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 Telecommunication Engineering

(2025-26 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

The Diploma in Electronics and Telecommunications at NIELIT Deemed To Be University aims to be a center of excellence in technology, research, and innovation. It strives to develop professionals who contribute to technological advancements and societal progress through quality education and industry-relevant skills.

Mission

The 3-year Diploma in Electronics and Communication aims to provide a strong foundation in electronics, communication systems, and emerging technologies. It emphasizes hands-on learning in areas like Embedded Systems, PCB design, and VLSI etc to ensure industry readiness. Ethical values, leadership, and adaptability to evolving technologies are integral to the curriculum. Strong industry collaborations offer internships, live projects, and career growth opportunities. Graduates are prepared for higher education, employment, and entrepreneurship in the electronics and communication sector.

Program Education Objectives

PEO1: Graduates leverage foundational and advanced concepts in Electronics engineering to excel in diverse professional roles, fostering innovation and critical problem-solving.

PEO2: Graduates demonstrate proficiency in advanced data engineering techniques, algorithms, and tools, addressing industry challenges and contributing to research and development.

PEO3: Graduates exhibit effective communication, teamwork, and ethical values, positioning them as responsible leaders and collaborators in the data engineering domain.

Program Outcomes

PO1: Apply fundamental concepts of mathematics, science, and core electronics and telecommunication engineering principles to solve technical problems.

PO2: Identify, formulate, and analyze engineering challenges in electronics and communication systems using industry-relevant tools and techniques

PO3: Design and develop electronic circuits, communication systems, and embedded solutions considering technical, environmental, and societal factors.

PO4: Utilize modern engineering tools, software, and laboratory equipment to analyze and simulate electronic and telecommunication systems.

PO5: Apply professional knowledge to assess societal, health, safety, and environmental impacts of engineering solutions in the field of electronics and telecommunication.
PO6: Demonstrate ethical behaviour, professional responsibility, and adherence to engineering codes of conduct.

PO7: Effectively communicate technical concepts, project reports, and engineering solutions through verbal, written, and graphical presentations.

PO8: Work effectively as an individual, in multidisciplinary teams, and demonstrate leadership in engineering projects.

Program Specific Outcomes

PSO1. Apply Core Concepts: Apply fundamental knowledge of electronic circuits, communication systems, and digital electronics to solve real-world technical problems.

PSO2. Use Modern Tools: Utilize modern hardware and software tools such as signal generators, spectrum analyzers, microcontrollers, and simulation tools (e.g., MATLAB, Multisim) for analysis, design, and testing of

electronic and communication systems.

PSO3. System Design and Implementation: Design, develop, and maintain basic electronic circuits and communication networks for industrial and consumer applications.

PSO4. Communication and Technical Skills: Demonstrate effective technical communication, teamwork, and project management skills in engineering environments and during field work or internships.

PSO5. Lifelong Learning and Ethics: Exhibit professional ethics, awareness of societal and environmental impacts, and commitment to lifelong learning in electronics and telecommunication technology.

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-DIPETE-101	DASH250006	Applied Mathematics-I	3	1	0	4
PC-DIPETE-102	DASH250005	Applied Science	3	0	2	4
PC-DIPETE-103	DCSE250032	Basic Computer Science and Electronics	2	0	4	4
PE-DIPETE-104	Elective	Program Elective				4
OE-DIPETE-105	Elective	Open Elective				4
AU-DIPETE-106	Elective	Audit Elective				0

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

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

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

Semester 5						
Semester Code	**Course Code**	**Course Title**	**L**	**T**	**P**	**Cr**
PC-DIPETE-501	DOEE250096	Embedded Systems Design	2	1	2	4
PC-DIPETE-502	DOEE250109	Fundamentals of Cellular Technology	3	0	2	4
PC-DIPETE-503	DOEE250145	Basics of IOT and its Applications	2	0	4	4
PC-DIPETE-504	DOEE250155	Optical Fiber Communication	3	1	0	4
PE-DIPETE-505	Elective	Program Elective				4
EE-DIPETE-506	EE	Summer Internship-II				2
EE-DIPETE-507	EE	Major Project -I				2

Semester 6						
Semester Code	**Course Code**	**Course Title**	**L**	**T**	**P**	**Cr**
PC-DIPETE-601	DOEE250148	Microwave and RADAR	3	0	2	4
PC-DIPETE-602	DOEE250203	VLSI with VHDL	3	0	2	4
AU-DIPETE-603	Elective	Audit Elective				0
EE-DIPETE-604	DASH250050	Entrepreneurship and Start-Ups	3	1	0	4
EE-DIPETE-605	EE	Major Project -II				2
EE-DIPETE-606	EE	Technical Seminar				2

Elective Courses

Elective Courses for PE Category						
Course Code	**Course Title**	**L**	**T**	**P**	**Cr**	**For Sem./Code**
DOEE250048	Control System and PLC	3	1	0	4	
DOEE250052	Power Electronics and Electric Vehicles	2	0	4	4	
DOEE250068	Basics of Sensors and Interfaces	2	0	4	4	
DOEE250079	Electronic Equipment Maintenance	3	0	2	4	
DOEE250080	Electronic Measurements and Instrumentation	2	0	4	4	
DOEE250098	Emerging Trends in Electronics	3	1	0	4	
DOEE250118	Industrial Automation	3	0	2	4	
DOEE250126	Introduction to Robotics	2	0	4	4	
DOEE250133	Computer Hardware Servicing	2	0	4	4	
DOEE250138	Medical Electronics	3	0	2	4	
DOEE250139	Memory Technologies	3	1	0	4	
DOEE250151	Nanotechnology	3	1	0	4	
DOEE250158	Solar Power Technologies	2	0	4	4	
DOEE250170	Product Design	3	0	2	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, 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
DOEE250145	Basics of IOT and its Applications	2	0	4	4

Course Outcomes:

CO1: Explain IoT concepts, architecture, building blocks, and communication models.
CO2: Analyze IoT design considerations, connectivity models, and process flows.
CO3: Demonstrate interfacing of sensors, actuators, and controllers in IoT systems.
CO4: Apply Embedded C programming concepts for IoT device development.
CO5: Implement sensor interfacing, communication modules, and cloud connectivity in IoT applications.

