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 - Computer Science and 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

To develop technically competent, ethically responsible, and industry-ready diploma professionals in Computer Science and Engineering who can contribute to technological innovation and societal development.

Mission

1. To impart quality technical education in the field of computer science and engineering through a practice-oriented curriculum.
2. To equip students with foundational knowledge, programming skills, and problem-solving abilities essential for the IT industry and allied sectors.
3. To promote innovation, teamwork, communication skills, and lifelong learning among students.
4. To inculcate ethical values and social responsibility in addressing engineering and technological challenges.
5. To prepare students for higher studies, employment, and entrepreneurship in the digital ecosystem.

Program Education Objectives

Graduates of the Diploma in Computer Science and Engineering will:
1. Apply core knowledge and technical skills in computing and IT systems to provide real-world solutions.
2. Engage in successful careers or further education in computer science, engineering, or related domains.
3. Exhibit professionalism, ethical behavior, and effective communication in workplace settings.
4. Demonstrate the ability to work in teams and adapt to emerging technologies through lifelong learning.
5. Contribute positively to society by designing sustainable and inclusive technology solutions.

Program Outcomes

Upon completion of the diploma program, students will be able to:
1. Engineering Knowledge: Apply knowledge of mathematics, science, and computing fundamentals to solve computer science problems.
2. Problem Analysis: Identify, analyze, and solve well-defined computing problems using appropriate techniques and tools.
3. Design and Development: Design software solutions for real-world needs with due consideration for quality, usability, and standards.
4. Modern Tool Usage: Use modern computing tools, hardware, and software platforms effectively.
5. Ethics and Communication: Demonstrate professional ethics, effective communication, and responsibility in computing practice.

Program Specific Outcomes

Diploma graduates will be able to:
1. Develop and maintain software applications using current programming languages, tools, and methodologies.
2. Design and manage databases, computer networks, and basic web-based solutions in a real-time environment.
3. Apply fundamental knowledge of emerging technologies such as cloud computing, IoT, and cybersecurity in practical scenarios.

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

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

Semester 3						
Semester Code	**Course Code**	**Course Title**	**L**	**T**	**P**	**Cr**
PC-DIPCSE-301	DCSE250066	Software Engineering Fundamentals	3	1	0	4
PC-DIPCSE-302	DCSE250057	Object-Oriented Programming Basics	2	0	4	4
PC-DIPCSE-303	DCSE250059	Basic Concepts of Data Structures	3	0	2	4
PE-DIPCSE-304	Elective	Program Elective				4
OE-DIPCSE-305	Elective	Open Elective				4
AU-DIPCSE-306	Elective	Audit Elective				0

Semester 4						
Semester Code	**Course Code**	**Course Title**	**L**	**T**	**P**	**Cr**
PC-DIPCSE-401	DCSE250102	Operating Systems	3	0	2	4
PC-DIPCSE-402	DCSE250060	Database Management Systems	2	0	4	4
PC-DIPCSE-403	DCSE250034	Data Communication and Computer Networks	3	1	0	4
PE-DIPCSE-404	Elective	Program Elective				4
AE-DIPCSE-405	DASH250091	Professional Values and Ethics	2	0	0	2
VA-DIPCSE-406	DASH250052	Environmental Science	2	0	0	2
EE-DIPCSE-407	EE	Minor Project				4

Semester 5						
Semester Code	**Course Code**	**Course Title**	**L**	**T**	**P**	**Cr**
PC-DIPCSE-501	DCSE250061	Introduction to e-Governance	3	0	2	4
PC-DIPCSE-502	DOEE250145	Basics of IOT and its Applications	2	0	4	4
PC-DIPCSE-503	DCSA250007	Web Design Fundamentals	2	0	4	4
PC-DIPCSE-504	DCSE250029	Computer Graphics	3	1	0	4
PE-DIPCSE-505	Elective	Program Elective				4
EE-DIPCSE-506	EE	Summer Internship-II				2
EE-DIPCSE-507	EE	Major Project-I				2

Semester 6						
Semester Code	**Course Code**	**Course Title**	**L**	**T**	**P**	**Cr**
PC-DIPCSE-601	DOAI250029	Artificial Intelligence with Python	2	0	4	4
PC-DIPCSE-602	DCSA250003	Mobile Application Development using Android	2	1	2	4
AU-DIPCSE-603	Elective	Audit Elective				0
EE-DIPCSE-604	DASH250050	Entrepreneurship and Start-Ups	3	1	0	4
EE-DIPCSE-605	EE	Major Project-II				2
EE-DIPCSE-606	EE	Technical Seminar				2

Elective Courses

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

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

Elective Courses for AU (Audit) Category					
Course Code	**Course Title**	**L**	**T**	**P**	**Cr**
DASH240027	Disaster Management	2	0	0	0
DASH240047	English for Research Paper Writing	2	0	0	0
DASH240052	Environmental Science	3	0	0	0
DASH240085	Pedagogy Studies	2	0	0	0
DASH240086	Personality Development through Life Enlightenment Skills	2	0	0	0
DASH240097	Sanskrit for Technical Knowledge	2	0	0	0
DASH240103	Stress Management by Yoga	2	0	0	0
DASH240104	Technical Presentation and Report Writing	0	0	2	0
DASH240106	Value Education	2	0	0	0
DASH240124	Constitution of India - AU	2	0	0	0
DASH250023	Constitution of India	2	1	0	0
DASH250027	Disaster Management	3	0	0	0

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

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

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

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

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

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

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

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

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

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

Detailed Syllabus

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

Course Outcomes:

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

Module 1:

Vector Algebra (9 hrs)

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

Module 2:

Differential Calculus (9 hrs)

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

Module 3:

Complex Numbers and Their Applications (8 hrs)

