CSE - ARTIFICIAL INTELLIGENCE

(For the batches admitted from the academic year 2021-22)

Vision

- To be a recognized Centre in the field of Computer Science and Engineering by imparting quality education and also equipping the students with latest technologies, soft skills and ethical values to face the challenges in industry & society.

Mission

- To provide quality education by imparting state of the art facility in Computer Science and Engineering.
- Enrich the students with innovative and problem-solving skills by establishing continuous Industry Institute interaction.
- To prepare the learners possessing social commitment and ethical values to face the dynamic challenges of industry and society.

Institutional Objectives

- To create a conducive and competitive environment for students through curricular and extra-curricular activities.
- Promote the culture of research among the faculty.
- To promote synergetic alliances with premier Institutions, Industry, CSIR laboratories and various Government organizations for Collaborative Research Projects.
- To promote economic and social enrichment of the society through Skill Development programmes, Entrepreneurship and extension activities.
- To introduce demand-driven new UG&PG academic programmes.
- To ensure a high degree of quality in terms of providing infrastructure, research ambience, faculty and staff development.

Core Values

- *Thirst for Quality Education:* The stake holders of the institute particularly management, employees and students of the institution have a consistent thirst for quality improvement of the processes and services in the institution.
- *Lifelong Learning:* In the fast-changing technological world, acquiring a special skill at one point of time will not be enough for ever long survival. Hence to

flourish in the work place and to bring in innovations in the ways of doing, employee, student as well as alumni must be continuous learners and tech savvy.

- *Diversity and Participation:* PBRVITS promotes the involvement of faculty, staff and students from all social, economic, ethnics, cultural and religious backgrounds to get the synergy of combining the diversified agents. The focus is on involving students to exhibit their talent in various curricular and co-curricular activities and strengthening alumni link to share their experiences to the students.
- *Academic Integrity and Accountability:* Management induces accountability in the employees for the career of the students and the academic leadership establishes a mentoring mechanism for realization of responsibilities of students towards their parents and in turn to the society.

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(For the batches admitted from the academic year 2021-22)

INDUCTION PROGRAM (3 weeks duration)
❖ Physical activity ❖ Creative Arts ❖ Universal Human Values ❖ Literary ❖ Proficiency Modules ❖ Lectures by Eminent People ❖ Visits to local Areas ❖ Familiarization to Dept./Branch & Innovations

Semester I (First year)

S. No	Category	CourseCode	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T	P	C			
1	BS	21A110101	Calculus and Special Functions	3	0	0	3	30	70	100
2	BS	21A110105	Applied Chemistry	3	0	0	3	30	70	100
3	ES	21A050302	C-Programming & Data Structures	3	0	0	3	30	70	100
4	BS	21A110106	Engineering Physics	3	0	0	3	30	70	100
5	HSMC	21A110202	English for Professionals	2	0	0	2	30	70	100
6	ES	21A050301	Engineering & IT Workshop	0	0	3	1.5	30	70	100
7	BS	21A110109A	Engineering Physics Lab	0	0	3	1.5	30	70	100
8	BS	21A110108B	Applied Chemistry Lab	0	0	3	1.5	30	70	100
9	ES	21A050303	C-Programming & Data Structures Lab	0	0	3	1.5	30	70	100
Total							**20**			**900**

Semester II (First year)

S. No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T	P	C			
1	BS	21A110102	Mathematical Methods	3	0	0	3	30	70	100
2	BS	21A110110	Probability and Statistics	3	0	0	3	30	70	100
3	ES	21A030301	Engineering Drawing	1	0	4	3	30	70	100
4	ES	21A050304	Advanced Data Structures through C++	3	0	0	3	30	70	100
5	ES	21A020303	Basic Electrical and Electronics Engineering	3	0	0	3	30	70	100
6	HSMC	21A110201	Communicative English Lab	0	0	3	1	30	70	100
7	ES	21A020304	Basic Electrical and Electronics Engineering Lab	0	0	3	1.5	30	70	100
8	ES	21A050305	Advanced Data Structures through C++ Lab	0	0	3	1.5	30	70	100
9	MC	21A000005	Biology for Engineers	2	0	0	0	30	0	0
Total							**19**			**800**

Semester III (Second year)

S. No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T	P	C			
1	BS	21A010111	Mathematical Foundations of Computer Science	3	0	0	3	30	70	100
2	PC	21A050401	Digital Logic Design & Computer Organization	3	0	0	3	30	70	100
3	PC	21A050402	Database Management Systems	3	0	0	3	30	70	100
4	PC	21A050403	Object Oriented Programming through Java	3	0	0	3	30	70	100
5	ES	21A050306	Python Programming & Data Science	3	0	0	3	30	70	100
6	PC	21A050404	Database Management Systems Lab	0	0	3	1.5	30	70	100
7	PC	21A050405	Object Oriented Programming through Java Lab	0	0	3	1.5	30	70	100
8	ES	21A050307	Python Programming & Data Science Lab	0	0	3	1.5	30	70	100
9	SC	21A050706	MATLAB Programming	1	0	2	2	30	70	100
10	MC	21A000002	Constitution of India	2	0	0	0	30	0	0
Total							**21.5**			**900**

Semester IV (Second year)

S. No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T	P	C			
1	PC	21A310402	Artificial Intelligence & Neural Networks	3	0	0	3	30	70	100
2	PC	21A050407	Software Engineering & OOAD	3	0	0	3	30	70	100
3	PC	21A050408	Computer Networks	3	0	0	3	30	70	100
4	PC	21A050409	Operating Systems	3	0	0	3	30	70	100
5	HSMC	21A110203	Managerial Economics and Financial Analysis	3	0	0	3	30	70	100
6	PC	21A310404	Artificial Intelligence & Neural Networks Lab	0	0	3	1.5	30	70	100
7	PC	21A050411	Software Engineering & OOAD Lab	0	0	3	1.5	30	70	100
8	PC	21A050412	Computer Networks & Operating Systems Lab	0	0	3	1.5	30	70	100
9	SC	21A050703	Advanced Java	1	0	2	2	30	70	100
Total							**21.5**			**900**
Internship-I (Mandatory) for 3 weeks during summer vacation										

Course Code	CALCULUS AND SPECIAL FUNCTIONS		L	T	P	C
21A110101	(Common to all branches)		3	0	0	3
Pre-requisite	NIL	Semester	I			

COURSE OBJECTIVES:

- This course will illuminate the students in the concepts of calculus and Mean value theorems.
- To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real-world problems and their applications.

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Utilize mean value theorems to real life problems.

CO2: Familiarize with functions of several variables which is useful in optimization.

CO3: Students will also learn important tools of calculus in higher dimensions. Students will become familiar with 2- dimensional coordinate systems.

CO4: Students will also learn important tools of calculus in higher dimensions. Students will become familiar with 3- dimensional coordinate systems.

CO5: Utilize special functions in evaluating definite integrals.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO2	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO3	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO4	3	2	2	3	-	-	-	-	-	-	-	2	1	-
CO5	3	3	2	2	-	-	-	-	-	-	-	1	1	-

UNIT – I (10 Hrs)

Mean Value Theorems: Rolle's Theorem, Lagrange's mean value theorem, Cauchy's mean value theorem, Taylor's and Maclaurin theorems with remainders (without proof) related problems.

Learning Outcomes: At the end of this unit, students should be able to

- Translate the given function as series of Taylor's and Maclaurin's with remainders (L3)
- Analyze the behaviour of functions by using mean value theorems (L3)

UNIT – II (12 Hrs)

Multi variable calculus: Partial derivatives, total derivatives, chain rule, Jacobians, maxima and minima of functions of two variables, method of Lagrange multipliers.

Learning Outcomes: At the end of this unit, students should be able to

- Find partial derivatives numerically and symbolically and use them to analyze and interpret the way a function varies. (L3)
- Acquire the Knowledge maxima and minima of functions of several variable (L1)
- Utilize Jacobian of a coordinate transformation to deal with the problems in change of variables (L3)

UNIT – III (10 Hrs)

Double Integrals: Evaluation of Double integrals, change of order of integration, change of variables. Areas using Double Integrals.

Learning Outcomes: At the end of this unit, students should be able to

- Evaluate double integrals of functions of several variables in two dimensions using Cartesian and polar coordinates (L5)
- Apply double integration techniques in evaluating areas bounded by region (L4)

UNIT – IV (10 Hrs)

Triple Integrals: Evaluation of triple integrals, change of variables between Cartesian, cylindrical and spherical polar co-ordinates, volumes using triple integrals.

Learning Outcomes: At the end of this unit, students should be able to

- Evaluate triple integrals in Cartesian, cylindrical and spherical polar coordinates. (L5)
- Apply triple integration techniques in evaluating volumes. (L4)

UNIT – V (12 Hrs)

Beta and Gamma functions: Beta and Gamma functions and their properties, relation between beta and gamma functions, evaluation of definite integrals using beta and gamma functions.

Learning Outcomes: At the end of this unit, students should be able to

- Understand beta and gamma functions and its relations (L2)
- Conclude the use of special function in evaluating definite integrals (L4)

TEXTBOOKS:

1. "Higher Engineering Mathematics", S. Grewal, Khanna Publishers, 44/e, 2017.
2. "Advanced Engineering Mathematics", Erwin Kreyszig, John Wiley & Sons,10/e, 2011.

REFERENCE BOOKS:

1. "Advanced Engineering Mathematics", R. K. Jain and S. R. K. Iyengar, Alpha Science International Ltd., 3/e, 2002.

2. "Calculus", George B. Thomas, Maurice D. Weir and Joel Hass, Thomas, Pearson Publishers, 13/e, 2013.
3. "Advanced Modern Engineering Mathematics", Glyn James, Pearson publishers, 4/e, 2011.
4. "Advanced Engineering Mathematics", Michael Greenberg, Pearson Education, 9th Edition.
5. "Advanced Engineering Mathematics with MATLAB", Dean G. Duffy, CRC Press
6. "Advanced Engineering Mathematics", Peter O'Neil, Cengage Learning.
7. "Engineering Mathematics Volumes-I &II", R.L. Garg Nishu Gupta, Pearson Education
8. "Higher Engineering Mathematics", B. V. Ramana, McGraw Hill Education
9. "Higher Engineering Mathematics", H. K. Das, Er. Rajnish Verma, S. Chand & Co. Ltd.
10. "Advanced Engineering Mathematics", N. Bali, M. Goyal, C. Watkins, Infinity Science Press.
11. "Engineering Mathematics", T.K.V Iyengar, B. Krishna Gandhi, S. Ranganatham, M.V.S.S.N Prasad, S. Chand Publications.

Course Code	APPLIED CHEMISTRY (Common to EEE, ECE, CSE, CSE-AI & CSE-IOT)		L	T	P	C
21A110105			3	0	0	3
Pre-requisite	NIL	Semester	I			

COURSE OBJECTIVES:

- To familiarize Applied chemistry and applications.
- To train the students on the principles and applications of electrochemistry and polymers.
- To introduce instrumental methods and applications.

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Explain the salient features of different theories along with their applications.
CO2: Discuss about the model engineering materials.
CO3: Apply the knowledge of various electrodes for the development of new batteries.
CO4: Identify the different polymers and their uses in various fields of engineering.
CO5: Analyze the knowledge of different analytical techniques used in engineering and also development of new techniques.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	2	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	1	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	2	-	-	-	-	-	-	-	-	-

UNIT-I (14 Hrs)

Structure and Bonding Models: Planck's quantum theory, dual nature of matter, Schrodinger equation, significance of Ψ and Ψ^2, Molecular orbital theory –bonding in homo and hetero nuclear diatomic molecules – energy level diagrams of O_2 and CO, π-molecular orbital's of butadiene and benzene, calculation of bond order. Crystal field theory–salient features–splitting in octahedral and tetrahedral geometry.

Learning Outcomes: At the end of this unit, students should be able to

- Illustrate the molecular orbital energy level diagram of different molecular species (L2)
- Discuss the basic concept of molecular orbital theory (L3)
- Explain the calculation of bond order of O_2 and CO molecules (L2)
- Discuss the salient features of Crystal field theory (L3)

UNIT-II (10 Hrs)

Modern Engineering Materials: Band theory of solids- band diagrams for conductors, Insulators, Semiconductors, Effect of doping on band structures.

Super conductors and Super capacitors: Introduction, Definition, Classification, Applications.

Nano chemistry: Introduction, classification of nano materials, properties and applications of Fullerenes, carbon nanotubes and Graphene nanoparticles.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the band theory of solids for conductors, semiconductors and insulators (L2)
- Demonstrate the application of Fullerenes, carbon nanotubes and Graphenes nanoparticles (L2).

UNIT-III (13 Hrs)

Electro Chemistry and Applications: Electrodes and their concepts, Types of Reference electrodes-their applications. Electrochemical cell, Nernst equation, Numerical problems on emf.

Primary cells – Zinc-air battery, Secondary cells – Lead-acid and Lithium-ion batteries-working of the batteries including cell reactions; Fuel cells- hydrogen-oxygen, methanol- oxygen fuel cells – working of the cells.

Potentiometry- principle, potentiometric titrations (redox titrations), Conductometry-conductometric titrations (acid-base titrations).

Electrochemical sensors– potentiometric sensors principle with examples, ampere metric sensors principle with examples and their applications.

Learning Outcomes: At the end of this unit, students should be able to

- Apply the Nernst equation for calculating electrode and cell potentials (L3)
- Differentiate between potentiometric and conductometric titrations (L2)
- Explain the theory of construction of battery and fuel cells (L2)

UNIT-IV (13 Hrs)

Polymer Chemistry: Introduction to polymers, functionality of monomers and their significance, Tacticity of polymers, Types of polymerization- chain growth, step growth and copolymerization with specific examples and mechanisms of polymer formation.

Plastomers-Thermoplastics and Thermo setting plastics, Preparation, properties and applications of– PVC, Teflon, Bakelite, Nylons.

Elastomers – Buna-S, Buna-N– preparation, properties and applications of Buna-S, Buna-N.

Conducting polymers, examples, classification, polyacetylene, polyaniline - mechanism of conduction and applications.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the different types of polymers and their applications (L2)
- Explain the preparation, properties and applications of Bakelite, Nylons (L2)

- Describe the mechanism of conduction in conducting polymers (L2)
- Discuss Buna-S and Buna-N and their applications (L2)

UNIT-V (10 Hrs)

Instrumental Methods and Applications: Introduction, Electromagnetic spectrum. Absorption of radiation: Beer-Lambert's law- Principle, instrumentation and applications of UV-Visible**,** IR-Spectroscopy's and pH-metry, Solid-Liquid Chromatography–TLC, retention factor.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the different types of spectral series in electromagnetic spectrum (L2)
- Understand the principles and applications of different analytical instruments (L2)

TEXTBOOKS:

1. "Engineering Chemistry", Jain and Jain, Dhanpat Rai publications, 17/e, 2018
2. "Engineering Chemistry", Shashi Chawla, Dhanpat Rai publications, 2/e, 2014
3. "Principles of Instrumental Analysis", Skoog, FJ Holler and SR Crouch, 7/e, 2018
4. "Applied Chemistry", Guesser, Springer's Publications, 2001
5. "Atkins' Physical Chemistry", Peter Atkins, Julio de Paula and James Keeler, Oxford University Press, 10/e, 2010

REFERENCE BOOKS:

1. "Concise Inorganic Chemistry", J. D. Lee, Oxford University Press, 5/e, 2008
2. "Engineering Chemistry", G. V. Subba Reddy, K. N. Jayaveera and Ramachandraiah, McGraw Hill, 2020.

Course Code	C-PROGRAMMING & DATA STRUCTURES		L	T	P	C
21A050302	(Common to all branches)		3	0	0	3
Pre-requisite	NIL	Semester	I			

COURSE OBJECTIVES:

- Introduce the Concept of Algorithm and use it to solve computational problems
- To illustrate the basic concepts of C Programming language
- Demonstrate the use of Control structures of C Programming language
- To discuss the concepts of Arrays, Functions, Pointers and Structures
- To familiarize with Stack, Queue and Linked lists data structures

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Solve computational problems, choose appropriate control structure depending on the problem to be solved.
CO2: Design applications in C using Arrays and Strings.
CO3: Modularize the problem and also solution.
CO4: Design applications in C using Functions, Pointers, and Structures.
CO5: Explore various operations on Stacks, Queues and Linked lists.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	-	-	-	-	-	-	-	-	1	-
CO2	3	3	1	-	-	-	-	-	-	-	-	-	1	-
CO3	3	3	1	3	-	-	-	-	-	-	-	-	1	-
CO4	3	3	3	2	1	-	-	-	-	-	-	-	-	2
CO5	1	2	3	1	-	-	-	-	-	-	-	-	-	2

UNIT-I (15 Hrs)

Computer Fundamentals, Algorithm, Flowchart.

Introduction to C Language: Characteristics, Identifiers, Constants, Data types, Keywords, Basic input/output statements, Structure of a C program.

Operators and Expressions: Operators classification, Assignment Operator, Arithmetic Operators, Relational and Logical Operators, Increment and Decrement Operators, Conditional Operator, Bitwise Operators with examples – Operator precedence and Associativity, Type casting.

Statements: Simple and Compound statements, Control Statements - Conditional/Decision statements, Loop Control Statements, Branch Control statements.

Learning Outcomes: At the end of this unit, students should be able to

- Solve complex problems using language independent notations (L3)
- Use C basic concepts to write simple C programs (L3)
- Test and execute the programs and correct syntax and logical errors (L4)
- Select the control structure for solving the problem (L4)
- Implement conditional branching, iterations (L2)

UNIT-II (12 Hrs)

Arrays: Declarations, Initialization and accessing elements, Single, Two and Multi-dimensional arrays.

Array Techniques: Array order reversal, finding the maximum and minimum number in a set, sorting the given array elements.

Strings: String I/O functions, String handling functions, Data conversion functions.

Learning Outcomes: At the end of this unit, students should be able to

- Use arrays to process multiple homogeneous data (L3)
- Solve mathematical problems using C Programming languages (L3)
- Apply string handling functions (L3)

UNIT-III (12 Hrs)

Functions: Types of functions, Library functions, User-defined functions, Function Categories, Nested functions, Recursion, Symbolic constants, Pre-processor Commands, Storage classes – auto, register, static, extern, Type qualifiers.

Input and output: Standard input and output, Non-formatted Input and Output statements, Formatted Input and Output statements.

Learning Outcomes: At the end of this unit, students should be able to

- Understand basic terminology of modular programming (L2)
- Apply modular approach for solving the problem (L3)
- Writing C programs using various storage classes to control variable access (L5)
- Apply input and output statements to process the data in various formats (L3)

UNIT-IV (12 Hrs)

Pointers: Pointers and addresses, Passing parameters to functions, Address Arithmetic operations, Void and Null pointers, Pointer and Arrays, Pointer and Strings, Array of Pointers, Pointer and Functions, Pointer-to-Pointer, Dynamic Memory Allocation. Uses of Pointers, Command line Arguments.

Structure and Union: Declaration and Initialization of a structure, Copy and comparisons, Array of structures, Structure with pointer, Nested structures, Type Definition, Enumeration, Union.

Learning Outcomes: At the end of this unit, students should be able to

- Structure the individual data elements to simplify the solutions (L6)
- Facilitate efficient memory utilization (L6)
- Use pointers and structures to formulate algorithm and write programs (L3)

UNIT-V (14 Hrs)

Data Structures: Overview of data structures, **Stack:** Representation of a stack, Operations and Applications of a Stack – Evaluation of Arithmetic Expressions, Implementation of Recursion – **Queue:** Representation of a queue, Operations and Applications of a Queue – CPU Scheduling in Multi-programming Environment.

Linked List: Representations of linked lists, singly linked list, doubly linked list, Circular linked list and its operations.