Module 1:

Introduction to Internet of Things:
Define the term “Internet of Things” Overview of Internet of Things (IoT), the characteristics of devices and applications in IoT ecosystem, building blocks of IoT, Various technologies making up IoT ecosystem, IoT levels, IoT design methodology, The Physical Design/Logical Design of IoT, Functional blocks of IoT and Communication Models.

Module 2:

Design consideration of IoT:
Working of Controlled Systems, Real-time systems with feedback loop e.g. thermostat in refrigrator, AC, etc. Connectivity models – TCPIP versus OSI model, different type of modes using wired and wireless methodology, the process flow of an IoT application.

Module 3:

Interfacing IoT devices:
Sensor - Measuring physical quantities in digital world e.g. light sensor, moisture sensor, temperature sensor, etc., Actuator – moving or controlling system e.g. DC motor, different type of actuators, Controller – Role of microcontroller as gateway to interfacing sensors and actuators, microcontroller vs microprocessor, different type of microcontrollers in embedded ecosystem.

Module 4:

Programming:
Embedded C Language basics - Variables and Identifiers, Built-in Data Types, Arithmetic operators and Expressions, Constants and Literals, assignment. Conditional Statements and Loops - Decision making using Relational Operators, Logical Connectives - conditions, if-else statement, Loops: while loop, do while, for loop, Nested loops, Infinite loops, Switch statement. Arrays – Declaring and manipulating single dimension arrays
Functions - Standard Library of C functions in Arduino IDE, Prototype of a function: Formal parameter list, Return Type, Function call.

Module 5:

Interfacing sensors:
The working of digital versus analog pins in Arduino platform, interfacing LED, Button, Sensors-DHT, LDR, MQ135. Display the data on Liquid Crystal Display (LCD), interfacing keypad, Serial communication – interfacing HC-05(Bluetooth module), Control/handle 220v AC supply – interfacing relay module. Think Speak Cloud.

Labs / Practicals:

1. Understanding Arduino UNO Board and Components

2. Installing and work with Arduino IDE
3. Blinking LED sketch with Arduino
4. Simulation of 4-Way Traffic Light with Arduino
5. Using Pulse Width Modulation
6. LED Fade Sketch and Button Sketch
7. Analog Input Sketch (Bar Graph with LEDs and Potentio-metre)
8. Digital Read Serial Sketch (Working with DHT/IR/Gas or Any other Sensor)
9. Working with Adafruit Libraries in Arduino
10. Interfacing with LCD module
11. Working with Shields
12. Interfacing Arduino with Cloud (Thingspeak API)

References:

1. Internet of Things, Raj Kamal, McGraw Hill Education; First edition (10 March 2017) ISBN 978-9352605224
2. Internet of Things: A Hands-On Approach, Arsheep Bahge and Vijay Madisetti, Orient Black Swan Private Limited - New Delhi; First edition (2015) ISBN : 978-8173719547
3. O level IOT and its Application bpb Publication
4. William Stallings, " Foundations of Modern Networking: SDN, NFV, QoE, IoT, and Cloud" Publisher: Addison-Wesley 2015

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
DOEE250148	Microwave and RADAR	3	0	2	4

Course Outcomes:

CO1: Explain the fundamentals of microwaves, transmission modes, frequency bands, and biological effects.
CO2: Analyze waveguides and transmission lines with cutoff frequencies, SWR, and impedance concepts.
CO3: Describe passive and active microwave devices and their applications.
CO4: Apply microwave measurement techniques using power meters, network analyzers, and spectrum analyzers.
CO5: Demonstrate the principles and operation of RADAR systems with related performance parameters.

Module 1:

Introduction to Microwaves: History and applications of microwave, Microwave transmission modes, Frequency bands, Impedance matching, Effect of microwaves on human body

Module 2:

Waveguide and Transmission line: Parallel plane and rectangular waveguides, cut off mode, cut off frequency, simple numericals
Transmission line equations and solutions, reflection and transmission coefficients, standing
wave ratio, simple numerical, Introduction to micro strip line

Module 3:

Passive and Active Microwave Devices: Directional Coupler, Power Divider, Attenuator, Resonator, Bends, Twists, Circulator, Isolator,
Gun diode, PIN diode, IMPATT diode,multi cavity klystron, reflex klystron, TWT

Module 4:

Microwave Measurements: Measurement of power, frequency and impedance at microwave range, network analyzer for
measurement of scattering parameters, spectrum analyzer for measurement of spectrum

Module 5:

Introduction to RADAR: Introduction, radar frequencies, operation, equation, CW radar, MTI radar, doppler effect, blind
speed, noise figure, noise temperature, displays, simple numericals

Labs / Practicals:

1. To identify and study different microwave frequency bands and observe transmission modes in a rectangular waveguide.
2. To study the concept of impedance matching in microwave transmission and observe its effect using VSWR measurement.
3. To determine the cut-off frequency and identify the dominant mode in a rectangular waveguide.
4. To determine the reflection coefficient and VSWR using a slotted line and to verify with a mismatched load.
5. To study the construction, working, and characteristics of passive microwave devices like directional coupler, circulator, isolator, and attenuator.
6. To study the characteristics of a Gunn diode and reflex klystron and observe the frequency and power variations.
7. To measure microwave power, frequency, and impedance using standard microwave bench setup.
8. To observe the frequency spectrum of a microwave signal using a Spectrum Analyzer.
9. To measure S-parameters (S11, S21) of a microwave device using a Vector Network Analyzer (VNA).
10. To understand the working of a CW radar system and observe the Doppler shift for moving targets.