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

Module 4:

Trigonometry (10 hrs)

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

Module 5:

Permutations, Combinations & Binomial Theorem (9 hrs)

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

Labs / Practicals:

N/A

References:

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

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

Course Outcomes:

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

Module 1:

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

Module 2:

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

Module 3:

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

Module 4:

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

Module 5:

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

Labs / Practicals:

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

References:

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

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

Course Outcomes:

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

Module 1:

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

Module 2:

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

Module 3:

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

Module 4:

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

Module 5:

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

Labs / Practicals:

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

References:

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

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

Course Outcomes:

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

Module 1:

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

Module 2:

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

Module 3:

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

Module 4:

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

Module 5:

Differential Equations (10 hrs)

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

Labs / Practicals:

N/A

References:

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

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

Course Outcomes:

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

Module 1:

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

Module 2:

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

Module 3:

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

Module 4:

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

Module 5:

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

Labs / Practicals:

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

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

References:

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

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

Course Outcomes:

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

Module 1:

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

Module 2:

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

Module 3:

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

Module 4:

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

Module 5:

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

Labs / Practicals:

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

variables.

References:

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

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

Course Outcomes:

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

Module 1:

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

Module 2:

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

Module 3:

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

Module 4:

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

Module 5:

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

Labs / Practicals:

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

References:

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

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

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

Course Outcomes:

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

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

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

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

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

Module 1:

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

Module 2:

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

Module 3:

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

Module 4:

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

Module 5:

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

Labs / Practicals:

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

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

References:

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

Course Code	Course Name	L	T	P	Cr
DCSE250066	Software Engineering Fundamentals	3	1	0	4

Course Outcomes:

CO1.Analyse and model customer's requirements and model its software design.
CO2.Use suitable software model for the problem at hand.
CO3.Estimate cost and efforts required in building software.
CO4.Analyse and compute impact of various risks involved in software development.
CO5.Design and build test cases, and to perform software testing.

Module 1:

Introduction
The Evolving Role of Software, Software Characteristics, Changing Nature of Software, Software Engineering as a Layered Technology, Software Process Framework, Framework and Umbrella Activities, Process Models, Capability Maturity Model Integration (CMMI).

Module 2:

Requirement Analysis
Software Requirement Analysis, Initiating Requirement Engineering Process, Requirement Analysis and Modelling Techniques, Flow Oriented Modelling, Need for SRS, Characteristics and
Components of SRS.

Module 3:

Software Project Management, Risk Management and Quality Management
Estimation in Project Planning Process, Project Scheduling.
Software Risks, Risk Identification, Risk Projection and Risk Refinement, RMMM Plan. Quality Concepts, Software Quality Assurance, Software Reviews, Metrics for Process and Projects.

Module 4:

Design Engineering
Design Concepts, Architectural Design Elements, Software Architecture, Data Design at the Architectural Level and Component Level, Mapping of Data Flow into Software Architecture, Modelling Component Level Design.

Module 5:

Testing Strategies & Tactics
Software Testing Fundamentals, Strategic Approach to Software Testing, Test Strategies for Conventional Software, Validation Testing, System testing, Black-Box Testing, White-Box Testing and their type, Basis Path Testing.

Labs / Practicals:

NA

References:

1.R.S. Pressman, Software Engineering: A Practitioner‘s Approach (7th Edition), McGraw- Hill, 2009.
2.P. Jalote, An Integrated Approach to Software Engineering (2nd Edition), Narosa Publishing House, 2003.
3.K.K. Aggarwal and Y. Singh, Software Engineering (2nd Edition), New Age International Publishers, 2008.

Course Code	Course Name	L	T	P	Cr
DCSE250057	Object-Oriented Programming Basics	2	0	4	4

Course Outcomes:

CO1: Understand and apply fundamental C++ programming concepts.
CO2: Explain and implement basic object-oriented programming principles.
CO3: Develop modular programs in C++ using functions.
CO4: Perform basic file input/output operations and handle exceptions in C++ programs.
CO5: Compare the basic syntax and structure of Java with C++ and write simple Java programs.

Module 1:

Basics of C++ Programming:
Introduction to C++ and its applications, Structure of a simple C++ program, Variables, data types, and constants, Basic operators and expressions, Input/output using cin and cout, Control structures: if, else, switch, Loops: for, while, do-while.

Module 2:

Introduction to Object-Oriented Concepts:
What is Object-Oriented Programming? Concepts: Classes and Objects, Defining and using simple classes, Member functions, Access specifiers: public & private, Simple constructor and destructor usage.

Module 3:

Working with Functions:
Defining and calling functions, Function arguments and return values, Function overloading, Inline functions, Default arguments, Call by value and call by reference.

Module 4:

Basics of File Handling & Exception Handling:
File operations in C++, Opening and closing files, Writing to and reading from text files, Introduction to exception handling:Basic use of try, catch, and throw.

Module 5:

Introduction to Java and Comparison with C++:
Basic structure of a Java program, Syntax comparison between C++ and Java, Simple class and object example in Java, Data types and operators in Java, Input/output using Scanner in Java, Basic concept of packages, Access modifiers: public, private.

Labs / Practicals:

1. Write a C++ program to print “Hello, World!” on the screen.
2. Write a C++ program to accept two numbers and perform addition, subtraction, multiplication, and division.
3. Develop a C++ program to check whether a number is even or odd using if-else.
4. Create a class ‘Rectangle’ in C++ with data members length and breadth. Include member functions to input and calculate the area.
5. Write a C++ program to demonstrate function overloading by calculating the area of a circle and a rectangle.
6. Write a C++ program to swap two numbers using call by reference.
7. Develop a program in C++ that performs division of two numbers and handles division-by-zero using try and

catch.
8. Write a simple Java program to define a class Employee with fields: name, employee ID, and salary. Write methods to accept and display the details.
9. Write a JAVA program to sort list of elements in ascending and descending order.
10. Write a Java program to generate the Fibonacci series up to n terms using a while loop.