Learning Outcomes: At the end of this unit, students should be able to

- Describe the operations of a stack (L2)
- Develop various operations on Queues (L6)
- Analyze various operations on singly linked list (L4)
- Interpret operations of doubly linked lists (L2)
- Apply various operations on Circular linked lists (L6)

TEXTBOOKS:

1. "The Complete Reference C", Herbert Schildt, McGraw Hill Education, Fourth Edition
2. "Programming in C and Data Structures", J.R. Hanly, Ashok N Kamthane and A. Ananda Rao, Pearson Education.
3. "Fundamentals of Data Structures in C", Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, Computer Science Press, Second Edition

REFERENCE BOOKS:

1. "The C Programming Language", Brain W Kernighan and Dennis M Ritchie, Prentice Hall Publication, Second Edition
2. "C and Data Structures", E Balaguruswamy, Tata McGraw Hill, Fourth Edition.
3. "Programming in C", Pradip Dey and Manas Ghosh, Oxford University Press, 2018.
4. "Schaum's Outline of Data Structures", Seymour Lipschutz, McGraw Hill, Revised First Edition.

Course Code	ENGINEERING PHYSICS		L	T	P	C
21A110106	(Common to ME, CSE-IOT & CSE-AI)		3	0	0	3
Pre-requisite	NIL	Semester	I			

COURSE OBJECTIVES:

- To present the basic concepts needed to understand the crystal structure of materials, X- ray diffraction and the importance of nano materials.
- To understand the mechanisms of lasers and propagation of light through optical fibres along with engineering applications.
- To explain the significant concepts of dielectric and magnetic materials that leads to potential applications in the emerging micro devices.
- To explain the significance of acoustics and ultrasound in different engineering fields.
- Evolution of band theory to distinguish materials and explain the properties of semiconductors.

COURSE OUTCOMES:

After the completion of the course, the student will be able to

CO1: Explain the important properties of crystals & structure determination using X-ray Diffraction along with the nano materials.

CO2: Identify the importance of lasers and fiber optics in different engineering fields

CO3: Understands the response of dielectric & magnetic materials to the applied electric & magnetic fields

CO4: Explain the basic concepts of acoustics and ultrasonics.

CO5: Elaborate the physical properties of semiconductors.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	-	-	-	-	-	-	-	-	-	-
CO2	3	1	2	-	-	-	-	-	-	-	-	-	-	-
CO3	3	1	2	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	2	-	-	-	-	-	-	-	-	-	-	-
CO5	3	1	1	-	-	-	-	-	-	-	-	-	-	-

UNIT-I (12 Hrs)

Crystallography & Nano materials

Crystallography: Introduction – Space lattice – Unit cell – Lattice parameters – Bravias lattice – Crystal systems – Packing fractions of SC, BCC and FCC - Directions and planes in crystals – Miller indices – Interplanar spacing in cubic crystals – X-ray diffraction - Bragg's law – Laue Method - Powder method.

Nano materials – Introduction – Surface area and quantum confinement – Physical properties: electrical and magnetic properties – Synthesis of nanomaterials: Top-down: Ball

Milling – Bottom-up: Chemical Vapour Deposition – Applications of nanomaterials.

Learning Outcomes: At the end of this unit, students should be able to

- Classify various crystal systems (L2)
- Identify different planes in the crystal structure (L3)
- Analyze the crystalline structure by Bragg's law to measure the crystallinity of a solid by powder method (L4)
- Identify the nano size dependent properties of nano materials (L2)
- Illustrate the methods for the synthesis and characterization of nano materials (L2)

UNIT - II (12 Hrs)

Lasers and Fiber optics

Lasers- Introduction – Characteristics of laser – Spontaneous and Stimulated emission of radiation – Einstein's coefficients – Population inversion – Lasing action – Pumping mechanisms – Nd-YAG laser – He-Ne laser – Applications of lasers.

Fiber optics- Introduction – Principle of optical fiber – Acceptance Angle – Numerical Aperture – Classification of optical fibers based on refractive index profile and modes – Transmission of signals in step index and graded index fibers – Propagation Losses (qualitative) – Applications of fiber in medical field .

Learning Outcomes: At the end of this unit, students should be able to

- Understand the basic concepts of LASER light Sources (L2)
- Apply the concepts to learn the types of lasers (L3)
- Identifies the Engineering applications of lasers (L2)
- Explain the working principle of optical fibers (L2)
- Classify optical fibers based on refractive index profile and mode of propagation (L2)
- Identify the applications of optical fibers in various fields (L2)

UNIT – III (12 Hrs)

Dielectric Materials- Introduction – Dielectric polarization – Dielectric polarizability, Susceptibility and Dielectric constant – Types of polarizations: Electronic, Ionic and Orientation polarizations (Qualitative) – Lorentz internal field – Clausius-Mossotti equation.

Magnetic Materials- Introduction – Magnetic dipole moment – Magnetization – Magnetic susceptibility and Permeability – Origin of permanent magnetic moment – Classification of magnetic materials: Dia, para & Ferro-Domain concept of Ferromagnetism (Qualitative) – Hysteresis – Soft and Hard magnetic materials.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the concept of dielectric constant and polarization in dielectric materials (L2)
- Summarize various types of polarization of dielectrics (L2)
- Interpret Lorentz field and Clausius - Mosotti relation in dielectrics (L2)

- Classify the magnetic materials based on susceptibility and their temperature dependence (L2)
- Explain the applications of dielectric and magnetic materials (L2)

UNIT - IV (13 Hrs)

Acoustics and Ultrasonics

Acoustics- Introduction – Requirements of acoustically good hall – Reverberation – Reverberation time – Sabine's formula (Derivation using growth and decay method) – Absorption coefficient and its determination – Factors affecting acoustics of buildings and their remedies.

Ultrasonics- Introduction – Properties – Production by magneto striction and piezoelectric methods – Detection – Acoustic grating – Non Destructive Testing – Applications.

Learning Outcomes: At the end of this unit, students should be able to

- Explain how sound is propagated in buildings (L2)
- Analyze acoustic properties of typically used materials in buildings (L4)
- Recognize sound level disruptors and their use in architectural acoustics (L2)
- Identify the use of ultrasonics in different fields (L3)

UNIT - V (13 Hrs)

Semiconductors- Origin of energy bands - Classification of solids into conductors, semiconductors and insulators -Intrinsic and extrinsic semiconductors (Qualitative treatment)– Density of carriers and Fermi levels in intrinsic & extrinsic semiconductors Drift & diffusion currents and Einstein's equation – Hall effect - Direct and indirect band gap semiconductors.

Learning Outcomes: At the end of this unit, students should be able to

- Classify the energy bands of semiconductors (L2)
- Interpret the direct and indirect band gap semiconductors (L2)
- Identify the type of semiconductor using Hall effect (L2)
- Identify applications of semiconductors in electronic devices (L2)

TEXTBOOKS:

1. "Engineering Physics", Dr. M. N. Avadhanulu & Dr. P. G. Kshirsagar, S. Chand and Company
2. "Engineering Physics", B.K. Pandey and S. Chaturvedi, Cengage Learning.
3. "Engineering Physics", K. Thyagarajan, McGraw Hill Publishers

REFERENCE BOOKS:

1. “Engineering Physics”, Shatendra Sharma, Jyotsna Sharma, Pearson Education, 2018
2. “Engineering Physics”, Sanjay D. Jain, D. Sahasrabudhe and Girish, University Press
3. “Semiconductor physics and devices - Basic principles”, Donald A, Neamen, McGraw Hill
4. “Engineering physics”, P.K. Palanisamy, SCITECH Publications
5. “Applied Physics”, S. Mani Naidu, Pearson Publications
6. “Lasers and Non-Linear Optics”, B.B Laud, New Age International Publishers.

Course Code	ENGLISH FOR PROFESSIONALS		L	T	P	C
21A110202	(Common to all branches)		2	0	0	2
Pre-requisite	NIL	Semester	I			

COURSE OBJECTIVES:

- To improve Reading and Writing proficiency of students in English with an emphasis on Vocabulary development.
- To provide knowledge of grammatical structures and encourage their appropriate use in writing.
- To improve students' comprehension skills required for academic and professional needs.
- To equip students with writing skills required for professional correspondence in different contexts.

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Demonstrate word knowledge and its usage in appropriate contexts.
CO2: Recognize and incorporate basic grammar mechanics and sentence variety in writing.
CO3: Improve comprehension skills through intensive and extensive reading practice.
CO4: Learn and apply various writing formats for effective communication.
CO5: Improve writing skills needed for professional correspondence in various contexts.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	2		-	-	-	-	-	-	3	-	2	-	-
CO2	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO3	-	3	-	3	-	-	-	-	-	3	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	3	-	-	-	-

UNIT-I (10 Hrs)

Vocabulary Building: Introduction to affixes and base words, Prefixes and suffixes, Basic comparing and contrasting, Idioms and Phrases, One word substitutes, Words often confused, Synonyms and Antonyms used in the everyday contexts, Using prior knowledge to determine the correct word for the context, Discovering the correct word in the sentence by looking at the surrounding words, Vocabulary in social interactions.

Learning Outcomes: At the end of this unit, students should be able to

- Recognize word parts: affixes, prefixes, suffixes and base words. (L2)
- Use words appropriately in a context. (L3)
- Guess the meanings of the words by using the contextual clues. (L2)
- Use synonyms, antonyms, phrases and idioms in writing. (L2)

UNIT-II (10 Hrs)

Essentials of Sentence Formation: Basic Sentence Structure, word order, Subject-Verb Concord, Using Tenses, Punctuation Marks, Correction of Common Errors

Learning Outcomes: At the end of this unit, students should be able to

- Frame a sentence without any grammatical errors. (L3)
- Use appropriate punctuation marks. (L3)
- Identify common errors in a sentence. (L2)

UNIT-III (10 Hrs)

Reading Comprehension: Understanding short real-world notices, messages, factual material - Scanning, skimming - Inferring meaning - Critical reading - Reading and information transfer

Learning Outcomes: At the end of this unit, students should be able to

- Use skimming and scanning strategies while reading. (L3)
- Infer meaning from the given text. (L3)
- Distinguish between the main idea and supporting ideas. (L3)
- Critically analyse the given text. (L4)

UNIT-IV (10 Hrs)

Writing Skills: Rules for good writing and composition; Paragraph Writing: Structure of a paragraph, Types of paragraphs, Usage of Cohesive Devices; Essay writing: Structure of an Essay, Types of Essays; Letter Writing (Formal and informal): Format and Structure; and Email writing

Learning Outcomes: At the end of this unit, students should be able to

- Learn to organize thoughts into meaningful paragraphs. (L2)
- Use cohesive devices in making the piece of writing more coherent. (L3)
- Compose essays on different topics in a more organised structure. (L3)
- Draft letter and emails in a definite format. (L3)

UNIT-V (10 Hrs)

Professional Correspondence: Internal Correspondences – Memorandum, Note Taking, Minutes of Meetings; External Correspondences - Business Letters - Cover Letters - Sale Letters - Inquiry Letters - Complaint Letters - Emails & Netiquette

Learning Outcomes: At the end of this unit, students should be able to

- Draft official e-mails and letters for different professional purposes. (L3)
- Write proficiently memos and minutes of meeting. (L3)

TEXTBOOKS:

1. "Technical Communication – Principles and Practice", Meenakshi Raman, Sangeeta Sharma, Oxford University Press

REFERENCE BOOKS:

1. "A Textbook of English Phonetics for Indian Students", T. Balasubramanian, Mc Millan India Pvt
2. "English Vocabulary in Use", Michael McCarthy, Cambridge University Press
3. "Strengthen your English", Bhaskaran, Horsburgh, Oxford University Press
4. "Practical English Usage", Michael Swan, Oxford University Press

ONLINE SOURCES FOR PRESCRIBED READING TEXTS:

1. https://digital.library.upenn.edu/women/sultana/dream/dream.html
2. https://owl.purdue.edu/
3. https://www.thesaurus.com/
4. https://www.readwritethink.org/classroom-resources/student-interactives
5. https://www.fluentu.com/blog/english/english-writing-websites/

Course Code	ENGINEERING & IT WORKSHOP LAB		L	T	P	C
21A050301	(Common to all branches)		0	0	3	1.5
Pre-requisite	NIL	Semester	I			

PART-A (ENGINEERING WORKSHOP)

COURSE OBJECTIVES:

- To familiarize the students with wood working, sheet metal operations, fitting and electrical house, Wiring and foundry skills.
- To provide technical training to the students on Word, Excel and Presentation.
- To make the students know about the internal parts of a computer.
- To learn how to use Internet facility for Browsing and Searching.

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Apply wood working skills and build different parts with metal sheets in real world applications.

CO2: Apply fitting operations in various applications and Preparation of moulds and castings.

CO3: Apply different types of basic electric circuit connections.

CO4: Prepare documentation, spread sheets for calculations and slides for Presentation.

CO5: Identify Computer peripherals and its functions, Internet browsing to obtain the required information

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	2	-	-	-	-	-	2	1	-
CO2	3	2	2	-	-	2	-	-	-	-	-	2	1	-
CO3	3	2	-	-	-	2	-	-	-	-	-	2	1	2
CO4	3	-	-	-	-	2	-	-	-	-	-	2	-	2
CO5	3	2	-	-	-	2	2	-	-	-	-	2	-	2

LIST OF TOPICS:

Wood Working: Familiarity with different types of woods and tools used in wood working and make following joints

a) Half – Lap joint b) Dovetail joint or Bridle joint

Sheet Metal Working: Familiarity with different types of tools used in sheet metal working, Developments of following sheet metal job from GI sheets

a) Tapered tray b) Conical funnel

Fitting: Familiarity with different types of tools used in fitting and do the following fitting exercises

a) V-fit b) Square fit.

Electrical Wiring: Familiarities with different types of basic electrical circuits and make the following connections

a) Parallel and series b) Two-way switch c) Godown lighting

Foundry:

a) Preparation of mould cavity using single piece pattern.
b) Preparation of mould cavity using split piece pattern

PART-B (IT WORKSHOP)

LIST OF TOPICS:

Task 1:

MS-Word: Students should be able to create documents using the word processor tool. Alignment of the lines, Inserting header and Footer, changing the font, changing the color, including images and tables in the word file, making page setup, copy and paste block of text, images, tables, linking the images which are present in other directory, formatting paragraphs, spell checking, etc. Students should be able to prepare project cover pages, content sheet and chapter pages at the end of the task using the features studied. Students should submit report.

Task 2:

Spreadsheet: Students should be able to create, open, save the application documents and format them as per the requirement. Creating cell data, inserting and deleting cell data, format cells, adjust the cell size, applying formulas and functions, preparing charts, sorting cells. Students should submit a user manual of the Spreadsheet.

Task 3:

Presentations: creating, opening, saving the presentations, selecting the style for slides, formatting the slides with different fonts, colors, creating charts and tables, inserting and deleting text, graphics and animations, bulleting and numbering, running the slide show.

Task 4: Learn about Computer: Identify the internal parts of a computer, and its peripherals. Write specifications for each part of a computer including peripherals and specification of Desktop computer. Submit it in the form of a report.

Task 5:

Browsing Internet: Student should access the Internet for Browsing. Students should search the Internet for required information. Students should be able to create e-mail account and send email.

REFERENCE BOOKS:

1. "Workshop Practice Manual", K. Venkata Reddy, BS Publications.
2. "Engineering work shop practice for JNTU", V. Ramesh babu, VRB Publishers Pvt. Ltd., 2009.
3. "Work shop manual", P. Kannaiah, K. L. Narayana, SCITECH Publishers.
4. "Engineering practices lab manual", Jeyapoovan, Saravanapandian, Vikas Publishing House, 4/E
5. "Dictionary of mechanical engineering", GHF Nayler, Jaico Publishing House.
6. "Introduction to Computers", Peter Norton, McGraw Hill
7. "MOS study guide for word, Excel, Power point & Outlook Exams", Joan Lambert, Joyce Cox.
8. "Introduction to Information Technology", ITL Education Solutions limited, Pearson Education.
9. "Networking your computers and devices", Rusen, Prentice Hall of India
10. "Bigelow's Trouble shooting, Maintaining & Repairing PCs", Bigelow, Tata McGraw Hill Edition

Course Code	ENGINEERING PHYSICS LAB		L	T	P	C
21A110109A	(Common to ME, CSE-IOT & CSE-AI)		0	0	3	1.5
Pre-requisite	NIL	Semester	I			

COURSE OBJECTIVES:

- Understand the role of Optical fiber parameters in engineering applications.
- Recognize the significance of laser by studying its characteristics and its application in finding the wavelength.
- Understands the concepts of interference, diffraction and their applications.
- Verify the Laws of Stretched Strings by sonometer.

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Operate various optical instruments
CO2: Estimate wavelength of laser using laser
CO3: Evaluate the acceptance angle of an optical fiber and numerical aperture
CO4: Plot the intensity of the magnetic field of circular coil carrying current with distance

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	1	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	1	-

LIST OF EXPERIMENTS

1. Determine the thickness of the wire using wedge shape method
2. Determination of the radius of curvature of the lens by Newton's ring method
3. Determination of wavelength by plane diffraction grating method
4. Determination of wavelength of LASER light using diffraction grating.
5. Determination of numerical aperture and acceptance angle of a given optical fiber
6. Magnetic field along the axis of a circular coil carrying current –Stewart Gee's method.
7. Sonometer: Verification of the three laws of stretched strings
8. Determination of particle size using LASER.
9. Study the variation of B versus H by magnetizing the magnetic material. (B-H curve)
10. Determination of rigidity modulus of material of a wire -dynamic method. (Torsional Pendulum)

REFERENCE BOOKS:

1. "A Textbook of Practical Physics", S. Balasubramanian, M.N. Srinivasan, S Chand Publishers, 2017.
2. http://vlab.amrita.edu/index.php -Virtual Labs, Amrita University

Course Code	APPLIED CHEMISTRY LAB		L	T	P	C
21A110108B	(Common to EEE, ECE, CSE, CSE-AI & CSE-IOT)		0	0	3	1.5
Pre-requisite	NIL	Semester	I			

COURSE OBJECTIVES:

- To get familiar with the basic concepts of Chemistry
- To verify the fundamental concepts with experiments.

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Distinguish different types of titrations in the volumetric analysis

CO2: Determine the cell constant and conductance of solutions

CO3: Measure the strength of an acid present in secondary batteries

CO4: Analyze the effect of absorbance of given sample solution on concentration by using colorimetry.

CO5: Prepare advanced polymer Bakelite materials.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	2	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	2	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-		-	-	-	-	-	-	-	-	-

LIST OF EXPERIMENTS

1. Preparation of Standard Oxalic acid solution
2. Determination of Strength of an acid in Lead- Acid battery
3. Estimation of Ferrous Iron by Dichrometry
4. Potentiometry - Determination of redox potentials and emfs
5. Conductometry - Determination of cell constant and conductance of solutions.
6. Conductometric titration of a) strong acid vs strong base b) weak acid vs strong base.
7. pH-metric titration of a) strong acid vs strong base b) weak acid vs strong base.
8. Verification of the Beer-Lambert's Law and determination of strength of the given unknown solution.
9. Determination of the Retention factor of the sample by Thin Layer Chromatography (TLC).
10. Measurement of 10Dq by spectrophotometric method.
11. Preparation of Bakelite and measurement of its mechanical properties (strength)
12. Preparation of nanomaterials.

TEXTBOOKS:

1. "A Text Book on Experiments and Calculations in Engineering Chemistry", S. Chand Publications, 9/e, 2003.
2. "Engineering Chemistry", Shashi Chawla, Dhanpat Rai publications, 2/e, 2014.
3. "Experiments in Applied Chemistry", Dr. Sunita Rattan, S. K. Kataria & Sons Publishers of Engineering, 2/e, 2004.

REFERENCE BOOKS:

1. "Vogel's Text Book of Quantitative Chemical Analysis", Mendham J et.al, Pearson Education, 6/e, 2012.

Course Code	C-PROGRAMMING & DATA STRUCTURES LAB (Common to all branches)		L	T	P	C
21A050303			0	0	3	1.5
Pre-requisite	NIL	Semester	I			

COURSE OBJECTIVES:

- To get familiar with the basic concepts of C Programming
- To make the student solve problems, implement algorithms using C language
- To design programs using arrays, strings, pointers and structures
- To design Stack and Queue operations
- To apply different operations on linked lists

COURSE OUTCOMES:

At the end of the course, the student will be able to

CO1: Demonstrate the basic concepts of C programming language.
CO2: Select the right control structure for solving the problem.
CO3: Develop C programs using functions, arrays, structures and pointers.
CO4: Illustrate the concepts Stacks and Queues.
CO5: Design operations on Linked lists.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	3	-	-	-	-	-	-	-	1	-
CO2	2	2	2	1	3	-	-	-	-	-	-	-	1	-
CO3	3	3	2	2	3	-	-	-	-	-	-	-	1	-
CO4	2	2	2	2	3	-	-	-	-	-	-	-	-	2
CO5	3	3	2	2	3	-	-	-	-	-	-	-	-	2

Week 1

a) Write a C program to swap the given two integer values without using temporary variable.
b) Write a C program to print the first 'N' Fibonacci sequence numbers.