11. To study the working of a Pulse Radar system and display types (A-scope), and to measure the range of a target.

References:

1. Microwave Engineering, D.M. Pozar Wiley (2013)
2. Foundation for Microwave Engineering, R.E. Collins Wiley (2007)
3. Radar Principals, Technology,
Applications, Byron Edde Pearson Education (2004)
4. Introduction to Radar Systems Merrill I.Skolnik, Tata McGraw-Hill (2001)

Course Code	Course Name	L	T	P	Cr
DOEE250203	VLSI with VHDL	3	0	2	4

Course Outcomes:

CO1: Explain VLSI design flow, design styles, MOS structure, and MOSFET characteristics.
CO2: Analyze the operation of MOS and CMOS inverters under different load conditions.
CO3: Design and implement combinational and sequential MOS logic circuits.
CO4: Apply VHDL for structural, behavioral, and dataflow modeling of digital systems.
CO5: Develop VHDL codes for combinational and sequential circuits like adders, multiplexers, and counters.

Module 1:

Digital System and MOS Transistor: VLSI design flow, Y chart, Practical design flow, Design Hierarchy Structural Decomposition in
the physical (geometrical) domain, FPGA, Gate Array Design, Standard Cell Based Design, Full
Custom Design, MOS structure, MOS system under external bias , Structure and operation of
MOSFET transistor, MOSFET current-voltage Characteristics.

Module 2:

MOS Inverters: MOS Inverter : Concept and working, Resistive load Inverter, Inverter with n-type MOSFET Load, Enhancement load NMOS, Depletion Load NMOS, Enhancement load and Depletion Load NMOS, CMOS Inverter: Circuit operation and description, Cascaded CMOS Inverter stage

Module 3:

MOS Circuits: Combinational MOS Logic Circuits, CMOS logic circuits, Complex logic circuit, Sequential
MOS circuit, VLSI Technology Environment & Processes in brief.

Module 4:

Introduction to VHDL: Data flow, behavioural, structural, Logic operations viz.AND,OR,NOR,NAND,NOT,EXOR ,EXNOR etc., Adder and Subtractor.

Module 5:

VHDL Programming: Multiplexer and Demultiplexer, Decoder and Encoder,4 bit Parallel Adder, Parity Generator and paritychecker, Basic sequential circuits- SR D Latch, RS, T, JK Flip flop, Parallel input Parallel output
, Shift Register, Up Counter, Down Counter

Labs / Practicals:

1. To design and simulate a digital system using structural decomposition in FPGA, and understand the VLSI design flow with standard cell and gate array perspectives.
2. To study the structure and operation of a MOSFET and plot its I-V characteristics under different gate voltages.
3. To construct and analyze the operation of different NMOS inverter configurations:Resistive Load Inverter, Enhancement-mode NMOS Load Inverter, Depletion-mode NMOS Load Inverter.
4. To construct and analyze a CMOS inverter circuit and observe the behavior of a cascaded CMOS inverter chain.
5. To design and simulate basic CMOS combinational logic gates (NAND and XOR) and understand the working of CMOS logic circuits.
6. To construct a basic sequential circuit (SR latch or D flip-flop) using CMOS gates and to understand the brief process steps in VLSI technology.
7. To write and simulate VHDL code for basic logic gates (AND, OR, NOT, NAND, NOR, XOR, XNOR) using Dataflow modeling, Behavioral modeling, Structural modeling.
8. To design, write VHDL code, and simulate 4-bit Adder using Dataflow modeling.
9. To implement and simulate the following sequential circuits using VHDL:D and JK Flip-Flop, 4-bit SISO Shift

Register, 4-bit Up/Down Counter.
10. To write, simulate, and verify VHDL programs for the following combinational logic circuits: 4:1 Multiplexer, 2:4 Decoder.

References:

1. Basic VLSI Design : Systems and Circuits, Doublas A. Puckness & Kamran Eshraghian, Prentice Hall of India Private Ltd., New Delhi, 1989.
2. Introduction to VLSI System, C. Mead & L. Canway, Addison Wesley Pub Co. 1990.
3. Introduction to NMOS & VLSI System Design, A. Mukharjee, Prentice Hall, 1986.
4. VLSI Design Techniques for analog and digital circuits, R.L. Geiger, P.E. Allen & N.R.Streder, McGraw Hill Int. 1990.
5. VHDL: Programming by Example, Douglas L. Perry
6. Digital Design with RTL Design, VHDL, and Verilog, Frank Vahid

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
DOEE250048	Control System and PLC	3	1	0	4

Course Outcomes:

CO1: Explain the fundamentals of control systems, transfer functions, and block diagram reduction techniques.
CO2: Analyze time-domain responses, steady-state errors, and system stability using standard test inputs and Routh's criterion.
CO3: Evaluate process controllers and their control actions including P, I, D, PI, PD, and PID controllers.
CO4: Demonstrate the fundamentals of PLC architecture, hardware components, and their role in industrial automation.
CO5: Develop and implement ladder logic programs using PLC instruction sets for automation applications.

