Mathematics-III for CSE Stream			
Course Code	24AD31	**CIE Marks**	50
Teaching Hours/Week (L: T: P)	3:2:0	**SEE Marks**	50
Credits	04	**Total Marks**	100
Contact Hours	50	**Exam Hours**	3
Examination type (SEE)	Theory		

Prerequisites:

The students should have knowledge on

- Basics of Probability and Statistics
- Understanding of Hypothesis
- Basic Mathematics
- Problem-Solving Skills

Course Objectives:

- To introduce the concept of random variables, probability distributions, specific discrete and continuous distributions with practical application in Computer Science Engineering and social life situations.
- To Provide the principles of statistical inferences and the basics of hypothesis testing with emphasis on some commonly encountered hypotheses.
- To Determine whether an input has a statistically significant effect on the system's response through ANOVA testing

Teaching-Learning Process (General Instructions)

Teachers can use following strategies to accelerate the attainment of the various course outcomes.

1. Chalk and Talk with Black Board
2. ICT based Teaching
3. Demonstration based Teaching

Module-1 **10 Hours**

Probability Distributions: Review of basic probability theory. Random variables (discrete and continuous), probability mass and density functions. Mathematical expectation, mean and variance. Binomial, Poisson, Exponential and normal distributions- problems (derivations for mean and standard deviation for Poisson distributions and Exponential distribution only)- Illustrative examples.

Text Book:1, 3.1,3.2,3.3 and 4.1, 4.2.

Module-2 **10 Hours**

Joint probability distribution: Joint Probability distribution for two discrete random variables, expectation, covariance and correlation.

Markov Chain: Introduction to Stochastic Process, Probability Vectors, Stochastic matrices, Regular stochastic matrices, Markov chains, Higher transition probabilities, Stationary distribution of Regular

Markov chains and absorbing states.

Text Book:1, 3.4, 4.1 to 4.3, **Reference book:3**, 31.2

Module-3	**10 Hours**

Statistical Inference:1 Introduction, sampling distribution, standard error, testing of hypothesis, levels of significance, test of significances, confidence limits, simple sampling of attributes, test of significance for large samples, comparison of large samples
Text Book:2, 27.1 to 27.8

Module-4	**10 Hours**

Statistical Inference:2 Sampling variables, central limit theorem and confidences limit for unknown mean. Test of Significance for means of two small samples, students 't' distribution, Chi-square distribution as a test of goodness of fit,F-Distribution**.**
Text Book:1, 8.1 to 8.5, and 9.4 **Text Book:2,** 27.13 to 27.19

Module-5	**10 Hours**

Design of Experiments & ANOVA: Principles of experimentation in design, Analysis of completely randomized design, randomized block design. The ANOVA Technique, Basic Principle of ANOVA, One-way ANOVA, Two-way ANOVA, Latin-square Design ,and Analysis of Co-Variance.
Text Book:1, 13.1 to 13.3, 13.11 **Reference Book:4**,12.4 to 12.6

Course outcomes (Course Skill Set):
At the end of the course, the student will be able to:

CO1: Explain the basic concepts of probability, random variables, probability distribution & apply suitable probability distribution models for the given scenario. (PO – 1,2,3 PSO—1)

CO2: Apply the notion of a discrete-time Markov chain and n-step transition probabilities to solve the given problem (PO – 1,2,3 PSO—1)

CO3: Use statistical methodology and tools in the engineering problem-solving process. (PO – 1,2,3 PSO—1,2)

CO4: Compute the confidence intervals for the mean of the population. (PO – 1,2,3)

CO5: Apply the ANOVA test related to engineering problems. (PO – 1,2,3)

Assessment Details (both CIE and SEE):

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- There are 25 marks for the CIE's Assignment component and 25 for the Internal Assessment Test component.
- Each test shall be conducted for 25 marks. The first test will be administered after 40-50% of the coverage of the syllabus, and the second test will be administered after 85-90% of the coverage of the syllabus. The average of the two tests shall be scaled down to 25 marks.
- Any two assignment methods mentioned in the regulations; if an assignment is project-based then only one assignment for the course shall be planned. The schedule for assignments shall be planned properly by the course teacher. The teacher should not conduct two assignments at the end of the semester if two assignments are planned. Each assignment shall be conducted for 25 marks. (If two assignments are conducted then the sum of the two assignments shall be scaled down to 25 marks)
- The final CIE marks of the course out of 50 will be the sum of the scale-down marks of tests and assignment/s marks.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by the University as per the scheduled timetable, with common question papers for the course (duration 03 hours).

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks.

Suggested Learning Resources:

Textbook:

1. Ronald E. Walpole, Raymond H Myers, Sharon L Myers & Keying Ye "Probability & Statistics for Engineers & Scientists", Pearson Education, 9th edition, 2017.
2. B. S. Grewal "Higher Engineering Mathematics", Khanna publishers, 44th Ed., 2021.
3. Peter Bruce, Andrew Bruce & Peter Gedeck "Practical Statistics for Data Scientists" O'Reilly Media, Inc., 2nd edition 2020.

Reference Books:

1. Erwin Kreyszig, **"Advanced Engineering Mathematics"**, John Wiley & Sons, 9th Edition, 2006.
2. G Haribaskaran **"Probability, Queuing Theory & Reliability Engineering",** Laxmi Publication, Latest Edition, 2006
3. B.V. Ramana: **"Higher engineering mathematics"** Tata McGraw-Hill Publishers, Fifth reprint 2008.

4. C R Kothari and Gaurav Garg **"Research Methodology Methods & Techniques"** New Age International Limited, 3rd Edition, 2014.
5. Irwin Miller & Marylees Miller, John E. Freund's "Mathematical Statistics with Applications" Pearson. Dorling Kindersley Pvt. Ltd. India, 8th edition, 2014.
6. S C Gupta and V K Kapoor, **"Fundamentals of Mathematical Statistics"**, S Chand and Company, Latest edition.
7. Robert V. Hogg, Joseph W. McKean & Allen T. Craig. **"Introduction to Mathematical Statistics"**, Pearson Education 7th edition, 2013.
8. Jim Pitman. **"Probability"**, Springer-Verlag, 1993.
9. Sheldon M. Ross, **"Introduction to Probability Models"** 11th edition. Elsevier, 2014.
10. A. M. Yaglom and I. M. Yaglom, **"Probability and Information",** D. Reidel Publishing Company. Distributed by Hindustan Publishing Corporation (India) Delhi, 1983.
11. P. G. Hoel, S. C. Port and C. J. Stone, **"Introduction to Probability Theory"**, Universal Book Stall, (Reprint), 2003.
12. S. Ross, **"A First Course in Probability"**, Pearson Education India, 6th Ed., 2002
13. N.P. Bali and Manish Goyal, **"A Textbook of Engineering Mathematics**", Laxmi Publications, Reprint, 2010.
14. 14. Veerarajan T, **"Engineering Mathematics (for semester III)**", Tata McGraw-Hill, New Delhi, 2010

Web links and Video Lectures(e-Resources):

- http://nptel.ac.in/courses.php?disciplineID=111
- http://www.class-central.com/subject/math(MOOCs)
- http://academicearth.org/
- http://www.bookstreet.in.

Activity Based Learning (Suggested Activities in Class)/Practical Based Learning

- Programming Assignment
- Case Study
- Seminars

Operating Systems			
Course Code	24AD32	**CIE Marks**	50
Teaching Hours/Week (L:T:P)	4:0:0	**SEE Marks**	50
Credits	04	**Total Marks**	100
Contact Hours	50	**Exam Hours**	3
Examination type (SEE)	Theory		

Prerequisite:

The Students Should have knowledge of

- Computer Architecture / Organization

Course objectives:

- To Demonstrate the need for OS and different types of OS
- To discuss suitable techniques for management of different resources
- To demonstrate different APIs/Commands related to processor, memory, storage, file system management and Access Control.
- Realize the different Concepts of OS in platform of usage through Case Studies.

Teaching-Learning Process (General Instructions):

Teachers can use following strategies to accelerate the attainment of the various course outcomes.

1. Chalk and Talk with Black Board
2. ICT based Teaching
3. Demonstration based Teaching

MODULE-1 **10 Hours**

Introduction to operating systems, System structures: What operating systems do; Computer System organization; Computer System architecture; Operating System structure; Operating System operations;

Process management; Memory management; Storage management; Protection and Security; Distributed system; Special-purpose systems; Computing environments. Operating System Services: User - Operating System interface; System calls; Types of system calls; System programs; Operating system design and implementation; Operating System structure; Virtual machines; Operating System debugging, Operating System generation; System boot.

Textbook 1: Ch 1.1 to 1.8, 2.1 to 2.6, 3.1 to 3.10

RBT: L1, L2, L3

MODULE-2 **10 Hours**

Process Management: Process concept; Process scheduling; Operations on processes; Inter process communication Multi-threaded Programming: Overview; Multithreading models; Thread Libraries; Threading issues.

Process Scheduling: Basic concepts; Scheduling Criteria; Scheduling Algorithms; Thread scheduling; Multiple-processor scheduling,

Textbook 1: Chapter – 3 (3.1-3.4), 4 (4.1-4.4), 5 (5.1 -5.5)

MODULE-3 **10 Hours**

Process Synchronization: Synchronization: The critical section problem; Peterson's solution; Synchronization hardware; Semaphores; Classical problems of synchronization;

Deadlocks: System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock.

Textbook 1: Chapter – 6 (6.1-6.6), 7 (7.1 -7.7)

MODULE-4 **10 Hours**

Memory Management: Memory management strategies: Background; Swapping; Contiguous memory allocation; Paging; Structure of page table; Segmentation.

Virtual Memory Management: Background; Demand paging; Copy-on-write; Page replacement; Allocation of frames; Thrashing.

Textbook 1: Chapter -8 (8.1-8.6), 9 (9.1-9.6)

MODULE-5 **10 Hours**

Implementing File system: File system structure; File system implementation; Directory implementation; Allocation methods; Free space management. Secondary Storage Structure, Protection: Mass storage structures; Disk structure; Disk attachment; Disk scheduling; Disk management; Protection: Goals of protection, Principles of protection, Domain of protection, Access matrix, Implementation of access matrix, Access control, Revocation of access rights, Capability-Based systems.

The Linux Operating System: Linux history; Design principles; Kernel modules; Process management; Scheduling: Memory Management; File systems, Input and output; Inter-process communication.

Textbook 1: Chapter -11(11.1-11.5),12(12.1-12.6),14(14.1-14.8),21(21.1-21.10)

Course outcome (Course Skill Set):

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

CO1: Explain the structure and functionality of operating system. (PO-1,2,3,10,12, PSO-1)

CO2: Apply appropriate CPU scheduling algorithms for the given problem. (PO-1,2,3,10,12, PSO-1)

CO3: Analyse the various techniques for process synchronization and deadlock handling. (PO-1,2,3,10,12, PSO-1,2)

CO4: Apply the various techniques for memory management. (PO-1,2,3,10,12, PSO-1,2)

CO5: Analyse File and Storage Structures and Implement Customized Case Studies. (PO-1,2,3,10,12, PSO-1,2)

Assessment Details (both CIE and SEE):

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- There are 25 marks for the CIE's Assignment component and 25 for the Internal Assessment Test component.
- Each test shall be conducted for 25 marks. The first test will be administered after 40-50% of the coverage of the syllabus, and the second test will be administered after 85-90% of the coverage of the syllabus. The average of the two tests shall be scaled down to 25 marks.
- Any two assignment methods mentioned in the regulations; if an assignment is project-based then only one assignment for the course shall be planned. The schedule for assignments shall be planned properly by the course teacher. The teacher should not conduct two assignments at the end of the semester if two assignments are planned. Each assignment shall be conducted for 25 marks. (If two assignments are conducted then the sum of the two assignments shall be scaled down to 25 marks)
- The final CIE marks of the course out of 50 will be the sum of the scale-down marks of tests and assignment/s marks.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted as per the scheduled timetable, with common question papers for the course (duration 03 hours).

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks.

Suggested Learning Resources:

Textbooks

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Principles 8th edition, Wiley-India, 2015

Reference Books

1. Ann McHoes Ida M Fylnn, Understanding Operating System, Cengage Learning, 6th Edition
2. D.M Dhamdhere, Operating Systems: A Concept Based Approach 3rd Ed, McGraw- Hill, 2013.
3. P.C.P. Bhatt, An Introduction to Operating Systems: Concepts and Practice 4th Edition, PHI(EEE),2014.
4. William Stallings Operating Systems: Internals and Design Principles, 6th Edition, Pearson.

Web links and Video Lectures(e-Resources):

- https://youtu.be/mXw9ruZaxzQ 14.09.2023 MKV-TEMPLATE for IPCC (26.04.2022) Annexure-III
- https://youtu.be/vBURTt97EkA
- https://www.youtube.com/watch?v=783KABtuE4&list=PLIemF3uozcAKTgsCIj82voMK3TMR0YE_f
- https://www.youtube.com/watch?v=3ITLMMeeXY&list=PL3pGy4HtqwD0n7bQfHjPnsWzkeRn6mkO

Activity Based Learning (Suggested Activities in Class)/ Practical Based Learning

- Case Study
- Assignments

Data Structures &Applications			
Course Code	24AD33	**CIE Marks**	50
Teaching Hours/Week (L: T:P)	3:0:0	**SEE Marks**	50
Credits	03	**Total Marks**	100
Contact Hours	40	**Exam Hours**	3
Examination type (SEE)	Theory		

Prerequisites:

The students should have knowledge of;

- Basic Programming Skills
- Understanding of Algorithms
- Basic Mathematics
- Problem-Solving Skills

Course Objectives:

- To explain fundamentals of data structures and their applications.
- To illustrate representation of Different data structures such as Stack, Queues.
- To Design and Develop Solutions to problems using Linked Lists
- To discuss applications of Nonlinear Data Structures in problem solving such as trees
- To introduce advanced Data structure concepts such as Graphs and Hash

Teaching-Learning Process (General Instructions)

Teachers can use following strategies to accelerate the attainment of the various course outcomes.

1. Chalk and TalkwithBlackBoard
2. ICT based Teaching
3. Demonstration based Teaching

Module-1 **8Hours**

INTRODUCTION TO DATA STRUCTURES: Data Structures, Classifications (Primitive & Non-Primitive), Data structure Operations pointers and dynamic Memory Allocation
ARRAYS and STRUCTURES: Arrays, Dynamic Allocated Arrays, Structures and Unions, Polynomials, Sparse Matrices, representation of Multidimensional Arrays, Strings
Text Book: Chapter-1:1.2 Chapter-2: 2.1 to 2.7

Module-2 **8Hours**

Stacks and Queues: Stacks, Stacks Using Dynamic Arrays, Queues, Circular Queues Using Dynamic Arrays, Evaluation of Expressions, Multiple Stacks and Queues.
Text Book: Chapter-3: 3.1,3.2,3.6 3.3, 3.4, 3.7

Module-3 **8Hours**

Linked Lists: Singly Linked lists and Chains, Representing Chains in C, Linked Stacks and Queues, Polynomials, Additional List operations, Sparse Matrices, Doubly Linked Lists.

Text Book: Chapter-4: 4.1 to 4.4 4.5,4.7,4.8

Module-4 **8Hours**

TREES: Introduction to trees, Binary Trees, Binary Tree Traversals, Threaded Binary Trees. Binary Search trees, Selection Trees, Forests, Representation of Disjoint sets, Counting Binary Trees, Leftist Trees. Efficient Binary Search Trees: AVL Trees, Red Black Tree
Text Book: Chapter-5: 5.1 to 5.3, 5.5 ,5.7 to 5.11

Module-5 **8Hours**

GRAPHS: The Graph Abstract Data Types, Elementary Graph Operations (BFS/DFS)
HASHING: Introduction, Static Hashing, Dynamic Hashing
Text Book Chapter-6: 6.1, 6.2 Chapter 8: 8.1 to 8.3

Course out comes(Course Skill Set):

At the end of the course, the student will be able to:
CO1: Explain different data structures and their applications. (PO – 1,2,3, PSO – 1)
CO2: Apply Arrays, Stacks and Queue data structures to solve the given problems. (PO – 1,2,3, PSO – 1,2)
CO3: Use the concept of linked list in problem solving. (PO – 1,2,3, PSO – 1,2)
CO4: Develop solutions using trees and graphs to model the real-world problem. (PO – 1,2,3, PSO – 1,2)
CO5: Explain the advanced Data Structures concepts such as Hashing Techniques and Optimal Binary Search Trees. (PO – 1,2,3, PSO – 1,2)

Assessment Details (both CIE and SEE):

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- There are 25 marks for the CIE's Assignment component and 25 for the Internal Assessment Component.
- Each test shall be conducted for 25 marks. The first test will be administered after 40-50% of the coverage of the syllabus, and the second test will be administered after 85-90% of the coverage of the syllabus. The average of the two tests shall be scaled down to 25 marks.

- Any two assignment methods mentioned in the regulations; if an assignment is project-based then only one assignment for the course shall be planned. The schedule for assignments shall be planned properly by the course teacher. The teacher should not conduct two assignments at the end of the semester if two assignments are planned. Each assignment shall be conducted for 25 marks. (If two assignments are conducted then the sum of the two assignments shall be scaled down to 25 marks)
- The final CIE marks of the course out of 50 will be the sum of the scale-down marks of tests and assignment/s marks.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by the University as per the scheduled timetable, with common question papers for the course (duration 03 hours).

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks.

Suggested Learning Resources:

Textbook:

1. Ellis Horowitz, Sartaj Sahni and Susan Anderson-Freed, Fundamentals of Data Structures in C, 2nd Ed, Universities Press, 2014

Reference Books:

1. Seymour Lipschutz, Data Structures Schaum's Outlines, Revised 1st Ed, McGraw Hill, 2014.
2. Gilberg &Forouzan, Data Structures: A Pseudo-codeapproachwithC,2ndEd, Cengage Learning,2014.
3. Reema Thareja, Data Structures usingC,3rd Ed, Oxfordpress,2012.
4. Jean-Paul Tremblay &Paul G. Sorenson, An Introduction to Data Structures with Applications, 2nd Ed, McGraw Hill, 2013.
5. A M Tenenbaum, Data Structures using C, PHI,1989
6. Robert Kruse, Data Structures and ProgramDesigninC,2ndEd, PHI,1996**.**

Web links and Video Lectures(e-Resources):

- http://elearning.vtu.ac.in/econtent/courses/video/CSE/06CS35.html
- https://nptel.ac.in/courses/106/105/106105171/
- http://www.nptelvideos.in/2012/11/data-structures-and-algorithms.html
- https://www.youtube.com/watch?v=3Xo6P_V-qns&t=201s
- https://ds2-iiith.vlabs.ac.in/exp/selection-sort/index.html

- https://nptel.ac.in/courses/106/102/106102064/
- https://ds1-iiith.vlabs.ac.in/exp/stacks-queues/index.html
- https://ds1-iiith.vlabs.ac.in/exp/linked-list/basics/overview.html
- https://ds1-iiith.vlabs.ac.in/List%20of%20experiments.html
- https://ds1-iiith.vlabs.ac.in/exp/tree-traversal/index.html
- https://ds1-iiith.vlabs.ac.in/exp/tree-traversal/depth-first-traversal/dft-practice.html
- https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01350159542807756812559/overview

Activity Based Learning (Suggested Activities in Class)/Practical Based Learning

- Role Play
- Flipped classroom
- Assessment Methods for 25 Marks (opt two Learning Activities)
  - Case Study
  - Programming Assignment
  - Gate Based Aptitude Test
  - MOOC Assignment for selected Module

Digital Design and Computer Organization			
Course Code	24AD34	**CIE Marks**	50
Teaching Hours/Week (L: T: P)	3:0:2	**SEE Marks**	50
Credits	04	**Total Marks**	100
Contact Hours	40 hours Theory + 20 Hours of Practical's	**Exam Hours**	3
Examination type (SEE)	Theory		

Prerequisites:

The students should have knowledge on

- Basic Electronics
- Digital Circuits
- Computer Architecture Concepts

Course Objectives:

- To demonstrate the functionalities of binary logic system
- To explain the working of combinational and sequential logic system
- To realize the basic structure of computer system
- To illustrate the working of I/O operations and processing unit

Teaching-Learning Process (General Instructions)

Teachers can use following strategies to accelerate the attainment of the various course outcomes.