Week 2

a) Write a C program to print reverse of a given integer value.
b) Write a C program to find the roots of a quadratic equation.

Week 3

Write a C program that use recursive functions.

i) GCD of given two values.
ii) Factorial of a given value.

Week 4

a) Write a C program to find both the largest and smallest number in a list of integers.

b) Write a C program to perform the following:

i) Addition of Two matrices ii) Multiplication of Two matrices

Week 5

a) Write a C program that displays the position or index in the string S where the string T begins or -1 if S doesn't contain T.

b) Write a C program to read a set of strings and sort them in alphabetical order.

Week 6

a) Write a C program to count number of alphabets, digits and special symbols of a given line.

b) Write a C program to check whether a given string is palindrome or not.

Week 7

Write a C program to demonstrate the difference between call-by-value and call-by-address mechanisms.

Week 8

Write a program to perform the operations addition, subtraction, multiplication of complex numbers.

Week 9

Write a C program that implement stack operations using arrays.

Week 10

a) Write a C program that implement linear queue operations using arrays.

b) Write a C program that implement circular queue operations using arrays.

Week 11

Write a C program that uses functions to perform the following operations on singly linked list.

i) Creation ii) Insertion iii) Deletion iv) Traversal

Week 12

Write a C program that uses functions to perform the following operations on doubly linked list.

i) Creation ii) Insertion iii) Deletion iv) Traversal

Week 13

Write a C program that uses functions to perform the following operations on circular linked list.
i) Creation ii) Insertion iii) Deletion iv) Traversal

TEXTBOOKS:

1. "Programming in C and Data Structures", J.R. Hanly, Ashok N Kamthane and A. Ananda Rao, Pearson Education.
2. "Computer Science: A Structured Programming Approach Using C", B.A. Forouzon and R.F. Gilberg, CENGAGE Learning, Third Edition, 2016.
3. "C and Data Structures", E Balaguruswamy, Tata McGraw Hill, Fourth Edition.
4. "Schaum's Outline of Data Structures", Seymour Lipschutz, McGraw Hill, Revised First Edition.

REFERENCE BOOKS:

1. "The C Programming Language", Brain W Kernighan and Dennis M Ritchie, Prentice Hall Publication, Second Edition,
2. "Fundamentals of Data Structures in C", Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, Computer Science Press, Second Edition.
3. "Programming in C", Pradip Dey and Manas Ghosh, Oxford University Press, 2018.

Course Code	MATHEMATICAL METHODS (Common to all branches)		L	T	P	C
21A110102			3	0	0	3
Pre-requisite	NIL	Semester	II			

COURSE OBJECTIVES:

- This course aims at providing use of matrix algebra techniques for practical applications.
- This course aims at providing the student with the knowledge on Various numerical Methods for solving equations, interpolating the polynomials, evaluation of integral equations and solution of differential equations.

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Develop the use of matrix algebra techniques that is needed by engineers for practical applications.

CO2: Understand and solve the roots of equation using Bisection method, Iterative method, Regula-Falsi method, Newton Raphson method and solve the system of algebraic equations.

CO3: Apply concept of interpolation and derive interpolating polynomial using Newton's forward and backward formulae, Lagrange's formulae, Gauss forward and backward formulae.

CO4: Solving initial value problems to ordinary differential equations.

CO5: Determine the process of finding integral equations using Simson's 1/3, Simson's 3/8 Rule and Trapezoidal rule and fitting a best curve using least squares method.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	1	-	-	-	-	-	-	-	-	-	-
CO2	3	2	1	1	-	-	-	-	-	-	-	-	1	-
CO3	3	3	1	1	-	-	-	-	-	-	-	-	1	-
CO4	3	2	1	2	-	-	-	-	-	-	-	2	1	-
CO5	3	2	1	1	-	-	-	-	-	-	-	2	1	-

UNIT- I (10 Hrs)

Matrices: Rank of a matrix by echelon form, normal form. Solving system of homogeneous and non-homogeneous equations linear equations. Eigen values and Eigenvectors and their Properties, Cayley- Hamilton theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton theorem, Diagonalization of a matrix.

Learning Outcomes: At the end of this unit, students should be able to

- Solving systems of linear equations, using technology to facilitate row reduction determine the rank, eigen values and eigenvectors (L3).
- Identify special properties of a matrix, such as positive definite, etc., and use this information to facilitate the calculation of matrix characteristics (L3)

UNIT - II (10 Hrs)

Solution of Algebraic & Transcendental Equations: Introduction-Bisection method-Iterative method-Regula-Falsi method-Newton Raphson method. System of Algebraic equations: Gauss Jordan Method-Gauss Seidal method.

Learning outcomes: At the end of this unit, students should be able to

- Calculate the roots of equation using Bisection method and Iterative method. (L3)
- Calculate the roots of equation using Regula-Falsi method and Newton Raphson method. (L3)
- Solve the system of algebraic equations using Gauss Jordan method and Gauss Seidal method. (L3)

UNIT - III (10 Hrs)

Interpolation: Finite differences-Newton's forward and backward interpolation formulae – Lagrange's formulae. Gauss forward and backward formula, Stirling's formula, Bessel's formula.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of interpolation. (L2)
- Derive interpolating polynomial using Newton's forward and backward formulae. (L3)
- Derive interpolating polynomial using Lagrange's formulae. (L3)
- Derive interpolating polynomial using Gauss forward and backward formulae. (L3)

UNIT - IV (12 Hrs)

Numerical Solutions of Ordinary Differential Equations: Solution by Taylor's series-Picard's Method of successive Approximations- Euler's Method - Modified Euler's Method-Runge-Kutta Methods.

Learning Outcomes: At the end of this unit, students should be able to

- Solve initial value problems to ordinary differential equations using Taylor's method. (L3)
- Solve initial value problems to ordinary differential equations using Euler's method and Runge Kutta methods. (L3)

UNIT - V (12 Hrs)

Numerical Integration & Curve Fitting:

Trapezoidal rule – Simpson's 1/3 Rule – Simpson's 3/8 Rule

Fitting of straight line – second degree curve –Exponential curve –Power curve by the method of least squares.

Learning Outcomes: At the end of this unit, students should be able to

- Fit a best curve using method of least squares. (L3)
- Solve integral equations using Simson's 1/3 and Simson's 3/8 rule. (L3)
- Solve integral equations using Trapezoidal rule. (L3)

TEXTBOOKS:

1. "Higher Engineering Mathematics", B. S. Grewal, Khanna publishers.
2. "Advanced Engineering Mathematics", Erwin Kreyszig, Wiley India
3. "Introductory Methods of Numerical Analysis", S. S. Sastry, PHI publishers.

REFERENCE BOOKS:

1. "Higher Engineering Mathematics", B. V. Ramana, Mc Graw Hill publishers.
2. "Advanced Engineering Mathematics", Alan Jeffrey, Elsevier Publishers
3. "A Text Book of Engineering Mathematics Vol – I", T.K.V. Iyengar, B. Krishna Gandhi, S. Chand & Company.

Course Code	PROBABILITY AND STATISTICS		L	T	P	C
21A110110	(Common to ME, CSE, CSE-AI & CSE-IOT)		3	0	0	3
Pre-requisite	NIL	Semester	II			

COURSE OBJECTIVES:

- To familiarize the students with the foundations of probability and statistical methods.
- To impart probability concepts and statistical methods in various applications Engineering.

COURSE OUTCOMES:

At the end of the course, the student will be able to

CO1: Solve the central tendency, correlation and correlation coefficient and regression

CO2: Understand the terminologies of basic probability, two types of random variables and their probability functions.

CO3: Interpret the behavior of various discrete and continuous probability distributions.

CO4: Apply the concept of hypothesis testing for large samples.

CO5: Apply the statistics for testing the significance of the given small sample data by using t- test, F- test and Chi-square test.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	3	-	-	-	-	-	-	-	-	-	-
CO2	2	2	-	3	-	-	-	-	-	1	-	-	-	-
CO3	3	2	-	3	-	-	-	-	-	-	-	-	-	-
CO4	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO5	2	1	-	-	-	-	-	-	-	-	-	-	-	-

UNIT-1 (12 Hrs)

Statistics Introduction, Measures of Variability (dispersion) Skewness Kurtosis, correlation, correlation coefficient, rank correlation, regression lines, regression coefficients and their properties

Learning Outcomes: At the end of this unit, students should be able to

- summarize the basic concepts of data science and its importance in engineering (L2)
- analyze the data quantitatively or categorically, measure of averages, variability (L4)
- adopt correlation methods and regression analysis (L5)

UNIT-II (11 Hrs)

Probability, probability axioms, addition law and multiplicative law of probability, conditional probability, Bayes theorem, random variables (discrete and continuous), probability density functions, properties.

Learning Outcomes: At the end of this unit, students should be able to

- Define the terms trial, events, sample space, probability, and laws of probability (L1)
- Make use of probabilities of events in finite sample spaces from experiments (L3)
- Apply Bayes theorem to real time problems (L3)
- Explain the notion of random variable, distribution functions and expected value (L2)

UNIT-III (12 Hrs)

Probability distributions: Discrete distribution - Binomial, Poisson approximation to the binomial distribution and their properties. Continuous distribution: normal distribution and their properties.

Learning Outcomes: At the end of this unit, students should be able to

- Apply Binomial and Poisson distributions for real data to compute probabilities, theoretical frequencies (L3)
- Interpret the properties of normal distribution and its applications (L2)

UNIT-IV (11 Hrs)

Estimation and Testing of hypothesis, large sample tests: Estimation-parameters, statistics, sampling distribution, point estimation, Formulation of null hypothesis, alternative hypothesis, the critical and acceptance regions, level of significance, two types of errors and power of the test. Large Sample Tests: Test for single proportion, difference of proportions, test for single mean and difference of means. Confidence interval for parameters in one sample and two sample problems

Learning Outcomes: At the end of this unit, students should be able to

- Explain the concept of estimation, interval estimation and confidence intervals (L2)
- Apply the concept of hypothesis testing for large samples (L4)

UNIT-V (11 Hrs)

Small sample tests: Student t-distribution (test for single mean, two means and paired t-test), testing of equality of variances (F-test), $\chi 2$ - test for goodness of fit, $\chi 2$ - test for independence of attributes.

Learning Outcomes: At the end of this unit, students should be able to

- Apply the concept of testing hypothesis for small samples to draw the inferences (L3)
- Estimate the goodness of fit (L5)

TEXTBOOKS:

1. "Miller and Freund's Probability and Statistics for Engineers", Richard A. Johnson, Pearson, 7/e, 2008.

2. "Fundamentals of Mathematical Statistics", S.C. Gupta and V.K. Kapoor, S. Chand & Sons Publications, 11/e, 2012.

REFERENCE BOOKS:

1. "A First Course in Probability", S. Ross, Pearson Education India, 2002.
2. "An Introduction to Probability Theory and its Applications", W. Feller, Wiley Publications, 1/e, 1968.
3. "Probability, Random Variables & Random Signal Principles", Peyton Z. Peebles, McGraw Hill Education, 4/e, 2001.

Course Code	ENGINEERING DRAWING		L	T	P	C
21A030301	(Common to all branches)		1	0	4	3
Pre-requisite	NIL	Semester	II			

COURSE OBJECTIVES:

- Bring awareness that Engineering Drawing is the Language of Engineers.
- Familiarize how industry communicates technical information.
- Teach the practices for accuracy and clarity in presenting the technical information.
- Develop the engineering imagination essential for successful design.
- Instruct the utility of drafting & modelling packages in orthographic and isometric drawings.
- Train the usage of 2D and 3D modelling.
- Instruct graphical representation of machine components.

COURSE OUTCOMES:

At the end of the course, the student will be able to

CO1: Construction of various conic curves, Cycloid curves
CO2: Construction of projections of Points, Lines applied in engineering
CO3: Construction of projections of Planes.
CO4: Construction of projection of solids development of surfaces regular Solids.
CO5: Representation of Ortho and Isometric views of solids.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	-	-	-	-	-	-	-	2	-	-	2	2
CO2	3	1	-	-	-	-	-	-	-	2	-	-	2	2
CO3	3	2	2	-	3	-	-	-	-	2	-	2	2	2
CO4	3	2	2	-	3	-	-	-	-	2	-	2	2	2
CO5	3	2	2	-	3	-	-	-	-	2	-	2	2	2

UNIT-I (12 Hrs)

Introduction to Engineering Drawing: Principles of Engineering Drawing and their Significance - Conventions in drawing-lettering - BIS conventions.

a) Conic sections including the rectangular hyperbola- general method only,

b) Cycloid, Epi-cycloid and Hypocycloid - general method only.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the significance of engineering drawing (L2)
- Know the conventions used in the engineering drawing (L1)
- Identify the curves obtained in different conic sections (L2)
- Draw different cycloidal curves. (L3)

UNIT– II (12 Hrs)

Projection of points, lines: Projection of points in any quadrant, lines inclined to one or both planes, finding true lengths, true angle made by line.

Learning Outcomes: At the end of this unit, students should be able to

- Know how to draw the projections of points, lines (L1)
- Find the true length of the lines. (L2)

UNIT-III (18 Hrs)

Projection of planes: Projections of regular plane inclined to both the planes and also draw the projections of different planes in Computerized drawing.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the procedure to draw projection of planes. (L2)
- Draw the projection of plane inclined to one plane and both the planes. (L3)
- Understand the different commands used in Computerized drawing to draw different planes. (L2)

UNIT- IV (15 Hrs)

Projections of solids: Projections of regular solids inclined to one or both planes by rotational method.

Development of Solids: Development of lateral Surfaces of Right Regular Solids (without section)-Prism, Cylinder, Pyramid, Cone.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the procedure to draw projection of solids. (L2)
- Draw the projection of solid inclined to one plane. (L3)
- Draw the projection of solids inclined to both the planes. (L3)

UNIT–V (18 Hrs)

Isometric and Orthographic Projections: Principles of isometric projection- Isometric Scale- Isometric Views- Conventions- Isometric Views of lines, Planes, Simple solids (cube, cylinder and cone). Conversion of Isometric Views to Orthographic Views. Drawing the Isometric views using Computerized drawing.

Learning Outcomes: At the end of this unit, students should be able to

- Learn the basics convectional representation of different projections (L1)
- Draw the Orthographic projection of simple solids. (L3)
- Draw the Isometric projection of simple solids. (L3)

TEXTBOOKS:

1. "Engineering Drawing", K. L. Narayana & P. Kannaiah, SciTech Publishers, Chennai, 3/e.
2. "Engineering Drawing + AutoCAD", K. Venugopal, V. Prabhu Raja, New Age Publishers.
3. "Engineering Drawing", N. D. Bhatt, Charotar Publishers, 53/e, 2016

REFERENCE BOOKS:

1. "Engineering Drawing", Dhanajay A Jolhe, Tata McGraw-Hill, Copy Right, 2009.
2. "Engineering Drawing", Basant Agarwal & C. M. Agarwal, Tata McGraw-Hill
3. "Engineering Drawing", Shah and Rana, Pearson Education, 2/e, 2009

Course Code	ADVANCED DATA STRUCTURES THROUGH C++ (Common to CSE CSE-AI & CSE-IOT)		L	T	P	C
21A050304			3	0	0	3
Pre-requisite	C Programming & Data Structures	Semester	II			

COURSE OBJECTIVES:

- To be familiar with basic techniques of object-oriented principles and exception handling using C++
- To be familiar with the concepts like Inheritance, Polymorphism
- Solve problems using data structures such as linear lists, stacks, queues
- Be familiar with advanced data structures such as balanced search trees.

COURSE OUTCOMES:

After the completion of the course, the student will be able to

CO1: Distinguish between procedures and object-oriented programming.
CO2: Apply advanced data structure strategies for exploring complex data structures.
CO3: Compare and contrast various data structures and design techniques in the area of Performance.
CO4: Implement data structure algorithms through C++.
CO5: Incorporate data structures into the applications such as binary search trees

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	-	-	-	-	-	-	-	-	1	-
CO2	3	2	2	2	-	-	-	-	-	-	-	-	1	-
CO3	3	2	3	2	-	-	-	-	-	-	-	-	1	-
CO4	3	2	2	3	-	-	-	-	-	-	-	-	-	2
CO5	3	3	2	2	-	-	-	-	-	-	-	-	-	2

UNIT-1 (13 Hrs)

Arrays: Abstract Data Types and the C++ Class, An Introduction to C++ Class- Data Abstraction and Encapsulation in C++- Declaring Class Objects and Invoking Member Functions- Special Class Operations- Miscellaneous Topics- ADTs and C++Classes, The Array as an Abstract Data Type, The Polynomial Abstract Data type- Polynomial Representation- Polynomial Addition. Spares Matrices.

Learning Outcomes: At the end of this unit, students should be able to

- Learn about OOPS concepts (L3).
- Learn and solve about different types of Class Types and Polynomial representation (L3)

UNIT- II (10 Hrs)

Stacks and Queues: Templates in C++, Template Functions- Using Templates to Represent Container Classes, The Stack Abstract Data Type, The Queue Abstract Data Type, Subtyping and Inheritance in C++, Evaluation of Expressions, Expression- Postfix Notation- Infix to Postfix.

Learning Outcomes: At the end of this unit, students should be able to

- Translate the given function as Templates in C++ (L3)
- Analyze the behaviour of different types of Classes, ADT and Expressions (L3)

UNIT – III (12 Hrs)

Linked Lists – I: Single Linked List and Chains, Representing Chains in C++, defining a Node in C++- Designing a Chain Class in C++- Pointer manipulation in C++- Chain Manipulation Operations, The Template Class Chain, Implementing Chains with Templates- Chain Iterators- Chain Operations- Reusing a Class, Circular Lists, Available Space Lists, Linked Stacks and Queues, Polynomials

Learning Outcomes: At the end of this unit, students should be able to

- Learn and implement different types of Linked Lists (L3)
- Acquire the Knowledge of functions of Templates in C++ (L1)
- Implement Chain Iterators and Polynomials (L3)

UNIT – IV (13 Hrs)

Linked Lists – II: Polynomial Representation- Adding Polynomials- Circular List Representation of Polynomials, Equivalence Classes, Sparse Matrices, Sparse Matrix Representation- Sparse Matrix Input- Deleting a Sparse Matrix, Doubly Linked Lists, Generalized Lists, Representation of Generalized Lists- Recursive Algorithms for Lists Reference Counts, Shared and Recursive Lists

Learning Outcomes: At the end of this unit, students should be able to

- Evaluate double integrals of functions of several variables using Polynomial Representation (L5)
- Apply Matrix techniques in evaluating different types (L4)
- Evaluating Generalized Lists and Recursive algorithms (L5)

UNIT-5 (12 Hrs)

Trees: Introduction, Terminology, Representation of Trees, Binary Trees, The Abstract Data Type, Properties of Binary Tress, Binary Tree Representations, Binary Tree Traversal and Tree Iterators, Introduction, Inorder Traversal Preorder Traversal, Postorder Traversal, Thread Binary Trees, Threads, Inorder Traversal of a Threaded Binary Tree, Inserting a Node into a Threaded Binary Tree, Heaps, Priority Queues, Definition of a Max Heap, Insertion into a Max Heap,

Deletion from a Max Heap, Binary Search Trees, Definition, Searching a Binary Search Tree, Insertion into a Binary Search Tree, Deletion from a Binary Search Tree, Height of Binary Search Tree.