Module 1:

Basics of control System: Control system: Basics of control system block diagram and practical examples , Classification of control systems: Open loop and closed loop systems- block diagram, practical
example and comparison, Linear and non -linear systems, Time varying and Time In-varying systems-practical example and comparison servo system, Transfer function: Close loop and openloop system RC. LC and RLC circuits-Differential equations and transfer functions and
analysis using Laplace transform, Block diagram reduction technique: Need, reduction rules.

Module 2:

Time domain stability analysis: Time Response: Transient and steady state response, Standard test inputs: Step, ramp,
parabolic, impulse and their corresponding Laplace transform, Analysis of first and second
order control system:
(i) Poles and zeros - S-plane represent Order of system (0, 1, 2)- standard equation examples and numerical problem.
(ii) First order system-Analysis for the unit step input, concept of time constant.
(iii) Second order system- Analysis for unit step input (no
derivation), concept, definition and effect of damping.
(iv) Time response specifications (no derivations)-Tp, Ts, Tr, Td, Mp, Ess, numerical problems.
Steady state analysis: Type 0, 1, 2
systems- Steady state error and error constants numerical problems, Stability: Concept of stability, root locations in S-plane and analysis- stable system, unstable system, critically stable systems,conditionally stable system, relative stability, Routh's stability criterion: Steps and
procedures to find stability by Routh's stability criteria.

Module 3:

Process controllers:Process Control System: Block diagram, functions of each block,Control actions:
(i)Discontinuous mode- ON-OFF controllers- equation, neutral zone (ii) Continuous modes:Proportlonal Controller - offset, proportional band.Proportional, Integral and Derivative controllers -o/p equation, response ,characteristics. Composite controllers: PI,PD,PID
controllerso/p equation, response.

Module 4:

Fundamentals of PLC: PLC-Block diagram, classification, (fixed and modular PLCs), need and benefits of PLC in automation, Description of different parts of PLC: CPU function, scanning cycle, speed of
execution,Power supply- block diagram and function of each block Memory — function and organization of ROM and RAM .Input and output modules- function, different input and output devices of PLC (only name and their uses), PLC Installation.

Module 5:

PLC hardware and programming: Discrete input modules: Block diagram, specifications of AC input modules and

DC input module. Sinking and sourcing concept in DC input modules, Discrete output modules: Block diagram description, specifications of AC module and DC output modules, Analog input and
output module: Block diagram,specifications, I/O addressing of PLC: Addressing data files, format of logical address, different addressing types,PLC Instruction set: Relay instructions,
tinier and counter instructions, data movement instructions, logical and comparison instructions, PLC Programs using Ladder programming language.

Labs / Practicals:

NA

References:

1. Control Systems Engineering, Nagrath and Gopal
2. Control Systems, A. Anand Kumar
3. Automatic Control Systems, B.C. Kuo
4. Programmable Logic Controllers, Frank D. Petruzella
5. Introduction to PLCs, Gary Dunning

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
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
DOEE250079	Electronic Equipment Maintenance	3	0	2	4

Course Outcomes:

CO1: Apply fundamental troubleshooting procedures to diagnose and repair electronic equipment.
CO2: Test and service passive components like resistors, capacitors, and inductors accurately.
CO3: Diagnose and analyze faults in semiconductor devices including diodes, BJTs, FETs, and op-amps.
CO4: Troubleshoot digital ICs and logic circuits using appropriate testing tools and techniques.
CO5: Perform repair and rework of Surface Mount Technology (SMT) assemblies effectively.

Module 1:

Fundamental Troubleshooting Procedures Inside An Electronic Equipment: Reading Drawings And Diagrams – Block Diagram, Circuit Diagram, Wiring Diagram; Dis-assembly and re-assembly of equipment, Equipment Failures and causes such as poor design, production deficiencies, careless storage and transport, inappropriate operating conditions, Nature of faults, Fault location procedure,Fault finding aids – Service and maintenance manuals and instruction manuals, Test and Measuring instruments, special tools Troubleshooting techniques, Approaching components for tests, Ground-ing systems in Electronic Equipment, Temperature sensitive Intermittent problems Corrective actions, Situations where repairs should not be attempted.

Module 2:

Passive Components and Their Testing: Passive Components- Resistors, Capacitors, Inductors Failures in fixed resistors, testing of resistors, variable resistors, variable resistors as potentiometers, failures in potentiometers, testing of potentiometers, servicing potentiometers, LDRs and Thermistors Types of capacitors and their performance, Failures in capacitors, testing of capacitors and precautions therein, variable capacitor types, Testing of inductors and inductance measurement.

Module 3:

Testing of Semiconductor Devices: Types of semiconductor devices, Causes of failure in Semiconductor Devices, Types of failure Test procedures for Diodes, special types of Diodes, Bipolar Junction Transistors, Field Effect Transistors, Thyristors Operational Amplifiers, Fault Diagnosis in op-amp. Circuits.

Module 4:

Logic IC families, Packages in Digital ICs, IC identification, IC pin-outs, Handling ICs, Digital troubleshooting methods – typical faults, testing digital ICs with pulse generators Logic clip, Logic Probe, Logic Pulser, Logic Current Tracer, Logic Comparator Special consideration for fault diagnosis in digital circuits Handling precautions for ICs sensitive to static electricity Testing flip-flops, counters, registers, multiplexers and de-multiplexers, encoders and decoders; Tri-state logic.

Module 5:

Rework and Repair of Surface Mount Assemblies,Surface Mount Technology and surface mount devices, Surface Mount Semiconductor packages – SOIC, SOT, LCCC, LGA, BGA, COB, Flatpacks and Quad Packs, Cylindrical Diode Packages, Packaging of Passive Components as SMDs Repairing Surface Mount PCBs, Rework Stations.