References:

1. E. Balagurusamy, Object-Oriented Programming with C++, McGraw Hill Education
2. Ashok N. Kamthane , Programming in C++, Pearson Education
3. Yashavant Kanetkar, Let Us C++", BPB Publications
4. E. Balagurusamy , Programming with Java, McGraw Hill Education
5. Kathy Sierra & Bert Bates, Head First Java (2nd Edition), O'Reilly Media

Course Code	Course Name	L	T	P	Cr
DCSE250059	Basic Concepts of Data Structures	3	0	2	4

Course Outcomes:

CO1: Define and explain basic data structure terminology and algorithm analysis using asymptotic notations.
CO2: Implement and apply linear data structures such as arrays, stacks, queues, and linked lists for various applications like expression evaluation and recursion.
CO3: Describe and perform operations on binary trees, binary search trees, heaps, and understand the conceptual aspects of advanced trees like AVL, m-trees, and B-Trees.
CO4: Demonstrate graph representations and traversals (DFS, BFS), and explain spanning trees and hashing techniques including hash functions and collision handling.
CO5: Analyze and implement fundamental sorting and searching algorithms and evaluate their efficiency.

Module 1:

Introduction:
Definition of Data Structure, Classification of Data Structures, Primitive Data Types, Abstract Data Types, Operations on Data Structure, Algorithms: Definition, Complexity of Algorithms, Asymptotic Notation - The Big-O, Omega and Theta notation.

Module 2:

Principles of Data structure:
Array, Stack, Queue, Linked-list and its types, Various Representations, Operations & Applications of Linear Data Structures, Stack Applications: Infix to postfix conversion, Infix to prefix conversion, evaluation of postfix expression, recursion.

Module 3:

Tree:
Definition of Trees, Binary Tree, Properties of Binary Tree, Memory Representation of Binary Tree, Operations Performed on Binary Tree, Binary Tree Traversal: Preorder, In-order, Post-order, Binary Search Tree, Operations on Binary Search Tree, Heap, Operations on Heap, AVL trees, m-trees and B-Trees (conceptual only).

Module 4:

Graphs & Hashing:
Introduction, Graph Terminologies, Graph, and Multigraphs. Directed Graphs, , Operations on Graphs, Graph Traversing: Breadth First Search (BFS), Depth First Search (DFS), Spanning tree, Minimum Spanning Tree (MST).

Module 5:

Sorting, Searching and Hashing:
Sorting: Bubble Sort, Selection Sort, Insertion Sort, Merge Sort.
Searching: Linear Search, Binary Search.
Hashing: Definition of Hashing, Need for a good hash function, Different hash functions (conceptual only)

Labs / Practicals:

1. Write a program to implement an array and perform the following operations:

• Insertion at a given position
• Deletion at a given position
• Display the array
2. Write a program to find the largest and smallest elements in an array.
3. Write a program to merge two sorted arrays into a third sorted array.
4. Write a program to reverse the elements of an array.
5. Write a program to convert an infix expression to a postfix expression using a stack.
6. Write a recursive program to solve the Tower of Hanoi problem using stacks.
7. Write a program to implement a circular queue using an array. Handle overflow and underflow conditions.
8. Write a program to create a singly linked list and perform the following operations:
• Insert at beginning
• Insert at end
• Insert at a specific position
• Delete by position or key
• Display the list
9. Write a C program to implement a binary search tree using linked representation and perform the following operations on it.
• Insert an item
• Search an item
• Inorder Traversal
10. Write a program to find the minimum and maximum value in a BST.
11. Write a C program to compare Linear Search and Binary Search on sorted data.
• Accept input size n, generate a sorted array of n elements.
12. Write a C program to sort employee records by salary using Insertion Sort.

References:

1. Horowitz, Sahni, and Anderson Freed: Fundamentals of Data Structures in C, 2nd Edition, Universities Press, 2008.

2. Robert Kruse, C.L Tondo and Bruce Leung, “Data Structure and Programming in C”, Pearson Education.

3. Yedidyah Langsam, Moshe J. Augenstein, and Aaron M. Tenenbaum, “Data Structure using C and C++”, Pearson Education 2nd Edition.

4. Seymour Lipschutz and G A Vijayalakshmi Pai, “Data Structures”, Tata Mc Grew Hills

5. Alfred V Aho, John E Hopcroft and Jeffery D Ullman, “ Data Structures and Algorithms”, Pearson Education.

6. Samiran Chattopadhyay, Debabrata Ghosh Dastidar and Matagini Chattopadhyay, “ Data Structures through C Language”, BPB Publication.

Course Code	Course Name	L	T	P	Cr
DCSE250102	Operating Systems	3	0	2	4

Course Outcomes:

CO1: Understand the basics of operating systems like kernel, shell, types and services of operating systems.
CO2:Understand the concept of program, process and thread and analyse various CPU scheduling Algorithms.
CO3: Describe and analyse the memory management and its allocation policies.
CO4: Understand the issues related to file system interface and implementation.
CO5: Understand disk management and explain disk scheduling algorithms for better utilization of external memory.
6: Configure OS in an efficient and secure manner.

Module 1:

Introduction: Overview of Operating System, basic concepts, UNIX/LINUX Architecture, Kernel, services and systems calls, system programs.

Module 2:

Process Management and Memory management: Process Management: Process concepts, operations on processes, IPC, Process Scheduling, Multithreaded programming. Memory management: Memory allocation, Swapping, Paging, Segmentation, Virtual Memory, various faults.