Learning Outcomes: At the end of this unit, students should be able to

- Understand Tree functions and its relations (L2)
- Conclude the use of different types of Trees representation (L4)

TEXTBOOKS:

1. "Data structures, Algorithms and Applications in C++", S. Sahni, University Press (India) Pvt. Ltd, 2nd edition.
2. "Data structures and Algorithm Analysis in C++", Mark Allen Weiss, Pearson Education Ltd., 2nd edition.
3. "Data structures and Algorithms in C++", Michael T. Goodrich, R. Tamassia and Mount, John Wiley and Sons, Wiley student edition

REFERENCE BOOKS:

1. "Data structures and algorithms in C++", 3rd Edition, Adam Drozdek, Thomson
2. "Data structures using C and C++", Langsam, Augenstein and Tanenbaum, PHI.
3. "Problem solving with C++ The Object of Programming", W.Savitch, Pearson education, Fourth edition

Course Code	BASIC ELECTRICAL & ELECTRONICS ENGINEERING (Common to ME, CSE, CSE-AI & CSE-IOT)		L	T	P	C
21A020303			3	0	0	3
Pre-requisite	NIL	Semester	II			

COURSE OBJECTIVES:

- To teach DC and AC electrical circuit analysis
- To explain working principles of transformers and electrical machines
- To impart knowledge on Power system generation, transmission and distribution
- Familiar with the theory, construction, and operation of electronic devices
- Learn about biasing of BJTs and FETs.
- Design and construct amplifiers, understand the concept & principles of logic devices.

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Apply concepts of KVL/KCL in solving DC circuits
CO2: Illustrate working principles of DC Motor, Transformer and Induction motors
CO3: Understand the basics of Power generation, Transmission and Distribution
CO4: Explain the theory, construction, operation and working of electronic devices.
CO5: Analyze and design small signal amplifier circuits, logic gate, combinational and sequential circuits

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	1	3	2	-	-	-	-	1	-	-
CO2	3	2	1	-	1	3	2	-	-	-	-	1	-	-
CO3	3	2	1	-	1	3	2	-	-	-	-	1	-	-
CO4	3	2	1	-	1	3	2	-	-	-	-	1	-	-
CO5	3	2	1	-	1	3	2	-	-	-	-	1	-	-

Part A: Basic Electrical Engineering

UNIT-I (10 Hrs)

DC & AC Circuits: Electrical circuit elements (R - L and C) - Kirchhoff laws - Series and parallel connection of resistances with DC excitation. Superposition Theorem - Representation of sinusoidal waveforms -peak and rms values - phasor representation - real power - reactive power - apparent power – power factor - Analysis of single-phase ac circuits consisting of RL - RC - RLC series circuits, Resonance.

Learning Outcomes: At the end of this unit, students should be able to

- Recall Kirchoff laws (L1)
- Analyze simple electric circuits with DC excitation (L4)

- Apply network theorems to simple circuits (L3)
- Analyze single phase AC circuits consisting of series RL - RC - RLC combinations (L4)

UNIT-II (10 Hrs)

DC & AC Machines: Principle and operation of DC Generator - EMF equations - OCC characteristics of DC generator –principle and operation of DC Motor – Performance Characteristics of DC Motor - Speed control of DC Motor – Principle and operation of Single-Phase Transformer - OC and SC tests on transformer -Principle and operation of 3-phase AC machines [Elementary treatment only]

Learning Outcomes: At the end of this unit, students should be able to

- Explain principle and operation of DC Generator & Motor. (L2)
- Perform speed control of DC Motor (L3)
- Explain operation of transformer and induction motor. (L2)
- Explain construction & working of induction motor - DC motor (L2)

UNIT-III (10 Hrs)

Basics of Power Systems: Layout & operation of Hydro, Thermal, Nuclear Stations - Solar & wind generating stations – Typical AC Power Supply scheme – Elements of Transmission line – Types of Distribution systems: Primary& Secondary distribution systems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand working operation of various generating stations (L1)
- Explain the types of Transmission and Distribution systems (L2)

TEXTBOOKS:

1. "Basic Electrical Engineering", D. P. Kothari and I. J. Nagrath, Tata McGraw Hill, 2010.
2. "Principles of Power System", V.K. Mehta & Rohit Mehta, S. Chand, 2018.

REFERENCE BOOKS:

1. "Fundamentals of Electrical Engineering", L. S. Bobrow, Oxford University Press, 2011.
2. "Electrical and Electronics Technology", E. Hughes, Pearson, 2010.
3. "Generation Distribution and Utilization of Electrical Energy", C.L. Wadhwa, New Age International Publications, 3rd Edition.

Part 'B'- Electronics Engineering

UNIT-I (10 Hrs)

Diodes and Applications: Semiconductor Diode, Diode as a Switch& Rectifier, Half Wave and Full Wave Rectifiers with and without Filters; Operation and Applications of Zener Diode, LED, Photo Diode.

Transistor Characteristics: Bipolar Junction Transistor (BJT) – Construction, Operation, Amplifying Action, Common Base, Common Emitter and Common Collector Configurations, Operating Point, Biasing of Transistor Configuration; Field Effect Transistor (FET) – Construction, Characteristics of Junction FET, Concepts of Small Signal Amplifiers –CE & CC Amplifiers.

Learning outcomes: At the end of this unit, students should be able to

- Remember and understand the basic characteristics of semiconductor diode. (L1)
- Understand principle of operation of Zener diode and other special semiconductor diodes (L1)
- Analyze BJT based biasing circuits. (L3)
- Design an amplifier using BJT based on the given specifications. (L4)

UNIT-II (10 Hrs)

Operational Amplifiers and Applications: Introduction to Op-Amp, Differential Amplifier Configurations, CMRR, PSRR, Slew Rate; Block Diagram, Pin Configuration of 741 Op-Amp, Characteristics of Ideal Op-Amp, Concept of Virtual Ground; Op-Amp Applications - Inverting, Non-Inverting, Summing and Difference Amplifiers, Voltage Follower, Comparator, Differentiator, Integrator.

Learning outcomes: At the end of this unit, students should be able to

- Describe operation of Op-Amp based linear application circuits, converters, amplifiers and non-linear circuits. (L2)
- Analyze Op-Amp based comparator, differentiator and integrator circuits. (L3)

UNIT-III (10 Hrs)

Digital Electronics: Logic Gates, Simple combinational circuits–Half and Full Adders, BCD Adder. Latches and Flip-Flops (S-R, JK and D), Shift Registers and Counters.

Learning outcomes: At the end of this unit, students should be able to

- Explain the functionality of logic gates. (L2)
- Apply basic laws and De Morgan's theorems to simplify Boolean expressions. (L3)
- Analyze standard combinational and sequential circuits. (L4)

TEXTBOOKS:

1. "Electronic Devices & Circuit Theory", R. L. Boylestad & Louis Nashlesky, Pearson Education, 2007.
2. "Op-Amps & Linear ICs", Ramakanth A. Gayakwad, Pearson, 4th Edition, 2017.
3. "Modern Digital Electronics", R. P. Jain, Tata Mcgraw Hill, 3rd Edition, 2003.
4. "Microcontrollers: Architecture, Programming, Interfacing and System Design", Raj Kamal, Pearson, 2nd Edition, 2012.

REFERENCE BOOKS:

1. "Basic Electronics - Devices, Circuits and IT Fundamentals", Santiram Kal, Prentice Hall of India, 2002.
2. "A Text Book of Electronic Devices and Circuits", R. S. Sedha, S.Chand & Co, 2010.
3. "Introductory Electronic Devices & Circuits - Conventional Flow Version", R. T. Paynter, Pearson Education, 2009.

Course Code	COMMUNICATIVE ENGLISH LAB		L	T	P	C
21A110201	(Common to all branches)		0	0	2	1
Pre-requisite	NIL	Semester	II			

COURSE OBJECTIVES:

- To make students communicate their thoughts, opinions and ideas freely in real life situations.
- To improve the language proficiency of students in English with special emphasis on Listening and Speaking skills.
- To equip students with professional skills & soft skills, Develop communication skills in formal and informal situations
- To help students present themselves confidently during Group Discussions and Oral Presentations

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Use creativity in listening to formal and informal conversations.
CO2: Analyze the concepts of active listening and barriers to listening.
CO3: Communicate effectively in everyday life using right oral expressions.
CO4: Acquire the confidence to present themselves effectively during academic and professional presentations.
CO5: Acquire basic knowledge of non-verbal communication and its importance.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	2	3	-	-	-	-	-
CO2	-	-	-	-	-	-	-	2	2	-	-	-	-	-
CO3	-	-	-	-	-	-	-	3	3	-	-	-	-	-
CO4	-	-	-	-	-	-	-	2	3	-	-	-	-	-
CO5	-	-	-	-	-	-	-	2	3	-	-	-	-	-

UNIT-I (6 Hrs)

Essentials of Listening: Purpose of Listening, Listening to Conversation (Formal and Informal), Active Listening- an Effective Listening Skill, Barriers to Listening, Listening to Announcements- (railway/ bus stations/ airport /sports announcement/commentaries etc.)

Learning Outcomes: At the end of this unit, students should be able to

- Know the difference between hearing and listening. (L2)
- Understand the purpose of active listening. (L2)
- Follow the announcements through focused listening. (L2)

UNIT-II (6 Hrs)

Listening Comprehension: Academic Listening (Listening to Lectures), Listening to Short Talks and Listening to Presentations, Note Taking Tips

Learning Outcomes: At the end of this unit, students should be able to

- Comprehend different academic lectures. (L3)
- Take notes while listening to short talks and lectures. (L3)
- Improve comprehension skills through listening to short talks and presentations. (L3)

UNIT-III (6 Hrs)

Communicating in everyday life: Asking for and giving information, Offering and responding to offers, Requesting and responding to requests, Congratulating people on their success, Expressing condolences, Asking questions and responding politely, Apologizing and forgiving,

Learning Outcomes: At the end of this unit, students should be able to

- Use appropriate expressions to communicate in everyday life. (L3)
- Communicate effectively in different contexts of conversations. (L3)
- Participate in role plays and situational dialogues with an exposure to social and professional contexts. (L3)

UNIT- IV (6 Hrs)

Presentation Skills: Giving Short Talks, Preparing power point presentation, Greeting and Introducing in presentations, Presenting a paper, Participating in group discussions (dos & don'ts)

Learning Outcomes: At the end of this unit, students should be able to

- Prepare a power point presentation effectively. (L3)
- Present a paper in a seminar. (L3)
- Participate in Group Discussions efficiently. (L3)

UNIT-V (6 Hrs)

Non-verbal Communication: Personal Appearance, Gestures, Postures, Facial Expression, Eye Contact, Body Language (Kinesics), Silence, Tips for Improving Non-Verbal Communication

Learning Outcomes: At the end of this unit, students should be able to

- Know the importance of body language in communication (L2)
- Improve non-verbal communication skills (L3)
- Understand how body language and non-verbal communication affects the personality of an individual in a social and professional set-up. (L2)

TEXTBOOKS:

1. "Technical Communication – Principles and Practice", Meenakshi Raman, Sangeeta Sharma, Oxford University Press

REFERENCE BOOKS:

1. "A Textbook of English Phonetics for Indian Students", T. Balasubramanian, Mc Millan India Pvt
2. "English Vocabulary in Use", Michael McCarthy, Cambridge University Press
3. "Strengthen your English", Bhaskaran, Horsburgh, Oxford University Press
4. "Practical English Usage", Michael Swan, Oxford University Press

ONLINE SOURCES:

1. https://learnenglish.britishcouncil.org/skills/listening
2. https://agendaweb.org/listening/comprehension-exercises.html
3. https://www.123listening.com/
4. https://www.linguahouse.com/learning-english/skill-4-learners/listening
5. https://www.talkenglish.com/listening/listen.aspx
6. https://ed.ted.co

Course Code	BASIC ELECTRICAL & ELECTRONICS ENGINEERING LAB (Common to ME, CSE, CSE-AI & CSE-IOT)		L	T	P	C
21A020304			0	0	3	1.5
Pre-requisite	NIL	Semester	II			

COURSE OBJECTIVES:

- To Verify Kirchoff's laws and Superposition theorem
- To learn performance characteristics of DC Machines and 1- Phase Transformer
- To Study the I – V Characteristics of Solar PV Cell
- To analyze the characteristics of Diodes, BJT, MOSFET, UJT
- To design the amplifier circuits from the given specifications.
- Exposed to linear and digital integrated circuits

COURSE OUTCOMES:

After completing the course, the student will be able to

CO1: Understand Kirchoff's Laws & Superposition theorem.

CO2: Analyze the various characteristics on 1-phase transformer and DC Machines by conducting various tests.

CO3: Analyze I – V Characteristics of PV Cell

CO4: Learn the characteristics of basic electronic devices like PN junction diode, Zener diode & BJT.

CO5: Construct and analyze the various diode rectifiers, clippers and clampers and other circuits.

CO-PO MAPPING;

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	1	3	2	-	-	-	-	1	-	-
CO2	3	2	1	-	1	3	2	-	-	-	-	1	-	-
CO3	3	2	1	-	1	3	2	-	-	-	-	1	-	-
CO4	3	2	1	-	1	3	2	-	-	-	-	1	-	-
CO5	3	2	1	-	1	3	2	-	-	-	-	1	-	-

PART A: ELECTRICAL ENGINEERING

LIST OF EXPERIMENTS:

1. Verification of Kirchhoff laws.
2. Verification of Superposition Theorem.
3. Magnetization characteristics of a DC Shunt Generator.
4. Speed control of DC Shunt Motor.
5. OC & SC test of 1 – Phase Transformer.
6. Load test on 1-Phase Transformer.
7. I – V Characteristics of Solar PV cell
8. Brake test on DC Shunt Motor.

PART B: ELECTRONICS ENGINEERING

LIST OF EXPERIMENTS:

1. PN Junction diode characteristics A) Forward bias B) Reverse bias.
2. Zener diode characteristics and Zener as voltage Regulator.
3. Full Wave Rectifier with & without filter.
4. Wave Shaping Circuits. (Clippers & Clampers)
5. Input & Output characteristics of Transistor in CB / CE configuration.
6. Frequency response of CE amplifier.
7. Inverting and Non-inverting amplifiers using Op-AMPs.
8. Verification of Truth Table of AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR gates using ICs.
9. Verification of Truth Tables of S-R, J-K& D flip flops using respective ICs.

Tools / Equipment Required: DC Power supplies, Multi meters, DC Ammeters, DC Voltmeters, AC Voltmeters, CROs all the required active devices

Note: Minimum of Six Experiments to be performed in each section.

Course Code	ADVANCED DATA STRUCTURES THROUGH C++ LAB (Common to CSE, CSE-AI & CSE-IOT)		L	T	P	C
21A050305			0	0	3	1.5
Pre-requisite	C Programming & Data Structures	Semester	II			

COURSE OBJECTIVES:

- To familiarize Advanced data structures using C++.
- To train the students on the sorting techniques
- To introduce Trees.

COURSE OUTCOMES:

After the completion of the course, the student will be able to

CO1: Solve computational problems, choose appropriate control structure depending on the problem to be solved.
CO2: Design applications in C++ using Trees.
CO3: Modularize the problem and also solution.
CO4: Design applications in C++ using Searching Techniques
CO5: Explore various operations on Linked Lists

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	3	-	-	-	-	-	-	-	1	-
CO2	2	2	2	1	3	-	-	-	-	-	-	-	1	-
CO3	3	3	2	2	3	-	-	-	-	-	-	-	1	-
CO4	2	2	2	2	3	-	-	-	-	-	-	-	-	2
CO5	3	3	2	2	3	-	-	-	-	-	-	-	-	2

LIST OF EXPERIMENTS:

1. Write a C++ program to sort the given data elements using bubble sort technique.
2. Write a C++ program to sort the given data elements using selection sort technique.
3. Write a C++ program to search a given element from the list of elements using linear search technique.
4. Write a C++ program to search a given element from the list of elements using binary search technique.
5. Write a C++ program to implement Stack ADT using an array.
6. Write a C++ program to implement Linear Queue ADT using an array.
7. Write a C++ program to implement Circular Queue ADT using an array.
8. Write a C++ program to implement Deque ADT using an array.
9. Write a C++ program to create a Single linked list ADT and display the elements.
10. Write a C++ program to create a Double linked list ADT and display the elements.
11. Write a C++ program to create a Circular single linked list and display the elements.
12. Write a C++ program to create a Circular double linked list and display the elements.
13. Write a C++ program to implement Stack ADT using linked list.

14. Write a C++ program to implement Linear Queue ADT using linked list.
15. Write a C++ program to create a binary search tree with the given data elements 23, 54, 12, 43, 56, 10, 52, 35 and apply In-order, Preorder and Post-order tree traversal techniques.

TEXTBOOKS:

1. "Data structures, Algorithms and Applications in C++", S. Sahni, University Press (India) Pvt. Ltd, 2nd edition.
2. "Data structures and Algorithm Analysis in C++", Mark Allen Weiss, Pearson Education Ltd., 2nd edition.
3. "Data structures and Algorithms in C++", Michael T. Goodrich, R. Tamassia and Mount, John Wiley and Sons, Wiley student edition

REFERENCE BOOKS:

1. "Data structures and algorithms in C++", 3rd Edition, Adam Drozdek, Thomson
2. "Data structures using C and C++", Langsam, Augenstein and Tanenbaum, PHI.
3. "Problem solving with C++ The Object of Programming", W. Savitch, Pearson education, Fourth edition

Course Code	BIOLOGY FOR ENGINEERS		L	T	P	C
21A000005			2	0	0	0
Pre-requisite	NIL	Semester	II			

COURSE OBJECTIVES:

- To provide basic understanding about life and life Process. Animal and plant systems.
- To understand what biomolecules, are, their structures are functions.
- Application of certain biomolecules in Industry.
- Brief introduction about human physiology and bioengineering.
- To understand hereditary units, i.e., DNA (genes) and RNA and their synthesis in living organism.
- How biology Principles can be applied in our daily life using different technologies.
- Brief introduction to the production of transgenic microbes, Plants and animals.

COURSE OUTCOMES:

After the completion of the course, the student will be able to

CO1: Explain about cells and their structure and function. Different types of cells and basics for classification of living Organisms.

CO2: Explain about biomolecules, their structure and function and their role in the living organisms.

CO3: How biomolecules are useful in Industry.

CO4: Briefly about human physiology.

CO5: Explain about genetic material, DNA, genes and RNA how they replicate, pass and preserve vital information in living Organisms.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	2	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	1	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	2	-	-	-	-	-	-	1	-	-

UNIT – I (10 Hrs)

Introduction to Basic Biology: Cell as Basic unit of life, cell theory, Cell shapes, Cell structure, Cell cycle. Chromosomes. Prokaryotic and eukaryotic Cell. Plant Cell, Animal Cell, Plant tissues and Animal tissues, Brief introduction to five kingdoms of classification.

Learning Outcomes: At the end of this unit, students should be able to

- Summarize the basis of life. (L1)

- Understand the difference between lower organisms (prokaryotes) from higher organisms(eukaryotes). (L2)
- Understand how organisms are classified. (L3)

UNIT – II (10 Hrs)

Introduction to Biomolecules: Carbohydrates, lipids, proteins, Vitamins and minerals, Nucleic acids (DNA and RNA) and their types. Enzymes, Enzyme application in Industry. Large scale production of enzymes by Fermentation.

Learning Outcomes: At the end of this unit, students should be able to

- Understand what are biomolecules? their role in living cells, their structure, function and how they are produced. (L1)
- Interpret the relationship between the structure and function of nucleic acids. (L2)
- Summarize the applications of enzymes in industry. (L3)
- Understand what is fermentation and its applications of fermentation in industry. (L4)

UNIT – III (10 Hrs)

Human Physiology: Nutrition: Nutrients or food substances. Digestive system, Respiratory system, (aerobic and anaerobic Respiration). Respiratory organs, respiratory cycle. Excretory system.

Learning Outcomes: At the end of this unit, students should be able to

- Understand what nutrients are (L1)
- Understand the mechanism and process of important human functions (L2 & L3)
- Select suitable fuels for IC engines (L3)
- Explain calorific values, octane number, refining of petroleum (L2)

UNIT – IV (10 Hrs)

Introduction to Molecular Biology and recombinant DNA Technology: Prokaryotic gene and Eukaryotic gene structure. DNA replication, Transcription and Translation. rDNA technology. Introduction to gene cloning.