1. Chalk and Talk with Black Board
2. ICT based Teaching
3. Demonstration based Teaching

Module-1 **8 Hours**

Introduction to Digital Design: Binary Logic, Basic Theorems And Properties Of Boolean Algebra, Boolean Functions, Digital Logic Gates, Introduction, The Map Method, Four-Variable Map, Don't-Care Conditions, NAND and NOR Implementation, Other Hardware Description Language – Verilog Model of a simple circuit.

Case Study: Design a solution for a Real Time Problem Using K-Maps.

Text book 1: 1.9, 2.4, 2.5, 2.8, 3.1, 3.2, 3.3, 3.5, 3.6, 3.9

Module-2 **8 Hours**

Combinational Logic: Introduction, Combinational Circuits, Design Procedure, Binary Adder-Subtractor, Decoders, Encoders, Multiplexers. HDL Models of Combinational Circuits – Adder, Multiplexer, Encoder. Sequential Logic: Introduction, Sequential Circuits, Storage Elements: Latches, Flip-Flops.
Case Study: Design a real-world control system based on Combinational and Sequential logic circuits to manage specific operational requirements effectively.

Text book 1: 4.1, 4.2, 4.4, 4.5, 4.9, 4.10, 4.11, 4.12, 5.1, 5.2, 5.3, 5.4.

Module-3 **8 Hours**

Basic Structure of Computers: Functional Units, Basic Operational Concepts, Bus structure, Performance – Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement. **Machine Instructions and Programs:** Memory Location and Addresses, Memory Operations, Instruction and Instruction sequencing, Addressing Modes.

Text book 2: 1.2, 1.3, 1.4, 1.6, 2.2, 2.3, 2.4, 2.5

Module-4 **8 Hours**

Input/output Organization: Accessing I/O Devices, Interrupts – Interrupt Hardware, Enabling and Disabling Interrupts, Handling Multiple Devices, Direct Memory Access: Bus Arbitration, Speed, size and Cost of memory systems. Cache Memories – Mapping Functions.

Case Study: Optimizing Cache Mapping in an AI-Based System

Text book 2: 4.1, 4.2.1, 4.2.2, 4.2.3, 4.4, 5.4, 5.5.1

Module-5 **8 Hours**

Basic Processing Unit: Some Fundamental Concepts: Register Transfers, Performing ALU operations, fetching a word from Memory, Storing a word in memory. Execution of a Complete Instruction. **Pipelining:** Basic concepts, Role of Cache memory, Pipeline Performance.

Case Study: Pipelining in AI-Powered

Text book 2: 7.1, 7.2, 8.1

PRACTICAL COMPONENT OF IPCC

Simulation packages preferred: Multisim, Modelsim, PSpice or any other relevant

Sl.No.	Experiments
1.	Given a 4-variable logic expression, simplify it using appropriate technique and simulate the same using basic gates.
2.	Design a 4 bit full adder and subtractor and simulate the same using basic gates.
3.	Design Verilog HDL to implement simple circuits using structural, Data flow and Behavioural model.
4.	Design Verilog HDL to implement Binary Adder-Subtractor – Half and Full Adder, Half and Full Subtractor.
5.	Design Verilog HDL to implement Decimal adder.
6.	Design Verilog program to implement Different types of multiplexer like 2:1, 4:1 and 8:1.
7.	Design Verilog program to implement types of De-Multiplexer.
8.	Design Verilog program for implementing various types of Flip-Flops such as SR, JK and D.

Course outcomes (Course Skill Set):

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

CO1: Apply the K–Map techniques to simplify various Boolean expressions. (PO – 1,2,3,5 PSO – 1)

CO2: Design different types of combinational and sequential circuits along with Verilog programs. (PO – 1,2,3,5 PSO – 1)

CO3: Describe the fundamentals of machine instructions, addressing modes and Processor performance. (PO – 1,2,3 PSO – 1)

CO4: Explain the approaches involved in achieving communication between processor and I/O devices. (PO – 1,2,3 PSO – 1)

CO5: Analyze internal Organization of Memory and Impact of cache/Pipelining on Processor Performance. (PO – 1,2,3 PSO – 1)

Assessment Details (both CIE and SEE):

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

CIE for the theory component of the IPCC (maximum marks 50)

- IPCC means practical portion integrated with the theory of the course.
- CIE marks for the theory component are 25 marks and that for the practical component is 25 marks.
- 25 marks for the theory component are split into 15 marks for two Internal Assessment Tests (Two Tests, each of 15 Marks with 01-hour duration, are to be conducted) and 10 marks for other assessment methods. The first test at the end of 40-50% coverage of the syllabus and the second test after covering 85-90% of the syllabus.
- Scaled-down marks of the sum of two tests and other assessment methods will be CIE marks for the theory component of IPCC (that is for 25 marks).
- The student has to secure 40% of 25 marks to qualify in the CIE of the theory component of IPCC.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

CIE for the practical component of the IPCC

1. 15 marks for the conduction of the experiment and preparation of laboratory record, and 10 marks for the test to be conducted after the completion of all the laboratory sessions.
2. On completion of every experiment/program in the laboratory, the students shall be evaluated including viva- voce and marks shall be awarded on the same day.
3. The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write- ups are added and scaled down to 15 marks.
4. The laboratory test (duration 02/03 hours) after completion of all the experiments shall be conducted for 50 marks and scaled down to 10 marks.
5. Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for 25 marks.
6. The student has to secure 40% of 25 marks to qualify in the CIE of the practical component of the IPCC.

Semester-End Examination:

Theory SEE will be conducted by the University as per the scheduled timetable, with common question papers for the course (**duration 03 hours**).

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks.

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper may include questions from the practical component.

Suggested Learning Resources:

Textbook:

1. M. Morris Mano & Michael D. Ciletti, Digital Design With an Introduction to Verilog Design, 5e, Pearson Education.
2. Carl Hamacher, ZvonkoVranesic, SafwatZaky, Computer Organization, 5th Edition, Tata McGraw Hill.

Web links and Video Lectures(e-Resources):

- https://elearning.vtu.ac.in/econtent/courses/web/CSE/15CS44.html
- https://cse11-iiith.vlabs.ac.in/
- https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01400535636112179

27045/overview

- https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01423541223732838 43162/overview
- https://onlinecourses.nptel.ac.in/noc21_ee39/preview

Activity Based Learning (Suggested Activities in Class)/Practical Based Learning

- Role Play
- Flipped classroom
- Assessment Methods for 25 Marks (opt two Learning Activities)
    - Case Study
    - Programming Assignment
    - Gate Based Aptitude Test

DATASTRUCTURESLABORATORY			
Course Code	24ADL35	**CIE Marks**	50
Teaching Hours/Week (L: T:P)	0:0:2	**SEE Marks**	50
Credits	01	**Total Marks**	100
Contact Hours	28	**Exam Hours**	3
Examination type (SEE)	Practical		

Prerequisites:

The students should have knowledge on

- Basic Programming Skills
- Understanding of Algorithms
- Problem-Solving Skills

Course Objectives:

This laboratory course enables students to gain practical experience in the design, development, implementation, analysis, and evaluation/testing of:

- Dynamic memory management
- Linear data structures and their applications such as stacks, queues, and lists
- Non-linear data structures and their applications such as trees and graphs

Teaching-Learning Process (General Instructions)

Teachers can use following strategies to accelerate the attainment of the various course outcomes.

1. Chalk and TalkwithBlackBoard
2. ICT based Teaching
3. Demonstration based Teaching

ProgramsList:	
1.	Develop a program in C for the following: a. Declare a calendar as an array of 7 elements (a dynamically created array) to represent the 7 days of a week. Each element of the array should be a structure having three fields: • The name of the day (a dynamically allocated string) • The date of the day (an integer) • The description of the activity for that day (a dynamically allocated string) b. Write functions create(), read(), and display() to: • Create the calendar • Read the data from the keyboard • Display the week's activity details report on the screen
2.	Develop a Program in C for the following operations on Strings. a. Read a mainString(STR),a PatternString(PAT) and a ReplaceString(REP) b. Perform Pattern Matching Operation: Find and Replace all occurrences of PAT in STR with REP if PAT exists in STR. Report suitable messages in case PAT does not exist in STR

	Support the program with functions for each of the above operations. Don't use Built-in functions.
3.	Develop a menu-driven program in C for the following operations on a STACK of integers (Array implementation of a stack with maximum size MAX): a. Push an element onto the stack b. Pop an element from the stack c. Demonstrate how a stack can be used to check for a palindrome d. Demonstrate overflow and underflow situations on the stack e. Display the status of the stack f. Exit Support the program with appropriate functions for each of the above operations.
4	Develop a Program in C for converting an Infix Expression to Postfix Expression. Program should support for both parent the sized and free parenthesized expressions with the operators:+,,*,/,%(Remainder),^(Power)and alphanumeric operands.
5.	Develop a Program in C for the following Stack Applications a) Evaluation of Suffix expression with single digit operands and operators: +, -, *, /, %, ^ b) Solving Tower of Hanoi problem with n disks
6.	Develop a menu-driven program in C for the following operations on a Circular QUEUE of characters (Array implementation of a queue with maximum size MAX): a. Insert an element into the Circular QUEUE b. Delete an element from the Circular QUEUE c. Demonstrate overflow and underflow situations on the Circular QUEUE d. Display the status of the Circular QUEUE e. Exit Support the program with appropriate functions for each of the above operations.
7	Develop a menu-driven program in C for the following operations on a Singly Linked List (SLL) of student data with the fields: USN, Name, Programme, Semester, and Phone Number: a. Create a SLL of *N* students' data by using front insertion b. Display the status of the SLL and count the number of nodes in it c. Perform insertion/deletion at the end of the SLL d. Perform insertion/deletion at the front of the SLL (demonstration of stack)
8	Develop a menu-driven program in C for the following operations on a Doubly Linked List (DLL) of employee data with the fields: SSN, Name, Department, Designation, Salary, and Phone Number: a. Create a DLL of *N* employees' data by using end insertion b. Display the status of the DLL and count the number of nodes in it c. Perform insertion and deletion at the end of the DLL d. Perform insertion and deletion at the front of the DLL e. Demonstrate how this DLL can be used as a double-ended queue

9	Develop a program in C for the following operations on a Singly Circular Linked List (SCLL) with header nodes: a. Represent and evaluate a polynomial **P(x, y) = $6x^2y^2 - 4y + 3x^3y + 2xy^5 - 2xy$** b. Find the sum of two polynomials **POLY1(x, y)** and **POLY2(x, y)** and store the result in **POLYSUM(x, y)**
10	Develop a menu-driven program in C for the following operations on a Binary Search Tree (BST) of integers: a. Create a BST with *N* integers: **6, 9, 5, 2, 8, 15, 24, 14, 7, 8, 5, 2** b. Traverse the BST in **Inorder**, **Preorder**, and **Postorder** c. Search the BST for a given element (**KEY**) and report an appropriate message
11	Develop a program in C for the following operations: Graph of Cities a. Create a graph of *N* cities using an adjacency matrix. b. Print all the nodes reachable from a given starting node in a directed graph using **DFS**/**BFS** method.
12.	Hash Table for Employee Records Given a file **F** of *N* employee records with a set **K** of keys (4-digit integers) that uniquely determine the records in **F**, assume that **F** is maintained in memory by a **Hash Table (HT)** of *m* memory locations with **L** as the set of memory addresses (2-digit integers). Develop a program in C that: • Uses a hash function **H: K → L** defined as **H(K) = K mod m** (remainder method). • Implements a hashing technique to map a given key **K** to the address space **L**. • Resolves collisions (if any) using **linear probing**.

Course Outcomes (Course Skill Set):

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

CO1: Analyze various linear and non-linear data structures. *(PO-1,2,3,5 PSO-1,2)*

CO2: Demonstrate the working principles of different types of data structures and their applications. *(PO-1,2,3,5 PSO-1,2)*

CO3: Use appropriate searching and sorting algorithms for a given scenario. *PO-1,2,3,5 PSO1-2)*

CO4: Apply suitable data structures for solving real-world problems. *(PO-1,2,3,5 PSO1-2)*

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation (CIE):

CIE marks for the practical course are **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment is to be evaluated for conduction with an observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments are designed by the faculty who is handling the laboratory session and are made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled down to **30 marks** (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct a test of 100 marks after the completion of all the experiments listed in the syllabus.
- In a test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability.
- The marks scored shall be scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and marks of a test is the total CIE marks scored by the student.

Web links and Video Lectures(e-Resources):

- https://ds1-iiith.vlabs.ac.in/exp/stacks-queues/index.html
- https://ds1-iiith.vlabs.ac.in/exp/linked-list/basics/overview.html
- https://ds1-iiith.vlabs.ac.in/List%20of%20experiments.html
- https://ds1-iiith.vlabs.ac.in/exp/tree-traversal/index.html
- https://ds1-iiith.vlabs.ac.in/exp/tree-traversal/depth-first-traversal/dft-practice.html

Object Oriented Programming with JAVA			
Course Code	24AD36A	**CIE Marks**	50
Teaching Hours/Week (L: T: P)	2:0:2	**SEE Marks**	50
Credits	03	**Total Marks**	100
Contact Hours	28 Theory +20 Practical	**Exam Hours**	3
Examination type (SEE)	Theory		

Prerequisites:

The students should have knowledge on

- Basic Programming Skills
- Understanding of Algorithms
- Basic Mathematics
- Problem-Solving Skills

Course Objectives:

- To learn primitive constructs JAVA programming language.
- To understand Object Oriented Programming Features of JAVA.
- To gain knowledge on: packages, multithreaded programing and exceptions.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes and make Teaching –Learning more effective

1. Use Online Java Compiler IDE: https://www.jdoodle.com/online-java-compiler/ or any other.
2. Demonstration of programing examples.
3. Chalk and board, power point presentations
4. Online material (Tutorials) and video lectures.

Module-1 **6 Hours**

An Overview of Java: Object-Oriented Programming (Two Paradigms, Abstraction, The Three OOP Principles), Using Blocks of Code, Lexical Issues (Whitespace, Identifiers, Literals, Comments, Separators, The Java Keywords).

Data Types, Variables, and Arrays: The Primitive Types (Integers, Floating-Point Types, Characters, Booleans), Variables, Type Conversion and Casting, Automatic Type Promotion in Expressions, Arrays, Introducing Type Inference with Local Variables.

Operators: Arithmetic Operators, Relational Operators, Boolean Logical Operators, The Assignment Operator, The ? Operator, Operator Precedence, Using Parentheses.

Control Statements: Java's Selection Statements (if, The Traditional switch), Iteration Statements (while, do-while, for, The For-Each Version of the for Loop, Local Variable Type Inference in a for Loop, Nested Loops), Jump Statements (Using break, Using continue, return).

Text Book 1:Chapter 2, 3, 4, 5

Module-2	6 Hours
Introducing Classes: Class Fundamentals**,** Declaring Objects**,** Assigning Object Reference Variables**,** Introducing Methods**,** Constructors**,** The this Keyword**,** Garbage Collection. **Methods and Classes:** Overloading Methods, Objects as Parameters, Argument Passing, Returning Objects, Recursion, Access Control, Understanding static, Introducing final, Introducing Nested and Inner Classes. **Text Book 1:Chapter 6, 7**	
Module-3	**6 Hours**
Inheritance: Inheritance Basics, Using super, Creating a Multilevel Hierarchy, When Constructors Are Executed, Method Overriding, Dynamic Method Dispatch, Using Abstract Classes, Using final with Inheritance, Local Variable Type Inference and Inheritance, The Object Class. **Interfaces:** Interfaces, Default Interface Methods, Use static Methods in an Interface, Private Interface Methods. **Text Book 1:Chapter 8, 9**	
Module-4	**5 Hours**
Packages: Packages, Packages and Member Access, Importing Packages. **Exceptions:** Exception-Handling Fundamentals**,** Exception Types**,** Uncaught Exceptions**,** Using try and catch, Multiple catch Clauses, Nested try Statements, throw, throws, finally, Java's Built-in Exceptions, Creating Your Own Exception Subclasses, Chained Exceptions. **Text Book 1:Chapter 9, 10**	
Module-5	**5 Hours**
Multithreaded Programming: The Java Thread Model, The Main Thread, Creating a Thread, Creating Multiple Threads, Using isAlive() and join(), Thread Priorities, Synchronization, Interthread Communication, Suspending, Resuming, and Stopping Threads, Obtaining a Thread's State. **Enumerations, Type Wrappers and Autoboxing:** Enumerations (Enumeration Fundamentals**,** The values() and valueOf() Methods), Type Wrappers (Character, Boolean, The Numeric Type Wrappers), Autoboxing (Autoboxing and Methods, Autoboxing/Unboxing Occurs in Expressions, Autoboxing/Unboxing Boolean and Character Values). **Text Book 1:Chapter 11, 12**	

Course outcomes (Course Skill Set):

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

- **CO1:** Demonstrate proficiency in writing simple programs involving branching and looping structures (PO-2,3,5 PSO-1)
- **CO2:** Design a class involving data members and methods for the given scenario. (PO-2,3,4,5 PSO-1,2)
- **CO3:** Apply the concepts of inheritance and interfaces in solving real world problems. (PO-2,3,4,5 PSO-1,2)
- **CO4:** Use the concept of packages and exception handling in solving complex problem (PO-

2,3,4,5 PSO-1,2)

CO5: Apply concepts of multithreading, autoboxing and enumerations in program development (PO-2,3,4,5 PSO-1,2)

Programming Experiments (Suggested and are not limited to)

1. Develop a JAVA program to add TWO matrices of suitable order N (The value of N should be read from command line arguments).
2. Develop a stack class to hold a maximum of 10 integers with suitable methods. Develop a JAVA main method to illustrate Stack operations.
3. A class called Employee, which models an employee with an ID, name and salary, is designed as shown in the following class diagram. The method raiseSalary (percent) increases the salary by the given percentage. Develop the Employee class and suitable main method for demonstration.
4. A class called MyPoint, which models a 2D point with x and y coordinates, is designed as follows:
   - Two instance variables x (int) and y (int).
   - A default (or "no-arg") constructor that construct a point at the default location of (0, 0).
   - A overloaded constructor that constructs a point with the given x and y coordinates.
   - A method setXY() to set both x and y.
   - A method getXY() which returns the x and y in a 2-element int array.
   - A toString() method that returns a string description of the instance in the format "(x, y)".
   - A method called distance(int x, int y) that returns the distance from this point to another point at the given (x, y) coordinates
   - An overloaded distance(MyPoint another) that returns the distance from this point to the given MyPoint instance (called another)
   - Another overloaded distance() method that returns the distance from this point to the origin (0,0) Develop the code for the class MyPoint. Also develop a JAVA program (called TestMyPoint) to test all the methods defined in the class.
5. Develop a JAVA program to create a class named shape. Create three sub classes namely: circle, triangle
   and square, each class has two member functions named draw () and erase (). Demonstrate polymorphism concepts by developing suitable methods, defining member data and main program.
6. Develop a JAVA program to create an abstract class Shape with abstract methods calculateArea() and calculatePerimeter(). Create subclasses Circle and Triangle that extend the Shape class and implement the respective methods to calculate the area and perimeter of each shape.
7. Develop a JAVA program to create an interface Resizable with methods resizeWidth(int width) and resizeHeight(int height) that allow an object to be resized. Create a class Rectangle that implements the Resizable interface and implements the resize methods
8. Develop a JAVA program to create an outer class with a function display. Create another

class inside the outer class named inner with a function called display and call the two functions in the main class.

9. Develop a JAVA program to raise a custom exception (user defined exception) for DivisionByZero using try, catch, throw and finally.
10. Develop a JAVA program to create a package named mypack and import & implement it in a suitable class.
11. Write a program to illustrate creation of threads using runnable class. (start method start each of the newly created thread. Inside the run method there is sleep() for suspend the thread for 500 milliseconds).
12. Develop a program to create a class MyThread in this class a constructor, call the base class constructor, using super and start the thread. The run method of the class starts after this. It can be observed that both main thread and created child thread are executed concurrently.

