisition, and analysis using modern instrumentation tools and techniques.

Module 1:

Fundamentals of Electronic Measurement and Instrumentation: 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 of errors, Statistical analysis , probability of errors, Limiting errors,Standards of measurement.

Module 2:

Electromechanical Instruments and AC, DC Bridges: 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: 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, Semiconductor Types, 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 For Proximity Sensing, Electro-Optical Sensors, Capacitive Sensors, Magnetic Sensors.

Module 4:

Signal generator and Signal Analyzer: 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, Spectrum analyzer and Logic analyzer; Signal conditioning and its necessity, process adopted.

Module 5:

Data Acquisition System: Signal conditioning,Functions of ,Signal conditioning, AC/DC Conditioning systems,

Data conversion: ADC, DAC, Generalized data acquisition system: single channel and multi-channel DAS.

Labs / Practicals:

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

References:

1. A.D. Helfrick and W.D. Cooper: "Modern Electronic Instrumentation and Measurement Techniques", PHI Publications.
2. A.K. Sawhney : "Electrical and Electronic Measurement and Instrumentation", Dhanpat Rai & 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 Graw Hill Publications

Course Code	Course Name	L	T	P	Cr
DOEE250118	Industrial Automation	3	0	2	4

Course Outcomes:

CO1. Understand the key components and importance of industrial automation.
CO2. Operate and control power electronic devices used in automation.
CO3. Design pneumatic and hydraulic systems for industrial applications.
CO4. Develop and troubleshoot PLC-based control systems using ladder diagrams.
CO5. Integrate SCADA and HMI for real-time control and monitoring in industrial environments.

Module 1:

Introduction to Automation:
Introduction to automation – advantages, requirements and examples; Block diagram of an automated system; Types of industrial control systems; Introduction to open and closed-loop control systems; Advantages of automation in industry.

Module 2:

Power Electronics in Automation:
DC to DC conversion using SCR, IGBT, MOSFET; Speed control of servo motors, DC motors, and stepper motors; Role of drives in automation.

Module 3:

Pneumatics and Hydraulics in Automation:
Overview of pneumatic and hydraulic systems; Construction and working of pneumatic components (cylinders, valves); Pneumatic logic gates, circuits, and actuators; Hydraulic circuits – meter-in and meter-out; Control elements and system layout.

Module 4:

PLC in Industrial Automation:
Introduction to PLC; Architecture and working of PLC; Logic gates and ladder diagrams; Timers, counters, and internal relays; PLC applications in motor control and industrial process automation.

Module 5:

SCADA and HMI:
SCADA systems – architecture and applications; HMI interfaces and applications; Integration of PLC with SCADA/HMI; Basics of industrial communication protocols used in automation.

Labs / Practicals:

1. Speed control of a DC motor using SCR
2. Operation of a step-down DC to DC converter using IGBT/MOSFET
3. Speed control of a servo drive
4. Speed control using pneumatic trainer setup
5. Speed control using hydraulic trainer setup
6. Design and implementation of single and double-acting cylinder circuits
7. Pneumatic logic control using AND operation
8. Pneumatic sequencing circuit implementation
9. Implementation of metre-in and metre-out circuits using pneumatic setup
10. Implementation of hydraulic logic circuits including metre-in and metre-out
11. Programming basic logic gates using ladder diagrams in PLC
12. Implementation of timer and counter operations in PLC
13. Design of DOL (Direct-On-Line) starter using PLC programming

14. Interfacing and controlling PLC parameters using HMI
15. Creating menu bar controls and graphical interface using HMI/SCADA platform

References:

1. S. K. Singh, Industrial Instrumentation and Control, Tata McGraw-Hill
2. Frank D. Petruzella, Programmable Logic Controllers, McGraw-Hill
3. R. K. Rajput, A Textbook of Power Electronics, Laxmi Publications

Course Code	Course Name	L	T	P	Cr
DOEE250122	Introduction To UAV Electronics	2	0	4	4

Course Outcomes:

CO1. Understand the working of drone electronic components and systems.
CO2. Design and integrate power systems, sensors, and controllers for UAVs.
CO3. Configure flight controllers and implement basic drone automation.
CO4. Develop and troubleshoot electronic circuits for drone applications.
CO5. Demonstrate knowledge of UAV regulations and safety protocol.

Module 1:

Introduction to Drone Electronics and Flight Principles:
Definition and history of drones, Types of drones and their applications, Drone components and terminology, Overview of Drone Technology, Basics of Electrical & Electronic Circuits in Drones, Types of UAVs: Fixed-Wing, Multi-Rotor, Hybrid, Flight Mechanics and Dynamics: Basic principles of flight mechanics, Factors affecting drone flight performance and efficiency.