Learning Outcomes At the end of this unit, students should be able to

- Understand and explain about gene structure and replication in prokaryotes and Eukaryotes (L1)
- Understand how genetic material is replicated and how RNA and proteins are synthesized. (L2)
- Understand about recombinant DNA technology and its application in different fields. (L3)
- Explain what is cloning. (L4)

UNIT – V (10 Hrs)

Application of Biology: Brief introduction to industrial Production of Enzymes, Pharmaceutical and therapeutic Proteins, Vaccines and antibodies. Basics of biosensors, biochips, Bio fuels, and Bio Engineering. Basics of Production of Transgenic plants and animals.

Learning Outcomes: At the end of this unit, students should be able to

- Understand, how biology is applied for production of useful products for mankind. (L1)
- What are biosensors, biochips etc. (L2)
- Understand transgenic plants and animals and their production (L3)

TEXTBOOKS:

1. "Cell and Molecular Biology", P. K. Gupta, Rastogi Publications, 5th Edition.
2. "Biotechnology", U. Satyanarayana., Books & Allied Ltd, 2017.

REFERENCE BOOKS:

1. "Biology: A Global Approach", N. A. Campbell, J. B. Reece, L. Urry, M. L. Cain and S. A. Wasserman, Pearson Education Ltd, 2018.
2. "Biology for Engineers", T Johnson, CRC press, 2011.
3. "Molecular Biology and Biotechnology", J.M. Walker and E.B. Gingold, Panima Publications, 2nd edition.
4. "Instant Notes in Biochemistry", David Hames, 2016.
5. "Instant Notes – Molecular Biology", Phil Tunner, A. McTennan, A. Bates & White, 2014.

Course Code	MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE (Common to CSE, CSE-AI & CSE-IOT)		L	T	P	C
21A110111			3	0	0	3
Pre-requisite	NIL	Semester	III			

COURSE OBJECTIVES:

- To explain about the Boolean algebra, Graph theory and Recurrence relations.
- To demonstrate the application of basic methods of discrete mathematics in Computer Science problem solving.
- To elucidate solving mathematical problems from algorithmic perspective.
- To introduce the mathematical concepts which will be useful to study advanced courses Design and Analysis of Algorithms, Theory of Computation, Cryptography and Software Engineering etc.
- To reveal how solutions of graph theory can be applied to computer science problems

COURSE OUTCOMES:

At the end of the course, the student will be able to

CO1: Evaluate elementary mathematical arguments and identify fallacious reasoning

CO2: Understand the properties of Compatibility, Equivalence and Partial Ordering relations, Lattices and Hassee Diagrams and the general properties of Algebraic Systems

CO3: Design solutions for problems using Permutations and Combinations

CO4: Solve the homogeneous and non-homogeneous recurrence relations

CO5: Apply the concepts of functions to identify different types of Graphs and trees

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012	PSO1	PSO2
CO1	3	3	2	3	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	2	-	-	-	-	-	-	-	-	-	-
CO3	3	3	2	1	-	-	-	-	-	-	-	-	-	-
CO4	3	3	2	3	-	-	-	-	-	-	-	-	-	-
CO5	3	3	3	3	-	-	-	-	-	-	-	-	-	-

UNIT-I (12 Hrs)

Statements and Notation, **Connectives**- Negation, Conjunction, Disjunction, Conditional and Bi-conditional, Statement formulas and Truth Tables. Well-formed formulas, Tautologies, Equivalence of Formulas, Duality Law, Tautological Implications.

Normal Forms: Disjunctive Normal Forms, Conjunctive Normal Forms, Principal Disjunctive Normal Forms (PDNF), Principal Conjunctive Normal Forms (PCNF), Ordering and Uniqueness of Normal Forms.

The Theory of Inference for the Statement Calculus: Rules of Inference, Consistency of Premises and Indirect Method of Proof. The predicate Calculus, Inference theory of the Predicate Calculus

Learning Outcomes: At the end of this unit, students should be able to

- Describe logical sentences in terms of predicates, quantifiers, and logical connectives (L1)
- Evaluate basic logic statements using truth tables and the properties of logic (L5)
- Apply rules of inference to test the consistency of premises and validity of arguments (L3)
- Verify the equivalence of two formulas and their duals (L4)
- Find the Principal Conjunctive and Principal Disjunctive Normal Forms of a statement formula. (L1)

UNIT-II (12 Hrs)

Set Theory: Basic concepts of Set Theory, Representation of Discrete structures, Relations and Ordering, Functions, Recursion.

Lattices and Boolean algebra: Lattices as Partially Ordered Sets, Boolean algebra, Boolean Functions, Representation and Minimization of Boolean Functions.

Algebraic Structures: Algebraic Systems: Examples and General Properties, Semi Groups and Monoids, Groups.

Learning Outcomes: At the end of this unit, students should be able to

- Describe equivalence, partial order and compatible relations (L1)
- Compute Maximal Compatibility Blocks (L3)
- Identify the properties of Lattices (L2)
- Evaluate Boolean functions and simplify expression using the properties of Boolean Algebra (L5)
- Infer Homomorphism and Isomorphism (L4)
- Describe the properties of Semi groups, Monoids and Groups (L1)

UNIT-III (10 Hrs)

Elementary Combinatorics: Basics of Counting, Combinations and Permutations, Enumeration of Combinations and Permutations, Enumerating Combinations and Permutations with repetitions, Enumerating Permutations and Combinations with constrained Representations, Binomial Coefficients, The Binomial and Multinomial Theorems, The Principle of Inclusion and Exclusion

Learning Outcomes: At the end of this unit, students should be able to

- Explain fundamental principle of counting (L2)
- Examine the relation between permutation and combination (L4)

- Solve counting problems by applying elementary counting techniques using the product and sum rules (L3)
- Apply permutations, combinations, the pigeon-hole principle, and binomial expansion to solve counting problems (L3)

UNIT-IV (10 Hrs)

Recurrence Relations: Generating Functions of Sequences, Calculating Coefficients of Generating Functions, Recurrence Relations, Solving Recurrence Relations by Substitution and Generating Functions, The method of Characteristic Roots, Solution of Inhomogeneous Recurrence Relations.

Learning Outcomes: At the end of this unit, students should be able to

- Find the generating functions for a sequence (L1)
- Design recurrence relations using the divide-and-conquer algorithm (L6)
- Solve linear recurrence relations using method of Characteristic Roots (L3)
- Outline the general solution of homogeneous or Inhomogeneous Recurrence Relations using substitution and method of generating functions (L2)
- Solve problems using recurrence relations and recursion to analyze complexity of Algorithms (L3)

UNIT-V (10 Hrs)

Graphs: Basic Concepts, Isomorphism and Sub graphs, Trees and their Properties, Spanning Trees, Directed Trees, Binary Trees, Planar Graphs, Euler's Formula, Multigraphs and Euler Circuits, Hamiltonian Graphs, Chromatics Number, The Four-Color Problem

Learning Outcomes: At the end of this unit, students should be able to

- Investigate if a given graph is simple or a multigraph, directed or undirected, cyclic or acyclic (L4)
- Describe complete graph and complete bipartite graphs (L1)
- Identify Euler Graphs, Hamilton Graph and Chromatic Number of a graph (L2)
- Apply the concepts of functions to identify the Isomorphic Graphs (L3)
- Apply depth-first and breadth-first search (L3)
- Apply Prim's and Kruskal's algorithms to find a minimum spanning tree (L3)

TEXTBOOKS:

1. "Discrete Mathematics for Computer Scientists & Mathematicians", Joe L. Mott. Abraham Kandel and Theodore P. Baker, Pearson, 2008, 2nd Edition,
2. "Discrete Mathematical Structures with Applications to Computer Science", J P Trembly and R Manohar, McGraw Hill, 2017, 1st Edition.

REFERENCE BOOKS:

1. "Discrete and Combinatorial Mathematics, an Applied Introduction", Ralph P. Grimaldi and B.V. Ramana, Pearson, 2016, 5th Edition.
2. "Graph Theory with Applications to Engineering", Narsingh Deo, Prentice Hall, 1979.
3. "Discrete Mathematics theory and Applications", D.S. Malik and M.K. Sen, Cengage Learning, 2012, 1st Edition.
4. "Elements of Discrete Mathematics, A computer Oriented approach", C L Liu and D P Mohapatra, McGraw Hill, 2018, 4th edition.

Course Code	DIGITAL LOGIC DESIGN AND COMPUTER ORGANIZATION (Common to CSE, CSE-AI & CSE-IOT)		L	T	P	C
21A050401			3	0	0	3
Pre-requisite	NIL	Semester	III			

COURSE OBJECTIVES:

- To understand the basic theoretical concepts of digital systems like the binary system and Boolean algebra.
- To express real life problem in logic design terminology.
- To use Boolean algebraic formulations to design digital systems. To design using combinational/sequential circuits
- To understand the Instruction execution stages.
- To explain the functions of the various computer hardware components.

COURSE OUTCOMES:

At the end of the course, the student will be able to

CO1: Identify the basic functional units and different ways of interconnecting to form a computer system.

CO2: Design; understand the number systems, combinational sequential circuits.

CO3: Inspect the Computer Arithmetic operations performed on fixed point and floating-point numbers.

CO4: Apply effective memory management strategies

CO5: Describe various techniques for I/O data transfer methods and interrupt handling mechanisms.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	2	-	-	-	-	-	-	-	-	-	-
CO3	3	2	3	2	-	-	-	-	-	-	-	-	-	-
CO4	2	3	2	2	-	-	-	-	-	-	-	-	-	-
CO5	2	3	2	1		-	-	-	-	-	-	-	-	-

UNIT- I (12 Hrs)

Basic Structure of Computers: Computer Types, Functional units, Basic operational concepts, Bus structures, Software, Performance, multiprocessors and multi computers, Computer Generations.

Data Representation: Binary Numbers, Fixed Point Representation. Floating – Point Representation. Number base conversions, Octal and Hexadecimal Numbers, complements, Signed binary numbers, Binary codes.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Identify the basic functional units and different ways of interconnecting to form a computer system. (L2)
- Summarize the binary number system (L2)
- Illustrate various binary codes (L3)

UNIT- II (12 Hrs)

Digital Logic Circuits - I: Basic Logic Functions, Logic gates, universal logic gates, Minimization of Logic expressions. Flip-flops, Combinational Circuits.

Digital Logic Circuits - II: Registers, Shift Registers, Binary counters, Decoders, Multiplexers, Programmable Logic Devices.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Develop a logic diagram using gates from a Boolean function (L3)
- Apply the map method for simplifying Boolean Expressions. (L2)
- Analyze and design combinational circuits. (L3)
- Explain the functionalities of latch and different flip-flops (L2)

UNIT- III (12 Hrs)

Computer Arithmetic: Algorithms for fixed point and floating-point addition, subtraction, multiplication and division operations, Hardware Implementation of arithmetic and logic operations, High performance arithmetic.

Instruction Set & Addressing: Memory Locations and Addresses, Machine addresses and sequencing, Various Addressing Modes, Instruction Formats, Basic Machine Instructions, IA-32 Pentium example.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Illustrate various addressing modes for accessing register and memory operands. (L3)
- Describe the instruction sequencing and various types of instructions. (L2)
- Describe the operations performed on floating point numbers. (L2)

UNIT- IV (11 Hrs)

Processor Organization: Introduction to CPU, Register Transfers, Execution of Instructions, Multiple Bus Organization, Hardwired Control, Microprogrammed Control.

Memory Organization: Concept of Memory, RAM, ROM memories, memory hierarchy, cache memories, virtual memory, secondary storage, memory management requirements.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Distinguish between hardwired and micro programmed control units. (L3)
- Recognize the various types of memories. (L2)
- Analyze the performance of cache memory. (L3)

- Apply effective memory management strategies (L2)

UNIT- V (11 Hrs)

Input / Output Organization: Introduction to I/O, Interrupts- Hardware, Enabling and disabling Interrupts, Device Control, Direct memory access, buses, interface circuits, standard I/O Interfaces.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Examine the basics of I/O data transfer synchronization. (L3)
- Analyze the interrupt handling mechanisms of various processors. (L3)
- Describe various techniques for I/O data transfer methods. (L2)

TEXTBOOKS:

1. "Computer Organization", Carl Hamacher, ZvonkoVranesic, SafwatZaky, McGraw Hill, 5th edition.
2. "Computer Architecture and Organization- An Integrated Approach", Miles Murdocca, Vincent Heuring, Wiley India, Second Edition.
3. "Computer Systems Architecture", M. Morris Mano, Pearson, 3rd Edition.

REFERENCE BOOKS:

1. "Computer Organization and Architecture", William Stallings, Pearson, Sixth Edition,
2. "Computer - organization and Design", David A. Paterson and John L. Hennessy, Elsevier.
3. "Fundamentals or Computer Organization and Design", Sivarama Dandamudi, Springer Int. Edition.
4. "Digital Design", M. Morris Mano, Pearson Education/PHI, Third Edition
5. "Fundamentals of Logic Design", Roth, Thomson, 5th Edition.

Course Code	DATABASE MANAGEMENT SYSTEM		L	T	P	C
21A050402	(Common to CSE, CSE-AI & CSE-IOT)		3	0	0	3
Pre-requisite	NIL	Semester	III			

COURSE OBJECTIVES:

- Train in the fundamental concepts of database management systems, database modelling and design, SQL, PL/SQL and system implementation techniques.
- Enable students to model ER diagram for any customized application
- Inducting appropriate strategies for optimization of queries.
- Provide knowledge on concurrency techniques
- Demonstrate the organization of Databases

COURSE OUTCOMES

At the end of the course, the student will be able to

CO1: Design a database for a real-world information system
CO2: Define transactions which preserve the integrity of the database
CO3: Generate tables for a database
CO4: Organize the data to prevent redundancy
CO5: Pose queries to retrieve the information from database.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3		-	-	-	-	-	-	-	2	1	-
CO2	3	2	3	3	-	-	-	-	-	-	3	3	1	-
CO3	-	2	3	3	-	-	-	-	-	-	2	-	1	-
CO4	-	2	-	3	2	-	-	-	-	-	-	-	-	2
CO5	-	-	-	3	3	-	-	-	-	-	-	3	-	2

UNIT-I (12 Hrs)

Introduction: Database systems applications, Purpose of Database Systems, view of Data, Database Languages, Relational Databases, Database Design, Data Storage and Querying, Transaction Management, Database Architecture, Data Mining and Information Retrieval, Specialty Databases, Database users and Administrators.

Introduction to Relational Model: Structure of Relational Databases, Database Schema, Keys, Schema Diagrams, Relational Query Languages, Relational Operations

Learning Outcomes: At the end of this unit, students should be able to

- Distinguish between Database and File System (L3)
- Categorize different kinds of data models (L4)
- Define functional components of DBMS (L1)

UNIT-II (12 Hrs)

Introduction to SQL: Overview of the SQL Query Language, SQL Data Definition, Basic Structure of SQL Queries, Additional Basic Operations, Set Operations, Null Values, Aggregate Functions, Nested Sub-queries, Modification of the Database. Intermediate SQL**:** Joint Expressions, Views, Transactions, Integrity Constraints, SQL Data types and schemas, Authorization.

Advanced SQL: Accessing SQL from a Programming Language, Functions and Procedures, Triggers, Recursive Queries, OLAP, Formal relational query languages.

Learning Outcomes: At the end of this unit, students should be able to

- Outline the elements of the relational model such as domain, attribute, tuple, relation, and entity (L4)
- Distinguish between various kinds of constraints like domain, key, and integrity (L4)
- Define relational schema (L1)
- Develop queries using Relational Algebra and SQL (L6)
- Perform DML operations on databases (L3)

UNIT-III (12 Hrs)

Database Design and the E-R Model: Overview of the Design Process, The Entity-Relationship Model, Constraints, Removing Redundant Attributes in Entity Sets, Entity-Relationship Diagrams, Reduction to Relational Schemas, Entity-Relationship Design Issues.

Relational Database Design: Features of Good Relational Designs, Atomic Domains and First Normal Form, Decomposition Using Functional Dependencies, Functional-Dependency Theory, Algorithms for Decomposition, Decomposition Using Multivalued Dependencies, More Normal Forms

Learning Outcomes: At the end of this unit, students should be able to

- Develop E-R model for the given problem (L6)
- Derive tables from E-R diagrams (L6)
- Differentiate between various normal forms based on functional dependency (L4)
- Apply normalization techniques to eliminate redundancy (L3)

UNIT-IV (11 Hrs)

Query Processing: Overview, Measures of Query cost, Selection operation, sorting, Join Operation, other operations, Evaluation of Expressions.

Query optimization: Overview, Transformation of Relational Expressions, Estimating statistics of Expression results, Choice of Evaluation Plans, Materialized views, Advanced Topics in Query Optimization.

Learning Outcomes: At the end of this unit, students should be able to

- Identify variety of methods for effective processing of given queries. (L2)

- Obtain knowledge related to optimization techniques. (L6)

UNIT-V (12 Hrs)

Transaction Management: Transactions: Concept, A Simple Transactional Model, Storage Structures, Transaction Atomicity and Durability, Transaction Isolation, Serializability, Isolation and Atomicity, Transaction Isolation Levels, Implementation of Isolation Levels, Transactions as SQL Statements.

Concurrency Control: Lock based Protocols, Deadlock Handling, Multiple granularities, Timestamp based Protocols, Validation based Protocols.

Recovery System: Failure Classification, Storage, Recovery and Atomicity, Recovery Algorithm, Buffer Management, Failure with Loss of Non-volatile Storage, Early Lock Release and Logical Undo Operations.

Learning Outcomes: At the end of this unit, students should be able to

- Understand various properties of transaction. (L2)
- Design atomic transactions for an application. (L6)
- Gain the knowledge about log mechanism and check pointing techniques for system recovery. (L6)

TEXTBOOKS:

1. "Database System Concepts" A. Silberschatz, H. F. Korth, S. Sudarshan, TMH, 2019, 6/e.

REFERENCE BOOKS:

1. "Database Management System", Shamkant B. Navathe, Ramez Elmasri, PEA, 6/e.
2. "Database Principles Fundamentals of Design Implementation and Management", Carlos Coronel, Steven Morris, Peter Robb, Cengage Learning.
3. "Database Management Systems", Raghurama Krishnan, Johannes Gehrke, TMH, 3/e.

Course Code	OBJECT ORIENTED PROGRAMMING THROUGH JAVA (Common to CSE, CSE-AI & CSE-IOT)		L	T	P	C
21A050403			3	0	0	3
Pre-requisite	C-Programming & Data Structures	Semester	III			

COURSE OBJECTIVES:

- To understand object-oriented concepts and problem-solving techniques
- To obtain knowledge about the principles of inheritance and polymorphism
- To implement the concept of packages, interfaces, exception handling and concurrency mechanism.
- To design the GUIs using applets and swing controls.
- To understand the Java Database Connectivity Architecture

COURSE OUTCOMES:

Students will be able to:

CO1: To solve real world problems using OOP techniques.
CO2: To apply code reusability through inheritance, packages, and interfaces
CO3: To develop applications by using parallel streams for better performance.
CO4: To solve problems using java collection framework and I/O classes.
CO5: To develop applets for web applications, to build GUIs and handle events generated by user interactions, to use the JDBC API to access database

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	-	-	-	-	-	-	-	-	3	1	-
CO2	2	3	3	-	-	3	-	-	-	-	3	-	1	-
CO3	-	-	3	-	2	-	-	-	-	-	3	3	1	-
CO4	-	-	3	3	3	-	-	-	-	-	3	3	-	2
CO5	-	-	3	3	3	-	-	-	-	-	3	3	-	2

UNIT–I (12 Hrs)

Introduction: Introduction to Object Oriented Programming, The History and Evolution of Java, Introduction to Classes, Objects, Methods, Constructors, this keyword, Garbage Collection, Data Types, Variables, Type Conversion and Casting, Arrays, Operators, Control Statements, Method Overloading, Constructor Overloading, Parameter Passing, Recursion, String Class and String handling methods.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the syntax, semantics, and features of Java Programming Language. (L2)
- Learn object-oriented features and understanding type conversion and casting. (L2)
- Understand different types of string handling functions and its usage. (L2)

UNIT–II (10 Hrs)

Inheritance: Basics, Using Super, Creating Multilevel hierarchy, Method overriding, Dynamic Method Dispatch, Using Abstract classes, Using final with inheritance, Object class,

Packages: Basics, finding packages and CLASSPATH, Access Protection, Importing packages.