Assessment Details (both CIE and SEE):

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

CIE for the theory component of the IPCC

- IPCC means practical portion integrated with the theory of the course.
- CIE marks for the theory component are 25 marks and that for the practical component is 25 marks.
- 25 marks for the theory component are split into 15 marks for two Internal Assessment Tests (Two Tests, each of 15 Marks with 01-hour duration, are to be conducted) and 10 marks for other assessment methods mentioned in the regulation. The first test at the end of 40-50% coverage of the syllabus and the second test after covering 85-90% of the syllabus.
- Scaled-down marks of the sum of two tests and other assessment methods will be CIE marks for the theory component of IPCC (that is for **25 marks)**.
- The student has to secure 40% of 25 marks to qualify in the CIE of the theory component of IPCC.

CIE for the practical component of the IPCC

- **15 marks** for the conduction of the experiment and preparation of laboratory record, and **10 marks** for the test to be conducted after the completion of all the laboratory sessions.
- On completion of every experiment/program in the laboratory, the students shall be evaluated including viva-voce and marks shall be awarded on the same day.

- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to **15 marks**.
- The laboratory test **(duration 02/03 hours)** after completion of all the experiments shall be conducted for 50 marks and scaled down to **10 marks.**
- Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **25 marks**.
- The student has to secure 40% of 25 marks to qualify in the CIE of the practical component of the IPCC.

SEE for IPCC

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours**)

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored by the student shall be proportionally scaled down to 50 Marks

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper may include questions from the practical component.

Suggested Learning Resources:

Textbook:

1. Java: The Complete Reference, Twelfth Edition, by Herbert Schildt, November 2021, McGraw-Hill, ISBN: 9781260463422

Reference Books:

1. Programming with Java, 6th Edition, by E Balagurusamy, Mar-2019, McGraw Hill Education, ISBN: 9789353162337.
2. Thinking in Java, Fourth Edition, by Bruce Eckel, Prentice Hall, 2006. (https://sd.blackball.lv/library/thinking_in_java_4th_edition.pdf)

Web links and Video Lectures(e-Resources):

- Java Tutorial: https://www.geeksforgeeks.org/java/
- Introduction To Programming In Java (by Evan Jones, Adam Marcus and Eugene Wu): https://ocw.mit.edu/courses/6-092-introduction-to-programming-in-java-january-iap-2010/
- Java Tutorial: https://www.w3schools.com/java/

• Java Tutorial: https://www.javatpoint.com/java-tutorial
Activity Based Learning (Suggested Activities in Class)/Practical Based Learning • Installation of Java (Refer: https://www.java.com/en/download/help/index_installing.html) • Demonstration of online IDEs like geeksforgeeks, jdoodle or any other Tools • Demonstration of class diagrams for the class abstraction, type visibility, composition and inheritance

Objected Oriented Programming with C++			
Course Code	24AD36B	**CIE Marks**	50
Teaching Hours/Week (L: T: P)	2:0:2	**SEE Marks**	50
Credits	03	**Total Marks**	100
Contact Hours	28 T+ 20 P	**Exam Hours**	3
Examination type (SEE)	Theory		

Prerequisites:

The students should have knowledge on

- Basic Programming Skills
- Understanding of Algorithms
- Basic Mathematics
- Problem-Solving Skills

Course Objectives:

- Understanding about object-oriented programming and Gain knowledge about the capability to store information together in an object.
- Understand the capability of a class to rely upon another class and functions.
- Understand about constructors which are special type of functions.
- Create and process data in files using file I/O functions
- Use the generic programming features of C++ including Exception handling

Teaching-Learning Process (General Instructions)

Teachers can use following strategies to accelerate the attainment of the various course outcomes.

1. Chalk and Talk with Black Board
2. ICT based Teaching
3. Demonstration based Teaching

Module-1 **6 Hours**

Introduction to Object Oriented Programming: Computer programming background- C++ overview.

First C++ Program -Basic C++ syntax, Object Oriented Programming: What is an object, Classes, methods and messages, abstraction and encapsulation, inheritance, abstract classes, polymorphism.

Textbook 1: Chapter 1(1.1 to 1.8)

Module-2 **6 Hours**

Functions in C++: Tokens – Keywords – Identifiers and constants – Operators in C++ – Scope resolution operator – Expressions and their types – Special assignment expressions – Function prototyping – Call by reference – Return by reference – Inline functions -Default arguments – Function overloading.

Textbook 2: Chapter 3(3.2,3.3,3.4,3.13,3.14,3.19, 3.20), Chapter 4(4.3,4.4,4.5,4.6,4.7,4.9)

Module-3	6 Hours
Inheritance & Polymorphism: Derived class Constructors, destructors-Types of Inheritance-Defining Derived classes, Single Inheritance, Multiple, Hierarchical Inheritance, Hybrid Inheritance. **Textbook 2: Chapter 6 (6.2,6.11) chapter 8 (8.1 to,8.8)**	
Module-4	**5 Hours**
I/O Streams: C++ Class Hierarchy- File Stream-Text File Handling- Binary File Handling during file operations. **Textbook 1: Chapter 12(12.5) , Chapter 13 (13.6,13.7)**	
Module-5	**5 Hours**
Exception Handling: Introduction to Exception - Benefits of Exception handling- Try and catch Block Throw statement- Pre-defined exceptions in C++ **Textbook 2: Chapter 13 (13.2 to13.6)**	

Course outcomes (Course Skill Set):

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

CO1: Able to understand and design the solution to a problem using object-oriented programming concepts. (PO-2,3,4,5 PSO-1,2)

CO2: Able to reuse the code with extensible Class types, User-defined operators and function Overloading. (PO-2,3,4,5 PSO-1,2)

CO3: Achieve code reusability and extensibility by means of Inheritance and Polymorphism. (PO-2,3,4,5 PSO-1,2)

CO4: Implement the features of C++ including templates, exceptions and file handling for providing programmed solutions to complex problems. (PO-2,3,4,5 PSO-1,2)

Programming Experiments (Suggested and are not limited to)

1. Write a C++ program to sort the elements in ascending and descending order.
2. Write a C++ program to find the sum of all the natural numbers from 1 to n.
3. Write a C++ program to swap 2 values by writing a function that uses call by reference technique.
4. Write a C++ program to demonstrate function overloading for the following prototypes.
   add(int a, int b)
   add(double a, double b)
5. Create a class named Shape with a function that prints "This is a shape". Create another class named Polygon inheriting the Shape class with the same function that prints "Polygon is a shape". Create two other classes named Rectangle and Triangle having the same function which prints "Rectangle is a polygon" and "Triangle is a polygon" respectively. Again, make another class named Square having the same

function which prints "Square is a rectangle".Now, try calling the function by the object of each of these classes.

6. Suppose we have three classes Vehicle, FourWheeler, and Car. The class Vehicle is the base class, the class FourWheeler is derived from it and the class Car is derived from the class FourWheeler. Class Vehicle has a method 'vehicle' that prints 'I am a vehicle', class FourWheeler has a method 'FourWheeler' that prints 'I have four wheels', and class Car has a method 'car' that prints 'I am a car'.
   So, as this is a multi-level inheritance; we can have access to all the other classes methods from the object of the class Car. We invoke all the methods from a Car object and print the corresponding outputs of the methods.
   So, if we invoke the methods in this order, car(), FourWheeler(), and vehicle(), then the output will be
   I am a car
   I have four wheels
   I am a vehicle
   Write a C++ program to demonstrate multilevel inheritance using this.
7. Write a C++ program to create a text file, check file created or not, if created it will write some text into the file and then read the text from the file.
8. Write a C++ program to write and read time in/from binary file using fstream
9. Write a function which throws a division by zero exception and catch it in catch block. Write a C++ program to demonstrate usage of try, catch and throw to handle exception.
10. Write a C++ program function which handles array of bounds exception using C++.

Assessment Details (both CIE and SEE):

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

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- 25 marks for the theory component are split into 15 marks for two Internal Assessment Tests (Two Tests, each of 15 Marks with 01-hour duration, are to be conducted) and 10 marks for other assessment methods mentioned in the regulation. The first test at the end of 40-50% coverage of the syllabus and the second test after covering 85-90% of the syllabus.
- Scaled-down marks of the sum of two tests and other assessment methods will be CIE marks

for the theory component of IPCC (that is for **25 marks)**.

- The student has to secure 40% of 25 marks to qualify in the CIE of the theory component of IPCC.

CIE for the practical component of the IPCC

- **15 marks** for the conduction of the experiment and preparation of laboratory record, and **10 marks** for the test to be conducted after the completion of all the laboratory sessions.
- On completion of every experiment/program in the laboratory, the students shall be evaluated including viva-voce and marks shall be awarded on the same day.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to **15 marks**.
- The laboratory test **(duration 02/03 hours)** after completion of all the experiments shall be conducted for 50 marks and scaled down to **10 marks.**
- Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **25 marks**.
- The student has to secure 40% of 25 marks to qualify in the CIE of the practical component of the IPCC.

SEE for IPCC

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours**)

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.

Marks scored by the student shall be proportionally scaled down to 50 Marks

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper may include questions from the practical component.

Suggested Learning Resources:

Textbook:

1. Bhushan Trivedi, "Programming with ANSI C++", Oxford Press, Second Edition, 2012.
2. Balagurusamy E, Object Oriented Programming with C++, Tata McGraw Hill Education Pvt.Ltd, Fourth Edition 2010.

Web links and Video Lectures(e-Resources):

- Basics of C++ - https://www.youtube.com/watch?v=BClS40yzssA
- Functions of C++ - https://www.youtube.com/watch?v=p8ehAjZWjPw

Activity Based Learning (Suggested Activities in Class)/Practical Based Learning

- Role Play
- Flipped classroom
- Assessment Methods for 25 Marks (opt two Learning Activities)
  - Case Study
  - Programming Assignment
  - Gate Based Aptitude Test
  - MOOC Assignment for selected Module

Python Programming for Data Science			
Course Code	24AD36C	**CIE Marks**	50
Teaching Hours/Week (L: T: P)	2:0:2	**SEE Marks**	50
Credits	03	**Total Marks**	100
Contact Hours	28 T + 20 P	**Exam Hours**	3
Examination nature (SEE)	Theory		

Prerequisites: NIL

Course Objectives:

- To understand Python constructs and use them to build the programs.
- To analyse different conditional statements and their applications in programs.
- To learn and use basic data structures in python language.
- To learn and demonstrate array manipulations by reading data from files.
- To understand and use different data in a data analytics context.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Chalk and board, power point presentations.
2. Online Material (Tutorials) and video lectures.
3. Demonstration of programming examples.

MODULE-1 6 **Hours**

Introduction to python: Elements of python language, python block structure, variables and assignment statement, data types in python, operations, simple input/output print statements, formatting print statement.

Text Book 1: Chapter 3 (3.2, 3.3, 3.4, 3.6, 3.7, 3.9 and 3.10)

MODULE-2 6 **Hours**

Decision structure: forming conditions, if statement, the if-else and nested if-else, **looping statements**: introduction to looping, python built in functions for looping, loop statements, jump statement.

Text Book 1: Chapter 4 (4.2 to 4.6), Chapter 5 (5.1 to 5.4)

MODULE-3 6 **Hours**

Lists: lists, operation on list, Tuples: introduction, creating, indexing and slicing, operations on tuples. sets: creating, operation in sets, introduction dictionaries, creating, operations, nested dictionary, looping over dictionary

Text Book 1: Chapter 7 (7.2 to 7.3), Chapter 8 (8.1 to 8.4) and Chapter 9 (9.1 to 9.3, 9.7 to 9.12

MODULE-4	5 **Hours**
The NumPy Library: Ndarray: the heart of the library, Basic operations, indexing, slicing and iterating, conditions and boolean arrays, array manipulation, general concepts, reading and writing array data on files. **The pandas Library:** an introduction to Data structure, other functionalities on indexes, operations between data structures, function application and mapping. **Text Book 2: Chapter 3 and Chapter 4.**	
MODULE-5	5 **Hours**
The pandas: Reading and Writing data: i/o API tools, CSV and textual files, reading data in CSV or text files, reading and writing HTML files, reading data from XML files, Microsoft excel files, JSON data, Pickle python object serialization. **Pandas in Depth: data manipulation:** data preparation, concatenating data transformation discretization binning, permutation, string manipulation, data aggregation group iteration. **Text Book 2: Chapter 5 and Chapter 6**	

Practical component of IPCC:

S. No Experiments

1. Develop a python program to read n digit integer number, and separate the integer number and display each digit. [Hint: input: 5678; output: 5 6 7 8, use: floor and mod operators)
2. Develop a python program to accept 4 numbers and display them in sorted order using a minimum number of if else statements.
3. Develop python scripts to Calculate the mean, median, mode, variance and standard deviation of n integer numbers.
4. Develop a program for checking if a given n digit number is palindrome or not. [hint: input 1221 output: palindrome, use //and % operator with loop statement]
5. Develop a python script to display a multiplication table for given integer n.
6. Develop a python script to rotate right about a given position in that list and display them. [hint: input [1,4,5, -10] position: 2, output: [-10,5,4,1]]
7. Develop and write a python script to interchange the digits of a given integer number. [hint: input: 23456, interchange: 3 and 5 output: 25436]
8. Develop a python program to capitalize a given list of strings. [hint: [hello, good, how, simple] output: [Hello, Good, How, Simple]
9. Using a dictionary, develop a python program to determine and print the number of duplicate words in a sentence.
10. Develop python program to read Numpy array and print row (sum, mean, std) and column (sum, mean, std)
11. Develop a python program to read and print in the console CSV file.
12. Develop a python program to read a HTML file with basic tags, and construct a dictionary and display the same in the console.

Course outcomes (Course Skill Set):

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

CO1: Describe the constructs of python programming. (PO – 1,2,3,4,5,9,12, PSO – 1,2)

CO2: Use looping and conditional constructs to build programs. (PO – 1,2,3,4,5,9,12, PSO – 1,2)

CO3: Apply the concept of data structure to solve the real-world problem. (PO – 1,2,3,4,5,9,12, PSO – 1,2)

CO4: Use the NumPy constructs for matrix manipulations. (PO – 1,2,3,4,5,9,12, PSO – 1,2)

CO5: Apply the Panda constructs for data analytics. (PO – 1,2,3,4,5,9,12, PSO – 1,2)

Assessment Details (both CIE and SEE):

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

CIE for the theory component of the IPCC

- IPCC means practical portion integrated with the theory of the course.
- CIE marks for the theory component are 25 marks and that for the practical component is 25 marks.
- 25 marks for the theory component are split into 15 marks for two Internal Assessment Tests (Two Tests, each of 15 Marks with 01-hour duration, are to be conducted) and 10 marks for other assessment methods mentioned in the regulation. The first test at the end of 40-50% coverage of the syllabus and the second test after covering 85-90% of the syllabus.
- Scaled-down marks of the sum of two tests and other assessment methods will be CIE marks for the theory component of IPCC (that is for **25 marks)**.
- The student has to secure 40% of 25 marks to qualify in the CIE of the theory component of IPCC.

CIE for the practical component of the IPCC

- **15 marks** for the conduction of the experiment and preparation of laboratory record, and **10 marks** for the test to be conducted after the completion of all the laboratory sessions.
- On completion of every experiment/program in the laboratory, the students shall be evaluated including viva-voce and marks shall be awarded on the same day.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to **15 marks**.
- The laboratory test **(duration 02/03 hours)** after completion of all the experiments shall be

conducted for 50 marks and scaled down to **10 marks.**

- Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **25 marks**.
- The student has to secure 40% of 25 marks to qualify in the CIE of the practical component of the IPCC.

SEE for IPCC

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours**)

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.

Marks scored by the student shall be proportionally scaled down to 50 Marks

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper may include questions from the practical component.

Suggested Learning Resources:

Text Books:

1. S. Sridhar, J. Indumathi, V.M. Hariharan "Python Programming", Pearson publishers, 1st edition 2023.
2. Fabio Nelli, "Python Data Analytics", Apress, Publishing, 1st Edition, 2015.

Reference Book:

3. Paul Deitel and Harvey deitel, "Intro to Python for Computer Science and Data science", 1st edition Pearson Publisher 2020.

Web links and Video Lectures (e-Resources):

- Nptel: Introduction to Python for Data Science
- https://www.youtube.com/watch?v=tA42nHmmEKw&list=PLh2mXjKcTPSACrQxPM2_1Ojus5HX88ht7

Activity Based Learning (Suggested Activities)/ Practical Based learning:

Assessment Methods

- Programming Assignment (10 Marks)

Data Analytics with Excel			
Course Code	24AD37A	**CIE Marks**	50
Teaching Hours/Week (L: T: P)	0:0:2	**SEE Marks**	50
Credits	01	**Total Marks**	100
Contact Hours	28	**Exam Hours**	3
Examination type (SEE)	Practical		

Prerequisites:

The students should have knowledge on

- Working with Windows
- File management (saving, organizing, navigating folders)C Programming
- Basic Math and Statistics

Course Objectives:

- To Apply analysis techniques to datasets in Excel
- Learn how to use Pivot Tables and Pivot Charts to streamline your workflow in Excel
- Understand and Identify the principles of data analysis
- Become adept at using Excel functions and techniques for analysis
- Build presentation ready dashboards in Excel

Teaching-Learning Process (General Instructions)

Teachers can use following strategies to accelerate the attainment of the various course outcomes.

1. ICT based Teaching
2. Demonstration based Teaching

Course outcomes (Course Skill Set):

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

CO1: Explain the structure and functionality of operating system. (PO 3,5,6,12)

CO 2: Apply appropriate CPU scheduling algorithms for the given problem. (PO 1,2,3,11,12)

CO 3: Analyse the various techniques for process synchronization and deadlock handling. (PO 1,2,3,11,12)

CO 4: Apply the various techniques for memory management.(PO 1,2,3,4,12)

CO 5: Analyse File and Storage Structures and Implement Customized Case Studies. (PO 1,2,3,12)	
Sl.NO	**Experiments**
1	**Getting Started with Excel**: Creation of spread sheets, Insertion of rows and columns, Drag & Fill, use of Aggregate functions.
2	**Working with Data** : Importing data, Data Entry & Manipulation, Sorting & Filtering.
3	**Working with Data:** Data Validation, Pivot Tables & Pivot Charts.
4	**Data Analysis Process**: Conditional Formatting, What-If Analysis, Data Tables, Charts & Graphs.
5	**Cleaning Data with Text Functions**: use of UPPER and LOWER, TRIM function, Concatenate.
6	**Cleaning Data Containing Date and Time Values:** use of DATEVALUE function, DATEADD and DATEDIF, TIMEVALUE functions.
7	**Conditional Formatting**: formatting, parsing, and highlighting data in spreadsheets during data analysis.
8	**Working with Multiple Sheets**: work with multiple sheets within a workbook is crucial for organizing and managing data, perform complex calculations and create comprehensive reports.
9	Create worksheet with following fields: Empno, Ename, Basic Pay(BP), Travelling Allowance(TA), Dearness Allowance(DA), House Rent Allowance(HRA), Income Tax(IT), Provident Fund(PF), Net Pay(NP). Use appropriate formulas to calculate the above scenario. Analyse the data using appropriate chart and report the data.
10	Create worksheet on Inventory Management: Sheet should contain Product code, Product name, Product type, MRP, Cost after % of discount, Date of purchase. Use appropriate formulas to calculate the above scenario. Analyse the data using appropriate chart and report the data.
11	Create worksheet on Sales analysis of Merchandise Store: data consisting of Order ID, Customer ID, Gender, age, date of order, month, online platform, Category of product, size, quantity, amount, shipping city and other details. Use of formula to segregate different categories and perform a comparative study using pivot tables and different sort of charts.
12	Generation of report & presentation using Autofilter &macro.