Module 2:

Electronic Components, Propulsion, and Power Systems:
Introduction of Battery, Battery Types for Drones: Li-Po, Li-Ion, LiFePO4, Selection criteria of Battery for Drone application, Electronic Speed Controllers (ESCs): Working, Types & Selection, Power Distribution Boards (PDBs) and Voltage Regulation, Working, Types: Brush and Brushless Motors, motor sizing and identification, mounting patterns and thread size, Thrust to Weight ratio, KV ratings, Introduction of radio control system, Transmitter and Receiver, Flight Controllers, Battery Eliminator Circuit, Propeller Design & Thrust Calculation, ESC Calibration & Motor Synchronization, Hands-on: Assembling and Testing Motor-Propeller Systems.

Module 3:

Sensors, Navigation and Imaging Systems:
Inertial Measurement Unit (IMU): Accelerometer, Gyroscope, Magnetometer, Barometric Pressure Sensors for Altitude Measurement, GPS & GNSS Modules for Drone Navigation, Optical Flow, LIDAR & Ultrasonic Sensors for Obstacle Avoidance, RADAR and range finder, Speed and Distance sensor, Image sensor, TOF sensor. Cameras in drones and selection criteria of camera for different range.

Module 4:

Flight Controllers, Embedded Systems, and Communication Technologies:
Introduction to Flight Controllers (Pixhawk, Ardupilot, Betalights), Microcontrollers & Embedded Systems in UAVs (STM32, Arduino, Raspberry Pi), PID Control & Stability Algorithms, Hands-on: Configuring and Programming Flight Controllers; Wireless Communication Technologies: RF, Wi-Fi, LoRa, 4G/5G, Radio Transmitters & Receivers: RC Systems, Frequency Bands, Telemetry Systems: Real-time Data Transmission & Processing, FPV (First-Person View) Systems & Video Transmission.

Module 5:

Drone Safety, Regulations, and Applications:
UAV Safety Protocols & Precautions, Drone Laws & Regulations (DGCA Guidelines), Overview of commercial and industrial drone applications, Case studies and examples of successful drone deployments, GPS based navigation system, Drone Camera Systems, Argo application, Drone Delivery, Future trends and developments in the drone industry.

Labs / Practicals:

1. To study different charging mode of LiPo battery used in UAV.
2. To demonstrate speed control of BLDC Motor using PWM technique.
3. Motor & ESC Testing using Thrust Measurement Rig

4. IMU Calibration & Sensor Data Acquisition
5. To configure, test and perform communication of FCB with motor, GPS, ESC and sensors.
6. Integrating GPS for Autonomous Navigation
7. Programming Flight Controllers PID tuning.
8. Installation of firmware using ardupilot
9. Assembling & Testing a Basic Quadcopter
10. To configure a telemetry module and monitor real-time data such as altitude, battery voltage, GPS coordinates using Ground Control Software (e.g., Mission Planner/QGroundControl).
11. To connect proximity sensors to a flight controller and demonstrate obstacle detection with buzzer or visual indicators.
12. To configure fail-safe protocols (loss of signal, low battery) in the flight controller and simulate conditions to test auto-land or return-to-home (RTH) functionality.

References:

1. Robert L. Boylestad / Louis Nashelsky “Electronic Devices and Circuit Theory”, Latest Edition, Pearson Education.
2. D. P. Kothari and I. J. Nagrath, “Basic Electrical Engineering”, Tata McGraw Hill.
3. J.B. Gupta, Basic Electrical Engineering, Kataria & Sons.
4. H S Kalsi, “Electronic Instrumentation”, Latest Edition, TMH Publication.
5. Behaviour of Lithium-Ion Batteries in Electric Vehicles: Battery Health, Performance, Safety, and Cost (Green Energy and Technology) by Gianfranco Pistoia, Boryann Liaw, Springer.
6. An Introduction to Analog and Digital Communication by Simon Haykin, Wiley Student Edition.
7. Electronics Communication System by Kennedy, Tata McGraw Hill Education Pvt Ltd, New Delhi.
8. Wireless Communications | Second Edition | By Pearson: Principles and Practice.
9. Programmable Microcontrollers With Applications (Cem Unsalan, H. Deniz Gurhan)
10. Drone Technology in Architecture, Engineering and Construction (, Tal Daniel).