Labs / Practicals:

1. To identify internal components of a basic electronic device (like a power supply, audio amplifier, or DVD player), interpret its diagrams (block, wiring, circuit), and perform safe disassembly and reassembly.
2. o simulate common faults in an electronic circuit (e.g., a power supply or amplifier) and troubleshoot using instruments and documentation (manuals, test points).

3. To identify various types of resistors, potentiometers, LDRs, and thermistors, and perform testing using a digital multimeter and continuity tester.
4. To identify various types of capacitors and inductors, test their values and conditions, and observe common failures.
5. To test and analyze basic op-amp circuits (inverting, non-inverting, comparator) and diagnose common faults like open inputs, shorted outputs, and supply issues.
6. To identify, test, and verify the working condition of semiconductor devices like: PN junction diodes, Zener diodes, LEDs, Bipolar Junction Transistors (BJT – NPN/PNP), Field Effect Transistors (FET-JFET/MOSFET)
7. To identify and test common digital ICs (gates, flip-flops, counters) using datasheets, pin diagrams, logic probe, and pulser, and observe the effect of static precautions during IC handling.
8. To troubleshoot faulty digital circuits such as 4-bit counter and multiplexer using logic clip, current tracer, and logic comparator, and identify common digital IC faults.
9. To solder, desolder, and replace surface mount components on a PCB using a hot air rework station and soldering tools, ensuring no damage to board or components.
10. To identify various surface mount components and semiconductor packages such as SOIC, SOT, BGA, LCCC, LGA, COB, Flatpacks, QFP, and passive SMDs, and understand their handling precautions.

References:

1.Modern Electronic Equipment: Troubleshooting, Repair and Maintenance, Khandpur, TMH 2006.
2. Electronic Instruments and Systems: Principles, Maintenance and Troubleshooting, R. G. Gupta, Tata McGraw Hill Edition 2001.
3. Student Reference Manual for Electronic Instrumentation Laboratories, David L Terrell, ButterworthHeinemann.
4. Electronic Testing and Fault Diagnosis, G. C. Loveday, A. H, Wheeler Publishing.

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
DOEE250098	Emerging Trends in Electronics	3	1	0	4

Course Outcomes:

CO1:Explain the architecture and working of IoT systems including sensors, microcontrollers, and communication protocols, and demonstrate basic embedded applications.
CO2:Understand and apply basic concepts of Artificial Intelligence and Machine Learning in electronics, particularly in automation, smart systems, and robotics.
CO3:Analyze the principles of VLSI and nanoelectronics technologies, and describe the evolution of integrated circuits, SoC, and the role of nanomaterials in future electronics.
CO4:Identify and evaluate modern wireless communication technologies like 5G, LPWAN, BLE, and their applications in IoT, smart cities, and industrial automation.
CO5:Demonstrate awareness of smart and sustainable electronic design, including power-efficient circuits, renewable integration, EMI/EMC standards, and 3D printing applications in prototyping.

Module 1:

Internet of Things (IoT) and Embedded Systems: IoT Fundamentals, Sensors and Actuators, Actuator types: relays, motors, servo motors,Sensor interfacing basics, Communication Technologies in IoT, Embedded Systems for IoT,Overview of microcontrollers (Arduino, ESP32, STM32, Raspberry Pi),GPIO programming, timers, ADC, Applications.

Module 2:

Artificial Intelligence (AI), Machine Learning (ML), and Robotics: Basics of AI and ML, AI in Electronics- Predictive maintenance of electronics, Smart automation using AI, Robotics and Control: Introduction to autonomous systems, Role of sensors, actuators, and controllers in robotics, Line follower robot – concept and implementation, Applications

Module 3:

VLSI, Nanoelectronics and System-on-Chip (SoC): Introduction to VLSI- Moore’s Law and evolution of integrated circuits, ASIC vs FPGA vs SoC, VLSI design flow overview
CMOS and Advanced Devices- CMOS technology basics, Short channel effects, FinFET, GAAFET, and other modern devices
Nanoelectronics- Introduction to nanomaterials: Graphene, CNTs, Advantages of nano-scale electronics, MEMS/NEMS (Micro/Nano Electro Mechanical Systems)

Module 4:

Advanced Wireless Communication Technologies: 5G and Beyond- Key features: enhanced data rate, low latency, massive MIMO, 5G architecture and core components, Applications in connected devices and autonomous vehicles
Wireless Sensor Networks (WSNs)-Network topologies, Power-efficient communication, Environmental and industrial monitoring
Emerging Wireless Technologies-LPWAN (LoRa, Sigfox, NB-IoT),RFID, NFC, BLE, Satellite-based communication systems

Module 5:

Smart and Sustainable Electronics: Power Management & Renewable Integration- Solar cells, charge controllers, MPPT basics, Energy harvesting circuits, Smart grid electronics
Electric Vehicles (EVs) and Battery Tech- Types of batteries: Li-Ion, Li-Po, Solid-state, EV charging systems and protocols, Battery Management Systems (BMS)
Environmental Compliance- E-Waste management, RoHS and WEEE directives, Low-power design techniques

Labs / Practicals:

NA

References:

1. Internet of Things: A Hands-on Approach by Arshdeep Bahga & Vijay Madisetti
2. Artificial Intelligence: A Guide for Thinking Humans by Melanie Mitchell
3. CMOS VLSI Design: A Circuits and Systems Perspective, Neil H.E. Weste & David Harris
4. Wireless Communications: Principles and Practice By Theodore S. Rappaport
5. Power Electronics: Circuits, Devices and Applications By Muhammad H. Rashid

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
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
DOEE250139	Memory Technologies	3	1	0	4

Course Outcomes:

CO1: Explain the fundamentals of memory systems, hierarchy, performance parameters, and memory addressing.
CO2: Analyze semiconductor memories including SRAM, DRAM architectures, and their applications.
CO3: Describe flash and advanced non-volatile memories such as EEPROM, FRAM, MRAM, and experimental devices.
CO4: Demonstrate memory interfacing, address decoding, timing, and memory expansion techniques.
CO5: Apply memory testing, fault diagnosis methods, error protection, and evaluate real-world applications.