Module 3:

File management: Concept of a file, access methods, directory structure, file system mounting, file sharing and protection, file system structure and implementation, directory implementation, free space management, efficiency and performance. Different types of file systems.

Module 4:

I/O System: Mass storage structure - overview, disk structure, disk attachment, disk scheduling algorithms, swap space management, RAID types.

Module 5:

OS Security: Authentication, Access Control, Access Rights, System Logs

Labs / Practicals:

1. Revision practice of various commands like man, cp, mv, ln, rm, unlink, mkdir, rmdir, etc and many more that were learnt in IT Workshop course and later.
2. Implement two way process communication using pipes.
3. Implement message queue form of IPC
4. Implement shared memory and semaphore form of IPC
5. Simulate the CPU scheduling algorithms - Round Robin, SJF, FCFS, priority
6. Simulate all FIFO Page Replacement Algorithm using C program
7. Simulate all LRU Page Replacement Algorithms using C program
8. Simulate Paging Technique of Memory Management
9. Practice various commands/utilitiessuch as catnl, uniq, tee, pg, comm, cmp, diff, tr, tar, cpio, mount, umount, find, umask, ulimit, sort, grep, egrep,fgrep cut, paste, join, du, df , ps, who, etc and many more.

References:

1. "Operating System Concepts (Tenth Edition)" by Abraham Silberschatz, Peter Baer Galvin, and Greg Gagne
https://os-book.com/OS10/index.html

2. "Operating Systems: Internals and Design Principles (Ninth Edition)" by William Stallings
http://williamstallings.com/OperatingSystems

3. "Modern Operating Systems (Fifth Edition)" by Andrew Stuart Tanenbaum and Herbert Bos
https://dl.acm.org/doi/10.5555/2655363

4. "Operating System Design: The Xinu Approach (Second Edition)" by Douglas Earl Comer
https://www.oreilly.com/library/view/operating-system-design/9781498712439

5. "The Design of the UNIX Operating System" by Maurice J. Bach
https://dl.acm.org/doi/10.5555/8570

6. "Advanced Programming in the UNIX Environment (Third Edition)" by William Richard Stevens and Stephen A. Rago
http://www.apuebook.com/apue3e.html

7. "Beej's Guide to Interprocess Communication" by Brian Hall
https://beej.us/guide/bgipc/pdf/bgipc_a4_c_2.pdf

Course Code	Course Name	L	T	P	Cr
DCSE250060	Database Management Systems	2	0	4	4

Course Outcomes:

CO1. Understand the basic database concepts, data models, schemas and instances.
CO2. Learn database design using Entity Relationship model and learn the use of constraints and relational algebra operations.
CO3. Gain proficiency in SQL and construct queries using SQL.
CO4. Understand the importance of normalization in database design.
CO5. Understand transaction processing, concurrency control and recovery

Module 1:

Introduction to Databases, File systems vs. Database systems, Characteristics of DBMS, Applications of DBMS, Advantages of using a DBMS, Database users and administrators, Three-level architecture of DBMS (ANSI/SPARC architecture), Data independence, Database schema, Instance, Generalization, Specialization, Structure of a DBMS, Overview of DBMS software (e.g., MySQL, SQL Server, Oracle, PostgreSQL)

Module 2:

Introduction to Data models: Hierarchical, Network, Relational, Object-oriented, Data Modeling using Entity Relationship (ER) model: entities, entity types, attributes, relationships, relationship types, E/R diagram notation, examples.
Relational data model: Concepts, schema, instances, keys, constraints, Relational algebra: Select, project, union, set difference, Cartesian product, joins, ER to Relational mapping, Relational algebra and relational calculus, Tuple Relational Calculus, Domain Relational Calculus

Module 3:

Structured Query Language (SQL): Basics of SQL, DDL, DML,DCL, structure – creation, alteration, defining constraints – Primary key, foreign key, unique, not null, check, IN operator, Functions - aggregate functions, Built-in functions – numeric, date, string functions, set operations, sub-queries, correlated sub-queries, Use of group by, having, order by, join and its types, Exist, Any, All , view and its types. Transaction control commands – Commit, Rollback, Save point, Cursors, Indexes, stored procedures, Triggers

Module 4:

Normalization – Introduction, Non loss decomposition and functional dependencies, First, Second, and third normal forms – dependency preservation, Boyce/Codd normal form.
Higher Normal Forms - Introduction, Multi-valued dependencies and Fourth normal form, Join dependencies and Fifth normal form.

Module 5:

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

Labs / Practicals:

1. Create a database, define tables using DDL, apply constraints (Primary, Foreign, Not Null, Unique).
2. Insert, update, delete, and retrieve records using SQL DML commands.
3. Write SQL queries using WHERE, ORDER BY, GROUP BY, HAVING, LIKE, etc.
4. Write SQL queries to demonstrate the use of INNER JOIN, LEFT OUTER JOIN, RIGHT OUTER JOIN, and SELF JOIN using appropriate sample tables.
5. Write nested subqueries with IN, EXISTS, and ANY/ALL.

6. Draw ER diagram for a sample application (e.g., Library or Hospital), map it to relational schema.
7. Normalize sample unstructured data up to 3NF or BCNF. Implement before-and-after schemas in SQL.
8. Create and execute stored procedures/functions for common operations.