Course Code	Course Name	L	T	P	Cr
DOEE250126	Introduction to Robotics	2	0	4	4

Course Outcomes:

CO1. Understand the fundamental concepts, terminology, and applications of robotics, including robotic structures, axes, joints, and coordinate systems.
CO2. Demonstrate hands-on skills in assembling and controlling basic robotic motions such as forward, backward, circular, and position-based movements.
CO3. Interface and program various sensors, actuators, and communication modules commonly used in robotic systems.
CO4. Apply knowledge of control systems to operate servos, stepper motors, and grippers in robotic applications.
CO5. Develop, simulate, and troubleshoot simple robotic systems for practical tasks such as line following, pick-and-place operations, and wireless communication.

Module 1:

Introduction to Robots:
Definition, need and applications of Robot, Difference between Human and the robot – Basic Terminologies (axis, Cartesian coordinates, rotate, translate, degree of freedom, home position, link and joints) – Specifications for a robot -Components of a robot system.

Module 2:

Robot Hands:
End effectors: need for end effector – Types of end effector – Robot gripper – mechanical and magnetic grippers - various gripping techniques – Manipulator – function of a manipulator – Robot controller – structure of a robot controller

Module 3:

Robot Vision:
Sensors – List of sensors used in robot – Working principle of Touch sensor, Proximity Sensors, Range and tactile sensors, Vision sensor and Displacement sensor.

Module 4:

Robot Brain:
Robot controller – Definition - functions of a controller – structure of a robot controller- Control system - open loop and closed loop control system – feedback control system- applications of control system

Module 5:

ROBOTIC POWER SYSTEM
Power systems for robot – Hydraulic, pneumatic, and electric power systems (DC motor, AC motor, servo motor and stepper motor) – diagram and working principle

Labs / Practicals:

1. Switch and LED Interfacing
2. Forward and Backward Motion Control
3. Left and Right Motion Control
4. Circular Motion Control

5. Buzzer Interfacing
6. Relay Interfacing
7. Velocity Control of Robot Wheels
8. Position Control Using Encoders
9. Serial Communication using UART
10. ADC Sensor Interfacing
11. Servo Motor Interfacing
12. Stepper Motor Interfacing
13. Gripper Mechanism – Pick and Place Operation
14. Line Follower Robot Implementation
15. ZigBee-Based Wireless Communication in Robotics

References:

Textbook:
1. S. K. Saha, Introduction to Robotics 2e, TATA McGraw Hills Education (2014)
2. Asitava Ghoshal, Robotics: Fundamental concepts and analysis, Oxford University Press (2006)
3. Dilip Kumar Pratihar, Fundamentals of Robotics, Narosa Publishing House, (2019)

References:
1. Introduction to Robotics: Mechanics and Control" – John J. Craig
2. Modern Robotics: Mechanics, Planning, and Control – Kevin M. Lynch & Frank C. Park
3. Robotics: Control, Sensing, Vision, and Intelligence – K. S. Fu, R. C. Gonzalez, C. S. G. Lee
4. K.C. Jain and L.N.Agarwal, Robotics: Principles and Practice, 1st edition, Khanna Publications, 2009
5. S.R.Deb and S.Deb, Robotics Technology and Flexible Automation 2nd edition, McGraw Hill Publications, 2017
6. Ganesh S. Hegde, A Text Book on Industrial Robotics, 2nd edition, University Science Press, 2015

Course Code	Course Name	L	T	P	Cr
DOEE250133	Computer Hardware Servicing	2	0	4	4

Course Outcomes:

CO1. Understand the architecture of a computer, motherboard types, and processor features.
CO2. Identify and explain motherboard interfaces, memory slots, and external connectors.
CO3. Troubleshoot and configure various input/output devices and display units.
CO4. Handle SMPS, UPS, and CMOS batteries for power management in PCs.
CO5. Perform BIOS configurations, OS installations, and basic software setups using command-line utilities.

Module 1:

Computer Hardware Fundamentals:
Definition of Hardware, Software, Firmware, Motherboard; Basic computer architecture; Schematic diagram of a typical motherboard; Comparison of motherboard form factors (ATX, Micro ATX, Mini-ITX, Nano-ITX, Pico-ITX); CPU, GPU, and multi-core processors; Need for heat sink, cooling fan, thermal paste.

Module 2:

Motherboard Interfaces and Memory:
Sockets, slots, ports, buses, chipsets; PCI/PCIe expansion slots; USB connector types and comparisons; RS-232, VGA, HDMI connectors; SDRAM technologies (DDR1 to DDR5); SSD vs HDD; SATA and IDE connectors.