Module 1:

Introduction to Memory Systems: Basic concepts of memory, Types of memory: Primary, Secondary, Tertiary,Memory hierarchy and its need, Classification: Volatile vs Non-Volatile memory, Memory performance parameters: access time, latency, bandwidth, Concept of memory addressing and memory maps

Module 2:

Semiconductor Memories: Static Random-Access Memories (SRAMs), SRAM
Cell Structures Bipolar SRAM, Advanced SRAM Architectures, Application Specific
SRAMs, DRAMs, MOS DRAM Cell, Bi-CMOS DRAM, Advanced DRAM Design and Architecture, Application Specific DRAMs, SRAM

Module 3:

Flash and Advanced Non-Volatile Memories: Masked ROMs, PROMs, Bipolar & CMOS PROM, EEPROMs, Floating Gate EPROM Cell, OTP EPROM, EEPROMs, Non-volatile SRAM, Flash
Memories,Ferroelectric Random-Access Memories (FRAMs), Analog Memories, Magneto Resistive Random-Access Memories (MRAMs), Experimental Memory Devices

Module 4:

Memory Interfacing and Organization: Interfacing memory with microcontrollers/microprocessors, Address decoding (absolute and partial), Memory read/write timing, Memory expansion techniques (width and depth), Bus architecture and role in memory access

Module 5:

Memory Testing, Fault Diagnosis, and Applications: Memory testing techniques: March tests, Checkerboard, Walking 1s & 0s, Fault models in memory: stuck-at, open, short, Use of memory testers and logic analyzers, Handling memory faults and protection techniques (parity, ECC), Industrial and embedded applications of memory technologies.

Labs / Practicals:

NA

References:

1. Digital Systems: Principles and Applications, Ronald J. Tocci, Neal S. Widmer.
2. Memory Systems: Cache, DRAM, Disk; Bruce Jacob, Spencer Ng, David Wang
3. Ashok K Sharma, “Advanced Semiconductor Memories: Architectures, Designs and Applications”, Wiley Interscience
4. Kiyoo Itoh, “VLSI memory chip design”, Springer International Ed.

5. Microprocessor Architecture, Programming and Applications with the 8085; Ramesh S. Gaonkar
6. Digital Electronics: Principles, Devices and Applications, Anil K. Maini

Course Code	Course Name	L	T	P	Cr
DOEE250151	Nanotechnology	3	1	0	4

Course Outcomes:

CO1: Explain the fundamentals, history, and nanoscale effects in nanoscience and nanotechnology.
CO2: Analyze the electrical, optical, thermal, and magnetic properties of materials at micro/nano level.
CO3: Classify nanostructures based on dimensions and explain quantum effects and synthesis approaches.
CO4: Apply various material characterization techniques (XRD, SEM, TEM, AFM, etc.) for nanomaterials.
CO5: Demonstrate applications of nanotechnology in energy storage, sensors, and biomedical systems.

Module 1:

Introduction to Nanoscience and Nanotechnology
History, Background and Interdisciplinary Nature of Nanoscience and Nanotechnology, Challenges of Rechard Feynman, Scientific Revolutions, Nanosized Effects Surface to Volume Ratio, Examples of Surface to Volume Ratio, Atomic Structure, Bohr Atomic Model, Molecules and Phases, Introduction to Classical Physics and Quantum Mechanics, Importance of Nanoscale Materials and Their Devices.

Module 2:

Basics of Material Science
Fundamentals of materials science, Introduction to microstructure and nanostructure; importance and examples for nanomaterials, biomaterials, electronic, optical and magnetic materials, composite materials, metals and alloys. Electrical Properties of Materials: Measurement of electrical resistivity, conductors, semiconductors and insulators. energy band structures in solids, band and atomic bonding models (metals, semiconductors, and insulators), drift velocity and electron mobility, factors influencing electrical resistivity of metals, intrinsic semiconduction, extrinsic semiconduction (n-type and p-type), Hall effect, rectifier and p-n rectifying junction (forward, and reverse bias), Optical Properties of Materials: Photoconducting materials: photoconductive device, and applications; Photodetectors: characteristics, charged coupled device, Thermal And Magnetic Properties

Module 3:

Classification of Nanostructures
Zero dimensional, one-dimensional and two-dimensional nanostructure materials - classification of solids: conductor, semiconductors, insulator, types of semiconductors, doping, diodes, current flow in semiconductors, ceramics and nanocomposites, quantum size effect (QSE) in 1D, 2D, 3D nanomaterials, quantum dots, nanowires, nanotubes, nanosheets, top down and bottom-up approach.

Module 4:

Characterization Techniques
X-ray diffraction, X-ray photoelectron spectroscopy, Energy dispersive X-ray analysis, electron diffraction. Scanning Electron Microscopy (SEM): Principle, Components, Advantages, Disadvantages and Applications, Transmission Electron Microscopy (TEM): Principle, Components and Applications, Atomic Force Microscopy (AFM): Principle, Components and Applications

Module 5:

Applications of Nanotechnology
Photovoltaics, Batteries, and Fuel cells: Nanobatteries: Introduction, advantages, nanotechnology applications under development, Fundamentals of Nanosensor Devices: Micro and nano-sensors, biosensor. Thermal energy sensors: temperature sensors, heat sensors, electromagnetic sensors, electrical resistance sensors, electrical current sensors, electrical voltage sensors, electrical power sensors, magnetic sensors, Mechanical sensors, pressure sensors, gas and liquid flow sensors, position

Labs / Practicals:

Need dto be added...