Course outcomes (Course Skill Set):

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

CO1: Use advanced functions and productivity tools to assist in developing worksheets. (PO 3,5,11,12 PSO-1,2)

CO2: Manipulate data lists using Outline and PivotTables. (PO 3,5,11,12 PSO-1,2)

CO3: Use Consolidation to summarize and report results from multiple worksheets. (PO 1,3,5,11,12 PSO-1,2)

CO4: Apply Macros and Auto filter to solve the given real world scenario. (PO 1,3,5,11,12 PSO-1,2)

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation (CIE):

CIE marks for the practical course are **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment is to be evaluated for conduction with an observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments are designed by the faculty who is handling the laboratory session and are made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled down to **30 marks** (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct a test of 100 marks after the completion of all the experiments listed in the syllabus.
- In a test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability.

- The marks scored shall be scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and marks of a test is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

- SEE marks for the practical course are 50 Marks.
- SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the Head of the Institute.
- The examination schedule and names of examiners are informed to the university before the conduction of the examination. These practical examinations are to be conducted between the schedule mentioned in the academic calendar of the University.
- All laboratory experiments are to be included for practical examination.
- (Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.
- Students can pick one question (experiment) from the questions lot prepared by the examiners jointly.
- Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.
- General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be made zero.
- The minimum duration of SEE is 02 hours

Suggested Learning Resources:

- Berk & Carey - Data Analysis with Microsoft® Excel: Updated for Offi ce 2007®, Third Edition, © 2010 Brooks/Cole, Cengage Learning, ISBN-13: 978-0-495-39178-4
- Wayne L. Winston - Microsoft Excel 2019: Data Analysis And Business Modeling, PHI, ISBN: 9789389347180
- Aryan Gupta-Data Analysis in Excel: The Best Guide. (https://www.simplilearn.com/tutorials/excel-tutorial/data-analysis-excel)

Project Management with Git			
Course Code	24AD37B	**CIE Marks**	50
Teaching Hours/Week (L: T: P)	0:0:2	**SEE Marks**	50
Credits	01	**Total Marks**	100
Contact Hours	28	**Exam Hours**	2
Examination nature (SEE)	Practical		

Prerequisites: NIL

Course Objectives:

- To become familiar with basic Git commands for version control.
- To create and manage branches for effective code organization.
- To understand how to collaborate and work with remote repositories.
- To master version control commands for efficient project management.

List of Experiments:

S. No Experiments

1. Setting up and using basic Git commands
    a. Create a new repository and configure it with essential settings.
    b. Track changes to files by adding them to the staging area and committing with descriptive messages.
2. Creating and Managing Branches

    Create a new branch named "feature-branch." Switch to the "master" branch. Merge the "feature-branch" into "master."
3. Merging and Conflict Resolution
4. Write the commands to merge a branch into the main branch and resolve any merge conflicts. Collaboration and Remote Repositories Clone a remote Git repository to your local machine.
5. Collaboration and Remote Repositories
    a. Fetch the latest changes from a remote repository and rebase your local branch onto the updated remote branch.
    b. Write the command to merge "feature-branch" into "master" while providing a custom commit message for the merge.
6. Pulling Changes

    Write the command to pull the latest changes from the remote "origin" repository.
7. Git Tags and Releases

    Write the command to create a lightweight Git tag named "v1.0" for a commit in your local

repository.

8. Advanced Git Operations

   Write the command to cherry-pick a range of commits from "source-branch" to the current branch.

9. Analysing and Changing Git History

   Given a commit ID, how would you use Git to view the details of that specific commit, including the author, date, and commit message?

10. Reviewing and Modifying Git Commit History

    Write the command to list all commits made by the author "Pressman" between "2024-01-01" and "2024-12-31."

11. Inspecting and Editing Git History

    Write the command to display the last five commits in the repository's history.

12. Exploring and Refining Git Commit Logs

Write the command to undo the changes introduced by the commit with the ID "xyz12345".

Course outcomes (Course Skill Set):

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

CO1: Use the basic commands related to git repository. (PO – 1,2,3,4,5,9,10,12, PSO – 1,2)

CO2: Create and manage the branches. (PO – 1,2,3,4,5,9,10,11,12, PSO – 1,2)

CO3: Apply commands related to collaboration and remote repositories. (PO – 1,2,3,4,5,9,10,11,12, PSO – 1,2)

CO4: Use the commands related to Git tags, releases and advanced git operations. (PO – 1,2,3,4,5,9,10,11,12, PSO – 1,2)

CO5: Analyse and change the git history. (PO – 1,2,3,4,5,9,10,11,12, PSO – 1,2)

Assessment Details (both CIE and SEE):

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation (CIE):

CIE marks for the practical course are 50 Marks.

- The split-up of CIE marks for record/ journal and test are in the ratio 60:40.

- Each experiment is to be evaluated for conduction with an observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments are designed by the faculty who is handling the laboratory session and are made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled down to 30 marks (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct a test of 100 marks after the completion of all the experiments listed in the
- syllabus.
- In a test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability.
- The marks scored shall be scaled down to 20 marks (40% of the maximum marks).
- The Sum of scaled-down marks scored in the report write-up/journal and marks of a test is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

- SEE marks for the practical course are 50 Marks.
- SEE shall be conducted by the two examiners. One from the same institute as an internal examiner and another from a different institute as an external examiner, appointed by the university.
- The examination schedule and names of examiners are informed to the university before the conduction of the examination. These practical examinations are to be conducted between the schedule mentioned in the academic calendar of the University.
- All laboratory experiments are to be included for practical examination.
- (Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. OR based on the course requirement evaluation rubrics shall be decided jointly by examiners.
- Students can pick one question (experiment) from the questions lot prepared by the examiners jointly.
- Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.
- General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)
- Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be made zero.

The minimum duration of SEE is 02 hours.
Suggested Learning Resources: • "Version Control with Git", 3rd Edition, by Prem Kumar Ponuthorai, Jon Loeliger Released October 2022, Publisher(s): O'Reilly Media, Inc. • "Pro Git book", written by Scott Chacon and Ben Straub and published by Apress, https://gitscm.com/book/en/v2 • https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01309444334736998 42782_shared /overview • https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01330134712177459 211926_share d/overview

Prompt Engineering			
Course Code	24AD37C	**CIE Marks**	50
Teaching Hours/Week (L: T: P)	0: 0: 2	**SEE Marks**	50
Credits	01	**Total Marks**	100
Contact Hours	28	**Exam Hours**	100
Examination nature (SEE)	Practical		

Prerequisite:
The students should have knowledge on
Knowledge on Basic Programming Skills (Python preferred)
Knowledge on Comfort with Using Chatbots or AI Tools
Knowledge on Internet Research Skills
Knowledge on Understanding of Ethics in AI Usage

Course objectives:
CLO 1: Understand the fundamentals and types of prompts used in generative AI models.
CLO 2: Explore the role of prompt engineering in shaping AI outputs and model behaviour.
CLO 3: Gain hands-on skills in designing, optimizing, and validating prompts for NLP and AI tasks.
CLO 4: Familiarize themselves with advanced prompting techniques such as Chain-of-Thought and React.
CLO 5: Apply prompt engineering responsibly by considering ethical implications and quality benchmarks.

Sl.NO	Experiment Description
1	**Design and compare different types of prompts** including zero-shot, one-shot, few-shot, and instructional prompts using a generative AI model.
2	**Evaluate and validate prompt quality** by testing multiple prompt variants for the same task and analysing output consistency and clarity.
3	**Develop prompts for common NLP tasks** such as sentiment analysis, summarization, translation, and text classification.
4	**Optimize a basic prompt** by refining it step-by-step using prompt tuning techniques to improve response accuracy and relevance.
5	**Test the same prompt across multiple generative AI models** (e.g., ChatGPT, Claude, Gemini) and analyse variations in output.
6	**Use the OpenAI Chat Completion API** to simulate a structured interaction using system, user, and assistant roles.
7	**Compare outputs from Instruct and ChatGPT** for the same prompts and identify Behavioral differences in response generation.

8	**Apply the CLEAR Framework** (Concise, Logical, Explicit, Adaptive, Reflective) to improve poorly performing prompts.
9	**Analyse the impact of small prompt changes** on output by modifying wording, tone, or context and documenting the effect.
10	**Implement Chain-of-Thought (CoT) prompting** for solving multi-step reasoning or problem-solving tasks.
11	**Use Tree-of-Thoughts or React prompting techniques** to model step-by-step decision-making in complex tasks.
12	**Explore Automatic Prompt Engineering (APE)** by using tools or code to automatically generate or refine effective prompts.

Course outcomes (Course Skill Set):

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

CO 1: Identify and classify different types of prompts and their use cases in AI systems. (PO -1,2,3,5,11 PSO -1,2)

CO 2: Develop and evaluate prompts for various NLP and generative AI applications. (PO -1,2,3,4,5,11 PSO -1,2)

CO 3: Use APIs and tools to implement prompt-based solutions and analyse output consistency. PO -1,2,3,4,5, PSO - 1,2)

CO 4: Apply frameworks and strategies to craft effective and adaptive prompts. (PO -1,2,3,5,7, 11 PSO -1,2)

CO 5: Demonstrate the ability to use advanced prompt techniques and ethical practices in AI. (PO -1,2,3,7,11 PSO - 1,2)

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation (CIE):

CIE marks for the practical course are 50 Marks.

- The split-up of CIE marks for record/ journal and test are in the ratio 60:40.
- Each experiment is to be evaluated for conduction with an observation sheet and record write-up.
- Rubrics for the evaluation of the journal/write-up for hardware/software experiments are designed by the faculty who is handling the laboratory session and are made known to students at the beginning of the practical session. Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled down to 30 marks (60% of maximum marks).

- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct 02 tests for 100 marks; the first test shall be conducted after the 8th week of the semester and the second test shall be conducted after the 14th week of the semester.
- In a test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability.
- The average of 02 tests is scaled down to **20 marks** (40% of the maximum marks).
- The Sum of scaled-down marks scored in the report write-up/journal and marks of a test is the total CIE marks scored by the student

Semester End Evaluation (SEE):

- SEE marks for the practical course are 50 Marks.
- All laboratory experiments are to be included for practical examination.
- (Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. OR based on the course requirement evaluation rubrics shall be decided jointly by examiners.
- Students can pick one question (experiment) from the questions lot prepared by the examiners jointly.
- Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.
- General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in
- 60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks.
- Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be made zero.

Suggested Learning Resources:

ChatGPT (OpenAI)	Generative AI model for prompt testing	https://chat.openai.com
OpenAI API Platform	Programmatic access to GPT models	https://platform.openai.c
Claude (Anthropic)	LLM for safe and interpretable prompts	https://claude.ai
Google Gemini (Bard)	AI chatbot by Google	https://gemini.google.co
Google Colab	Cloud-based Jupyter notebook	https://colab.research.goo e.com
PromptPerfect	Prompt optimization tool	https://promptperfect.jina
FlowGPT	Prompt sharing and community exploration	https://flowgpt.com
PromptBase	Marketplace of engineered prompts	https://promptbase.com

LangChain	Framework for LLM-based applications	https://www.langchain.com
LlamaIndex	Data framework for connecting LLMs	https://www.llamaindex.ai
PromptLayer	Logs, tracks, and evaluates prompt usage via API	https://www.promptlayer.com

Activity Based Learning (Suggested Activities in Class)/Practical Based Learning

Design and test effective AI prompts through hands-on tasks.
Analyse and refine outputs via iterative improvement.
Engage in collaborative AI problem-solving activities.

PHYSICAL EDUCATION (SPORTS & ATHLETICS) – I			
Semester: III			
Course Code	24PE38	**CIE Marks**	**100 Marks**
Teaching Hours/Week (L: T: P)	0:0:1		
Examination type (SEE)	24P		

Course Outcomes: At the end of the course, the student will be able to

1. Understand the fundamental concepts and skills of Physical Education, Health, Nutrition and Fitness
2. Familiarization of health-related Exercises, Sports for overall growth and development
3. Create a foundation for the professionals in Physical Education and Sports
4. Participate in the competition at regional/state / national / international levels.
5. Create consciousness among the students on Health, Fitness and Wellness in developing and maintaining a healthy lifestyle.
6. Understand and practice of Traditional Games

Module I : Orientation **4 Hours**

A. Lifestyle
B. Health & Wellness
C. Pre-Fitness test.

Module II: General Fitness & Components of Fitness **4 Hours**

A. Warming up (Free Hand exercises)
B. Strength – Push-up / Pull-ups
C. Speed – 30 Mtr Dash

Module III : Specific games (Any one to be selected by the student) **16 Hours**

1. Kabaddi – Hand touch, Toe Touch, Thigh Hold, Ankle hold and Bonus.
2. Kho-Kho – Giving Kho, Single Chain, Pole dive, Pole turning, 3-6 Up.

Scheme and Assessment for auditing the course and Grades

Sl. No.	Activity	Marks
1.	Participation of student in all the modules	20
2.	Quizzes – 2, each of 15 marks	30
3.	Final presentation / exhibition / Participation in competitions/ practical on specific tasks assigned to the students	50
	Total	**100**

YOGA			
Course Code	24YO38	**CIE Marks**	100
Teaching Hours/Week (L: T: P)	0:0:2	**SEE Marks**	0
Credits	0	**Total Marks**	100
Contact Hours	20-24	**Exam Hours**	
Examination type (SEE)	Practical		

The Health Benefits of Yoga

The benefits of various yoga techniques have been supposed to improve

- body flexibility,
- performance,
- stress reduction,
- attainment of inner peace, and
- self-realization.

The system has been advocated as a complementary treatment to aid the healing of several ailments such as

- coronary heart disease,
- depression,
- anxiety disorders,
- asthma, and
- extensive rehabilitation for disorders including musculoskeletal problems and traumatic brain injury.

The system has also been suggested as behavioral therapy for smoking cessation and substance abuse (including alcohol abuse).

If you practice yoga, you may receive these physical, mental, and spiritual benefits:

- Physical
  1. Improved body flexibility and balance
  2. Improved cardiovascular endurance (stronger heart)
  3. Improved digestion
  4. Improved abdominal strength
  5. Enhanced overall muscular strength
  6. Relaxation of muscular strains
  7. Weight control
  8. Increased energy levels
  9. Enhanced immune system
- Mental
  1. Relief of stress resulting from the control of emotions
  2. Prevention and relief from stress-related disorders
  3. Intellectual enhancement, leading to improved decision-making skills
- Spiritual
  1. Life with meaning, purpose, and direction
  2. Inner peace and tranquility
  3. Contentment

Module-1	**3 Hours**

Introduction of Yoga, Aim and Objectives of yoga, Prayer: Yoga, its meaning, definitions, Different schools of yoga, importance of prayer.

Module-2	**3 Hours**
Brief introduction of yogic practices for common man: Yogic practices for common man to promote positive health	
Module-3	**3 Hours**
Rules and regulations: Rules to be followed during yogic practices by practitioner Misconceptions of yoga: Yoga its misconceptions	
Module-4	**3 Hours**
Suryanamaskara: Suryanamaskar prayer and its meanitrg, Need, importance and benefits of Suryanamaskar 12 count, 2 rounds	
Module-5	**3 Hours**
Asanas: Asana, Need, importance of Asana. Different types of asanas. Asana its meaning by name, technique, precautionary measures and benefits of each asana. Different types of Asanas 1. Sitting a. Padmasana b. Vajrasana 2. Standing a. Vrikshana b. Trikonasana 3. Prone line a. Bhujangasana b. Shalabhasana 4. Supine line a. Utthitadvipadasana **b.** Ardhahalasana	

NATIONAL SERVICE SCHEME (NSS)			
Course Code	24NS38 / 48	**CIE Marks**	100
Teaching Hours/Week (L: T:P)	0:0:2	**SEE Marks**	-
Credits	NCMC – Non Credit Mandatory Course (Completion of the course shall be mandatory for the award of degree)	**Total Marks**	100
Contact Hours	28	**Exam Hours**	-
Examination type (SEE)	NA		

Course objectives: National Service Scheme (NSS) will enable the students to:

- Understand the community in general in which they work.
- Identify the needs and problems of the community and involve them in problem –solving.
- Develop among themselves a sense of social & civic responsibility & utilize their knowledge
- in finding practical solutions to individual and community problems.
- Develop competence required for group-living and sharing of responsibilities & gain skills
- in mobilizing community participation to acquire leadership qualities and democratic attitudes.
- 5. Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony in general.

General Instructions - Pedagogy :

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

- In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that
- the activities will develop students' theoretical and applied social and cultural skills.
- State the need for NSS activities and its present relevance in the society and Provide real-life examples.
- Support and guide the students for self-planned activities.
- You will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress in real activities in the field.
- Encourage the students for group work to improve their creative and analytical skills.

National Service Scheme (NSS) – Contents

1. Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing.
2. Waste management– Public, Private and Govt organization, 5 R's.
3. Setting of the information imparting club for women leading to contribution in social and economic issues.
4. Water conservation techniques – Role of different stakeholders– Implementation.
5. Preparing an actionable business proposal for enhancing the village income and approach for implementation.
6. Helping local schools to achieve good results and enhance their enrolment in Higher/technical/ vocational education.
7. Developing Sustainable Water management system for rural areas and implementation approaches.
8. Contribution to any national level initiative of Government of India. For eg. Digital India, Skill India, Swatch Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc.
9. Spreading public awareness under rural outreach programs.(minimum5 programs).
10. Social connect and responsibilities.
11. Plantation and adoption of plants. Know your plants.
12. Organize National integration and social harmony events /workshops /seminars. (Minimum 02 programs).
13. Govt. school Rejuvenation and helping them to achieve good infrastructure.

NOTE:

- Student/s in individual or in a group Should select any one activity in the beginning of each semester till end of that respective semester for successful completion as per the instructions of NSS officer with the consent of HOD of the department.

At the end of every semester, activity report should be submitted for evaluation.

Distribution of Activities - Semester wise from 3rd to 6th semester	
Sem	**Topics / Activities to be Covered**
3rd Sem for 25 Marks	1. Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing. 2. Waste management– Public, Private and Govt organization, 5 R's. 3. Setting of the information imparting club for women leading to contribution in social and economic issues.

4th Sem for 25 Marks	4. Water conservation techniques – Role of different stakeholders– Implementation. 5. Preparing an actionable business proposal for enhancing the village income and approach for implementation. 6. Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education.
5th Sem for 25 Marks	7. Developing Sustainable Water management system for rural areas and implementation approaches. 8. Contribution to any national level initiative of Government of India. Foreg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc. 9. Spreading public awareness under rural outreach programs.(minimum5 programs). 10. Social connect and responsibilities.
6th Sem for 25 Marks	11. Plantation and adoption of plants. Know your plants. 12. Organize National integration and social harmony events /workshops /seminars. (Minimum 02 programs). 13. Govt. school Rejuvenation and helping them to achieve good infrastructure.

Pedagogy – Guidelines, it may differ depending on local resources available for the study as well as environment and climatic differences, location and time of execution.