References:

1. Silberschatz, Korth, Sudarshan – Database System Concepts, McGraw Hill Year: 2020 (7th edition).
2. Elmasri and Navathe – Fundamentals of Database Systems, Pearson Edition 2016
3. Raghu Ramakrishnan, Johannes Gehrke – Database Management Systems, McGraw Hill
4. Database Systems Concepts Author H.f.Korth and Silberschatz Publisher McGraw Hill
5. Database System Author Hector Garcia-Molina, Jeff Ullman, and Jennifer Widom Publisher Pearson Edition 2nd Edition
6. C.J. Date – An Introduction to Database Systems, Pearson

Course Code	Course Name	L	T	P	Cr
DCSE250034	Data Communication and Computer Networks	3	1	0	4

Course Outcomes:

CO1. Describe the hardware, software components of a network and their interrelations.
CO2. Compare OSI and TCP/IP network models.
CO3. Describe,analyze and compare different protocols at the data link, network, and transport layer.
CO4. Design/implement data link and network layer protocols in a simulated networking environment.
CO5. Explain and apply network security concepts, tools, safe practices, emerging technologies, and cyber hygiene measures.

Module 1:

Module 1:
Basics of Networking and Communication:
Introduction to Computer Networks: Definition, Importance, and Real-world Applications, Types of Computer Networks, Network Topologies, Network Models: OSI Model, TCP/IP Model, Switching Techniques: Circuit Switching, Packet Switching, Message Switching.

Module 2:

Module 2:
Physical and Data Link Layer:
Analog Signal, digital signal, encoding techniques, digital modulation techniques, Transmission Media, and multiplexing (frequency division, time divion and wavelength division multiplexing).
Framing Methods, Error Detection Techniques, Flow Control Protocols, Medium Access Control: ALOHA, CSMA/CD, Ethernet Basics and IEEE 802.3, Wireless LAN (Wi-Fi) : Basic operation and use cases.

Module 3:

Module 3:
Network Layer and IP Addressing:
Functions of Network Layer: Packet Forwarding, Logical Addressing, IP Addressing: IPv4, IPv6, Subnetting, Basic Routing Concepts: Static vs Dynamic Routing, Networking Devices: Hub, Switch, Router, Bridge, Gateway

Module 4:

Module 4:
Transport and Application Layers:
Transport Layer Basics: TCP, UDP, Ports and Sockets, Common Application Layer Protocols: HTTP, FTP, SMTP, POP3, DNS, Overview of the Internet and Web Browsing: URL and Domain Name, How Browsers Communicate with Servers, Introduction to IP and DNS Resolution.

Module 5:

Module 5:
Introduction to Network Security and Emerging Trends:
Basic Network Security Concepts: Importance of Security in Networks, Common Threats: Virus, Malware, Phishing, Security Tools: Introduction to Firewalls and Antivirus Software, Basic Safety Practices in Networking: Strong Passwords, Use of Secure Websites, Network Hygiene, Emerging Trends:5G Networks, IoT (Internet of Things), Cloud Computing, Cyber Hygiene: Safe browsing, protecting digital identity, Online Threats Awareness: Social Engineering, Fake Wi-Fi Networks.

Labs / Practicals:

NA

References:

1. "Data Communications and Networking" – Behrouz A. Forouzan McGraw Hill Education.
2. "Computer Networks" – Andrew S. Tanenbaum, David Wetherall Pearson Education.
3. "Computer and Communication Networks" – Nader F. Mir
Pearson Education.
4. "Introduction to Computer Networks" – Tata McGraw Hill or Technical Publications (local authors).

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
DCSE250061	Introduction to e-Governance	3	0	2	4

Course Outcomes:

CO1: Through exposure to introductory ideas and practices followed in a selected number of e-Governance initiatives in India, the course will help students to understand and appreciate the essence of e-Governance.
CO2: Explain the role and impact of ICT in governance and development.
CO3: Describe the e-Governance lifecycle and identify key elements in the design and implementation of e-Government projects.
CO4: Assess the effectiveness of Indian e-Governance initiatives through case studies and field visits.
CO5: Collaborate in teams to evaluate, present, and report on real-world e-Governance projects through mini projects.

Module 1:

Exposure to emerging trends in ICT for development; Understanding of design and implementation of e-Government projects, e-governance lifecycle.

Module 2:

Need for Government Process Re-engineering (GPR); National e-Governance Plan(NeGP) for India; SMART Governments & Thumb Rules

Module 3:

Architecture and models of e-Governance, including Public Private Partnership (PPP); Need for In- novation and Change Management in eGovernance; Critical Success Factors; Major issue including corruption, resistance for change, e-Security and Cyber laws

Module 4:

Focusing on Indian initiatives and their impact on citizens; Sharing of case studies to highlight best practices in managing e-Governance projects in Indian context. Visits to local e-governance sites (CSC, eSeva, Post Office, Passport Seva Kendra, etc) as part of Tutorials.

Module 5:

Mini Projects by students in groups – primarily evaluation of various e-governance projects.

Labs / Practicals:

List of Practical Activities:
1.Visit to a Common Service Center (CSC)
2.Register on the DigiLocker Platform
3.Visit to a local e-Seva Kendra or Municipality portal
4.Visit to Passport Seva Kendra or Post Office.
5.Explore the Passport Seva Portal.
6.Online registration for any government portal (demo only)
7.Interaction with beneficiaries of any government e-service
8.Simulate Application for PAN Card or Aadhaar Update (Use the NSDL or UIDAI portal).
9.Access and Analyze Benefits of a Welfare Scheme (e.g., PMAY, PM-KISAN).
10.Use the MyGov Platform (Register and participate in a quiz, discussion, or survey)

11.Group discussion on role of e-Governance during COVID-19
12.Create a poster/presentation on SMART Governance
13.Case study presentation on Aadhaar or DigiLocker
14.Analyze and report on a G2C service portal
15.Final project presentation on selected e-Governance service

References:

1.Managing Transformation –Objectives to Outcomes. J Satyanarayana, Prentice Hall India
2.The State, IT and Development. Kenneth Kenniston, RK Bagga and Rohit Raj Mathur, Sage Publications India Pvt Ltd.
3.e-Government -The Science of the Possible. J Satyanarayana, Prentice Hall, India
4.http://www.csi-sigegov.org/publications.php
5.https://negd.gov.in
6.https://www.nisg.org/case-studies-on-e-governance-in-india

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
DCSA250007	Web Design Fundamentals	2	0	4	4

Course Outcomes:

CO1: Understand how the Internet and Web technologies work.
CO2: Develop static web pages using HTML and structure them efficiently.
CO3: Apply styling and layout management through CSS and CSS3.
CO4: Use JavaScript for client-side programming and interactivity.
CO5: Comprehend basic web hosting procedures and design principles for responsive websites.