References:

1. Nanotechnology, Importance & Applications, M.H. Fulekar, I.K. International Publishing House, New Delhi, 2011
2. Applications of Nanotechnology, Prasad Puthiyillam, LAP Lambert Academic Publishing, Mauritius, 2018, ISBN: 978-613-9-58532-8
3. Material Science & Engineering – An Introduction by William D. Callister Jr.
4. Grain growth and control of microstructure and lecture in polycrystalline materials by V. Lu. Novikov & Vladimi Novikov
5. Introduction to Nanotechnology by Charles P. Poole, Jr., Frank J. Owens
3. Nanotechnology, Fundamentals and Applications, Manasi Karkare, I.K. International Publishing, New Delhi, 2008, ISBN: 978-81-89866-99-0

Course Code	Course Name	L	T	P	Cr
DOEE250158	Solar Power Technologies	2	0	4	4

Course Outcomes:

CO1. State the different types of Solar Cells, Modulesand Solar Radiation, Explain the Need, importance and scopeof Solar Energy resources.
CO2. Describe the working Systemcomponents and their functions. Calculating output and dimensioning ofsolar cell systems. Explain Examples of CSP-systems globally.
CO3. Describe the working of Solar Thermal Power Plantsusing single line diagram and state the functions of themajor equipment and auxiliaries of each plant.
CO4. Describe the working of Prepare economic analysisfor Commercial/ Industrial/ Residential PV Hybrid energy conservation systems.

Module 1:

Solar Radiation, Solar Cells and Modules:
Properties of sunlight. Absorption by the atmosphere. Calculation of solar irradiance at surfaces. The function of solar cells fromsemiconductor physics. Different solar cell technologies and fabricationmethods. Concepts for increasing efficiencybasedon loss analysis. Wavelength sensitivity. Series connectionof solar cells to modules.Module function and characteristics. Shadingof cells and modules.

Module 2:

Solar Cell Systems
Systemcomponentsandtheir functions.Calculatingoutput and dimensioning of solar cell systems. Analysis and computer simulation of a solar cell system.Concentrated sunlight and solar power (CSP). Properties of optical concentrationsystems. Solarcells inconcentratedsunlight. Overviewof thedifferentcomponentsinaCSPsystemand their functions. Examples of CSP-systems globally.

Module 3:

Solar thermal
Thermodynamic description of solar collectors. Optical properties of solar collectors and technologies for fabrication.Solar thermal systems fordifferentapplications in Sweden and abroad. Storage of solar generated heat.

Module 4:

Hybrid systems
Combinations of solar thermal and solar cell systems. Overview of different applications. District heatingwith solar thermal components.

Module 5:

Active solar energy in systems:
How large-scale deployment of active solar energy is possibleinSwedenandglobally.Buyingandsellingheatand electric energy. Grid aspects of large-scaledeployment of solar cells as well as environmental and socioeconomic aspects.

Labs / Practicals:

1. Familiarization with different solar energy gadgets.
2. To study solar photovoltaic system
3. To study about solar lighting, solar pumping, solarfencing, solar cooker
4. To study solar drying system
5. To study solar distillation
6. To study solar pond
7. Solar insolation measurement using Opticalpyranometer

8. Solar cell/module/Array modelling, I-V char and performanceanalysis
9. Case studies of Commercial/ Industrial/ Residential PV energy conservation systems and their economic analysis
10. Experiment on VI-Characteristics and Efficiency of 1kWpSolar PV System.
11. Experiment on Shadowing effect and diode-based solution in1kWpSolar PV System.
12. Experiment on Performance assessment of Grid connected and Standalone 1kWp Solar Power System.

References:

1. A Text book of Power System Engineering, A Chakrabarti, M. L Soni, P. V. Gupta, U. S. Bhatnagar, Dhanpat Rai Publication
2. Renewable Energy Technologies, Solanki, Chetan S. , PHI Learning, New Delhi, 2011
3. Renewable Energy Sources for Sustainable Development, N.S. Rathore and N. L. Panwar, New India Publishing Agency, New Delhi
4. Renewable Energy Resources, J. Twidell and T. Weir, E & F N Spon Ltd, London, 1999
5. Electric Power Generation: Transmission and Distribution, S. N. Singh, PHI Learning, New
6. Electrical Power, Dr. S.L. Uppal
7. Electrical Power System, Mehta, V.K. S. Chand and Company Bew Delhi, 2011.

Course Code	Course Name	L	T	P	Cr
DOEE250170	Product Design	3	0	2	4

Course Outcomes:

CO1: Analyze and design analog & digital circuits using passive/active components, op-amps, ADC/DAC, and logic families.
CO2: Evaluate characteristics of test & measurement instruments, sensors, and display devices for electronic system applications.
CO3: Design regulated power supply and power management circuits using linear, switching regulators, batteries, and solar cells.
CO4: Develop microcontroller-based embedded systems using ARM Cortex architecture, peripheral interfacing, and communication protocols.
CO5: Apply PCB design tools, fabrication, assembly methods, EMI/EMC practices, and additive manufacturing techniques for electronic product development.