1. **Evaluation Of the Topic** Evaluation as per the rubrics Of scheme and syllabus by NSS officer
2. **Activity Report:** Report should be submitted by individual to the concerned evaluation authority
3. **Team Size:** May be individual or team

Sl No	Topic	Location	Activity execution
1.	Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing.	Farmers land/Villages/ roadside/ community area/ College campus etc…..	Site selection /proper consultation/Continuous monitoring/ Information board
2.	Waste management– Public, Private and Govt organization, 5 R's.	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/campus etc…..	Site selection /proper consultation/Continuous monitoring/ Information board
3.	Setting of the information imparting club for women leading to contribution in social and economic issues.	Women empowerment groups/ Consulting NGOs & Govt Teams / College campus etc…..	Group selection/proper consultation/Continuous monitoring/ Information board
4.	Water conservation techniques – Role of different stakeholders– Implementation.	Villages/ City Areas / Gram panchayat/ public associations/Government Schemes officers/campus etc…..	site selection / proper consultation/Continuous monitoring/ Information board
5.	Preparing an actionable business proposal for enhancing the village income and approach for implementation.	Villages/ City Areas / Gram panchayat/ public associations/Government Schemes officers/campus etc…..	Group selection/pro per consultation/Continuous monitoring/ Information board
6.	Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education.	Local government / private/ aided schools/Government Schemes officers/ etc…..	School selection/proper consultation/Continuous monitoring/ Information board

7.	Developing Sustainable Water management system for rural areas and implementation approaches.	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	site selection/proper consultation/Continuous monitoring/ Information board
8.	Contribution to any national level initiative of Government of India. For eg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc.	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	Group selection/pro per consultation/Continuous monitoring / Information board
9.	Spreading public awareness under rural outreach programs.(minimum5 programs). ///// Social connect and responsibilities.	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	Group selection/pro per consultation/Continuous monitoring / Information board
10.	Plantation and adoption of plants. Know your plants.	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/campus etc…..	Place selection/proper consultation/Continuous monitoring / Information board
11.	Organize National integration and social harmony events /workshops/seminars. (Minimum 02 programs).	Villages/ City Areas Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	Place selection/proper consultation/Continuous monitoring / Information board
12.	Govt. school Rejuvenation and helping them to achieve good infrastructure.	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	Place selection/proper consultation/Continuous monitoring / Information board

Analysis & Design of Algorithms			
Course Code	24AD41	**CIE Marks**	50
Teaching Hours/Week (L: T: P)	3:0:0	**SEE Marks**	50
Credits	03	**Total Marks**	100
Contact Hours	40	**Exam Hours**	3
Examination type (SEE)	Theory		

Prerequisites:

The students should have knowledge on

- Fundamental of Data Structures
- Understanding of Algorithms
- Basic Mathematics
- Problem-Solving Skills

Course Objectives:

- To learn the methods for analyzing algorithms and evaluating their performance.
- To demonstrate the efficiency of algorithms using asymptotic notations.
- To solve problems using various algorithm design methods, including brute force, greedy, divide and conquer, decrease and conquer, transform and conquer, dynamic programming, backtracking, and branch and bound.
- To learn the concepts of P and NP complexity classes.

Teaching-Learning Process (General Instructions)

Teaching-Learning Process (General Instructions)

These are sample strategies; which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) does not mean only the traditional lecture method, but different types of teaching methods may be adopted to achieve the outcomes.
2. Utilize video/animation films to illustrate the functioning of various concepts.
3. Promote collaborative learning (Group Learning) in the class.
4. Pose at least three HOT (Higher Order Thinking) questions in the class to stimulate critical thinking.
5. Incorporate Problem-Based Learning (PBL) to foster students' analytical skills and develop their ability to evaluate, generalize, and analyze information rather than merely recalling it.
6. Introduce topics through multiple representations.
7. Demonstrate various ways to solve the same problem and encourage students to devise their own creative solutions.
8. Discuss the real-world applications of every concept to enhance students' comprehension

Module-1	8 Hours
INTRODUCTION: What is an Algorithm?, Fundamentals of Algorithmic Problem Solving. **FUNDAMENTALS OF THE ANALYSIS OF ALGORITHM EFFICIENCY:** Analysis Framework, Asymptotic Notations and Basic Efficiency Classes, Mathematical Analysis of Non recursive Algorithms, Mathematical Analysis of Recursive Algorithms. **BRUTE FORCE APPROACHES:** Selection Sort and Bubble Sort, Sequential Search and Brute Force String Matching. **Chapter 1 (Sections 1.1,1.2), Chapter 2(Sections 2.1,2.2,2.3,2.4), Chapter 3(Section 3.1,3.2)**	
Module-2	**8 Hours**
BRUTE FORCE APPROACHES (contd..): Exhaustive Search (Travelling Salesman problem and Knapsack Problem). **DECREASE-AND-CONQUER:** Insertion Sort, Topological Sorting. **DIVIDE AND CONQUER:** Merge Sort, Quick Sort, Binary Tree Traversals, Multiplication of Large Integers and Strassen's Matrix Multiplication.	
Module-3	**8 Hours**
TRANSFORM-AND-CONQUER: Balanced Search Trees, Heaps and Heapsort. **Greedy Method:** General method, Coin Change Problem, Knapsack Problem, solving Job sequencing with deadlines Problems **SPACE-TIME TRADEOFFS:** Sorting by Counting: Comparison counting sort, Input Enhancement in String Matching: Horspool's Algorithm. **Chapter 6 (Sections 6.3,6.4), Chapter 7 (Sections 7.1,7.2)**	
Module-4	**8 Hours**
DYNAMIC PROGRAMMING: Three basic examples, The Knapsack Problem and Memory Functions, Warshall's and Floyd's Algorithms. **THE GREEDY METHOD:** Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm, Huffman Trees and Codes. **Chapter 8 (Sections 8.1,8.2,8.4), Chapter 9 (Sections 9.1,9.2,9.3,9.4)**	
Module-5	**8 Hours**
LIMITATIONS OF ALGORITHMIC POWER: Decision Trees, P, NP, and NP-Complete Problems. **COPING WITH LIMITATIONS OF ALGORITHMIC POWER**: Backtracking (n-Queens problem, Subset-sum problem), Branch-and-Bound (Knapsack problem), Approximation algorithms for NP-Hard problems (Knapsack problem). **Chapter 11 (Section 11.2, 11.3), Chapter 12 (Sections 12.1,12.2,12.3)**	
Course outcome (Course Skill Set) At the end of the course, the student will be able to: 1. Apply asymptotic notational method to analyze the performance of the algorithms in terms of time complexity.(PO 1,2,3,4 PSO-1) 2. Demonstrate divide & conquer approaches and decrease & conquer approaches to solve computational problems.(PO 1,2,3,4,5 PSO-1) 3. Make use of transform & conquer and dynamic programming design approaches to solve the	

given real world or complex computational problems. (PO 1,2,3,4,5 PSO-1)

4. Apply greedy and input enhancement methods to solve graph & string based computational problems. (PO 1,2,3,4,5 PSO-1)
5. Analyse various classes (P,NP and NP Complete) of problems Illustrate backtracking, branch & bound and approximation methods. (PO 1,2,3,4,5 PSO-1)

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by the University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.

Marks scored shall be proportionally **reduced to 50 marks**

Suggested Learning Resources:

Textbooks

1. Introduction to the Design and Analysis of Algorithms, By Anany Levitin, 3rd Edition (Indian), 2017, Pearson.

Reference books

1. Computer Algorithms/C++, Ellis Horowitz, Sartaj Sahni and Rajasekaran, 2nd Edition, 2014, Universities Press.

2. Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, 3rd Edition, PHI.

Design and Analysis of Algorithms, S. Sridhar, Oxford (Higher Education)

Web links and Video Lectures(e-Resources):

- https://www.youtube.com/watch?v=tSo9yzBUTHA
- https://www.youtube.com/watch?v=5_5oE5lgrhw
- https://www.youtube.com/watch?v=STL8ESuETmM
- https://www.youtube.com/watch?v=Y2A8RzxegSA
- https://www.youtube.com/watch?v=gBz44smaa9A
- https://www.youtube.com/watch?v=8TVaEGeaGGc
- https://www.youtube.com/watch?v=kPRA0W1kECg
- https://www.youtube.com/watch?v=v0eQ4nXJjsk
- https://www.youtube.com/watch?v=MtQL_ll5KhQ
- https://www.youtube.com/watch?v=jsmMtJpPnhU
- https://www.youtube.com/watch?v=tKwnms5iRBU
- https://www.youtube.com/watch?v=oBt53YbR9Kk
- https://www.youtube.com/watch?v=OQ5jsbhAv_M
- https://www.youtube.com/watch?v=Aa2sqUhIn-E
- https://www.youtube.com/watch?v=SZXXnB7vSm4
- https://www.youtube.com/watch?v=MHXR4PCY8c0
- https://www.youtube.com/watch?v=kJuKy5FqhrE
- https://www.youtube.com/watch?v=TtuNf6XMhiw
- Design and Analysis of Algorithms: https://nptel.ac.in/courses/106/101/106101060/

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Promote real-world problem-solving and competitive problem solving through group discussions to engage students actively in the learning process.

- Encourage students to enhance their problem-solving skills by implementing algorithms and solutions through programming exercises, fostering practical application of theoretical concepts.

Assessment Methods -

1. Problem Solving Assignments (Hacker Rank/ Hacker Earth / Leadcode)
    - Gate Based Aptitude Test

Database Management Systems			
Course Code	24AD42	**CIE Marks**	50
Teaching Hours/Week (L:T:P)	3:0:0	**SEE Marks**	50
Credits	03	**Total Marks**	100
Contact Hours	40	**Exam Hours**	3
Examination nature (SEE)	Theory		

Prerequisite:

The students should have knowledge on

- Discrete Mathematics

Course objectives:

- Describe the basic elements of a relational database management system
- Design entity relationship for the given scenario.
- Apply various Structured Query Language (SQL) statements for database manipulation.
- Analyse various normalization forms for the given application.
- Understand the concepts related to NoSQL databases.

Teaching-Learning Process (General Instructions)

Teachers can use following strategies to accelerate the attainment of the various course outcomes.

1. Chalk and Talk with Black Board
2. ICT based Teaching
3. Demonstration based Teaching

MODULE-1 **08 Hours**

Introduction to Databases: Introduction, Characteristics of database approach, Advantages of using the DBMS approach, History of database applications. Overview of Database Languages and Architectures: Data Models, Schemas, and Instances. Three schema architecture and data independence, and interfaces, The Database System environment. Conceptual Data Modelling using Entities and Relationships: Entity types, Entity sets and structural constraints, Weak entity types, ER diagrams, Specialization and Generalization.
Textbook 1:Ch 1.1 to 1.8, 2.1 to 2.6, 3.1 to 3.10

RBT: L1, L2, L3

MODULE-2 **08 Hours**

Relational Model: Relational Model Concepts, Relational Model Constraints and relational database schemas, Update operations, transactions, and dealing with constraint violations.
Relational Algebra: Unary and Binary relational operations, additional relational operations (aggregate, grouping, etc.) Examples of Queries in relational algebra.
Mapping Conceptual Design into a Logical Design: Relational Database Design using ER-to-Relational mapping.
Textbook 1: Ch 5.1 to 5.3, Ch 8.1 to 8.5; Ch 9.1 to 9.2 Textbook 2: 3.5

RBT: L1, L2, L3

MODULE-3	08 Hours
SQL: SQL data definition and data types, Schema change statements in SQL,SQL Languages (DML,DDL,TCL) specifying constraints in SQL, retrieval queries in SQL, INSERT, DELETE, and UPDATE statements in SQL, Additional features of SQL. SQL: Advanced Queries: More complex SQL retrieval queries, Specifying constraints as assertions and action triggers, Cursor , Stored Procedure, Views in SQL. // transferred from 4th to 3rd module **Textbook 1:** Ch 6.1 to 6.5 and Ch 7.1 to 7.3 **RBT:** L1, L2, L3	
MODULE-4	**08 Hours**
Normalization: Database Design Theory — Introduction to Normalization using Functional and Multivalued Dependencies: Informal design guidelines for relation schema, Functional Dependencies, Normal Forms based on Primary Keys, Second and Third Normal Forms, Boyce-Codd Normal Form, Multivalued Dependency and Fourth Normal Form, Join Dependencies and Fifth Normal Form. // transferred from 3rd to 4th module. Transaction Processing: Introduction to Transaction Processing, Transaction and System concepts, Desirable properties of Transactions, Characterizing schedules based on recoverability, Characterizing schedules based on Serializability, Concurrency Control in Databases: Two-phase locking techniques for Concurrency control. **Textbook 1:** Ch 14.1 to 14.7 and Ch 20.1 to 20.6 **RBT:** L1, L2, L3	
MODULE-5	**8 Hours**
MongoDB: Basics, Documents, Collections, Databases, Query Language, Installation, The Mongo Shell, MongoDB CRUD Operations, Create, Read, Projection, Update, Delete, Aggregate, MongoDB Node.js Driver, Schema Initialization, Reading from MongoDB, Writing to MongoDB. Querying **Textbook 3:** Chapter 6 - **Textbook 4 :** Chapter 4	

Course outcome (Course Skill Set):

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

1. Identify, analyze and define database objects, enforce integrity constraints on a database using RDBMS. (PO – 1,2,3,4,5 PSO – 1,2)
2. Use Structured Query Language (SQL) for database manipulation. (PO – 1,2,3,4,5 PSO – 1,2)
3. Design and build simple database systems. (PO – 1,2,3,4,5 PSO – 1,2)
4. Develop application to interact with databases. (PO – 1,2,3,4,5 PSO – 1,2)

Assessment Details (both CIE and SEE):

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- There are 25 marks for the CIE's Assignment component and 25 for the Internal Assessment Test component.
- Each test shall be conducted for 25 marks. The first test will be administered after 40-50% of the coverage of the syllabus, and the second test will be administered after 85-90% of the coverage of the syllabus. The average of the two tests shall be scaled down to 25 marks.
- Any two assignment methods mentioned in the regulations; if an assignment is project-based then only one assignment for the course shall be planned. The schedule for assignments shall be planned properly by the course teacher. The teacher should not conduct two assignments at the end of the semester if two assignments are planned. Each assignment shall be conducted for 25 marks. (If two assignments are conducted then the sum of the two assignments shall be scaled down to 25 marks)
- The final CIE marks of the course out of 50 will be the sum of the scale-down marks of tests and assignment/s marks.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by the University as per the scheduled timetable, with common question papers for the course (duration 03 hours).

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks.

Suggested Learning Resources:

TEXTBOOKS:

1. Fundamentals of Database Systems, Ramez Elmasri and Shamkant B. Navathe, 7th Edition, 2017, Pearson.
2. Database management systems, Ramakrishnan, and Gehrke, 3rd Edition, 2014, McGraw Hill.
3. Vasan Subramanian, Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node. Apress, 2019.

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning
Mini Project: Project Based Learning

REFERENCES:

1.Abraham Silberschatz, Henry F. Korth, S. Sudarshan, *Database System Concepts*, McGraw Hill, 7th Edition, 2020.
2.C.J. Date, *An Introduction to Database Systems*, Pearson Education, 8th Edition.
3.Amol Nayak, *MongoDB for Developers*, Packt Publishing.
4.Dr. P. S. Deshpande, *SQL and PL/SQL for Oracle 10g*, Dreamtech Press.

Web links and Video Lectures (e-Resources):

Sure! Here are the direct links:

- https://www.youtube.com/watch?v=GgznCfPjXOk
- https://www.youtube.com/watch?v=I1zbwBqgOQY
- https://www.youtube.com/watch?v=ryeGFOMZhK4
- https://www.youtube.com/watch?v=WK8MHedLFmk
- https://www.youtube.com/watch?v=IBEuwmYsMKI
- https://www.youtube.com/watch?v=rBmo2UAa8Lk
- https://www.youtube.com/watch?v=EjcAqAJjmEo

Activity Based Learning (Suggested Activities in Class)/ Practical Based Learning

- Case Study
- Assignments
- Mini Project

Principles of AI			
Course Code	24AD43	**CIE Marks**	50
Teaching Hours/Week (L: T:P: S)	3:0:0	**SEE Marks**	50
Credits	03	**Total Marks**	100
Contact Hours	40 hours	**Exam Hours**	3
Examination type (SEE)	Theory		

Prerequisites:

The students should have knowledge on

- Linear Algebra, probability and statistics
- Algorithms
- Discrete mathematics and Logic

Course Objectives:

- Gain a historical perspective of AI and its foundations.
- Become familiar with basic principles of AI toward problem solving
- Get to know approaches of inference, perception, knowledge representation, and learning

Teaching-Learning Process (General Instructions)

Teachers can use following strategies to accelerate the attainment of the various course outcomes.

1. Chalk and Talk with Black Board
2. ICT based Teaching
3. Demonstration based Teaching

Module-1 8 Hours

Introduction: What is AI? Foundations and History of AI Intelligent Agents: Agents and environment, Concept of Rationality, The nature of environment, The structure of agents.

Text Book1: Chapter 1- 1.1, 1.2, 1.3 Chapter 2- 2.1, 2.2, 2.3, 2.4

Module-2 8 Hours

Problem-solving: Problem-solving agents, Example problems, Searching for Solutions Uninformed Search Strategies: Breadth First search, Depth First Search, Iterative deepening depth first search

Text Book 1: Chapter 2: 2.3,2.4,2.5,2.6,2.7.2.8.1,2.8.

Module-3 8 Hours

Informed Search Strategies: Heuristic functions, Greedy best first search, A*search. Heuristic

Functions Logical Agents: Knowledge–based agents, The Wumpus world, Logic, Propositional logic, Reasoning patterns in Propositional Logic

Text Book 1: Chapter 3-3.5,3.6 Chapter 4 – 4.1, 4.2 Chapter 7- 7.1, 7.2, 7.3, 7.4, 7.5

Module-4 **8 Hours**

First Order Logic: Representation Revisited, Syntax and Semantics of First Order logic, Using First Order logic. **Inference in First Order Logic** :Propositional Versus First Order Inference, Unification, Forward Chaining, Backward Chaining, Resolution

Text Book 1: Chapter 8- 8.1, 8.2, 8.3 Chapter 9- 9.1, 9.2, 9.3, 9.4, 9.5

Module-5 **8 Hours**

Uncertain Knowledge and Reasoning: Quantifying Uncertainty: Acting under Uncertainty, Basic Probability Notation, Inference using Full Joint Distributions, Independence, Baye's Rule and its use. Wumpus World Revisited **Expert Systems:** Representing and using domain knowledge, ES shells. Explanation, knowledge acquisition

Text Book 1: Chapter 13-13.1, 13.2, 13.3, 13.4, 13.5, 13.6

Text Book 2: Chapter 20

Course outcomes (Course Skill Set):

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

CO1: Apply knowledge of agent architecture, searching and reasoning techniques for different applications. (PO-1,2,4 PSO-1,2)

CO2: Compare various Searching and Inferencing Techniques.(PO-2,4 PSO-1,2)

CO3: Develop knowledge base sentences using propositional logic and first order logic (PO-1,2,3,4 PSO-1,2)

CO4: Describe the concepts of quantifying uncertainty. (PO-1,2,4 PSO-1,2)

CO5: Use the concepts of Expert Systems to build applications. (PO-2,4,5,6,7,11 PSO-1,2)

Assessment Details (both CIE and SEE):

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- There are 25 marks for the CIE's Assignment component and 25 for the Internal Assessment Test component.
- Each test shall be conducted for 25 marks. The first test will be administered after 40-

50% of the coverage of the syllabus, and the second test will be administered after 85-90% of the coverage of the syllabus. The average of the two tests shall be scaled down to 25 marks.

- Any two assignment methods mentioned in the regulations; if an assignment is project-based then only one assignment for the course shall be planned. The schedule for assignments shall be planned properly by the course teacher. The teacher should not conduct two assignments at the end of the semester if two assignments are planned. Each assignment shall be conducted for 25 marks. (If two assignments are conducted then the sum of the two assignments shall be scaled down to 25 marks)
- The final CIE marks of the course out of 50 will be the sum of the scale-down marks of tests and assignment/s marks.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted as per the scheduled timetable, with common question papers for the course (duration 03 hours).

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks.

Text Book:

1. Stuart J. Russell and Peter Norvig , Artificial Intelligence, 3rd Edition, Pearson,2015
2. Elaine Rich, Kevin Knight, Artificial Intelligence, 3rd edition,Tata McGraw Hill,2013

Reference Books:

1. George F Lugar, Artificial Intelligence Structure and strategies for complex, Pearson Education, 5th Edition, 2011
2. Nils J. Nilsson, Principles of Artificial Intelligence, Elsevier, 1980
3. Saroj Kaushik, Artificial Intelligence, Cengage learning, 2014

Web links and Video Lectures(e-Resources):

1. https://www.kdnuggets.com/2019/11/10-free-must-read-books-ai.html
2. https://www.udacity.com/course/knowledge-based-ai-cognitive-systems--ud409
3. https://nptel.ac.in/courses/106/105/106105077/

Activity Based Learning - Practical-Based Learning

- Group discussion on Real world examples
- Project based learning
- Simple strategies on gaming, reasoning and uncertainty etc

Data Analytics with R			
Course Code	24AD44	**CIE Marks**	50
Teaching Hours/Week (L: T:P: S)	3:0:2	**SEE Marks**	50
Credits	04	**Total Marks**	100
Contact Hours	40hrs -T + 20hrs -P	**Exam Hours**	3
Examination type (SEE)	Theory		

Prerequisites:

The students should have knowledge on

- Basic concepts of statistics
- Programming concepts like loops, conditionals, functions
- Tables or csv files

Course Objectives:

- To Gain the knowledge of R Programming Concepts
- To Explain the concepts of Data Visualization
- To Explain the concept of Statistics in R.
- To Work with R charts and Graphs

Teaching-Learning Process (General Instructions)

Teachers can use following strategies to accelerate the attainment of the various course outcomes.