Module 1:

Introduction to Internet and Web Technologies: History, working of Internet, WWW, HTTP, URL, DNS, Web Browsers, Search Engines, Internet Protocols – TCP/IP, FTP.

Module 2:

HTML: Introduction to HTML, Elements and Attributes, Formatting Tags, Lists, Tables, Hyperlinks, Images, Forms, Frames, Audio and Video embedding, HTML5 features.

Module 3:

CSS: Introduction to CSS, Syntax, Types (Inline, Internal, External), Selectors, Box Model, Styling Text, Links, Lists, Tables, and Forms; CSS3 features and animation.

Module 4:

JavaScript: Basics of JavaScript, Variables, Operators, Functions, Conditional Statements, Loops, Events, Arrays, Form validation, DOM Manipulation.

Module 5:

Introduction to Web Hosting and Design Principles: Domain names, Web servers, Hosting, FTP usage; Responsive Design, Accessibility, Basic SEO principles.

Labs / Practicals:

1. Create a basic webpage using HTML with headings, paragraphs, and formatting.
2. Design an HTML form for user registration with input validation.
3. Apply internal and external CSS to style a multipage website.
4. Create a responsive webpage layout using CSS Flexbox/Grid.
5. Write JavaScript code for input validation in HTML forms.
6 Implement a simple image slider using JavaScript and DOM.
7. Demonstrate use of HTML5 multimedia elements (audio/video).
8. Upload a sample website to a free web hosting platform using FTP.

References:

Textbooks
1. Thomas A. Powell, “HTML and CSS: The Complete Reference”, McGraw-Hill, 5th Edition.
2. Jon Duckett, “JavaScript and JQuery: Interactive Front-End Web Development”, Wiley, 2014.
3. Robin Nixon, “Learning PHP, MySQL & JavaScript”, O'Reilly Media, 5th Edition.

References / Online Resources
1. https://www.w3schools.com/
2. https://developer.mozilla.org/en-US/
3. https://www.tutorialspoint.com/html/

4. https://html.com/

Course Code	Course Name	L	T	P	Cr
DCSE250029	Computer Graphics	3	1	0	4

Course Outcomes:

CO1: Understand the basics of computer graphics systems and their architecture. Discuss various algorithms for scan conversion and filling of basic objects and their comparative analysis.
CO2: Apply geometric transformations and model graphical objects using OpenGL.
CO3: Develop interactive applications with input and event handling.
CO4: Illustrate concepts of 3D viewing, projections, and shading models.
CO5: Implement algorithms for clipping, rasterization, and rendering pipeline stages.

Module 1:

Introduction to Computer Graphics and OpenGL
Introduction to Computer Graphics: Applications, physical vs. synthetic images,
Graphics Systems: Imaging systems, synthetic camera model, Graphics Architectures: Programmable pipelines, performance metrics, Graphics Programming: Sierpinski gasket, 2D applications, OpenGL Basics: OpenGL API, primitives, attributes, colors Viewing & Control: Viewing, control functions, recursive graphics, 3D Gasket & Implicit Functions

Module 2:

Interaction and Input Mechanisms
Interaction & Input Devices: Event handling, input models, Client-Server Architecture, Display Lists and Modeling: Reusability, efficiency, Event Driven Programming: Menus, picking, Building Interactive Models: CAD systems, Animation and Logic Operations

Module 3:

Geometric Transformations and Modeling
Geometric Objects: Scalars, points, vectors, Three-dimensional Primitives; Coordinate Systems and Frames; Modeling a Colored Cube; Affine Transformations; Rotation, Translation and Scaling; Geometric Objects and Transformations; Transformation in Homogeneous Coordinates; Concatenation of Transformations; OpenGL Transformation Matrices; Interfaces to 3D applications; Quaternion's.

Module 4:

Viewing and Shading
Classical and computer viewing; Viewing with a Computer; Positioning of the camera; Simple projections; Projections in OpenGL; Hidden- surface removal; Interactive Mesh Displays; Parallel-projection matrices; Perspective-projection matrices; Projections and Shadows. Light and Matter; Light Sources; The Phong Lighting model; Computation of vectors; Polygonal Shading; Approximation of a sphere by recursive subdivisions; Light sources in OpenGL; Specification of materials in OpenGL; Shading of the sphere model; Global Illumination.

Module 5:

Implementation Techniques and Rendering Pipeline
Basic Implementation Strategies; Four major tasks; Clipping; Line-segment clipping; Polygon clipping; Clipping of other primitives; Clipping in three dimensions; Rasterization; Bresenham's algorithm; Polygon Rasterization; Hidden-surface removal; Antialiasing; Display considerations.

Labs / Practicals:

NA

References:

1.Edward Angel: Interactive Computer Graphics A Top-Down Approach with OpenGL, 5th Edition, Pearson Education, 2008.
2.Donald Hearn and Pauline Baker: Computer Graphics OpenGL Version 3th Edition, Pearson Education, 2004.
3.F.S. Hill Jr.: Computer Graphics Using OpenGL, 3th Edition, PHI, 2909.
4.James D Foley, Andries Van Dam, Steven K Feiner, John F Hughes, Computer Graphics, Pearson Education 1997.