Interfaces: Definition, Implementing Interfaces, Extending Interfaces, Nested Interfaces, Applying Interfaces, Variables in Interfaces.

Learning Outcomes: At the end of this unit, students should be able to

- Implement types of Inheritance and developing new classes based on existing classes (L3)
- Distinguish between system packages and user defined packages. (L4)
- Demonstrate features of interfaces to implement multiple inheritances. (L3)

UNIT – III (12 Hrs)

Exception handling - Fundamentals, Exception types, Uncaught exceptions, using try and catch, multiple catch clauses, nested try statements, throw, throws and finally, built- in exceptions, creating own exception sub classes.

Stream based I/O (java.io) – The Stream Classes-Byte streams and Character streams, reading console Input and Writing Console Output, File class, Reading and
writing Files, Random access file operations, The Console class, Serialization, Enumerations, Autoboxing, Generics.

Learning Outcomes: At the end of this unit, students should be able to

- Learn what exceptions are and how they are handled. (L2)
- Learn when to use exception handling and how to create user defined exceptions (L6)
- Learn the difference between various files and streams. (L4)

UNIT – IV (12 hrs)

Multithreading: The Java thread model, creating threads, Thread priorities, Synchronizing threads, Interthread communication.

The Collections Framework (java.util): Collections overview, Collection Interfaces, The Collection classes- Array List, Linked List, Hash Set, Tree Set, Priority Queue, Array Deque. Hash table, Properties, Stack, Vector, String Tokenizer, Bit Set, Date, Calendar, Random, Formatter, Scanner.

Learning Outcomes: At the end of this unit, students should be able to

- Understand concurrency, parallelism, and multithreading (L2)
- Learn the importance of collections and use prebuilt generic data structures from framework. (L3)

UNIT-V (12 hrs)

Applet: Basics, Architecture, Applet Skeleton, requesting repainting, using the status window, passing parameters to applets

GUI Programming with Swings – The origin and design philosophy of swing, components and containers, layout managers, event handling, using a push button, jtextfield, jlabel and image icon, the swing buttons, jtext field, jscrollpane, jlist, jcombobox, trees, jtable, An overview of jmenubar, jmenu and jmenuitem, creating a main menu, show message dialog, show confirm dialog, show input dialog, show option dialog, jdialog, create a modeles sdialog.

Accessing Databases with JDBC:

Types of Drivers, JDBC Architecture, JDBC classes and Interfaces, Basic steps in developing JDBC applications, Creating a new database and table with JDBC.

Learning Outcomes: At the end of this unit, students should be able to

- Learn how to use the Nimbuslook-and-feel (L3)
- Understand the GUI programming. (L2)
- Understand basic steps in developing JDBC applications (L2)

TEXTBOOKS:

1. "Java The complete reference", Herbert Schildt, McGraw Hill Education (India) Pvt. Ltd, 9th edition.
2. "Java How to Program", Paul Dietel, Harvey Dietel, Pearson Education,10th Edition.

REFERENCE BOOKS:

1. "Understanding Object-Oriented Programming with Java", T. Budd, Pearson Education, updated edition.
2. "Core Java Volume – 1 Fundamentals", Cay S. Horstmann, Pearson Education.
3. "Java Programming for core and advanced learners", Sagayaraj, Dennis, Karthik and Gajalakshmi, University Press
4. "Introduction to Java programming", Y. Daniel Liang, Pearson Education.
5. Object Oriented Programming through Java", P. Radha Krishna, "University Press.
6. "Programming in Java", S. Malhotra, S. Choudhary, Oxford Univ. Press, 2nd edition.
7. "Java Programming and Object-oriented Application Development", R.A. Johnson, Cengage Learning.

Course Code	PYTHON PROGRAMMING & DATA SCIENCE (Common to CSE, CSE-AI & CSE-IOT)		L	T	P	C
21A050306			3	0	0	3
Pre-requisite	NIL	Semester	III			

COURSE OBJECTIVES:

- To learn the fundamentals of Python.
- To discuss the concepts of Functions and Exceptions.
- To familiarize with Python libraries for Data Analysis and Data Visualization.
- To introduce preliminary concepts in Pattern Recognition and Machine learning.
- To provide an overview of Deep Learning and Data Science models.

COURSE OUTCOMES:

At the end of the course, the student will be able to

CO1: Examine Python syntax and semantics and be fluent in the use of Python flow control and functions.

CO2: Demonstrate proficiency in handling Strings and File Systems.

CO3: Create, run and manipulate Python Programs using core data structures like Lists, Dictionaries and use Regular Expressions.

CO4: Interpret the concepts of NumPy, MatPlotLib, & Pandas as used in Python.

CO5: Implement exemplary applications related to Machine Learning, Deep learning and Data Science Models in Python.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	3	-	-	-	-	-	-	-	1	-
CO2	2	2	2	1	3	-	-	-	-	-	-	-	1	-
CO3	3	3	2	2	3	-	-	-	-	-	-	-	1	-
CO4	2	2	2	2	3	-	-	-	-	-	-	-	-	2
CO5	3	3	2	2	3	-	-	-	-	-	-	-	-	2

UNIT-I (15 Hrs)

Parts of Python Programming Language: Identifiers, Keywords, Statements and Expressions, Variables, Operators, Precedence and Associativity, Data Types, Indentation, Comments, Reading Input, Print Output, Type Conversions, The type() Function and Is Operator, Dynamic and Strongly Typed Language,

Control Flow Statements: The if Decision Control Flow Statement, The if…else Decision Control Flow Statement, The if…elif…else Decision Control Statement, Nested if Statement, The while Loop, The for Loop, The continue and break Statements.

Lists: Creating Lists, Basic List Operations, Indexing and Slicing in Lists, Built-In Functions used on Lists, List Methods, The del Statement.

Dictionaries: Creating Dictionary, Accessing and Modifying key: value Pairs in Dictionaries, Built-In Functions Used on Dictionaries, Dictionary Methods, The del Statement.
Tuples and Sets: Creating Tuples, Basic Tuple Operations, Indexing and Slicing in Tuples, Built-In Functions Used on Tuples
Learning outcomes: At the end of this unit, students should be able to

- List the basic constructs of Python. (L1)
- Apply the conditional execution of the program (L3)
- Use the data structure lists, Dictionaries and Tuples (L3)

UNIT-II (10 Hrs)
Strings: Creating and Storing Strings, Basic String Operations, Accessing Characters in String by Index Number, String Slicing and Joining, String Methods, Formatting Strings,
Functions: Built-In Functions, Commonly Used Modules, Function Definition and Calling the Function, The return Statement and void Function, Scope and Lifetime of Variables, Default Parameters.
Errors and Exceptions: What Are Exceptions? Exceptions in Python, Detecting and Handling Exceptions, Exceptions as Strings, Raising Exceptions, Assertions, Standard Exceptions
Learning Outcomes: At the end of this unit, students should be able to

- Design programs for manipulating strings (L6)
- Solve the problems by applying the modularity principle. (L3)
- Classify exceptions and explain the ways of handling them. (L4)

UNIT-III (10 hrs)
Files: Types of Files, Creating and Reading Text Data, File Methods to Read and Write Data, Reading and Writing Binary Files,
Introduction to **NumPy, Pandas, Matplotlib**.
Exploratory Data Analysis (EDA): Data Science life cycle, Descriptive Statistics, Basic tools (plots, graphs and summary statistics) of EDA, Philosophy of EDA.
Data Visualization: Scatter plot, bar chart, histogram, boxplot, heat maps, etc
Learning Outcomes: At the end of this unit, students should be able to

- Creating file handling scripts. (L6)
- Demonstrate various mathematical operations on arrays using NumPy (L2)
- Analyze and manipulate Data using Pandas (L4)
- Creating static, animated, and interactive visualizations using Matplotlib. (L6)

UNIT-IV (15 hrs)
Introduction to Pattern Recognition and Machine Learning: Patterns, features, pattern representation, the curse of dimensionality, dimensionality reduction.

Classification—linear and non-linear. Bayesian, Nearest neighbor classifier, Logistic regression, Naïve-Bayes, decision trees and random forests; boosting and bagging.
Clustering---partitional and hierarchical; k-means clustering. Regression.
Cost functions, Cross-validation, Confusion matrix, evaluation metrics
Learning Outcomes: At the end of this unit, students should be able to

- Define Patterns and their representation (L1)
- Describe the Classification and Clustering (L2)
- Illustrate cost functions and class imbalance (L3)

UNIT-V (10 hrs)
Introduction to Deep Learning: Perceptron, Multilayer perceptron. Back propagation. Loss functions. Hyper parameter tuning, Overview of RNN, CNN and LSTM.
Overview of Data Science Models: Applications to text, images, recommender systems, image classification, Social network graphs
Learning Outcomes: At the end of this unit, students should be able to

- Describe RNN, CNN and LSTM (L2)
- Explain the applications of Data Science (L2)

TEXTBOOKS:

1. "Think Python", Allen B. Downey, SPD/O'Reilly, 2nd edition, 2016
2. "Doing Data Science, Straight Talk from the Frontline", Cathy O'Neil, Rachel Schutt, O'Reilly, 2013.
3. "Pattern Recognition and Machine Learning", Christopher Bishop, Springer, 2007.

REFERENCE BOOKS:

1. "Introduction to Python Programming", Gowri Shankar S, Veena A, CRC Press/Taylor & Francis, 1st Edition, 2018. ISBN-13: 978-0815394372,
2. "Python Data Science Handbook: Essential Tools for Working with Data", Jake Vander Plas, O'Reilly Media, 1st Edition, 2016. ISBN-13: 978-1491912058
3. "Hands-On Machine Learning with Scikit-Learn and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems", Aurelien Geron, O'Reilly Media, 2nd Edition, 2019. ISBN – 13: 978-9352139057
4. "Core Python Applications Programming", Wesley J Chun, Pearson Education India, 3rd Edition, 2015. ISBN-13: 978-9332555365.
5. "Flask Web Development: Developing Web Applications with Python", Miguel Grinberg, O'Reilly Media, 2nd Edition, 2018. ISBN-13: 978-1491991732.

Course Code	DATABASE MANAGEMENT SYSTEMS LAB		L	T	P	C
21A050404	(Common to CSE, CSE-AI & CSE-IOT)		0	0	3	1.5
Pre-requisite	NIL	Semester	III			

COURSE OBJECTIVES:

- To implement the basic knowledge of SQL queries and relational algebra.
- To construct database models for different database applications.
- To apply normalization techniques for refining of databases.
- To practice various triggers, procedures, and cursors using PL/SQL.
- To design and implementation of a database for an organization

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Design a database for a real-world information system
CO2: Define transactions which preserve the integrity of the database
CO3: Generate tables for a database
CO4: Organize the data to prevent redundancy
CO5: Pose queries to retrieve the information from database.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	-	-	-	-	-	-	-	-	1	-
CO2	3	2	2	2	-	-	-	-	-	-	-	-	1	-
CO3	3	2	3	2	-	-	-	-	-	-	-	-	1	-
CO4	3	2	2	3	-	-	-	-	-	-	-	-	-	2
CO5	3	3	2	2	-	-	-	-	-	-	-	-	-	2

LIST OF EXPERIMENTS:

I. CREATION OF DATA BASE TABLES

1. Create a table called Employee with fields (Empno, Ename, Job, Mgr, Sal)
   a. Add a column commission with domain to the Employee table.
   b. Insert any five records into the table.
   c. Update the column details of job
   d. Rename the column of Employ table using alter command.
   e. Delete the employee whose empno is 19

2. Create department table with fields (Deptno, Deptname, Location).
   a. Add column designation to the department table.
   b. Insert values into the table.
   c. List the records of emp table grouped by dept no.

d. Update the record where dept no is 9.
e. Delete any column data from the table.

II: EXECUTING QUERIES USING DDL AND DML COMMANDS

1. a. Create a user and grant all permissions to the user on employee table.
   b. Insert the any three records in the employee table and use rollback. Check the result.
   c. Add primary key constraint and not null constraint to the employee table.
   d. Insert null values to the employee table and verify the result.
   e. By using the group by clause, display the names who belongs to dept no 10 along with average salary.
   f. Display lowest paid employee details under each department.
   g. Display number of employees working in each department and their department number
2. a. Create a user and grant all permissions to the user on department table
   b. Insert values in the department table and use commit.
   c. Add constraints like unique and not null to the department table.
   d. Insert repeated values and null values into the table.
   e. Calculate the average salary for each different job.
   f. Show the average salary of each job excluding manager.
   g. Show the average salary for all departments employing more than three people.
   h. Display employees who earn more than the lowest salary in department30

III. CASE STUDIES:

1. E-commerce Platform
2. Inventory Management
3. Railway System
4. Hospital Data Management
5. Course management system
6. Library Data Management
7. Bank management system
8. Payroll Management Solution
9. Saving Student Records
10. Supply chain management system

Note-1: The above applications need to be executed on data base connectivity (JDBC/ODBC)

Note-2: The complete details of the applications cited above will be available in the Lab Manuals.

REFERENCE BOOKS:

1. "Database Systems", Ramez Elmasri, Shamkant, B. Navathe, Pearson Education, 6th Edition, 2013.
2. "Database System Concepts" Peter Rob, Carles Coronel, Cengage Learning, 7th Edition, 2008.

Course Code	OBJECT ORIENTED PROGRAMMING THROUGH JAVA LAB (Common to CSE, CSE-AI & CSE-IOT)		L	T	P	C
21A050405			0	0	3	1.5
Pre-requisite	C Programming & Data Structures	Semester	III			

COURSE OBJECTIVES:

- To introduce the concepts of Java.
- To Practice object-oriented programs and build java applications.
- To implement java programs for establishing interfaces.
- To implement sample programs for developing reusable software components.
- To establish database connectivity in java and implement GUI applications.

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Recognize the Java programming environment.
CO2: Develop efficient programs using multithreading.
CO3: Design reliable programs using Java exception handling features.
CO4: Extend the programming functionality supported by Java.
CO5: Select appropriate programming construct to solve a problem.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	-	-	-	-	-	-	-	-	1	-
CO2	3	2	2	2	-	-	-	-	-	-	-	-	1	-
CO3	3	2	3	2	-	-	-	-	-	-	-	-	1	-
CO4	3	2	2	3	-	-	-	-	-	-	-	-	-	2
CO5	3	3	2	2	-	-	-	-	-	-	-	-	-	2

LIST OF APPLICATIONS

1. E-commerce Platform
2. Inventory Management
3. Railway System
4. Hospital Data Management
5. Course management system
6. Library Data Management
7. Bank management system
8. Payroll Management Solution
9. Saving Student Records

10. Supply chain management system

For Every Application:

The following Tasks need to be done:

1. Write a java program to create classes and declare variables?
2. Write a java program to create a constructor?
3. Write a java program to perform exception handling to catch runtime exceptions?
4. Write a java program to implement inheritance for increasing reusability of code?
5. Write a java program to create interfaces for achieving data abstraction?
6. Write a java program to create files for input and output data storage?
7. Write a java program for implementing collection framework for effective management of data objects?
8. Write a java program for creating Graphical User Interface using swings?
9. Write a java program for implementing jdbc connectivity for application connecting with database?

Note-1: The above applications need to be executed on data base connectivity (JDBC/ODBC)

Note-2: The complete details of the applications cited above will be available in the Lab Manuals.

Course Code	PYTHON PROGRAMMING & DATA SCIENCE LAB (Common to CSE, CSE-AI, CSE-IOT)		L	T	P	C
21A050307			0	0	3	1.5
Pre-requisite	NIL	Semester	III			

COURSE OBJECTIVES:

- To train the students in solving computational problems
- To elucidate solving mathematical problems using Python programming language
- To understand the fundamentals of Python programming concepts and its applications.
- Practical understanding of building different types of models and their evaluation

COURSE OUTCOMES:

After completing the course, the student will be able to

CO1: Illustrate the use of various data structures. (L3)
CO2: Analyze and manipulate Data using Pandas (L4)
CO3: Creating static, animated, and interactive visualizations using Matplotlib. (L6)
CO4: Understand the implementation procedures for the machine learning algorithms. (L2)
CO5: Apply appropriate data sets to the Machine Learning algorithms (L3)

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	3	-	-	-	-	-	-	-	1	-
CO2	2	2	2	1	3	-	-	-	-	-	-	-	1	-
CO3	3	3	2	2	3	-	-	-	-	-	-	-	1	-
CO4	2	2	2	2	3	-	-	-	-	-	-	-	-	2
CO5	3	3	2	2	3	-	-	-	-	-	-	-	-	2

LIST OF EXPERIMENTS:

Week 1
Write a program to demonstrate a) Different numeric data types and b) To perform different Arithmetic Operations on numbers in Python.

Week 2
Write a program to create, append, and remove lists in Python.

Week 3
Write a program to demonstrate working with tuples in Python.

Week 4
Write a program to demonstrate working with dictionaries in Python.

Week 5
Write a program to demonstrate a) arrays b) array indexing such as slicing, integer array indexing and Boolean array indexing along with their basic operations in NumPy.

Week 6

Write a program to compute summary statistics such as mean, median, mode, standard deviation and variance of the given different types of data.

Week 7

Write a script named copyfile.py. This script should prompt the user for the names of two text files. The contents of the first file should be the input that to be written to the second file.

Week 8

Write a program to demonstrate Regression analysis.

Week 9

Write a program to demonstrate the working of the decision tree-based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.

Week 10

Write a program to implement the Naïve Bayesian classifier for a sample training data set stored as a .CSV file.

Week 11

Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set.

Week 12

Write a program to implement k-Means clustering algorithm to cluster the set of data stored in .CSV file. Compare the results of various "k" values for the quality of clustering.

Week 13

Write a program to build Artificial Neural Network and test the same using appropriate data sets.

TEXTBOOKS:

1. "Deep Learning with Python", Francois Chollet, Manning Publications Company, 1/e, 2017.
2. "How to Think Like a Computer Scientist: Learning with Python 3", Peter Wentworth, Jeffrey Elkner, Allen B. Downey and Chris Meyers, 3rd edition. URL: http://www.ict.ru.ac.za/Resources/cspw/thinkcspy3/thinkcspy3.pdf
3. "Head First Python a Brain Friendly Guide", Paul Barry, O'Reilly, 2nd Edition, 2016
4. "Pandas for Everyone Python Data Analysis", Daniel Y. Chen, Pearson Education, 2019

Course Code	MATLAB PROGRAMMING LAB		L	T	P	C
21A050706			1	0	2	2
Pre-requisite	C Programming & Data Structures	Semester	III			

COURSE OBJECTIVES:

- Understand the concepts of Game design and development.
- Learn the processes, mechanics and issues in Game Design.
- Be exposed to the Core architectures of Game Programming.
- Know about Game programming platforms, frame works and engines.
- Learn to develop games.

COURSE OUTCOMES:

After completion of the course, the student will be able to:

CO1: Gain knowledge of basic procedural programming concepts and computational thinking
CO2: Become proficient in the use of modern computational tools
CO3: Develop basic problem-solving skills
CO4: Develop experience in designing a solution to engineering problems using software
CO5: Be able to document solutions to engineering problems and communicate the results

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	-	-	-	-	-	-	-	1	-
CO2	3	2	2	2	3	-	-	-	-	-	-	-	1	-
CO3	2	2	2	2	3	-	-	-	-	-	-	-	1	-
CO4	3	2	3	3	2	-	-	-	-	-	-	-	-	2
CO5	2	3	2	2	2	-	-	-	-	-	-	-	-	2

LIST OF EXPERIMENTS

Week 1 – Week 4: MODULE-I

Introduction to MATLAB - Characters, Relational Expressions, Vectors, Matrices. Introduction to programming, scripts, I/O, plots, Functions and commands

All the above must be practiced with exercises and Hands-on examples using the existing tool boxes

Week 5 – Week 8: MODULE - II

Loops and Branching statements, Vectorizing and Timing codes

All the above must be practiced with exercises and Hands-on examples using the existing tool boxes

Week 9 – Week 12: MODULE - III

User Interface design: MATLAB Program Organization, Debugging, Live-scripts, Data Transfer All the above must be practiced with exercises and Hands-on examples using the existing tool boxes

TEXTBOOKS:

1. "MATLAB: A Practical Introduction to Programming and Problem solving", Storm Attaway, Elsevier, Fifth Edition, 2018.