1. Chalk and Talk with Black Board
2. ICT based Teaching
3. Demonstration based Teaching

Module-1	**5 Hours**

Basics of R

Introducing R, Initiating R, Packages in R, Environments and Functions, Flow Controls, Loops, Basic Data Types in R, Vectors

Text Book1: Chapter 1: 1.1 to 1.7 Chapter 2: 2.1,2.2

Module-2	**5 Hours**

Basics of R Continued

Matrices and Arrays, Lists, Data Frames, Factors, Strings, Dates and Times

Text Book 1: Chapter 2: 2.3,2.4,2.5,2.6,2.7.2.8.1,2.8.

Module-3	**6 Hours**

Data Preparation Datasets, Importing and Transformation Exporting files, Accessing Databases, Data Cleaning

Text Book 1: Chapter 3: 3.1,3.2,3.3,3.4

Module-4	**6 Hours**

Graphics using R

Exploratory Data Analysis, Main Graphical Packages, Pie Charts, Scatter Plots, Line Plots, Histograms, Box Plots, Bar Plots, Other Graphical packages

Text Book 1: Chapter 4: 4.1 to 4.9

Module-5	**6 Hours**

Statistical Analysis using R

Basic Statistical Measures, Normal distribution, Binomial distribution, Correlation Analysis, Regression Analysis-Linear Regression Analysis of Variance

Text Book 1: Chapter 5: 5.1, 5.3, 5.4, 5.5, 5.6.1, 5.7

Course outcomes (Course Skill Set):

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

CO1: Describe the structures of R Programming. (PO-5 PSO-1,2)

CO2: Illustrate the basics of Data Preparation with real world examples. (PO-2,3,5 PSO-1,2)

CO3: Apply the Graphical Packages of R for visualization. (PO-1,2,3,4,5 PSO-1,2)

CO4: Apply various Statistical Analysis methods for data analytics. (PO-1,2,3,4,5 PSO-1,2)

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

CIE for the theory component of the IPCC (maximum marks 50)

- IPCC means practical portion integrated with the theory of the course.
- CIE marks for the theory component are 25 marks and that for the practical component is 25 marks.
- 25 marks for the theory component are split into 15 marks for two Internal Assessment Tests (Two Tests, each of 15 Marks with 01-hour duration, are to be conducted) and 10 marks for other assessment methods mentioned in 22OB4.2. The first test at the end of 40-50% coverage of the syllabus and the second test after covering 85-90% of the syllabus.
- Scaled-down marks of the sum of two tests and other assessment methods will be CIE marks for the theory component of IPCC (that is for 25 marks).
- The student has to secure 40% of 25 marks to qualify in the CIE of the theory component of IPCC.

CIE for the practical component of the IPCC

- 15 marks for the conduction of the experiment and preparation of laboratory record, and

10 marks for the test to be conducted after the completion of all the laboratory sessions.

- On completion of every experiment/program in the laboratory, the students shall be evaluated including viva-voce and marks shall be awarded on the same day.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to 15 marks.
- The laboratory test (duration 02/03 hours) after completion of all the experiments shall be conducted for 50 marks and scaled down to 10 marks.
- Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for 25 marks.
- The student has to secure 40% of 25 marks to qualify in the CIE of the practical component of the IPCC.

SEE for IPCC

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (duration 03 hours)

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored by the student shall be proportionally scaled down to 50 Marks

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper may include questions from the practical component.

Text Book:

1. R Programming: An Approach to Data Analytics, G. Sudhamathy and C. Jothi Venkateswaran, MJP Publishers, 2019

Reference Books:

1. An Introduction to R, Notes on R: A Programming Environment for Data Analysis and Graphics. W. N. Venables, D.M. Smith and the R Development Core Team. Version 3.0.1 (2013-05-16)
2. Cotton, R. (2013). Learning R: A Step by Step Function Guide to Data Analysis. 1st ed. O'Reilly Media Inc

- **Web links and Video Lectures(e-Resources):**
- https://cran.r-project.org/doc/manuals/r-release/R-intro.pdf
- http://www.tutorialspoint.com/r/r_tutorial.pdf
- https://users.phhp.ufl.edu/rlp176/Courses/PHC6089/R_notes/intro.html
- https://cran.r-project.org/web/packages/explore/vignettes/explore_mtcars.html
- https://www.w3schools.com/r/r_stat_data_set.asp
- https://rpubs.com/BillB/217355

Activity Based Learning - Practical-Based Learning Programming Assignment (10 Marks)	
Practical Component	
Sl.NO	**Experiments**
1	Demonstrate the steps for installation of R and R Studio. Perform the following: Assign different type of values to variables and display the type of variable. Assign different types such as Double, Integer, Logical, Complex and Character and understand the difference between each data type. a) Demonstrate Arithmetic and Logical Operations with simple examples. b) Demonstrate generation of sequences and creation of vectors. c) Demonstrate Creation of Matrices d) Demonstrate the Creation of Matrices from Vectors using Binding Function. e) Demonstrate element extraction from vectors, matrices and arrays
2	Assess the Financial Statement of an Organization being supplied with 2 vectors of data: Monthly Revenue and Monthly Expenses for the Financial Year. You can create your own sample data vector for this experiment) Calculate the following financial metrics: a) Profit for each month. b) Profit after tax for each month (Tax Rate is 30%). c) Profit margin for each month equals to profit after tax divided by revenue. d) Good Months – where the profit after tax was greater than the mean for the year. e) Bad Months – where the profit after tax was less than the mean for the year. f) The best month – where the profit after tax was max for the year. g) The worst month – where the profit after tax was min for the year. **Note:** a) All Results need to be presented as vectors b) Results for Dollar values need to be calculated with $0.01 precision, but need to be presented in Units of $1000 (i.e 1k) with no decimal points c) Results for the profit margin ratio need to be presented in units of % with no decimal point. d) It is okay for tax to be negative for any given month (deferred tax asset) e) Generate CSV file for the data.
3	Develop a program to create two 3 X 3 matrices A and B and perform the following operations a) Transpose of the matrix b) addition c) subtraction d) multiplication
4	Develop a program to find the factorial of given number using recursive function calls.
5	Develop an R Program using functions to find all the prime numbers up to a specified number by the method of Sieve of Eratosthenes.
6	The built-in data set mammals contain data on body weight versus brain weight. Develop R commands to:

<table>
<tr><td></td><td>a) Find the Pearson and Spearman correlation coefficients. Are they similar?
b) Plot the data using the plot command.
c) Plot the logarithm (log) of each variable and see if that makes a difference.</td></tr>
<tr><td>7</td><td>Develop R program to create a Data Frame with following details and do the following operations
<table>
<tr><th>itemCode</th><th>itemCategory</th><th>itemPrice</th></tr>
<tr><td>1001</td><td>Electronics</td><td>700</td></tr>
<tr><td>1002</td><td>Desktop Supplies</td><td>300</td></tr>
<tr><td>1003</td><td>Office Supplies</td><td>350</td></tr>
<tr><td>1004</td><td>USB</td><td>400</td></tr>
<tr><td>1005</td><td>CD Drive</td><td>800</td></tr>
</table>
a) Subset the Data frame and display the details of only those items whose price is greater than or equal to 350.
b) Subset the Data frame and display only the items where the category is either “Office Supplies” or “Desktop Supplies”
c) Create another Data Frame called “item-details” with three different fields itemCode, ItemQtyonHand and ItemReorderLvl and merge the two frames</td></tr>
<tr><td>8</td><td>Let us use the built-in dataset air quality which has Daily air quality measurements in New York, May to September 1973. Develop R program to generate histogram by using appropriate arguments for the following statements.
a) Assigning names, using the air quality data set.
b) Change colors of the Histogram
c) Remove Axis and Add labels to Histogram
d) Change Axis limits of a Histogram
e) Add Density curve to the histogram</td></tr>
<tr><td>9</td><td>Design a data frame in R for storing about 20 employee details. Create a CSV file named “input.csv” that defines all the required information about the employee such as id, name, salary, start_date, dept. Import into R and do the following analysis.
a) Find the total number rows & columns
b) Find the maximum salary
c) Retrieve the details of the employee with maximum salary
d) Retrieve all the employees working in the IT Department.
e) Retrieve the employees in the IT Department whose salary is greater than 20000 and write these details into another file “output.csv”</td></tr>
<tr><td>10</td><td>Using the built in dataset mtcars which is a popular dataset consisting of the design and fuel consumption patterns of 32 different automobiles. The data was extracted from the 1974 Motor Trend US magazine, and comprises fuel consumption and 10 aspects of automobile design and performance for 32 automobiles (1973-74 models). Format A data frame with 32 observations on 11 variables : [1] mpg</td></tr>
</table>

	Miles/(US) gallon, [2] cyl Number of cylinders [3] disp Displacement (cu.in.), [4] hp Gross horsepower [5] drat Rear axle ratio,[6] wt Weight (lb/1000) [7] qsec 1/4 mile time, [8] vs V/S, [9] am Transmission (0 = automatic, 1 = manual), [10] gear Number of forward gears, [11] carb Number of carburetors Develop R program, to solve the following: a) What is the total number of observations and variables in the dataset? b) Find the car with the largest hp and the least hp using suitable functions c) Plot histogram / density for each variable and determine whether continuous variables are normally distributed or not. If not, what is their skewness? d) What is the average difference of gross horse power(hp) between automobiles with 3 and 4 number of cylinders(cyl)? Also determine the difference in their standard deviations. e) Which pair of variables has the highest Pearson correlation?
11	Demonstrate the progression of salary with years of experience using a suitable data set (You can create your own dataset). Plot the graph visualizing the best fit line on the plot of the given data points. Plot a curve of Actual Values vs. Predicted values to show their correlation and performance of the model. Interpret the meaning of the slope and y-intercept of the line with respect to the given data. Implement using lm function. Save the graphs and coefficients in files. Attach the predicted values of salaries as a new column to the original data set and save the data as a new CSV file.

Analysis & Design of Algorithms Lab			
Course Code	24ADL45	**CIE Marks**	50
Teaching Hours/Week (L: T: P)	0:0:2	**SEE Marks**	50
Credits	01	**Total Marks**	100
Contact Hours	28	**Exam Hours**	3
Examination type (SEE)	Practical		

Prerequisites:

The students should have knowledge on

- Fundamental of Data Structures and Programming Language
- Understanding of Algorithms
- Basic Mathematics
- Problem-Solving Skills

Course Objectives:

- To design and implement various algorithms in C/C++ programming using suitable development tools to address different computational challenges.
- To apply diverse design strategies for effective problem-solving.
- To Measure and compare the performance of different algorithms to determine their efficiency and suitability for specific tasks.

Sl.No	Experiments
1	Design and implement C/C++ Program to find Minimum Cost Spanning Tree of a given connected undirected graph using Kruskal's algorithm.
2	Design and implement C/C++ Program to find Minimum Cost Spanning Tree of a given connected undirected graph using Prim's algorithm.
3	a. Design and implement C/C++ Program to solve All-Pairs Shortest Paths problem using Floyd's algorithm. b. Design and implement C/C++ Program to find the transitive closure using Warshal's algorithm.
4	Design and implement C/C++ Program to find shortest paths from a given vertex in a weighted connected graph to other vertices using Dijkstra's algorithm.
5	Design and implement C/C++ Program to obtain the Topological ordering of vertices in a given digraph.
6	Design and implement C/C++ Program to solve 0/1 Knapsack problem using Dynamic Programming method.
7	Design and implement C/C++ Program to solve discrete Knapsack and continuous Knapsack problems using greedy approximation method.

8	Design and implement C/C++ Program to find a subset of a given set S = {sl , s2,.....,sn} of n positive integers whose sum is equal to a given positive integer d.
9	Design and implement C/C++ Program to sort a given set of n integer elements using Selection Sort method and compute its time complexity. Run the program for varied values of n> 5000 and record the time taken to sort. Plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.
10	Design and implement C/C++ Program to sort a given set of n integer elements using Quick Sort method and compute its time complexity. Run the program for varied values of n> 5000 and record the time taken to sort. Plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.
11	Design and implement C/C++ Program to sort a given set of n integer elements using Merge Sort method and compute its time complexity. Run the program for varied values of n> 5000, and record the time taken to sort. Plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.
12	Design and implement C/C++ Program for N Queen's problem using Backtracking.

Course outcomes (Course Skill Set):

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

- **CO1:** Develop programs to solve computational problems using suitable algorithm design strategy. (PO 1,2,3,4,5 PSO-1)
- **CO2:** Compare algorithm design strategies by developing equivalent programs and observing running times for analysis (Empirical). (PO 1,2,3,4,5 PSO-1)
- **CO3:** Make use of suitable integrated development tools to develop programs (PO 1,2,3,4,5 PSO-1)
- **CO4:** Choose appropriate algorithm design techniques to develop solution to the computational and complex problems. (PO 1,2,3,4,5 PSO-1)
- **CO5:** Demonstrate and present the development of program, its execution and running time(s) and record the results/inferences. (PO 1,2,3,4,5 PSO-1)

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation (CIE):

CIE marks for the practical course are **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment is to be evaluated for conduction with an observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments are designed by the faculty who is handling the laboratory session and are made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each

experiment write-up will be evaluated for 10 marks.

- Total marks scored by the students are scaled down to **30 marks** (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct a test of 100 marks after the completion of all the experiments listed in the syllabus.
- In a test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability.
- The marks scored shall be scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and marks of a test is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

- SEE marks for the practical course are 50 Marks.
- SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the Head of the Institute.
- The examination schedule and names of examiners are informed to the university before the conduction of the examination. These practical examinations are to be conducted between the schedule mentioned in the academic calendar of the University.
- All laboratory experiments are to be included for practical examination.
- (Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.
- Students can pick one question (experiment) from the questions lot prepared by the examiners jointly.
- Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.
- General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)
- Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be made zero.

The minimum duration of SEE is 02 hours

ALGORITHMIC GAME THEORY			
Course Code	24AD46A	**CIE Marks**	50
Teaching Hours/Week (L: T: P)	2:2:0	**SEE Marks**	50
Credits	03	**Total Marks**	100
Contact Hours	40	**Exam Hours**	3
Examination type (SEE)	Theory		

Prerequisites:

The students should have knowledge on
- Basic Programming Skills
- Understanding of Algorithms
- Basic Mathematics
- Problem-Solving Skills

Course Objectives:

- Comprehend the basics of strategic gaming and mixed strategic equilibrium.
- Enable students to develop skills on extensive gaming strategies.
- Analyze and discuss various gaming models.
- Illustrate some real-time situations

Teaching-Learning Process (General Instructions)

These are sample Strategies, teachers can use to accelerate the attainment of the various course outcomes.

1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the delivered lessons shall develop students' theoretical and applied Mathematical skills.
2. State the need for Mathematics with Engineering Studies and Provide real-life examples.
3. Support and guide the students for self–study.
4. You will assign homework, grading assignments and quizzes, and documenting students' progress.
5. Encourage the students to group learning to improve their creative and analytical skills.
6. Show short related video lectures in the following ways:
   - As an introduction to new topics (pre-lecture activity).
   - As a revision of topics (post-lecture activity).
   - As additional examples (post-lecture activity).
   - As an additional material of challenging topics (pre-and post-lecture activity).
   - As a model solution for some exercises (post-lecture activity).

Module-1 **8 Hours**

Introduction to Strategic Games: What is game theory? The theory of rational choice, Strategic games; Examples: The prisoner's dilemma, Bach or Stravinsky, Matching pennies; Nash equilibrium; Examples of Nash equilibrium; Best response functions; Dominated actions.

Text Book 1

Module-2	8 Hours
Introduction; Strategic games in which players may randomize; Mixed strategy Nash equilibrium; Dominated actions; Pure equilibrium when randomization is allowed. Illustration: Expert Diagnosis; Equilibrium in a single population. **Text Book 1**	
Module-3	**8 Hours**
Extensive games with perfect information; Strategies and outcomes; Nash equilibrium; Sub-game perfect equilibrium; Finding sub-game perfect equilibria of finite horizon games: Backward induction; Illustrations: The ultimatum game, Stackelberg's model of duopoly. **Text Book 1**	
Module-4	**8 Hours**
Bayesian Games**,** Motivational examples; General definitions; Two examples concerning information; Illustrations: Cournot's duopoly game with imperfect information, Providing a public good; Auctions: Auctions with an arbitrary distribution of valuations. **Text Book 1**	
Module-5	**8 Hours**
Competative Games: Strictly competitive games and maximization. **Repeated games:** The main idea; Preferences; Repeated games; Finitely and infinitely repeated Prisoner's dilemma; Strategies in an infinitely repeated Prisoner's dilemma; Nash equilibrium of an infinitely repeated Prisoner's dilemma, Nash equilibrium payoffs of an infinitely repeated Prisoner's dilemma. **Text Book 1**	

Course outcomes (Course Skill Set):

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

CO1: Interpret the basics of strategic gaming and extensive games. (PO-2 PSO-1)
CO2: Analyze gaming strategies on real-time incidence. (PO-2,4 PSO-1)
CO3: Develop the models of gaming on real-time incidence. (PO-1,2,3,4,5,7 PSO-1,2)
CO4: Apply game theory in the real-world problems. (PO-1,2,3,4,5,7,11 PSO-1,2)

Assessment Details (both CIE and SEE):

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- There are 25 marks for the CIE's Assignment component and 25 for the Internal Assessment Test component.
- Each test shall be conducted for 25 marks. The first test will be administered after 40-50% of the coverage of the syllabus, and the second test will be administered after 85-90% of the coverage of the syllabus. The average of the two tests shall be scaled down to 25 marks.
- Any two assignment methods mentioned in the regulations; if an assignment is project-based then only one assignment for the course shall be planned. The schedule for assignments shall be planned properly by the course teacher. The teacher should not conduct two assignments at the end of the semester if two assignments are planned. Each assignment shall be conducted for 25 marks. (If two assignments are conducted then the sum of the two assignments shall be scaled down to 25 marks)
- The final CIE marks of the course out of 50 will be the sum of the scale-down marks of tests and assignment/s marks.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by the University as per the scheduled timetable, with common question papers for the course (duration 03 hours).

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks.

Suggested Learning Resources:

Textbook:

1. **Martin Osborne: "An Introduction to Game Theory",** Oxford University Press, First Indian Edition, 2009, 7th impression, ISBN – 0195128958.

Reference Books:

1. **Roger B. Myerson: "Analysis of Conflict Game Theory",** Re-print Edition, Harvard University Press, 2008, ISBN – 978-0674341166.
2. **Frederick S. Hillier and Gerald J. Lieberman: "Introduction to Operations Research, Concepts and Cases",** 9th Edition; Tata McGraw Hill, 2010, ISBN – 0073376299.
3. **Joel Watson: "An Introduction to Game Theory"** Strategy, 2nd Edition, W.W. Norton &Company, 2007, ISBN – 9780393929348.