Course Code	Course Name	L	T	P	Cr
DOAI250029	Artificial Intelligence with Python	2	0	4	4

Course Outcomes:

CO1: Define AI concepts, its history, types, and distinguish AI from human intelligence.
CO2: Implement and evaluate machine learning models using Python for supervised and unsupervised tasks.
CO3: Develop basic deep learning models using neural networks and understand CNNs for image classification.
CO4: Apply NLP techniques such as text preprocessing, sentiment analysis, and language modeling.
CO5: Demonstrate fundamental computer vision tasks using OpenCV for image processing and analysis.
CO6: Able to design and implement various machine learning algorithms in a range of real-world applications.

Module 1:

Introduction to Artificial Intelligence
•Definition and Goals of AI
•History and Applications of AI
•Types of AI (Narrow, General, Super)
•Intelligent Agents and Environments
•AI vs Human Intelligence
•Python for AI: Libraries Overview (NumPy, Pandas, Matplotlib, Scikit-learn)

Module 2:

Machine Learning
•Overview of Machine Learning and Types (Supervised, Unsupervised, Reinforcement)
•Data Preprocessing and Visualization
•Supervised Learning Algorithms: Linear Regression, k-NN, Decision Trees
•Unsupervised Learning: k-Means Clustering
•Model Evaluation: Accuracy, Confusion Matrix, Cross-validation

Module 3:

Introduction to Deep Learning
•Introduction to Neural Networks (Perceptrons, FeedForward Networks, Gradient Descent).
•Basic Concepts of Deep Learning (Layers, Activation Function)
•Introduction to Convolutional Neural Networks (CNNs) for Image classification.
•Simple Neural Network Implementation in Python

Module 4:

Natural Language Processing and its Applications
•Introduction to NLP
•Text Preprocessing (Tokenization, Stop Words, Lemmatization)
•Bag of Words and TF-IDF
•Sentiment Analysis using Python
•Real-world AI Applications: Chatbots, Image Recognition, Recommendation Systems

Module 5:

Computer Vision and its Applications
•Introduction to Computer Vision
•Image Processing Basics (Image Presentation, Pixels, Color Models).
•Image Filtering (Blurring, Sharpening, Edge Detection (Sobel, Canny)
•OpenCV Library for Computer Vision in Python

Labs / Practicals:

List of 10 Practical Exercises
1.Using a simple Linear Regression Model (Scikit-Learn) predict house prices based on a single feature (eg. Square Footage) using a synthetic or small real-world dataset.
2.Using KNN Model (Scikit-Learn) classify the iris dataset. Evaluate its accuracy using a train-test, split and visualize the decision boundaries (if possible, for 2 features).
3.Apply the K-Means clustering algorithm to a given dataset (eg Customer segmentation data). Determine an appropriate number of cluster using the elbow method.
4.Build a simple Feed-Forward neural network (using Tensorflow or Keras) with atleast one hidden layer to classify the MNIST handwritten digit dataset. Train the model and report its accuracy and loss.
5.Given a collection of raw text document. Perform tokenization, lowercasing and stop word removed. Implement stemming or lemmatization. Calculate word frequencies and display the top 10 most frequent word (use NLTK Library).
6.Develop a basic sentiment analysis model using NLTK and Scikit-Learn. Train on a small dataset.
7.Load an image and perform
a. Convert to Gray Scale.
b. Apply a Gaussian blur filter.
c. Detect edges using the Sobel and Canny edge detector.
d. Display the original and processed image.
8.Using a simple CNN model to perform an image classification on a dataset.
9.Using Decision Tree Model, classify the MNIST digit dataset. Evaluate the model.
10.Using logistic regression model, classify the iris dataset and evaluate the model.

References:

1."Artificial Intelligence: A Modern Approach" by Stuart Russell and Peter Norvig
2."Python Machine Learning" by Sebastian Raschka and Vahid Mirjalili
3."Deep Learning with Python" by François Chollet
4.Artificial Intelligence, Author: Saroj Kaushik
Publisher: Cengage Learning India
5.Programming in Python, Author: T. R. Padmanabhan
Publisher: Universities Press
6.Machine Learning, Author: V.K. Jain
Publisher: Khanna Book Publishing
7.Artificial Intelligence with Python, Author: Prateek Joshi (Indian-origin, Packt Publishing)
8.Introduction to Machine Learning, Author: Alok Sharma
Publisher: Katson Publishing House
9."Natural Language Processing with Python" by Steven Bird, Ewan Klein, and Edward Loper (NLTK Book).
10."Learning OpenCV: Computer Vision with the OpenCV Library" by Gary Bradski and Adrian Kaehler

Course Code	Course Name	L	T	P	Cr
DCSA250003	Mobile Application Development using Android	2	1	2	4

Course Outcomes:

CO1: Understand the architecture, lifecycle, and development environment of Android applications.
CO2: Design and build responsive user interfaces using Android layout and widget components.
CO3: Develop Android applications using activities, intents, and persistent data storage.
CO4: Integrate multimedia, location, and device services such as sensors and GPS in Android apps.
CO5: Deploy Android applications and apply debugging, testing, and publishing techniques.