Course Code	CONSTITUTION OF INDIA		L	T	P	C
21A000002	(Common to all branches)		2	0	0	0
Pre-requisite	NIL	Semester	III			

COURSE OBJECTIVES

- To Enable the student to understand the importance of constitution
- To understand the structure of executive, legislature and judiciary
- To understand philosophy of fundamental rights and duties
- To understand the autonomous nature of constitutional bodies like Supreme Court and high court controller and auditor general of India and Election Commission of India.
- To understand the central-state relation in financial and administrative control

COURSE OUTCOMES:

At the end of the course, students will be able to

CO1: Understand historical background of the constitution making and its importance for building a democratic India.

CO2: Understand the functioning of three wings of the government i.e., executive, legislative and judiciary.

CO3: Understand the value of the fundamental rights and duties for becoming good citizen of India.

CO4: Analyze the decentralization of power between central, state and local self-government

CO5: Apply the knowledge in strengthening of the constitutional institutions like CAG, Election Commission and UPSC for sustaining democracy.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	3	-	2	1	-	-	1	-	-
CO2	-	-	-	-	-	3	-	2	1	-	-	1	-	-
CO3	-	-	-	-	-	3	-	2	1	-	-	1	-	-
CO4	-	-	-	-	-	3	-	2	1	-	-	1	-	-
CO5	-	-	-	-	-	3	-	2	1	-	-	1	-	-

UNIT-I (10 Hrs)

Introduction to Indian Constitution – Constitution -Meaning of the term - Indian Constitution-Sources and constitutional history - Features– Citizenship – Preamble - Fundamental Rights and Duties - Directive Principles of State Policy.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of Indian constitution (L1)
- Apply the knowledge on directive principle of state policy (L3)
- Analyze the History and features of Indian constitution (L4)
- Learn about Preamble, Fundamental Rights and Duties (L1)

UNIT-II (10 Hrs)

Union Government and its Administration Structure of the Indian Union - Federalism - Centre-State relationship – President's Role, power and position - PM and Council of ministers - Cabinet and Central Secretariat –Lok Sabha - Rajya Sabha - The Supreme Court and High Court - Powers and Functions

Learning Outcomes: At the end of this unit, students should be able to

- Understand the structure of Indian government (L1)
- Differentiate between the state and central government (L4)
- Explain the role of President and Prime Minister (L2)
- Know the Structure of supreme court and High court (L1)

UNIT-III (10 Hrs)

State Government and its Administration - Governor - Role and Position -CM and Council of ministers - State Secretariat-Organization Structure and Functions

Learning Outcomes: At the end of this unit, students should be able to

- Understand the structure of state government (L1)
- Analyze the role of Governor and Chief Minister (L4)
- Explain the role of State Secretariat (L2)
- Differentiate between structure and functions of state secretariat (L4)

UNIT-IV (10 Hrs)

Local Administration - District's Administration Head - Role and Importance - Municipalities - Mayor and role of Elected Representatives -CEO of Municipal Corporation Panchayati Raj - Functions– PRI –Zilla Parishath - Elected officials and their roles – CEO, Zilla Parishath - Block level Organizational Hierarchy - (Different departments) - Village level - Role of Elected and Appointed officials - Importance of grass root democracy

Learning Outcomes: At the end of this unit, students should be able to

- Understand the local Administration (L1)
- Compare and contrast district administration's role and importance (L4)
- Analyze the role of Mayor and elected representatives of Municipalities (L4)
- Learn about the role of Zilla Parishath block level organization (L1)

UNIT-V (10 Hrs)

Election Commission - Election Commission- Role of Chief Election Commissioner and Election Commissionerate - State Election Commission -Functions of Commissions for the welfare of SC/ST/OBC and Women

Learning Outcomes: At the end of this unit, students should be able to

- Know the role of Election Commission (L1)

- Contrast and compare the role of Chief Election commissioner and Commissionerate (L4)
- Analyze the role of state election commission (L4)
- Evaluate various commissions viz SC/ST/OBC and women (L6)

TEXTBOOKS:

1. "Introduction to the Constitution of India", Durga Das Basu, Prentice Hall of India Pvt. Ltd. New Delhi
2. "Indian Constitution", Subash Kashyap, National Book Trust

REFERENCE BOOKS:

1. "Dynamics of Indian Government & Politics", J.A. Siwach,
2. "Constitutional Law of India", H.M.Sreevai, 4th edition in 3 volumes (Universal Law Publication)
3. "Indian Government and Politics", J.C. Johari, Hans India

Course Code	ARTIFICIAL INTELLIGENCE & NEURAL NETWORKS		L	T	P	C
21A310402			3	0	0	3
Pre-requisite	C Programming & Data Structures	Semester	IV			

COURSE OBJECTIVES:

- Define Artificial Intelligence and establish the cultural background for study
- Understand various learning algorithms
- Explore the searching and optimization techniques for problem solving.
- Illustrate the importance of knowledge representation
- Understand Neural networks and its types.

COURSE OUTCOMES:

After the completion of the course, the student will be able to

CO1: Examine how an agent can learn from success and failure, reward and punishment.
CO2: Learn different searching techniques to solve a problem.
CO3: Explain how knowledge can be represented using propositional and First order logic.
CO4: Solve real world problems using Neural network concepts.
CO5: Implement applications using forward and backward neural networks.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	3	3	-	-	-	2	-	2	2	1	-
CO2	2	2	2	2	2	-	-	-	2	-	2	2	1	-
CO3	3	3	3	3	2	-	-	-	2	-	2	3	1	-
CO4	3	3	2	2	3	-	-	-	2	-	3	1	-	2
CO5	3	3	2	3	2	-	-	-	1	-	1	2	-	2

UNIT – I (12 Hrs)

Introduction: AI problems, foundation of AI and history of AI intelligent agents: Agents and Environments, the concept of rationality, the nature of environments, structure of agents, problem solving agents, problem formulation.

Learning Outcomes: At the end of this unit, students should be able to

- Get knowledge on foundations of AI. (L2)
- Understand Agents working environments (L2)
- Problem formulation methodologies. (L2)

UNIT – II (12 Hrs)

Searching: Searching for solutions, uniformed search strategies – Breadth first search, depth first Search. Search with partial information (Heuristic search) Greedy best first search, A* search.

Learning Outcomes: At the end of this unit, students should be able to

- Learn Uninformed searching methodologies (L2)
- Learn Informed searching methodologies (L2)

UNIT – III (11 Hrs)

Knowledge Representation & Reasons: Logical Agents, Knowledge – Based Agents, the Wumpus world, logic, propositional logic, Resolution patterns in propositional logic, Resolution, Forward & Backward. Chaining. First order logic. Inference in first order logic, propositional Vs. first order inference, unification & lifts forward chaining, Backward chaining, Resolution.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the importance of knowledge for agent (L2)
- Learn basic concepts of forward and backward chaining. (L3)
- Practice the resolution process. (L3)

UNIT – IV (10 Hrs)

Introduction to NN: Characteristics of Neural Networks, Historical Development of Neural Networks Principles, Artificial Neural Networks: Terminology, Models of Neuron, Topology, Basic Learning Laws, Pattern Recognition Problem, Basic Functional Units, Pattern Recognition Tasks by the Functional Units.

Learning Outcomes: At the end of this unit, students should be able to

- Understand major features of Neural Networks. (L2)
- Learn and practice various concepts in ANN (L2)
- Learn how to perform pattern recognition using functional units. (L3)

UNIT – V (11 Hrs)

Feed Forward Neural Networks: Introduction, Analysis of pattern Association Networks, Analysis of Pattern Classification Networks, Analysis of pattern storage Networks. Analysis of Pattern Mapping Networks.

Feedback Neural Networks: Introduction, Analysis of Linear Auto associative FF Networks, Analysis of Pattern Storage Networks.

Learning Outcomes: At the end of this unit, students should be able to

- Understand importance of forward and backward neural networks. (L2)

TEXTBOOKS:

1. "Artificial Intelligence – A Modern Approach", Stuart Russel, Peter Norvig, PHI/ Pearson Education, Second Edition.
2. "Artificial Neural Networks", B. Yagna Narayana, PHI.

REFERENCE BOOKS:

1. "Artificial Intelligence", E. Rich and K. Knight, TMH, 2nd Edition.
2. "Artificial Intelligence and Expert Systems", Patterson, PHI.
3. "Expert Systems: Principles and Programming", Giarrantana-Riley, Thomson, Fourth Edition.
4. "PROLOG Programming for Artificial Intelligence", Ivan Bratka, Pearson Education, Third Edition.
5. "Neural Networks", Simon Haykin, PHI.
6. "Artificial Intelligence", Patrick Henry Winston, Pearson Edition, 3rd Edition.

Course Code	SOFTWARE ENGINEERING & OOAD		L	T	P	C
21A050407	(Common to CSE, CSE-AI & CSE-IOT)		3	0	0	3
Pre-requisite	NIL	Semester	IV			

COURSE OBJECTIVES:

- The students will have a broad understanding of the discipline of software engineering and its application to the development of and management of software systems.

COURSE OUTCOMES:

At the end of the course, students will be able to

CO1: Knowledge of basic SW engineering methods and practices, and their appropriate application; general understanding of software process models such as the waterfall and evolutionary models. understanding of the role of project management including planning, scheduling, risk management, etc.

CO2: Understanding of software requirements and the SRS document. Understanding of different software architectural styles.

CO3: Understanding of implementation issues such as modularity and coding standards. Understanding of approaches to verification and validation including static analysis, and reviews.

CO4: Understanding of software testing approaches such as unit testing and integration testing. Understanding of software evolution and related issues such as version management. Understanding on quality control and how to ensure good quality software.

CO5: Understanding of some ethical and professional issues that are important for software engineers. Development of significant teamwork and project-based experience

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	-	-	-	-	-	-	-	-	1	-
CO2	3	3	3	2	-	-	-	-	-	-	-	-	1	-
CO3	3	2	3	2	-	-	-	-	-	-	-	-	1	-
CO4	2	3	2	2	-	-	-	-	-	-	-	-	-	2
CO5	2	3	2	1		-	-	-	-	-	-	-	-	2

UNIT- I (12 Hrs)

Basic concepts: abstraction versus decomposition, evolution of software engineering techniques, Software development life cycle (SDLC) models: Iterative waterfall model, Prototype model, Evolutionary model, Spiral model, RAD model, Agile models, software project management: project planning, project estimation, COCOMO, Halstead's Software Science, project scheduling, staffing, Organization and team structure, risk management, configuration management.

Learning Outcomes: At the end of this unit, students should be able to

- Recognize the basic issues in commercial software development. (L3)
- Summarize software lifecycle models. (L5)
- Infer Workout project cost estimates using COCOMO and schedules using PERT and GANTT charts (L3)

UNIT- II (12 Hrs)

Requirements Engineering: Software Requirements, Requirements engineering Process, Requirement's elicitation, Requirements Analysis, Structured Analysis, Data Oriented Analysis, Object oriented Analysis, Prototyping Analysis, Requirements Specification, Requirements Validation, requirement Management.

Learning Outcomes: At the end of this unit, students should be able to

- Identify basic issues in software requirements analysis and specification. (L3)
- Develop SRS document for sample problems using IEEE 830 format. (L5)
- Develop algebraic and axiomatic specifications for simple problems. (L6)

UNIT- III (12 Hrs)

Software Design: Software Design Process, Characteristics of Good Software Design, Design Principles, Modular Design, Design Methodologies, Structured Design, Object-Oriented Design: Object oriented Analysis and Design Principles. UML Diagrams, Basic Behavioural Modelling: Interactions, Interaction diagrams. Case Study: The Unified Library application.

Learning Outcomes: At the end of this unit, students should be able to

- Identify the basic issues in software design. (L3)
- Apply the structured, object-oriented analysis and design (SA/SD) technique. (L5)
- Recognize the basic issues in user interface design. (L4)

UNIT- IV (12 Hrs)

Implementation: Coding Principles, Coding Process, Code verification, Code documentation Software Testing: Testing Fundamentals, Test Planning, Black Box Testing, White Box Testing, Levels of Testing, Usability Testing, Regression testing, Debugging approaches.

Learning Outcomes: At the end of this unit, students should be able to

- Identify the basic issues in coding practice. (L3)
- Recognize the basic issues in software testing. (L5)
- Design test cases for black box and white box testing. (L6)

UNIT- V (11 Hrs)

Software Project Management: Project Management Essentials, what is Project management, Software Configuration Management. Project Planning and Estimation: Project Planning activities, Software Metrics and measurements, Project Size Estimation, Effort Estimation Techniques

Learning Outcomes: At the end of this unit, students should be able to

- Identify the basic issues in Software Project Management. (L3)
- Learn and practice project planning activities. (L5)
- Design and develop software metrics and Estimations. (L6)

TEXTBOOKS:

1. "Fundamentals of Software Engineering", Rajib Mall, PHI, 5th Edition, 2018.
2. "Software Engineering- Practioner Approach", Pressman R, McGraw Hill.
3. "Fundamentals of Object-Oriented Design in UML", Meilir Page-Jones, Pearson Education.

REFERENCE BOOKS:

1. "Software Engineering", Somerville, Pearson
2. "Software Engineering Concepts", Richard Fairley, Tata McGraw Hill.
3. "An integrated approach to Software Engineering", Jalote Pankaj, Narosa

Course Code	COMPUTER NETWORKS		L	T	P	C
21A050408	(Common to CSE, CSE-AI & CSE-IOT)		3	0	0	3
Pre-requisite	NIL	Semester	IV			

COURSE OBJECTIVES:

- Understand the basic concepts of Computer Networks.
- Introduce the layered approach for design of computer networks
- Familiarize with the applications of Internet
- Explore the network protocols used in Internet environment
- Explain the format of headers of IP, TCP and UDP
- Elucidate the design issues for a computer network

COURSE OUTCOMES:

At the end of the course, students will be able to

CO1: Identify the software and hardware components of a Computer network (L3)
CO2: Develop new routing, and congestion control algorithms (L3)
CO3: Assess critically the existing routing protocols (L5)
CO4: Explain the functionality of each layer of a computer network (L2)
CO5: Choose the appropriate transport protocol based on the application requirements (L3)

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	-	-	-	-	-	-	-	1	-
CO2	3	2	2	2	3	-	-	-	-	-	-	-	1	-
CO3	2	2	2	2	3	-	-	-	-	-	-	-	1	-
CO4	3	2	3	3	2	-	-	-	-	-	-	-	-	2
CO5	2	3	2	2	2	-	-	-	-	-	-	-	-	2

UNIT–I (8 Hrs)

Computer Networks and the Internet: What is the Internet? The Network Edge, The Network Core, Delay, Loss, and Throughput in Packet-Switched Networks, Protocol Layers and their Service Models, Networks under attack, History of Computer Networking and the Internet

Learning Outcomes: At the end of this unit, students should be able to

- Enumerate the hardware components of a computer network (L1)
- List the layers of a Computer Network (L1)
- Identify the performance metrics of a computer network (L3)

UNIT–II (12 Hrs)

Application Layer Principles of Network Applications, The web and HTTP, File transfer: FTP, Electronic mail in the internet, DNS-The Internet's Directory Service, Peer-to-Peer Applications

Learning outcomes: At the end of this unit, students should be able to

- Design new applications of a computer network (L6)
- Analyze the application protocols (L4)
- Extend the existing applications (L2)

UNIT–III (14 Hrs)

Transport Layer: Introduction and Transport-Layer Services, Multiplexing and De-multiplexing, Connectionless Transport: UDP, Principles of Reliable Data transfer, Connection-Oriented Transport: TCP, Principles of Congestion Control, TCP Congestion Control

Learning outcomes: At the end of this unit, students should be able to

- Design Congestion control algorithms (L6)
- Select the appropriate transport protocol for an application (L3)
- Identify the transport layer services (L2)

UNIT–IV (12 Hrs)

The Network Layer: Introduction, Virtual Circuit and Datagram Networks, The Internet Protocol (IP): Forwarding and Addressing in the Internet, Routing Algorithms, Routing in the Internet, Broadcast and Multicast Routing

Learning outcomes: At the end of this unit, students should be able to

- Compare routing algorithms (L4)
- Design routing algorithms (L6)
- Extend the existing routing protocols (L2)

UNIT–V (12 Hrs)

The Layer: Links, Access Networks, and LANs Introduction to the Link Layer, Error-Detection and Correction Techniques, Multiple Access Links and Protocols, Switched Local Area Networks, Link Virtualization: A Network as a Link Layer, Data Center Networking, Retrospective: A Day in the Life of a Web Page Request

Learning outcomes: At the end of this unit, students should be able to

- Compare medium access protocols (L4)
- Classify the computer networks (L2)
- Design a Data Centre for an organization (L6)

TEXTBOOKS:

1. "Computer Networking: A Top-Down Approach", James F. Kurose, Keith W. Ross, Pearson, 6th edition, 2019.

REFERENCE BOOKS:

1. "Data communications and Networking", Forouzan, McGraw Hill Publication, 5th Edition.
2. "Computer Networks", Andrew S. Tanenbaum", David J. Wetherall, Pearson, 5th Edition.
3. "Networks for Computer Scientists and Engineers", Youlu Zheng, Shakil Akthar, Oxford Publishers, 2016.

Course Code	OPERATING SYSTEMS		L	T	P	C
21A050409	(Common to CSE, CSE-AI & CSE-IOT)		3	0	0	3
Pre-requisite	NIL	Semester	IV			

COURSE OBJECTIVES:

- Understand basic concepts and functions of operating systems
- Understand the processes, threads and scheduling algorithms.
- Provide good insight on various memory management techniques
- Expose the students with different techniques of handling deadlocks
- Explore the concept of file-system and its implementation issues
- Familiarize with the basics of Linux operating system
- Implement various schemes for achieving system protection and security

COURSE OUTCOMES:

At the end of this course students will be able to:

CO1: Realize how applications interact with the operating system. Analyze the functioning of a kernel in an Operating system.

CO2: Summarize resource management in operating systems. Analyze various scheduling algorithms

CO3: Examine concurrency mechanism in Operating Systems. Apply memory management techniques in design of operating systems

CO4: Understand the functionality of file system. Compare and contrast memory management techniques.

CO5: Understand the deadlock prevention and avoidance. Perform administrative tasks on Linux based systems.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	-	-	-	-	-	-	-	1	-
CO2	3	2	2	2	3	-	-	-	-	-	-	-	1	-
CO3	2	2	2	2	3	-	-	-	-	-	-	-	1	-
CO4	3	2	3	3	2	-	-	-	-	-	-	-	-	2
CO5	2	3	2	2	2	-	-	-	-	-	-	-	-	2

UNIT-I (8 Hrs)

Operating Systems Overview: Introduction, Operating system functions, Operating systems operations, Computing environments, Open-Source Operating Systems

System Structures: Operating System Services, User and Operating-System Interface, systems calls, Types of System Calls, system programs, Operating system Design and Implementation, Operating system structure, Operating system debugging, System Boot.

***Learning Outcomes**:* At the end of this unit, students should be able to

- Identify major components of operating systems (L2)
- Understand the types of computing environments (L2)
- Explore several open-source operating systems (L3)
- Recognize operating system services to users, processes and other systems (L3)

UNIT-II (12 Hrs)

Process Concept: Process scheduling, Operations on processes, Inter-process communication, Communication in client server systems. Multithreaded Programming: Multithreading models, Thread libraries, Threading issues, Examples. Process Scheduling: Basic concepts, Scheduling criteria, Scheduling algorithms, Multiple processor scheduling, Thread scheduling, Examples.
Inter-process Communication: Race conditions, Critical Regions, Mutual exclusion with busy waiting, Sleep and wakeup, Semaphores, Mutexes, Monitors, Message passing, Barriers, Classical IPC Problems - Dining philosophers' problem, Readers and writers problem.