Module 1:

Analog & Digital Circuit Design: Introduction to Analog Circuits: Overview of Passive components (Resistance, Capacitance & Inductance), High frequency response, coding and selection of passive components.Overview of active components, Diodes, types and selection of diodes, LEDs, Zener Diodes, Power diodes, BJTs, MOSFETs, IGBTs and their applications as switch and amplifier.
Operational Amplifiers: Basics of OP amp and their characteristics, Op Amp applications, Summing amplifiers, Instrumentation amplifiers, Comparators, Voltage to current convertors, sample and hold circuits, Frequency response of amplifiers, feedback theory.
ADCs and DACs: Introduction to ADC and DAC, ADC parameters, SAR type ADC,Flash ADC, Dual slope ADC, DAC parameters, weighted and R-2R ladder ADC.
Designing of ADC and DAC with ADC0809 and DAC 0800.
Digital Concepts : Introduction to Logic families, Digital Voltage standards, Types, Logic signal Voltage Levels, Noise Margin, Switching Voltage Level standards, Level translators, Drivers, Transceivers , Interfacing between different logic families, Fan In, Fan out.CMOS Logic Design ,Combinational Circuit Design, Sequential Circuit Design, Memories, Design of controller and Data path units, State Machines, Design Examples & Case Studies.

Module 2:

Test & Measurement Equipment,Sensors and Display Devices: Functional elements of an instrument; Static characteristics; Meaning of static calibration, accuracy, precision, bias, sensitivity, linearity, threshold, resolution, hysteresis and dead space.
Introduction to multimeter, Difference between Analog and Digital multimeter, logging multimeter, DSO, characteristics of DSO, Passive, Active & High voltage probes, MSO,Power Harmonic analyser.
Types of sensors, pressure, temperature, touch sensors.
LCD displays, TFT displays.

Module 3:

Power supply and power management circuits: Introduction to Power supply, characteristics of power supply, Transformer based power supply, half wave and full wave, Design of power supply.
Regulators, characteristics, Line and Load regulation, linear regulators, LDO, Switching regulators, buck, boost, fly back regulators, Point of load (POL) concept.
Introduction to batteries, Li Ion Battery, Battery charging,charging profile, Introduction to solar cell, portable solar powered products, Low power design techniques, Power management circuits.
Trouble shooting

Module 4:

Microcontroller based system design: Introduction to ARM cortex Processor architecture, Interrupt mechanisms and Exception handling, Programming using Embedded C, Cross compilation, Tool chains and Development environments.
Peripheral Interfacing: Switches, LCD, Keyboard, GPIO programming, etc. through processor ports, Generating delays and PWM using timers, Watchdog, UART, I2C,SPI,etc. Interacting with real world using ADC and DAC.

Module 5:

PCB Design tools and Product Manufacturing: Semiconductor Packages: Single chip packages or modules. (SCM) Commonly used
packages and advanced packages; Materials in packages, Current trends in Packaging, Multichip modules (MCM) - types; System-in package (SIP); Packaging roadmaps;
Hybrid circuits.
Printed Circuit Boards:Evolution and Classification of Printed Circuit Boards, Modern
PCBDesign and Manufacturing, PCB fabricationmethodologies(SSB, DSB and
multilayer board), PCB design considerations/ design rules for analog, digital and power
applications, PCB Design standards.
PCB Assembling and soldering methods, board tracing and trouble shooting, board bring
up.
EMI / EMC: Electromagnetic interference and its compatibility in electronic
systems. Conducted and radiated emissions, cross talk and reflection behavior of the circuit in time domain.
Thermal management of electronic devices and systems, IP rating of Electronic products.
3D Printing: Introduction to Additive Manufacturing, Process Chart of AM, Classification of AM, Materials used in AM, Application of AM.

Labs / Practicals:

1. To design, construct, and test a three-input summing amplifier using an operational amplifier (Op-Amp) and verify output voltage for given input values.
2. To interface ADC0809 with a microcontroller (e.g., 8051 or Arduino) and convert an analog input voltage into a digital value.
3. To measure voltage, current, and resistance using both analog and digital multimeters, and to understand static characteristics such as accuracy, precision, resolution, and sensitivity.
4. To interface LM35 analog temperature sensor with a microcontroller (or Arduino) and display the temperature reading on a 16x2 LCD.
5. To design, construct, and test a transformer-based full-wave power supply using a bridge rectifier, capacitor filter, and a 7805 linear voltage regulator, and measure line/load regulation.
6. To test a Li-Ion battery charging circuit using a TP4056 charging module and monitor the charging profile using a digital multimeter under different charging states.
7. To interface a 16x2 alphanumeric LCD with an ARM Cortex-M based microcontroller and display a custom message using Embedded C.
8. To interface an LM35 analog temperature sensor with ARM Cortex-M microcontroller, read data using ADC, and display it via UART on a serial monitor.
9. To design and simulate a single-sided PCB layout for a simple DC power supply (e.g., using 7805 regulator) using PCB design software such as KiCad / EasyEDA / Proteus.
10. To assemble a simple PCB circuit (e.g., LED flasher), perform hand soldering, and use multimeter and continuity tester to diagnose open/short faults.

References:

1. Design of Analog CMOS ICs - Razavi
2. Microelectronic circuits : Adel Sedra and Kenneth C. Smith
3. Electronic Test Instruments: Analog and Digital Measurements,Robert Writte
4. Modern Electronic Test and Measuring Instruments: N Kularatna.
5. Power Management Integrated Circuits by Mona.M.Hella& Patrick Mercier
6. Principles of Solar Cells, LEDs and Related Devices by Kitai A.
7. The Definitive Guide to the ARM Cortex M3, Joseph Yiu, Newnes.
8. ARM Cortex M3 Reference manual.

9. Product Design & Development - Karl T Ulrich & Steven D. Eppinger; McGraw H
10. Semiconductor Packaging: Materials interaction and reliability by Andrea Chen &Randy.