Web links and Video Lectures(e-Resources):

- http://nptel.ac.in/courses.php?disciplineID=111
- http://www.class-central.com/subject/math(MOOCs)
- http://academicearth.org/

Activity Based Learning (Suggested Activities in Class)/Practical Based Learning

- Role Play
- Flipped classroom
- Assessment Methods for 25 Marks (opt two Learning Activities)
  - Case Study
  - Programming Assignment
  - Gate Based Aptitude Test
  - MOOC Assignment for selected Module

DISCRETE MATHEMATICS			
Course Code	24AD46B	CIE Marks	50
Teaching Hours/Week(L:T:P:S)	2:2:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Examination type(SEE)	Theory		

Prerequisites:

Basic mathematical skills

Fundamental understanding of functions and relations

Analytical thinking and problem-solving abilities

Course objectives:

To help students to understand discrete and continuous mathematical structures.

To impart basics of relations and functions.

To facilitate students in applying principles of Recurrence Relations to find the generating functions and solve the Recurrence relations.

To have the knowledge of groups and their properties to understand the importance of algebraic properties relative to various number systems.

Teaching Learning Process Pedagogy (General Instructions):

These are sample strategies teachers can use to accelerate the attainment of the various course outcomes.

In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the delivered lessons shall develop students' theoretical and applied Mathematical skills.

State the need for Mathematics with Engineering Studies and provide real-life examples.

Support and guide the students for self–study.

You will assign homework, grade assignments and quizzes, and document students' progress.

Encourage the students to group learning to improve their creative and analytical skills.

Show short related video lectures in the following ways:

- As an introduction to new topics (pre-lecture activity).
- As a revision of topics (post-lecture activity).
- As additional examples (post-lecture activity).
- As additional material of challenging topics (pre- and post-lecture activity).
- As a model solution for some exercises (post-lecture activity).

Module-1:Fundamentals of Logic (8hours)

Basic Connectives and Truth Tables, Logic Equivalence– The Laws of Logic, Logical Implication–Rules of Inference. The Use of Quantifiers, Quantifiers, Definitions and the Proofs of Theorems.

(RBT Levels:L1,L2andL3)

Module-2:Properties of the Integers (8Hours)

Mathematical Induction, The Well Ordering Principle– Mathematical Induction, Recursive Definitions. Fundamental Principles of Counting: The Rules of Sum and Product, Permutations, Combinations–The Binomial Theorem, Combinations with Repetition.

(RBT Levels:L1,L2andL3)

Module-3:Relationsand Functions (8hours)

Cartesian Products and Relations, Functions –Plain and One-to-One, Onto Functions. The Pigeon-hole Principle, Function Composition and Inverse Functions.
Properties of Relations, Computer Recognition–Zero-One Matrices and Directed Graphs, Partial Orders – Hassel Diagrams, Equivalence Relations and Partitions

(RBT Levels:L1,L2andL3)

Module-4:The Principle of Inclusion and Exclusion (8Hours)

The Principle of Inclusion and Exclusion, Generalizations of the Principle, Derangements – Nothing is in its Right Place, Rook Polynomials.
Recurrence Relations: First Order Linear Recurrence Relation, The Second Order Linear Homogeneous Recurrence Relation with Constant Coefficients**.**

(RBT Levels:L1,L2andL3)

Module-5:Introduction to Groups Theory (8Hours)

Definitions and Examples of Particular Groups Klein 4-group, Additive group of Integers modulo n, Multiplicative group of Integers modulo-p and permutation groups, Properties of groups, Sub groups, cyclic groups, Cosets, Lagrange's Theorem

(RBT Levels:L1,L2andL3)

Course outcome (Course Skill Set)

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

CO1. Apply concepts of logical reasoning and mathematical proof techniques in proving theorems and statements. (PO-1,2 PSO-1)
CO2. Demonstrate the application of discrete structures in different fields of computer science. (PO-1,2,4 PSO-1)
CO3. Apply the basic concepts of relations, functions, and partially ordered sets for computer representations. (PO-1,2,4 PSO-1)
CO4. Solve problems involving recurrence relations and generating functions. (PO-1,2,3,4 PSO-1)
CO5. Illustrate the fundamental principles of Algebraic structures with problems related to computer science & engineering. (PO-1,2,4 PSO-1)

Assessment Details (both CIE and SEE)

The weight age of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE, the minimum passing mark is 35% of the maximum marks (18 out of 50 marks). The student is declared as a pass in the course if he/she secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE(Continuous Internal Evaluation)and SEE(Semester End Examination)Taken together.

Continuous Internal Evaluation:

- There are 25 marks for the CIE's Assignment component and 25 for the Internal Assessment Test component.
- Each test shall be conducted for 25 marks. The first test will be administered after 40-50% of the coverage of the syllabus, and the second test will be administered after 85-90% of the coverage of the syllabus. The average of the two tests shall be scaled down to 25 marks.
- Any two assignment methods mentioned in the 22OB2.4. If an assignment is project-based, then only one assignment for the course shall be planned. The schedule for assignments shall be planned properly by the course teacher. The teacher should not conduct two assignments at the end of the semester if two assignments are planned. Each assignment shall be conducted for 25 marks. (If two assignments are conducted then the sum of the two assignments shall be scaled down to 25 marks.)
- The final CIE marks of the course out of 50 will be the sum of the scaled-down marks of tests and assignment/s marks.

Semester-End Examination:

Theory SEE will be conducted by the University as per the scheduled timetable, with common question papers for the course (duration 03 hours).

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions) should have a mix of topics under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books (Name of the author / Title of the Book / Name of the publisher / Edition and Year)

Text Books:

1. Ralph P. Grimaldi, B.V. Ramana: Discrete Mathematical Structures – An Applied Introduction, 5th Edition, Pearson Education, 2004.
2. Ralph P. Grimaldi: Discrete and Combinatorial Mathematics, 5th Edition, Pearson Education, 2004.

Reference Books:

1. Basavaraj S. Anami and Venakanna S. Madalli: Discrete Mathematics – A Concept-based Approach, Universities Press, 2016.
2. Kenneth H. Rosen: Discrete Mathematics and its Applications, 6th Edition, McGraw Hill, 2007.
3. Jayant Ganguly: A Treatise on Discrete Mathematical Structures, Sanguine-Pearson, 2010.
4. D. S. Malik and M. K. Sen: Discrete Mathematical Structures – Theory and Applications, Latest Edition, Thomson, 2004.
5. Thomas Koshy: Discrete Mathematics with Applications, Elsevier, 2005, Reprint 2008.

http://nptel.ac.in/courses.php?disciplineID=111
http://www.class-central.com/subject/math(MOOCs)
http://academicearth.org/
http://www.themathpage.com/
http://www.abstractmath.org/
http://www.ocw.mit.edu/courses/mathematics/

Graph Theory			
Course Code	24AD46C	**CIE Marks**	50
Teaching Hours/Week (L: T: P)	2:2:0	**SEE Marks**	50
Credits	03	**Total Marks**	100
Contact Hours	40	**Exam Hours**	3
Examination type (SEE)	Theory		

Prerequisites:

The students should have knowledge on

- Basic Algebra
- Discrete Mathematics
- Proof Techniques
- Linear Algebra

Course Objectives:

- Appreciate the definition and basics of graphs along with types and their examples. Understand the notion of planarity and coloring of a graph.
- Understand the definition of a tree and learn its applications to fundamental circuits. Know the applications of graph theory to network flows.
- To give the learner a broad exposure of combinatorial Mathematics through applications especially the Computer Science application.

Teaching-Learning Process (General Instructions)

Teachers can use following strategies to accelerate the attainment of the various course outcomes.

1. Chalk and Talk with Black Board
2. ICT based Teaching
3. Demonstration based Teaching

Module-1 **8 Hours**

Introduction to Graph Theory: Definition and properties of a graph, subgraph, and Examples, Complements, and Graph Isomorphism, Vertex Degree, Euler Trails and Circuits, Planar Graphs, Hamilton Paths and Cycles, Graph Colouring, and Chromatic Polynomials. Directed graphs and their properties.

Module-2 **8 Hours**

Trees: Definitions, Properties, and Examples, Routed Trees, Trees and Sorting, Weighted Trees and Prefix Codes.

Optimization and Matching: Dijkstra‟s Shortest Path Algorithm, Minimal Spanning Trees – The algorithms of Kruskal and Prim, Transport Networks – Max-flow, Min-cut Theorem. Matching Theory.

Module-3	8 Hours
Fundamental Principles of Counting: The Rules of Sum and Product, Permutations, Combinations – The Binomial Theorem, Combinations with Repetition, The Catalon Numbers **The Principle of Inclusion and Exclusion:** The Principle of Inclusion and Exclusion, Generalizations of the Principle	
Module-4	**8 Hours**
Generating Functions: Introductory Examples, Definition and Examples – Calculational Techniques, Partitions of Integers, the Exponential Generating Function. The Summation Operator.	
Module-5	**8 Hours**
Recurrence Relations: First Order Linear Recurrence Relation, The Second Order Linear Homogeneous Recurrence Relation with Constant Coefficients, The Non-homogeneous Recurrence Relation. The Method of Generating Functions.	

Course outcomes (Course Skill Set):

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

CO1: Know the history and development of graph theory and apply the fundamental results of graph theory. (PO-1,2,11)

CO 2: Apply various proof techniques in proving theorems in graph theory. (PO-1,2,3 PSO-1)

CO 3: Write algorithms to solve problems in graph theory. (PO-1,2,3,4 PSO-1)

CO 4: The learner able to apply combinatorial Mathematics to the applications in the Computer Science field. (PO-1,2,3,4 PSO-1)

Assessment Details (both CIE and SEE):

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- There are 25 marks for the CIE's Assignment component and 25 for the Internal Assessment Test component.
- Each test shall be conducted for 25 marks. The first test will be administered after 40-50% of the coverage of the syllabus, and the second test will be administered after 85-90% of the coverage of the syllabus. The average of the two tests shall be scaled down to 25 marks.
- Any two assignment methods mentioned in the regulations; if an assignment is project-based then only one assignment for the course shall be planned. The schedule for assignments shall be planned properly by the course teacher. The teacher should not conduct two

assignments at the end of the semester if two assignments are planned. Each assignment shall be conducted for 25 marks. (If two assignments are conducted then the sum of the two assignments shall be scaled down to 25 marks)

- The final CIE marks of the course out of 50 will be the sum of the scale-down marks of tests and assignment/s marks.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by the University as per the scheduled timetable, with common question papers for the course (duration 03 hours).

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks.

Textbooks

1. Ralph P. Grimaldi: Discrete and Combinatorial Mathematics, 5 th Edition, Pearson Education, 2004.
2. Narasingh Deo: Graph Theory with Applications to Engineering and Computer Science. 2016.

Reference Books

1. Kenneth H Rosen: Discrete Mathematics & its Applications with Combinatorics and Graph Theory. 6th Edition, 2009.
2. D.S. Chandrasekharaiah: Graph Theory and Combinatorics, Prism, 2005
3. Chartrand Zhang: Introduction to Graph Theory, TMH, 2006.
4. Richard A. Brualdi: Introductory Combinatorics, 4th Edition, Pearson Education, 2004.
5. Geir Agnarsson & Raymond Geenlaw: Graph Theory, Pearson Education, 2007.

Web links and Video Lectures(e-Resources):

- http://www.class-central.com/subject/math(MOOCs)
- http://academicearth.org/
- http://www.bookstreet.in/
- http://www.bookstreet.in/

Activity Based Learning (Suggested Activities in Class)/Practical Based Learning

- Quiz
- Assignment
- Seminar

OPTIMIZATION TECHNIQUE			
Course Code	24AD46D	**CIE Marks**	50
Teaching Hours/Week (L: T: P)	2:2:0	**SEE Marks**	50
Credits	03	**Total Marks**	100
Contact Hours	40	**Exam Hours**	3
Examination type (SEE)	Theory		

Prerequisites:

The students should have knowledge on

- Basic Programming Skills
- Understanding of Algorithms
- Basic Mathematics
- Problem-Solving Skills

Course Objectives:

- Appreciate the importance of linear algebra in computer science and allied engineering science.
- Gain the knowledge of linear algebra tools and concepts to implememt them in their core domain.
- Improve their mathematical thinking and acquire skills required for sustained lifelong learning.

Teaching-Learning Process (General Instructions)

Teachers can use following strategies to accelerate the attainment of the various course outcomes. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the delivered lessons shall develop students' theoretical and applied Mathematical skills.
State the need for Mathematics with Engineering Studies and Provide real-life examples.
Support and guide the students for self–study.
You will assign homework, grading assignments and quizzes, and documenting students' progress.
Encourage the students to group learning to improve their creative and analytical skills.
Show short related video lectures in the following ways:

- As an introduction to new topics (pre-lecture activity).
- As a revision of topics (post-lecture activity).
- As additional examples (post-lecture activity).
- As an additional material of challenging topics (pre-and post-lecture activity).
- As a model solution of some exercises (post-lecture activity).

Module-1 **8 Hours**

VECTOR CALCULUS: Functions of several variables, Differentiation and partial differentials, gradients of vector-valued functions, gradients of matrices, useful identities for computing gradients, linearization **.**

Text Book: 1,2,3

Module-2	8 Hours
APPLICATIONS OF VECTOR CALCULUS: Backpropagation and automatic differentiation, gradients in a deep network, The Gradient of Quadratic Cost, Descending the Gradient of Cost, The Gradient of Mean Squared Error. **Text Book: 1,2,3**	
Module-3	**8 Hours**
Convex Optimization-1: Local and global optima, convex sets and functions separating hyperplanes, application of Hessian matrix in optimization, Optimization using gradient descent, Sequential search 3- point search and Fibonacci search. **Text Book: 1,2,3**	
Module-4	**8 Hours**
Convex Optimization-2: Unconstrained optimization -Method of steepest ascent/descent, NR method, Gradient descent, Mini batch gradient descent, Stochastic gradient descent. **Text Book: 1,2,3**	
Module-5	**8 Hours**
Advanced Optimization: Momentum-based gradient descent methods: Adagrad, RMSprop and Adam. Non-Convex Optimization: Convergence to Critical Points, Saddle-Point methods. **Text Book: 1,2,3**	

Course outcomes (Course Skill Set):

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

CO1: Apply the concepts of vector calculus to solve the given problem. (PO-1,2,4 PSO-1)
CO2: Apply the concepts of partial differentiation in machine learning and deep neural networks. (PO-1,2,3,4 PSO-1,2)
CO3: Analyze the convex optimization algorithms and their importance in computer science & engineering. (PO-1,2,3,4 PSO-1,2)
CO4: Apply the optimization algorithms to solve the problem. (PO-1,2,3,4 PSO-1,2)
CO5: Analyze the advanced optimization algorithms for machine learning. (PO-1,2,3,4 PSO-1,2)

Assessment Details (both CIE and SEE):

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- There are 25 marks for the CIE's Assignment component and 25 for the Internal Assessment Test component.
- Each test shall be conducted for 25 marks. The first test will be administered after 40-50% of the coverage of the syllabus, and the second test will be administered after 85-90% of the coverage of the syllabus. The average of the two tests shall be scaled down to 25 marks.
- Any two assignment methods mentioned in the regulations; if an assignment is project-based then only one assignment for the course shall be planned. The schedule for assignments shall be planned properly by the course teacher. The teacher should not conduct two assignments at the end of the semester if two assignments are planned. Each assignment shall be conducted for 25 marks. (If two assignments are conducted then the sum of the two assignments shall be scaled down to 25 marks)
- The final CIE marks of the course out of 50 will be the sum of the scale-down marks of tests and assignment/s marks.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by the University as per the scheduled timetable, with common question papers for the course (duration 03 hours).

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. 4. Marks scored shall be proportionally reduced to 50 marks.

Suggested Learning Resources:

Textbook:

1. Mathematics for Machine learning, Marc Peter Deisennroth, A. Aldo Faisal, Cheng Soon Ong, 2020, Cambridge University Press.
2. S. Bubeck, Convex Optimization: Algorithms and Complexity, Foundations and Trends in Optimization, 2015.
3. S. Boyd, N. Parikh, and E. Chu," Distributed optimization and statistical learning via the alternating direction method of multipliers", Foundations and Trends in Machine Learning, Now Publishers Inc.

Reference Books:

1. Linear Algebra and Optimization for Machine Learning, Charu C. Aggarwal, Springer, 2020.
2. Beck, First-Order Methods in Optimization, MOS-SIAM Series on Optimization, 2017.
3. F. Bach, "Learning with Submodular Functions: A Convex Optimization Perspective", Foundations and Trends in Machine Learning, Now Publishers Inc.

Web links and Video Lectures(e-Resources):

- https://ocw.mit.edu/courses/mathematics/18-06sc-linear-algebra-fall- 2011/index.htm
- https://www.math.ucdavis.edu/~linear/linear.pdf
- https://www.coursera.org/learn/linear-algebra-machine-learning
- https://nptel.ac.in/syllabus/111106051/
- https://github.com/epfml/OptML_course
- https://www.youtube.com/playlist?list=PL4O4bXkI-fAeYrsBqTUYn2xMjJAqlFQzX

Activity Based Learning (Suggested Activities in Class)/Practical Based Learning

- Role Play
- Flipped classroom
- Assessment Methods for 25 Marks (opt two Learning Activities)
  - Case Study
  - Programming Assignment
  - Gate Based Aptitude Test
  - MOOC Assignment for selected Module

ANGULAR JS LABORATORY			
Course Code	**24AD47A**	**CIE Marks**	50
Teaching Hours/Week (L: T: P)	0:0:2	**SEE Marks**	50
Credits	01	**Total Marks**	100
Contact Hours	28	**Exam Hours**	3
Examination type (SEE)	Practical		

Prerequisites:

The students should have knowledge on

- Expertise of HTML
- Understanding of java script
- Basic Form creation
- Problem-Solving Skills

Course objectives:

- To learn the basics of Angular JS framework.
- To understand the Angular JS Modules, Forms, inputs, expression, data bindings and Filters
- To gain experience of modern tool usage (VS Code, Atom or any other] in developing Web applications

Descriptions (if any):

- Implement all the programs in "Java script, HTML" Programming Language and Linux OS.

Sl.NO	Experiments
1	Develop Angular JS program that allows user to input their first name and last name and display their full name. **Note**: The default values for first name and last name may be included in the program.
2	Develop an Angular JS application that displays a list of shopping items. Allow users to add and remove items from the list using directives and controllers. **Note**: The default values of items may be included in the program.
3	Develop a simple Angular JS calculator application that can perform basic mathematical operations (addition, subtraction, multiplication, division) based on user input.
4	Write an Angular JS application that can calculate factorial and compute square based on given user input.
5	Develop AngularJS application that displays a details of students and their CGPA. Allow users to read the number of students and display the count. **Note**: Student details may be included in the program.
6	Develop an AngularJS program to create a simple to-do list application. Allow users to add, edit, and delete tasks. **Note**: The default values for tasks may be included in the program.

7	Write an AngularJS program to create a simple CRUD application (Create, Read, Update, and Delete) for managing users.
8	Develop AngularJS program to create a login form, with validation for the username and password fields.
9	Create an AngularJS application that displays a list of employees and their salaries. Allow users to search for employees by name and salary. **Note**: Employee details may be included in the program.
10	Create AngularJS application that allows users to maintain a collection of items. The application should display the current total number of items, and this count should automatically update as items are added or removed. Users should be able to add items to the collection and remove them as needed. **Note**: The default values for items may be included in the program.
11	Create AngularJS application to convert student details to Uppercase using angular filters. **Note**: The default details of students may be included in the program.
12	Create an AngularJS application that displays the date by using date filter parameters

NOTE: Include necessary HTML elements and CSS for the above Angular applications.

Course outcomes (Course Skill Set):
At the end of the course the student will be able to:

1. Develop Angular JS programs using basic features. (PO-3,4,5 PSO-1)
2. Develop dynamic Web applications using AngularJS modules. (PO-3,4,5 PSO-1,2)
3. Make use of form validations and controls for interactive applications. (PO-3,4,5 PSO-1,2)
4. Appy the concepts of Expressions, data bindings and filters in developing Angular JS programs. (PO-3,4,5 PSO-1,2)
5. Make use of modern tools to develop Web applications. (PO-3,4,5 PSO-1,2)

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation (CIE):
CIE marks for the practical course are **50 Marks**.
The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment is to be evaluated for conduction with an observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments are designed by the faculty who is handling the laboratory session and are made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.