***Learning Outcomes**:* At the end of this unit, students should be able to

- Understand the importance, features of a process and methods of communication between processes. (L2)
- Improving CPU utilization through multi programming and multithreaded programming (L3)
- Examine several classical synchronization problems (L3)

UNIT-III (12 Hrs)

Memory-Management Strategies: Introduction, Swapping, Contiguous memory allocation, Paging, Segmentation, Examples. Virtual Memory Management: Introduction, Demand paging, Copy on-write, Page replacement, Frame allocation, Thrashing, Memory-mapped files, Kernel memory allocation, Examples.

***Learning Outcomes**:* At the end of this unit, students should be able to

- Examine the various techniques of allocating memory to processes (L3)
- Summarize how paging works in contemporary computer systems (L3)
- Understanding the benefits of virtual memory systems. (L2)

UNIT-IV (14 Hrs)

Deadlocks: Resources, Conditions for resource deadlocks, Ostrich algorithm, Deadlock detection And recovery, Deadlock avoidance, Deadlock prevention. File Systems: Files, Directories, File system implementation, management and optimization. Secondary-Storage Structure: Overview of disk structure, and attachment, Disk scheduling, RAID structure, Stable storage implementation.

***Learning Outcomes**:* At the end of this unit, students should be able to

- Investigate methods for preventing/avoiding deadlocks (L3)
- Examine file systems and its interface in various operating systems (L2)
- Analyze different disk scheduling algorithms (L3)

UNIT-V (14 Hrs)

System Protection: Goals of protection, Principles and domain of protection, Access matrix, Access control, Revocation of access rights. System Security: Introduction, Program threats, System and network threats, Cryptography as a security, User authentication, implementing security defenses, firewalling to protect systems and networks, Computer security classification. Case Studies: Linux, Microsoft Windows.

***Learning Outcomes**:* At the end of this unit, students should be able to

- Infer various schemes available for achieving system protection. (L2)
- Acquiring knowledge about various countermeasures to security attacks (L3)
- Outline protection and security in Linux and Microsoft Windows. (L2)

TEXTBOOKS:

1. "Operating System Concepts", Silberschatz A, Galvin P B, and Gagne G, Wiley, 9th edition, 2016.
2. "Modern Operating Systems", Tanenbaum A S, Pearson Education, 3rd edition, 2008.

REFERENCE BOOKS:

1. "Operating Systems Design and Implementation", Tanenbaum A S, Woodhull A S, PHI, 3rd edition, 2006.
2. "Operating Systems A Concept Based Approach", Dhamdhere D MTata McGraw-Hill, 3rd edition, 2012.
3. "Operating Systems -Internals and Design Principles", Stallings W, Pearson Education, 6th edition, 2009
4. "Operating Systems", Nutt G, Pearson Education, 3rd edition, 2004

Course Code	MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS (Common to all branches)		L	T	P	C
21A110203			3	0	0	3
Pre-requisite	NIL	Semester	IV			

COURSE OBJECTIVES:

- To inculcate the basic knowledge of microeconomics and financial accounting.
- To make the students learn how demand is estimated for different products, input-output relationship for optimizing production and cost.
- To know the various types of Market Structures & pricing methods and its strategies.
- To give an overview on investment appraisal methods to promote the students to learn how to plan long-term investment decisions.
- To provide fundamental skills on accounting and to explain the process of preparing financial statements.

COURSE OUTCOMES:

After completion of the course the student will be able to:

CO1: Analyse the consumer behaviour with regard to their product or services and measure demand of a particular product or services by applying various methods in given situation

CO2: Determine Break Even Point (BEP) of an enterprise Assess the cost behaviour, costs useful for managerial decision making

CO3: Determine the price of a product or services in given market condition

CO4: Analyze the financial position by using different types of ratios and interpret the financial accounting

CO5: Evaluate the investment proposals under payback period, ARR, IRR, NPV & PI methods

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	2	-	-	-	1	1	-	1	-	-	-	-	-
CO2	-	2	2	-	-	1	2	-	-	-	-	3	-	-
CO3	-	-	-	-	-	-	2	-	2	-	1	1	-	-
CO4	1	-	1	1	-	-	1	-	2	-	-	2	-	-
CO5	1	-	2	-	-	1	2	-	-	-	-	1	-	-

UNIT- I (11 Hrs)

Introduction to Managerial Economics and Demand Analysis: Managerial Economics– Definition – Nature & Scope - Contemporary importance of Managerial Economics - Demand Analysis - Concept of Demand - Demand Function - Law of Demand - Elasticity of Demand - Significance - Types of Elasticity - Measurement of Elasticity of Demand- Demand Forecasting- Factors governing Demand Forecasting - Methods of Demand Forecasting - Relationship of Managerial Economics with Financial Accounting and Management.

Learning Outcomes: At the end of this unit, students should be able to

- Know the nature and scope of Managerial Economics and its importance. (L1)
- Understand the concept of demand and its determinants. (L2)
- Analyse the elasticity and degree of elasticity. (L4)
- Evaluate demand forecasting methods. (L5)
- Design the process of demand estimation for different types of demand. (L6)

UNIT- II (10 Hrs)

Theory of Production and Cost Analysis:

Production Function – Short-run and Long-run Production Function -Isoquants and Iso costs, MRTS –Least cost combination of Inputs, Cobb-Douglas Production Function - Laws of Returns – Internal and External Economies of scale – **Cost & Break-Even Analysis** - Cost concepts and Cost behavior - Break-Even Analysis (BEA)–Determination of Break-Even Point (Simple Problems)-Managerial significance of Break-Even Analysis

Learning Outcomes: At the end of this unit, students should be able to

- Know the production function, Input-output relationship and different cost concepts. (L1)
- Apply the least-cost combination of inputs. (L3)
- Analyse the behaviour of various cost concepts. (L4)
- Evaluate BEA for real time business decisions. (L5)
- Develop Profit appropriation for different levels of business activity. (L6)

UNIT- III (11 Hrs)

Introduction to Markets and New Economic Environment:

Market structures Types of Markets-Perfect and Imperfect Competition- Features of Perfect Competition– Monopoly -Monopolistic Competition –Oligopoly-Price-Output Determination-Pricing Methods and Strategies- Forms of Business Organizations - Sole Proprietorship - Partnership – Joint Stock Companies-Public Sector Enterprises - New economic Environment - **Economic Liberalization – Privatization – Globalization.**

***Learning Outcomes*:** At the end of this unit, students should be able to

- Know the production function, input-output relationship and different cost concepts. (L1)
- Apply the least-cost combination of inputs. (L3)
- Analyse the behaviour of various cost concepts. (L4)
- Evaluate BEA for real time business decisions. (L5)

UNIT- IV (10 Hrs)

Capital and Capital Budgeting: Concept of Capital-Significance-Types of Capital-Components of Working Capital - Sources of Short-term and Long-term Capital -Estimating Working capital requirements-**Capital Budgeting**–Features of Capital Budgeting Proposals –

Methods and Evaluation of Capital Budgeting Projects – Pay Back Method – Accounting Rate of Return (ARR) – Net Present Value (NPV) – Internal Rate Return (IRR) Method (simple problems)

Learning Outcomes: At the end of this unit, students should be able to

- Know the concept of Capital Budgeting and its importance in business (L1)
- Contrast and compare different investment appraisal methods. (L4)
- Analyse the process of selection of investment alternative using different appraisal methods. (L4)
- Evaluate methods of Capital budgeting techniques. (L5)
- Design different investment appraisals and make wise investments. (L6)

UNIT–V (10 Hours)

Introduction to Financial Accounting and Analysis: Financial Accounting – Concept – Emerging need and Importance - Double-Entry Book Keeping, Journal, Ledger, Trial Balance - Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet (with simple adjustments). ***Financial Analysis*** **-** Ratios- Liquidity, Leverage, Profitability and Activity Ratios (Simple Problems)

Learning Outcomes: At the end of this unit, students should be able to

- Know the concept and convention and significance of accounting. (L1)
- Apply the fundamental knowledge of accounting while posting the Journal entries. (L3)
- Analyze the process and preparation of Financial Accounts and Financial Ratios. (L4)
- Evaluate the Financial performance of an enterprise by using financial statements. (L5)

TEXTBOOKS:

1. "Managerial Economics", Varshney & Maheswari, S. Chand, 2013.
2. "Managerial Economics and Financial Analysis", Aryasri, MGH, 4th edition, 2019

REFERENCE BOOKS:

1. "Managerial economics", Ahuja HL, S. Chand, 3rd edition, 2013.
2. "Managerial Economics and Financial Analysis", S. A. Siddiqui and A. S. Siddiqui, New Age International, 2013.
3. "Principles of Business Economics", Joseph G. Nellis and David Parker, Pearson, 2nd edition, New Delhi.
4. "Managerial Economics in a Global Economy", Dominick Salvatore, Cengage Learning, 2013.

Course Code	ARTIFICIAL INTELLIGENCE & NEURAL NETWORKS LAB		L	T	P	C
21A310404			0	0	3	1.5
Pre-requisite	NIL	Semester	IV			

COURSE OBJECTIVES:

- To understand the working concepts of training and testing data using candidate elimination, ID3 algorithms.
- To understand the practical concepts of ANN's by using Backpropagation concepts.
- To understand and calculate the accuracy of Bayesian networks classifiers.
- To apply and compare the EM algorithm and K-Means algorithms in terms of performance.
- To understand the Regression concepts.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the implementation procedures for the machine learning algorithms.
CO2: Design Java/Python programs for various Learning algorithms.
CO3: Apply appropriate data sets to the Machine Learning algorithms.
CO4: Identify and apply Machine Learning algorithms to solve real world problems.
CO5: Apply back propagation algorithm using different datasets.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	-	-	-	-	-	-	-	1	-
CO2	3	2	2	2	3	-	-	-	-	-	-	-	1	-
CO3	2	2	2	2	3	-	-	-	-	-	-	-	1	-
CO4	3	2	3	3	2	-	-	-	-	-	-	-	-	2
CO5	2	3	2	2	2	-	-	-	-	-	-	-	-	2

LAB EXPERIMENTS:

1. Implement and demonstrate FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.
2. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
3. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
4. Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.

5. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
6. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
7. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.
8. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.
9. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
10. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.

Note:

- The programs can be implemented in either JAVA or Python.
- For Problems 1 to 6 and 10, programs are to be developed without using the built-in classes or APIs of Java/Python.
- Data sets can be taken from standard repositories (https://archive.ics.uci.edu/ml/datasets.html) or constructed by the students.

Course Code	SOFTWARE ENGINEERING & OOAD LAB		L	T	P	C
21A050411	(Common to CSE, CSE-AI, CSE-IOT)		0	0	3	1.5
Pre-requisite	NIL	Semester	IV			

COURSE OBJECTIVES:

- To Learn and implement the fundamental concepts of software Engineering.
- To explore functional and non-functional requirements through SRS.
- To practice the various design diagrams through appropriate tool.
- To learn to implement various software testing strategies.

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Demonstrate the basic concepts of Software Engineering.
CO2: Identify basic issues in software requirements analysis and specification
CO3: Apply the structured, object-oriented analysis and design (SA/SD) technique.
CO4: Design test cases for black box and white box testing.
CO5: Learn and practice project planning activities.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	-	-	-	-	1	-
CO2	3	1	2	-	-	-	-	-	-	-	-	-	1	-
CO3	3	1	2	-	-	-	-	-	-	-	-	-	1	-
CO4	3	2	2	-	-	-	-	-	-	-	-	-	-	2
CO5	3	2	2	-	-	-	-	-	-	-	-	-	-	2

SE LAB Experiments List

Week-1

Draw the Work Breakdown Structure for the system to be automated

Week-2

Using COCOMO model estimate effort.

Week-3

a) Calculate effort using FP oriented estimation model.
b) Analyze the Risk related to the project and prepare RMMM pla

Week-4

Develop Time-line chart and project table using PERT or CPM project scheduling methods.

Week-5

Draw E-R diagrams, and DFD for the project.
Design of Test cases based on requirements and design.

Week-6

Test a piece of code which executes a specific functionality in the code to be tested and asserts a certain behavior or state using Junit.

Week-7

a) Test the percentage of code to be tested by unit test using any code coverage tools
b) Write C/C++/Java/Python program for classifying the various types of coupling.

Week-8

a) Write a C/C++/Java/Python program for classifying the various types of cohesion.
b) Write a C/C++/Java/Python program for object-oriented metrics for design proposed Chidamber and kremer. (Popularly called as CK metrics)

OOAD LAB Experiments List

Take three case studies:

- Customer Support System (in the Object-Oriented Analysis & Design with the Unified Process by Satzinger, Jackson & Burd Cengage Learning)
- Point-Of-Sale Terminal (in Larman textbook)
- Library Management System (in the reference book no. 2 i.e., UML toolkit)

Week-9

Familiarization with Rational Rose or *UML

Week-10

For each case study:
a) Identify and analyse events
b) Identify Use cases

Week-11

For each case study:
a) Develop event table
b) Identify & analyse domain classes

Week-12

For each case study:

a) Represent use cases and a domain class diagram using Rational Rose

b) Develop CRUD matrix to represent relationships between use cases and problem domain classes

Course Code	COMPUTER NETWORKS & OPERATING SYSTEMS LAB (Common to CSE, CSE-AI & CSE-IOT)		L	T	P	C
21A050412			0	0	3	1.5
Pre-requisite	NIL	Semester	IV			

COURSE OBJECTIVES:

- To understand the working of character and bit stuffing
- To understand the Dijkstra's algorithm and its performance
- To analyze the performance of DES encryption algorithms
- To understand CPU scheduling algorithms and page replacement algorithms

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Know how data is transmitted and checking of errors.,
CO2: Inter process communication including shared memory, pipes and messages
CO3: Simulation of CPU Scheduling Algorithms. (FCFS, RR, SJF, Priority, Multilevel Queuing)
CO4: Simulation of Banker's Algorithm for Deadlock Avoidance, Prevention Program for FIFO, LRU, and OPTIMAL page replacement algorithm.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	-	-	-	-	-	-	-	1	-
CO2	3	2	2	2	3	-	-	-	-	-	-	-	1	-
CO3	2	2	2	2	3	-	-	-	-	-	-	-	1	-
CO4	3	2	3	3	2	-	-	-	-	-	-	-	-	2

PART-A

Week 1

Implement the data link layer framing methods such as character, character stuffing and bit stuffing.

Week 2

Implement on a data set of characters the three CRC polynomials – CRC 12, CRC 16 and CRC CCIP.

Week 3

Implement Dijkstra 's algorithm to compute the Shortest path thru a graph.

Week 4

a) Take an example subnet graph with weights indicating delay between nodes. Now obtain Routing table art each node using distance vector routing algorithm
b) Take an example subnet of hosts. Obtain broadcast tree for it.

Week 5

a) Take a 64-bit playing text and encrypt the same using DES algorithm.
b) Write a program to break the above DES coding

Week 6

Using RSA algorithm Encrypt a text data and Decrypt the same.

PART-B

Week7

Simulate the following CPU scheduling algorithms a) Round Robin b) SJF c) FCFS d) Priority

Week 8

Simulate all file allocation strategies a) Sequential b) Indexed c) Linked

Week 9

Simulate MVT and MFT

Week 10

Simulate all File Organization Techniques a) Single level directory b) Two level c) Hierarchical d) DAG

Week 11

a) Simulate Bankers Algorithm for Dead Lock Avoidance
b) Simulate Bankers Algorithm for Dead Lock Prevention

Week 12

Simulate all page replacement algorithms a) FIFO b) LRU c) LFU Etc. …

Week 13

a) Simulate Paging Technique of memory management.
b) Experiments on fork, shared memory and semaphores

TEXTBOOKS:

1. "Introduction to Data Communications and Networking", Behrouz Forouzan, Tata McGraw Hill, 2015, 5th Edition.
2. "Data and Computer Communications", Stallings, PHI, 2015, 10th Edition.

REFERENCE BOOKS:

1. "Data Communication", William Schewber, McGraw Hill, 1987.
2. "Computer Networks", Tanenbaum, PHI, 5th Edition, 2011.
3. "Operating System Concepts", Abraham Silberchatz, Peter B. Galvin, Greg Gagne, John Wiley, Eight Edition
4. "Operating Systems: Internals and Design Principles", Stallings, Pearson Education, Sixth Edition, 2009.
5. "Modern Operating Systems", Andrew S Tanenbaum, PHI, Second Edition.

REFERENCE WEB SITES:

1. http://www.cse.iitk.ac.in/users/dheeraj/cs425/
2. http://www.tcpipguide.com/free/t_OSIReferenceModelLayers.htm
3. http://iit.qau.edu.pk/books/Data%20Communications%20and%20Networking%20By%20Behrouz%20A.Forouzan.pdf
4. http://www.networkdictionary.com/protocols/osimodel.php

Course Code	ADVANCED JAVA		L	T	P	C
21A050703	(Common to CSE, CSE-AI & CSE-IOT)		1	0	2	0
Pre-requisite	C Programming & Data Structures	Semester	IV			

COURSE OBJECTIVES:

- The course is designed to provide programming fundamentals using JAVA

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Implement object-oriented programming concepts
CO2: Use and create package and interfaces in a java program.
CO3: Understanding of advance website development tools.
CO4: Use Graphical user interface in java program.
CO5: Creates applets.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	-	-	-	-	-	-	-	-	3	1	-
CO2	2	3	3	-	-	3	-	-	-	-	3	-	1	-
CO3	-	-	3	-	2	-	-	-	-	-	3	3	1	-
CO4	-	-	2	3	3	-	-	-	-	-	3	3	-	2
CO5	-	-	3	3	2	-	-	-	-	-	3	3	-	2

Topics to be covered

1. **Introduction of OOPs:** Summarized overview of Object-Oriented programming Technique.

2. **Class and its objects:** Define class and its object, Constructor, types of Constructors, Default Constructor, method over loading, constructor overloading.

3. **Inheritance:** Define inheritance and its type. Constructor in inheritance, super keyword, method overriding.

4. **Package and interface:** Define Package, how to use it, how to access multiple inheritance using interface, dynamic binding

5. **Variables and Inner Classes:** Types of variables, use of static keyword, Inner classes and its importance.

6. **Exception Handling:** Define Exception, how to handle exception, checked and unchecked exception, custom exception, try, catch and finally keywords.

7. **Java I/O:** How to take input from different devices. Hierarchy of java io class.

8. **String:** String methods, StringBuffer class and its methods.

9. **Multithreading:** Creating thread and running it, Multiple Thread acting on single object, Synchronization, Thread communication, Thread group, Thread priorities, Daemon Thread, Life Cycle of Thread.

10. **applets:** Defining the applet and Applet class, life cycle of applets, Font class, Graphics.

11. **Event Handling:** Define Event and its class, Listener, Adapter, MouseListener, MouseMotionListener, KeyListener.

12. **Swing and its Component Layout:** Swing components and Container, different layout, FlowLayout, BorderLayout, GridLayout.

Experiments List

Week 1

Develop a Java Program to implement the concept OOP

Week 2

Develop a Java Program to implement the concept of Inheritance

Week 3

Develop a Java Program to implement the Packages & Interfaces

Week 4

Develop a Java Program to implement Exception handling

Week 5

Develop a Java Program to implement the concept of Java I/O

Week 6

Develop a Java Program to demonstrate Text File Reading and Writing

Week 7

Develop a Java Program to demonstrate the Strings handling

Week 8

Develop a Java Program to implement the concept Multithreading

Week 9

Develop a Java Program to implement the concept of applet

Week 10

Develop a Java Program to implement Event Handling

Week 11

Develop a Java Program to implement a Simple Calculator

Week 12

Develop a Java Program to demonstrate Swing and its Component Layout

REFERENCE BOOKS:

1. "SCJP Sun Certified Programmer", Kathy Sierra and Bert Bates
2. "The Complete Reference", TMH.
3. "Java SE8 for Programmers", Paul Deitel and Harvey Deitel, Deitel Developer Series, 3rd Edition
4. www.tutorialspoint.com/java/
5. www.javatpoint.com/java-tutorial
6. www.udemy.com/java-tutorial/