Module 3:

Input and Output Devices:
Construction and working of membrane and mechanical keyboards, optical mouse; Concepts of webcam and scanner (document, biometric); Printer types and laser printer working; Comparison of display types (LCD, LED, Plasma, TFT, OLED); Basics of projectors.

Module 4:

Power Supply Components:
SMPS: block diagram and operation; ATX power connector; UPS: Online and offline types; CMOS battery: role and importance; Power banks and battery connection concepts.

Module 5:

BIOS and Operating System:
BIOS and its types (Legacy, UEFI); BIOS setup utility and configuration; POST sequence and error codes; Windows OS installation, user management, directory access permissions; Software installation via CMD.

Labs / Practicals:

1. Study of Laptop vs Desktop motherboard architecture
2. Identification and analysis of motherboard form factors (ATX, Micro ATX, Mini ITX, Nano-ITX)
3. Disassembly and reassembly of a motherboard
4. Identification of expansion slots, sockets, memory interfaces
5. Identification of front and rear panel connectors
6. RAM expansion, SATA/IDE drive setup, storage capacity enhancement
7. Troubleshooting input/output devices (keyboard, mouse, scanner, display)

8. Installation of webcam, scanner, and biometric devices
9. Installation and configuration of a laser printer
10. Configuration of a projector using VGA/HDMI
11. SMPS output voltage measurement and cable identification
12. CMOS battery testing and battery bank configuration
13. Troubleshooting faulty SMPS/UPS
14. BIOS setup: system time, boot settings, factory reset
15. Installation of Windows OS and application software via CMD

References:

Textbooks:
1. Albert Alan Clemets, The Principles of Computer Hardware, 4th Edition, Oxford University Press, 2013
2. Ernest Ron Gilster, PC Hardware – A Beginner's Guide, 1st Edition, McGraw-Hill Education, 2005
3.. D. Balasubramanian, Computer Installation and Servicing, 2nd Edition, Tata McGraw-Hill, 2010

References / Online Resources:
1. https://nielit.gov.in/aurangabad/content/computer-hardware-maintenance-0
2. https://archive.nptel.ac.in/courses/106/105/106105214/
3. https://www.buildcomputers.net/motherboard-form-factors.html
4. https://softwarekeep.com/en-in/blogs/how-to/how-to-install-windows-10-81-or-7-using-a-bootable-usb
5. https://www.xfurbish.com/blog/the-complete-guide-to-understanding-laptop-motherboards
6. https://premioinc.com/blogs/blog/motherboard-form-factors

Course Code	Course Name	L	T	P	Cr
DOEE250138	Medical Electronics	3	0	2	4

Course Outcomes:

CO1. Understand human body systems and transducers used in medical instrumentation.
CO2. Identify and explain diagnostic and monitoring equipment used in hospitals.
CO3. Recognize therapeutic devices and their applications.
CO4. Understand and describe modern imaging techniques used in clinical diagnosis.
CO5. Apply knowledge of biotelemetry systems and safety practices in handling medical electronics.

Module 1:

Introduction to Human Physiology & Biomedical Instrumentation:
Bio-potentials and their generation (resting and action potential), Block Diagrams of CNS, cardiovascular, respiratory, and urinary systems, Electrodes: Micro, Skin-Surface, Needle, Biomedical sensors and transducers, Signal conditioning and amplification

Module 2:

Diagnostic & Monitoring Instruments:
ECG (Electrocardiography), EEG (Electroencephalography), EMG (Electromyography), Pulse oximeter (SpO2 monitoring), Blood Pressure monitoring (Sphygmomanometer), Electroretinography (ERG), Audiometry

Module 3:

Therapeutic Instruments:
Electrotherapy devices, Implantable Cardioverter Devices: Pacemakers, ICD, Dialysis machines: Hemodialysis and Peritoneal, Respiratory therapy: Ventilators, Heart-Lung Machine

Module 4:

Modern Imaging Techniques
Ultrasonic imaging: Axial Echo Cardiography, X-ray Imaging, CT, PET, Infrared imaging, MRI technique,Laser Endoscopy

Module 5:

Biotelemetry and Patient Safety
Biotelemetry systems: Block diagram, single and multi-channel telemetry, Chronic disease management, telemedicine, Electrical safety: physiological effects, micro/macro shock, Safety in electrosurgical units: grounding, burns, high-frequency current hazards

Labs / Practicals:

1. Measurement of heart rate using fingertip Pulse Sensor and display on LCD
2. Acquisition and visualization of ECG signal using a basic ECG module and oscilloscope
3. Measurement of body temperature using LM35/DS18B20 and display using microcontroller
4. Demonstration of blood pressure measurement using a digital sphygmomanometer
5. Interfacing of a biomedical sensor (e.g., photoplethysmography - PPG) with Arduino
6. Study and demonstration of ultrasonic imaging using simulation software
7. Demonstration of basic electrical safety measures for biomedical equipment (e.g., checking grounding and insulation resistance)

References:

Textbooks
1. R.S. Khandpur, Handbook of Biomedical Instrumentation, 3rd Edition, McGraw Hill Education, 2014
2. M. Arumugam, Biomedical Instrumentation, Anuradha Publications, 2017
3. Lesile Cromwell, Fred J. Weibell, Erich A. Pfeiffer, Biomedical Instrumentation and Measurement, 2nd Edition, Prentice-Hall of India, 2008

Course Code	Course Name	L	T	P	Cr
DOEE250143	Basics of Wireless Sensor Networks	2	0	4	4

Course Outcomes:

CO1: Explain fundamentals of wireless sensor networks, protocol models, applications, and design challenges.
CO2: Analyze wireless technologies, sensor-node architectures, energy usage, and transceiver design.
CO3: Evaluate MAC and routing protocols for efficient communication in WSNs.
CO4: Examine transport protocols and middleware frameworks for reliable WSN operations.
CO5: Apply synchronization and localization techniques in the design of WSN applications

Module 1:

Fundamentals of Wireless Sensor Networks:
Wireless Networks and Protocol Suites, OSI & TCP/IP Models, Adhoc vs Sensor Networks, Applications, Challenges in WSN design

Module 2:

Wireless Technologies and Sensor Node Architecture:
Bluetooth, IEEE 802.11 series, ZigBee, RFID; Sensor-node hardware, Energy consumption, OS considerations, Physical layer and transceiver design

Module 3:

Protocols in WSNs: MAC and Routing:
MAC fundamentals, Types: Schedule-based & Random access; Sensor-MAC, Zebra-MAC; Routing fundamentals, Flooding, LEACH, PEGASIS, Directed Diffusion, Geographical Routing

Module 4:

Transport Protocols and Middleware:
Transport layer issues in WSNs, TCP/UDP feasibility, CODA, ESRT; Middleware: Principles, Architecture, MiLAN, IrisNet

Module 5:

Time Synchronization and Localization:
Synchronization techniques, Localization methods (proximity, trilateration, triangulation); Integration into WSN design

Labs / Practicals:

1. Identification of different wireless communication technologies (ZigBee, Wi-Fi, Bluetooth, RFID).
2. Familiarization with WSN hardware: sensor nodes, microcontrollers, transceivers.
3. Study and demonstration of ZigBee communication between two nodes.
4. Simulation of basic sensor node network using open-source tools (e.g., Tinkercad, NS2).
5. Basic experiment on wireless range and signal strength using Bluetooth modules.
6. LED control using wireless sensor nodes (basic I/O communication).
7. Study and configuration of a star topology using ZigBee modules (e.g., XBee).
8. Power consumption comparison: active vs. sleep mode of a sensor node.
9. Temperature data collection and wireless transmission using DHT11 sensor and ZigBee.
10. Simple routing demonstration using hop-to-hop data transfer simulation.
11. Introduction to Arduino IDE for programming sensor nodes.
12. Study of MAC layer behavior using basic C/C++ code (e.g., collision demonstration).
13. Demonstration of data logging using sensor node and serial monitor.
14. Use of a mobile app (e.g., Blynk) to visualize WSN data wirelessly.
15. Case Study: Designing a simple WSN application for home automation or weather monitoring.

References:

Textbooks
1. Holger Karl, Andreas Willig, Protocols and Architectures for Wireless Sensor Networks, John Wiley.
2. Kazem Sohraby, Daniel Minoli, Taieb Znati, Wireless Sensor Networks: Technology, Protocols, and Applications, John Wiley.
3. Ananthram Swami et al., Wireless Sensor Networks: Signal Processing and Communications Perspectives, John Wiley.

References / Online Resources
1. Bhaskar Krishnamachari, Networking Wireless Sensors, Cambridge University Press.
2. C. S. Raghavendra, Krishna M. Sivalingam, Taieb Znati, Wireless Sensor Networks, Kluwer Academic.
3. https://nptel.ac.in/courses/106105160