- Total marks scored by the students are scaled down to **30 marks** (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct a test of 100 marks after the completion of all the experiments listed in the syllabus.
- In a test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability.
- The marks scored shall be scaled down to **20 marks** (40% of the maximum marks).
- The Sum of scaled-down marks scored in the report write-up/journal and marks of a test is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

- SEE marks for the practical course are 50 Marks.
- SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the Head of the Institute.
- The examination schedule and names of examiners are informed to the university before the conduction of the examination. These practical examinations are to be conducted between the schedule mentioned in the academic calendar of the University.
- All laboratory experiments are to be included for practical examination.
- (Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.
- Students can pick one question (experiment) from the questions lot prepared by the examiners jointly.
- Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.
- General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)
- Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be made zero.

The minimum duration of SEE is 02 hours

DBMS with SQL and Mongo DB			
Course Code	24AD47B	**CIE Marks**	50
Teaching Hours/Week (L: T: P)	0:0:2	**SEE Marks**	50
Credits	01	**Total Marks**	100
Contact Hours	28	**Exam Hours**	3
Examination type (SEE)	Practical		

Prerequisites:

- Basic Programming Skills
- Understanding of Algorithms
- Problem-Solving Skills

Course Objectives:

1. Practice relational (SQL) and NoSQL (MongoDB) database operations.
2. Develop skills in schema creation, data manipulation, and complex queries.
3. Work with real-world data examples.

Teaching-Learning Process (General Instructions)

Teachers can use following strategies to accelerate the attainment of the various course outcomes.

1. Chalk and Talk with Black Board
2. ICT based Teaching
3. Demonstration based Teaching

PART-A

1. Creating Tables, Users, and Constraints

Table: Employee(EMPNO, ENAME, JOB, MANAGER_NO, SAL, COMMISSION)

a) Create a new user and grant all permissions to the user.
b) Create the Employee table.
c) Insert three records into Employee table using INSERT.
d) Use ROLLBACK to undo the transaction.
e) Check the results after rollback.
f) Add PRIMARY KEY and NOT NULL constraints to the Employee table.
g) Try to insert NULL values and verify the constraint enforcement.

2. Altering Tables and DML Operations

Table: Employee(EMPNO, ENAME, JOB, MGR, SAL)

a) Add a new column COMMISSION with appropriate data type.
b) Insert five records into the Employee table.
c) Update JOB column details for any employee.
d) Rename a column in the Employee table using the ALTER command.
e) Delete the employee whose EMPNO is 105.

3. Queries using Aggregate Functions

Table: Employee(E_id, E_name, Age, Salary)

a) Create the Employee table with specified attributes.

b) Count the number of employees in the table.
c) Find the maximum age of employees.
d) Find the minimum age of employees.
e) Display salaries in ascending order.
f) Find grouped salaries using GROUP BY.

4. Triggers

Table: CUSTOMERS(ID, NAME, AGE, ADDRESS, SALARY)

Create a row-level trigger for the CUSTOMERS table that fires on INSERT, UPDATE, or DELETE operations and displays the salary difference between the old and new SALARY.

5. Cursors

Table: Employee(E_id, E_name, Age, Salary)

Create a cursor for the Employee table:

- Declare variables
- Open the cursor
- Extract values from the table using the cursor
- Close the cursor

PART-B

6. Creating Tables, Users, and Constraints

Table: Employee(EMPNO, ENAME, JOB, MANAGER_NO, SAL, COMMISSION)

a) Create a new user and grant all permissions to the user.
b) Create the Employee table.
c) Insert three records into Employee table using INSERT.
d) Use ROLLBACK to undo the transaction.
e) Check the results after rollback.
f) Add PRIMARY KEY and NOT NULL constraints to the Employee table.
g) Try to insert NULL values and verify the constraint enforcement.

7. Altering Tables and DML Operations

Table: Employee(EMPNO, ENAME, JOB, MGR, SAL)

a) Add a new column COMMISSION with appropriate data type.
b) Insert five records into the Employee table.
c) Update JOB column details for any employee.
d) Rename a column in the Employee table using the ALTER command.
e) Delete the employee whose EMPNO is 105.

8. Queries using Aggregate Functions

Table: Employee(E_id, E_name, Age, Salary)

a. Create the Employee table with specified attributes.
b. Count the number of employees in the table.
c. Find the maximum age of employees.
d. Find the minimum age of employees.
e. Display salaries in ascending order.
f. Find grouped salaries using GROUP BY.

9. Triggers

Table: CUSTOMERS(ID, NAME, AGE, ADDRESS, SALARY)

Create a row-level trigger for the CUSTOMERS table that fires on INSERT, UPDATE, or DELETE operations and displays the salary difference between the old and new SALARY.

10. Cursors

Table: Employee(E_id, E_name, Age, Salary)

Create a cursor for the Employee table:

- Declare variables
- Open the cursor
- Extract values from the table using the cursor
- Close the cursor

Additional Programs

13. Text Search

a. Develop a query to perform text search on a Catalog data collection for a given word.

b. Develop queries to exclude documents containing certain words or phrases.

Reference: Book 2, Chapter 9

14. Aggregation Pipeline for Text Search

Develop an aggregation pipeline to demonstrate text search on a Catalog data collection.

Reference: Book 2, Chapter 9

Course outcomes(Course Skill Set):

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

CO1: Design, implement, and query relational schemas. (PO – 1,2,3,5,112 PSO – 1,2)

CO2: Perform CRUD and aggregation with MongoDB. (PO – 1,2,3,5,11 PSO – 1,2)

CO3: Demonstrate proficiency with SQL joins views, indexing, and transactions. (PO – 1,2,3,5,11 PSO – 1,2)

CO4: Apply database concepts in small applications. (PO – 1,2,3,5,12 PSO – 1,2)

Assessment Details (both CIE and SEE):

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- CIE marks for the practical course are 50 Marks. The split-up of CIE marks for record/ journal and test are in the ratio 60:40.
- Each experiment is to be evaluated for conduction with an observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments are designed by the faculty who is handling the laboratory session and are made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled down to 30 marks (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct a test of 100 marks after the completion of all the experiments listed in the syllabus.
- In a test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability.
- The marks scored shall be scaled down to 20 marks (40% of the maximum marks). The Sum of scaled-down marks scored in the report write-up/journal and marks of a test is the total CIE marks scored by the student
- Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

SEE marks for the practical course are 50 Marks.

- SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the Head of the Institute.
- The examination schedule and names of examiners are informed to the university before the conduction of the examination. These practical examinations are to be conducted between the schedule mentioned in the academic calendar of the University
- All laboratory experiments are to be included for practical examination.
- (Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. OR based on the course requirement evaluation rubrics shall be decided jointly by examiners.
- Students can pick one question from PART-A and one question from PART-B (experiment) from the questions lot prepared by the examiners jointly and 50% weightage for each part.
- Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners) Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be made zero. The minimum duration of SEE is 02 hours

Text Books:

1: MongoDB: The Definitive Guide — Kristina Chodorow, 2nd Edition, O'Reilly, 2013.
2: MongoDB in Action — Kyle Banker et al., 2nd Edition, Manning Publications, 2016.

Reference Book:
1: MongoDB Complete Guide — Manu Sharma, 1st Edition, BPB Publications, 2023.

Web links and Video Lectures(e-Resources):

1) Installation of MongoDB: https://www.youtube.com/watch?v=dEm2AS5amyA

2) Aggregation in MongoDB: https://www.youtube.com/watch?v=vx1C8EyTa7Y

Additional Resources:

1) MongoDB in Action — Source Code Download: https://www.manning.com/downloads/529

2) MongoDB Practice Exercises: https://www.w3resource.com/mongodb-exercises/

MERN LABORATORY			
Course Code	**24AD47C**	**CIE Marks**	50
Teaching Hours/Week (L: T: P)	0:0:2	**SEE Marks**	50
Credits	01	**Total Marks**	100
Contact Hours	28	**Exam Hours**	2
Examination type (SEE)	Practical		

Prerequisites:

The students should have knowledge on

- Expertise of HTML Knowledge of Object-Oriented Programming
- Understanding of java script
- Database fundamentals
- Problem-Solving Skills

Course objectives:

Course objectives:

1. Understand and apply critical web development languages and tools to create dynamic and responsive web applications.
2. To build server-side applications using Node.js and Express
3. Develop user interfaces with React.js,
4. Manage data using MongoDB, and integrate these technologies to create full stack apps
5. Understanding APIs and routing.

Descriptions (if any):

Sl.NO	Experiments
1	Using MongoDB, create a collection called transactions in database usermanaged (drop if it already exists) and bulk load the data from a json file, transactions.json Upsert the record from the new file called transactions_upsert.json in Mongodb.
2	Query MongoDB with Conditions: [Create appropriate collection with necessary documents to answer the query] a. Find any record where Name is Somu b. Find any record where total payment amount (Payment.Total) is 600. c. Find any record where price (Transaction.price) is between 300 to 500. d. Calculate the total transaction amount by adding up Payment.Total in all records.
3	a. Write a program to check request header for cookies. b. write node.js program to print the a car object properties, delete the second property and get length of the object.
4	a. Read the data of a student containing usn, name, sem, year_of_admission from node js and store it in the mongodb b. For a partial name given in node js, search all the names from mongodb student documents created in Question(a)
5	Implement all CRUD operations on a File System using Node JS
6	Develop the application that sends fruit name and price data from client side to Node.js server using Ajax
7	Develop an authentication mechanism with email_id and password using HTML and Express JS (POST method)

8	Develop two routes: find_prime_100 and find_cube_100 which prints prime numbers less than 100 and cubes less than 100 using Express JS routing mechanism
9	Develop a React code to build a simple search filter functionality to display a filtered list based on the search query entered by the user.
10	Develop a React code to collect data from rest API.

Course outcomes (Course Skill Set):

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

CO1: Apply the fundamentals of MongoDB, such as data modelling, CRUD operations, and basic queries to solve given problem.(PO-12,3,5,11 PSO-1,2)

CO2: Use constructs of Express.js, including routing, software and constructing RESTful APIs to solve real world problems. .(PO-12,3,5,11 PSO-1,2)

CO3: Develop scalable and efficient RESTful APIs using NodeJS. .(PO-12,3,5,11 PSO-1,2)

CO4: Develop applications using React, including components, state, props, and JSX syntax. .(PO-12,3,5,11 PSO-1,2)

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation (CIE):

CIE marks for the practical course are **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment is to be evaluated for conduction with an observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments are designed by the faculty who is handling the laboratory session and are made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled down to **30 marks** (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct a test of 100 marks after the completion of all the experiments listed in the syllabus.
- In a test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability.
- The marks scored shall be scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and marks of a test is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

- SEE marks for the practical course are 50 Marks.
- SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the Head of the Institute.
- The examination schedule and names of examiners are informed to the university before the conduction of the examination. These practical examinations are to be conducted between the schedule mentioned in the academic calendar of the University.
- All laboratory experiments are to be included for practical examination.
- (Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.
- Students can pick one question (experiment) from the questions lot prepared by the examiners jointly.
- Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.
- General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)
- Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be made zero.
- The minimum duration of SEE is 02 hours

Suggested Learning Resources:

- Vasan SubramanianPro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node, Apress; 1st ed. edition (1 April 2017)
- . Eddy Wilson Iriarte Koroliova,MERN Quick Start Guide, Packt Publishing (31 May 2018),
- https://www.geeksforgeeks.org/mern-stack/
- https://blog.logrocket.com/mern-stack-tutorial/

Universal Human Values			
Course Code	24UH48	**CIE Marks**	50
Teaching Hours/Week (L: T: P)	2:0:0	**SEE Marks**	50
Credits	02	**Total Marks**	100
Contact Hours	25	**Exam Hours**	03
Examination type (SEE)	Theory		

Prerequisites: NIL

Course Objectives:

This course is intended to:

- To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
- To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
- To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.
- This course is intended to provide a much-needed orientation input in value education to the young enquiring minds.

Teaching-Learning Process (General Instructions):

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. The methodology of this course is explorational and thus universally adaptable. It involves a systematic and rational study of the human being vis-à-vis the rest of existence.
2. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the activities will develop students' theoretical and applied skills.
3. State the need for UHV activities and its present relevance in the society and provide real-life examples.
4. Support and guide the students for self-study activities.
5. You will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress in real activities in the field.
6. This process of self-exploration takes the form of a dialogue between the teacher and the students to begin with, and then to continue within the student in every activity, leading to continuous self-evolution.
7. Encourage the students for group work to improve their creative and analytical skills.

Module- 1	5 Hours
Introduction to Value Education: Understanding the need, Basic Guidelines, Content and process for Value Education; Self-Exploration: What is it? - its content and process, Natural Acceptance and Experiential Validation- as the mechanism for self-exploration; Continuous Happiness and Prosperity: A look at basic Human Aspirations; Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority; Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario; Method to fulfill the above human aspirations: understanding and living in harmony at various levels.	
Module- 2	**5 Hours**
Understanding Harmony in the Human Being: Understanding Human being as the Co-existence of the Self and the Body, Understanding the needs of Sukh and Suvidha; Understanding the Body as an Instrument of the Self, Understanding the characteristics and activities of self and harmony in self; Understanding the harmony of the Self with the Body, Programs to ensure self-regulation and Health	
Module- 3	**5 Hours**
Understanding Harmony in the Family and Society: Harmony in the Family – the Basic Unit of Human Interaction; Understanding values in human-human relationship - meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti; 'Trust' – the Foundational Value of Relationship, Understanding the meaning of Vishwas - difference between intention and competence; Understanding the meaning of Samman - difference between respect and differentiation, the other salient values in relationship; Understanding the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals; Visualizing a universal harmonious order in society- Undivided Society (Akhand Samaj), Universal Order (Sarvabhaum Vyawastha)- from family to world family!	
Module- 4	**5 Hours**
Understanding Harmony in the Nature/Existence: Understanding the harmony in the Nature; Interconnectedness and mutual fulfillment among the four orders of nature - recyclability and self-regulation in nature; Understanding Existence as Co-existence (Sah-astitva) of mutually interacting units in all-pervasive space; Holistic perception of harmony at all levels of existence.	
Module- 5	**5 Hours**
Implications of the Holistic Understanding – a Look at Professional Ethics: Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct; A Basis for Humanistic Education; Humanistic Constitution and Universal Human Order; Competence in	

Professional Ethics: Ability to utilize the professional competence for augmenting universal human order, Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, Ability to identify and develop appropriate technologies and management patterns for above production systems; Case studies of typical holistic technologies, management models and production systems; Strategy for transition from the present state to Universal Human Order: At the level of individual: as socially and ecologically responsible engineers, technologists and managers, At the level of society: as mutually enriching institutions and organizations.

Course outcomes (Course Skill Set):

At the end of the course, students are expected to become more aware of themselves, and their surroundings (family, society, nature):

CO1: Apprehend the need of Value Education over Human aspirations (PO-6, PO-7)

CO2: Assimilate Harmony over the physical needs and to overcome the self- needs for a prosperous life. (PO-6, PO-7)

CO3: Recognize the need of Harmony in the Family and Society for a better World. (PO-6, PO-7)

CO4: Explain the need of mutual understanding for Holistic Harmony in all the Levels of Human Existence. (PO-6, PO-7)

CO5: Explain the Holistic understanding of Harmony and Professional Ethics at Individual Level and Society. (PO-6, PO-7)

Assessment Details (both CIE and SEE):

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- There are 25 marks for the CIE's Assignment component and 25 for the Internal Assessment Test component.
- Each test shall be conducted for 25 marks. The first test will be administered after 40-50% of the coverage of the syllabus, and the second test will be administered after 85-90% of the coverage of the syllabus. The average of the two tests shall be scaled down to 25 marks.
- Any two assignment methods mentioned in the regulations; if an assignment is project-based then only one assignment for the course shall be planned. The schedule for assignments shall be planned properly by the course teacher. The teacher should not

conduct two assignments at the end of the semester if two assignments are planned. Each assignment shall be conducted for 25 marks. (If two assignments are conducted then the sum of the two assignments shall be scaled down to 25 marks)

- The final CIE marks of the course out of 50 will be the sum of the scale-down marks of tests and assignment/s marks.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by the University as per the scheduled timetable, with common question papers for the course (duration 03 hours).

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks.

Suggested Learning Resources:

Text Books:

1. "The Textbook: A Foundation Course in Human Values and Professional Ethics", R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2010. ISBN 978- 8-174- 46781-2

Reference Books:

1. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.
2. PL Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
3. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991
4. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and HarperCollins, USA
5. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, limits to Growth, Club of Romes Report, Universe Books.
6. Subhas Palekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) Krishi Tantra Shodh, Amravati.
7. A Nagraj, 1998, Jeevan Vidya ek Parichay, Divya Path Sansthan, Amarkantak.
8. E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.
9. A.N. Tripathy, 2003, Human Values, New Age International Publishers.

Web links and Video Lectures (e-Resources):

1. https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw
2. https://www.youtube.com/watch?v=P4vjfE-YnVk&list=PLWDeKF97v9SP7wSlapZcQRrT7OH0ZlGC4
3. **Course handouts:** https://drive.google.com/drive/folders/1zioX_4L2fCNX4Agw282PN86pcZZT3Osr?usp=sharing
4. **Presentation slides:** https://drive.google.com/drive/folders/1rMUKh1s0HPRBlpp_b1mpS-duNRcwS6YH?usp=sharing

PHYSICAL EDUCATION (SPORTS & ATHLETICS) – II			
Semester: IV			
Course Code	24PE49	**CIE Marks**	**100 Marks**
Teaching Hours/Week (L: T: P)	0:0:2		
Examination type (SEE)	24P		

Course Outcomes: At the end of the course, the student will be able to

1. Understand the ethics and moral values in sports and athletics
2. Perform in the selected sports or athletics of student's choice.
3. Understand the roles and responsibilities of organization and administration of sports and games.

Module I : Ethics and Moral Values **4 Hours**

A. Ethics in Sports
B. Moral Values in Sports and Games

Module II : Specific Games (Any one to be selected by the student) **16 Hours**

A. Volleyball – Attack, Block, Service, Upper Hand Pass and Lower hand Pass.
B. Athletics (Track Events) – Any event as per availability of Ground.

Module III: Role of Organization and administration **4 Hours**

Scheme and Assessment for auditing the course and Grades:

Sl. No.	Activity	Marks
1.	Participation of student in all the modules	20
2.	Quizzes – 2, each of 15 marks	30
3.	Final presentation / exhibition / Participation in competitions/ practical on specific tasks assigned to the students	50
	Total	**100**

YOGA			
Course Code	24YO49	**CIE Marks**	100
Teaching Hours/Week (L: T: P)	0:0:2	**SEE Marks**	0
Credits	0	**Total Marks**	100
Contact Hours	20-24	**Exam Hours**	
Examination type (SEE)	Practical		

Module-1 **3 Hours**

Patanjali' s Ashtanga Yoga: Yama - Ahimsa, satya, asteya, brahm acarya, aparigraha.

Niyama - shoucha, santosh, tapa svaadhyaya, Eshvarapranidhan

Module-2 **3 Hours**

Suryanamaskara: Suryanamaskar l2 count 4 rounds

Module-3 **3 Hours**

Asanas: Need, importance of Asana. Different types of asana. Asana its meaning by name, technique, precautionary measures and benefits of each asana

Different types of Asanas

1. Sitting
    a. Sukhasana
    b. Paschimottanasana
2. Standing
    a. Ardhakati Chakrasana
    b. Parshva Chakrasana
3. Prone line
    a. Dhanurasana
4. Supine line
    a. Halasana
    b. Karna Peedasana

Module-4 **3 Hours**

Kapalabhati: Meaning, importance and benefits of Kapalabhati. 40 strokes/min 3 rounds

Module-5 **3 Hours**

Pranayama: Meaning, Need, importance of Pranayama. Different types. Meaning by name, technique, precautionary measures and benefits of each

Different types of Pranayama
Suryanuloma -Viloma

1. Chandranuloma-Viloma
2. Suryabhedana
3. Chandra Bhedana
4. Nadishodhana