Module 1:

Introduction to Android and Development Environment
Overview of Mobile App Development Landscape
Introduction to Android OS: History, Features, and Architecture
Android Studio: Installation and Setup
Android Project Structure (Manifest, Java/Kotlin files, Res folder)
Activity Lifecycle
Hello World App
Emulator and Device Testing Basics

Module 2:

User Interface Design and Layout Management
UI Components: TextView, EditText, Button, ImageView, CheckBox, RadioButton, Spinner
Layouts: LinearLayout, RelativeLayout, ConstraintLayout, FrameLayout
Event Handling and Listeners
Toasts, Dialog Boxes, and Snackbars
RecyclerView and Adapters
Menus: Options Menu, Context Menu

Module 3:

Activities, Intents, and Data Persistence
Intents: Explicit and Implicit
Activity Communication (startActivityForResult)
Fragments: Introduction and Usage
Shared Preferences and Internal Storage
SQLite Database: CRUD Operations
Room Persistence Library (Basics)

Module 4:

Advanced Features and Device Integration
Multimedia: Audio, Video Playback
Camera Integration
Accessing Device Sensors: Accelerometer, Gyroscope
Location and Maps: GPS and Google Maps API (Basic)
Background Tasks: AsyncTask, WorkManager (Intro)
Permissions and Security

Module 5:

App Deployment, Debugging and Project Development
Debugging Tools in Android Studio
Unit Testing and UI Testing Basics
App Signing and Versioning
Publishing App to Google Play (Overview)
Mini Project / Capstone Project
Best Practices in Android Development

Labs / Practicals:

1. Create a “Hello World” Android app using Android Studio and test on emulator.
2. Design a login UI screen using different layout managers and widgets.
3. Create an app with multiple activities and pass data using intents.
4. Store user preferences using SharedPreferences and display them.
5. Develop a simple SQLite-based app for student record management.
6. Integrate Google Maps to display current location.
7. Capture image using device camera and display in the app.
8. Create a media player app that plays audio or video from the device.
9. Develop an app with sensor-based interaction, such as shake detection.
10. Final Mini Project: A complete Android app with at least one form of persistent data storage and sensor/location integration.

References:

Kushwaha, D. S., & Misra, R.
Android Application Development: A Beginner's Guide
McGraw Hill Education, 2018.

Mednieks, Z., Dornin, L., Meike, G., & Nakamura, M.
Programming Android
O’Reilly Media, 3rd Edition, 2012.

Donn Felker
Android Application Development for Dummies
Wiley Publishing, 3rd Edition, 2015.

Joseph Annuzzi Jr., Lauren Darcey, and Shane Conder
Android Wireless Application Development (Volume I & II)
Addison-Wesley, 2015.

Wei-Meng Lee
Beginning Android Programming with Android Studio
Wiley, 4th Edition, 2021.

Online Resources

Android Developers Official Documentation
https://developer.android.com

Google Codelabs – Android Development Tutorials
https://developer.android.com/codelabs

Android Jetpack (UI, Room, WorkManager)
https://developer.android.com/jetpack

Kotlin Language Documentation
https://kotlinlang.org/docs/home.html

Udacity Course: Developing Android Apps with Kotlin
https://www.udacity.com/course/developing-android-apps-with-kotlin--ud9012

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

Course Outcomes:

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

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

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

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

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

Module 1:

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

Module 2:

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

Module 3:

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

Module 4:

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

Module 5:

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

Labs / Practicals:

N/A

References:

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

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

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

Course Outcomes:

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

Module 1:

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

Module 2:

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

Module 3:

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

Module 4:

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

Module 5:

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

Labs / Practicals:

N/A

References:

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

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

Course Outcomes:

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

Module 1:

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

Module 2:

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

Module 3:

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

Module 4:

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

Module 5:

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

Labs / Practicals:

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

References:

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

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

Course Outcomes:

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

Module 1:

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

Module 2:

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

Module 3:

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

Module 4:

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

Module 5:

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

Labs / Practicals:

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

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

References:

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

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

Course Outcomes:

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

Module 1:

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

Module 2:

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

Module 3:

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

Module 4:

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

Module 5:

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

Labs / Practicals:

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

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

References:

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

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

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

Course Outcomes:

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

Module 1:

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

Module 2:

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

Module 3:

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

Module 4:

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

Module 5:

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

Labs / Practicals:

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

References:

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

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

Course Outcomes:

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

Module 1:

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

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

Module 2:

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

Module 3:

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

Module 4:

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

Module 5:

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

Labs / Practicals:

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

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

References:

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

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

Course Outcomes:

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

Module 1:

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

Module 2:

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

Module 3:

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

Module 4:

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

Module 5:

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

Labs / Practicals:

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

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

References:

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

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

Course Outcomes:

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

Module 1:

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

Module 2:

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

Module 3:

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

Module 4:

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

Module 5:

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

Labs / Practicals:

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

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

References:

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

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

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

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

Course Outcomes:

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

Module 1:

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

Module 2:

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

Module 3:

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

Module 4:

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

Module 5:

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

Labs / Practicals:

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

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

References:

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

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

Course Outcomes:

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

Module 1:

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

Module 2:

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

Module 3:

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

Module 4:

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

Module 5:

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

Labs / Practicals:

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

References:

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

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

Course Outcomes:

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

Module 1:

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

Module 2:

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

Module 3:

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

Module 4:

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

Module 5:

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

Labs / Practicals:

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

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

References:

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

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

Course Outcomes:

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

Module 1:

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

Module 2:

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

Module 3:

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

Module 4:

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

Module 5:

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

Labs / Practicals:

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

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

References:

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

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

Course Outcomes:

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

Module 1:

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

Module 2:

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

Module 3:

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

Module 4:

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

Module 5:

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

Labs / Practicals:

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

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

References:

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

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

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

Course Outcomes:

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

Module 1:

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

Module 2:

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

Module 3:

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

Module 4:

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

Module 5:

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

Labs / Practicals:

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

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

References:

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

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

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

Course Outcomes:

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

Module 1:

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

Module 2:

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

Module 3:

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

Module 4:

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

Module 5:

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

Labs / Practicals:

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

References:

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

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