EAST POINT COLLEGE OF ENGINEERING & TECHNOLOGY

An Autonomous Institution Affiliated to Visvesvaraya Technological University (VTU) Belagavi
Approved by All India Council for Technical Education (AICTE), New Delhi.
Recognized by Govt. of Karnataka
Accredited by NAAC with A Grade
UG programs Accredited by National Board of Accreditation (NBA): CSE, ECE & ISE

DEPARTMENT OF CSE (ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING)

SYLLABUS

Academic Batch 2024 – 2028 (Autonomous)

Undergraduate Bachelor of Engineering Program - B.E.

Outcome Based Education (OBE)

III & IV SEMESTER

2024-2028

III SEMESTER

Engineering Mathematics – III			
Course Code	24CI31	**CIE Marks**	50
Teaching Hours/Week (L: T: P)	3:2:0	**SEE Marks**	50
Credits	04	**Total Marks**	100
Contact Hours	55	**Exam Hours**	3
Examination type (SEE)	Theory		

Prerequisites:

The students should have knowledge of

- Basics of Probability and Statistics
- Understanding of Hypothesis
- Basic Mathematics

Course Objectives:

This course will enable the students 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.
- Provide the principles of statistical inferences and the basics of hypothesis testing with emphasis on some commonly encountered hypotheses.
- 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 **11 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 **11 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, Text book:3 - 31.2

MODULE-3 **11 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 **11 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 **11 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 Text 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)

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

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

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:

Text Books:

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. 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.

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. Peter Bruce, Andrew Bruce & Peter Gedeck, "Practical Statistics for Data Scientists" O'Reilly Media, Inc., 2nd edition 2020.

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.
- VTU EDUSAT PROGRAMME – 20

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

- Programming Assignment
- Seminar

Operating Systems			
Course Code	24CI32	**CIE Marks**	50
Teaching Hours/Week (L: T: P)	4:0:0	**SEE Marks**	50
Credits	04	**Total Marks**	100
Contact Hours	55	**Exam Hours**	3
Examination type (SEE)	Theory		

Prerequisites:

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 **11 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

MODULE-2 **11 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 **11 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 **11 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 **11 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 - 1,2,3,9,11, PSO - 1,2,3)
- **CO2:** Apply appropriate CPU scheduling algorithms for the given problem. (PO - 1,2,3,9,11, PSO - 1,2,3)
- **CO3:** Analyse the various techniques for process synchronization and deadlock handling. (PO - 1,2,3,9,11, PSO - 1,2,3)
- **CO4:** Apply the various techniques for memory management. (PO - 1,2,3,9,11, PSO - 1,2,3)
- **CO5:** Analyse File and Storage Structures and Implement Customized Case Studies. (PO - 1,2,3,9,11, PSO - 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:

Text Book:

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=3-ITLMMeeXY&list=PL3pGy4HtqwD0n7bQfHjPnsWzkeRn6mkO

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

- Case Study
- Assignments

Data Structures & Applications			
Course Code	24CI33	**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 Talk with Black Board
2. ICT based Teaching
3. Demonstration based Teaching

Module-1 **8 Hours**

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 **8 Hours**

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 **8 Hours**

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 **8 Hours**

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 **8 Hours**

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 outcomes (Course Skill Set):

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

CO1: Explain different data structures and their applications. (PO – 1,2,3,5, PSO – 1,3)

CO2: Apply Arrays, Stacks and Queue data structures to solve the given problems. (PO – 1,2,3,5, PSO – 1,3)

CO3: Use the concept of linked list in problem solving. (PO – 1,2,3,5, PSO – 1,3)

CO4: Develop solutions using trees and graphs to model the real-world problem. (PO – 1,2,3,5, PSO – 1,3)

CO5: Explain the advanced Data Structures concepts such as Hashing Techniques and Optimal Binary Search Trees. (PO – 1,2,3,5, PSO – 1,3)

Assessment Details (both CIE and SEE):

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Continuous Internal Evaluation:

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- 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:

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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_013501595428077568125559/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 & Computer Organization			
Course Code	24CI34	**CIE Marks**	50
Teaching Hours/Week (L: T: P)	3:0:2	**SEE Marks**	50
Credits	04	**Total Marks**	100
Contact Hours	40L + 15P	**Exam Hours**	3
Examination type (SEE)	Theory		

Prerequisites:

The students should have knowledge of

- 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)

These are sample Strategies that teachers can use 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

Sl. No	Experiments Simulation packages preferred: Multisim, ModelSim, PSpice or any other relevant
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 Behavioral 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 multiplexers 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 – 1,2,3,5,11, PSO – 1,3)

CO2: Design different types of combinational and sequential circuits along with Verilog programs. (PO – 1,2,3,5,11, PSO – 1,3)

CO3: Describe the fundamentals of machine instructions, addressing modes and Processor performance. (PO – 1,2,3,11, PSO – 1)

CO4: Explain the approaches involved in achieving communication between processor and I/O devices. (PO – 1,2,3,11, PSO – 1)

CO5: Analyze internal Organization of Memory and Impact of cache/Pipelining on Processor Performance. (PO – 1,2,3,11, 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

- 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 regulations. 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. M. Morris Mano & Michael D. Ciletti, Digital Design with an Introduction to Verilog Design, 5e, Pearson Education.
2. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, 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_01400535636112179270 45/overview
- https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01423541223732838431 62/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

Data Structures & Applications Laboratory			
Course Code	24CIL35	**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 of

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

Course Objectives:

This laboratory course enables students to get practical experience in design, develop, implement, analyze and evaluation/testing of

- Dynamic memory management
- Linear data structures and the 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 Talk with Black Board
2. ICT based Teaching
3. Demonstration based Teaching

Sl. No	Experiments (Implement all the programs in "C" and Linux OS)
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 7 days of a week. Each Element of the array is a structure having three fields. The first field is the name of the Day (A dynamically allocated String), The second field is the date of the Day (A integer), the third field is the description of the activity for a particular day (A dynamically allocated String). b. Write functions create (), read () and display (); to create the calendar, to read the data from the keyboard and to print weeks activity details report on screen.
2	Develop a Program in C for the following operations on Strings. a. Read a main String (STR), a Pattern String (PAT) and a Replace String (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 STACK of Integers (Array Implementation of Stack with maximum size MAX) a. Push an Element onto Stack b. Pop an Element from Stack c. Demonstrate how Stack can be used to check Palindrome d. Demonstrate Overflow and Under flow situations on Stack e. Display the status of 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 parenthesized 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 Circular QUEUE of Characters (Array Implementation of Queue with maximum size MAX) a. Insert an Element onto Circular QUEUE b. Delete an Element from Circular QUEUE c. Demonstrate Overflow and Under flow situations on Circular QUEUE d. Display the status of 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 Singly Linked List (SLL) of Student Data with the fields: *USN, Name, Programme, Sem, PhNo* a. Create a SLL of N Students Data by using *front insertion*. b. Display the status of SLL and count the number of nodes in it c. Perform Insertion/Deletion at End of SLL d. Perform Insertion/Deletion at Front of SLL (Demonstration of stack)
8	Develop a menu driven Program in C for the following operations on Doubly Linked List (DLL) of Employee Data with the fields: *SSN, Name, Dept, Designation, Sal, Ph. No* a. Create a DLL of N Employees Data by using *end insertion*. b. Display the status of DLL and count the number of nodes in it c. Perform Insertion and Deletion at End of DLL d. Perform Insertion and Deletion at Front of DLL e. Demonstrate how this DLL can be used as Double Ended Queue.
9	Develop a Program in C for the following operations on Singly Circular Linked List (SCLL) with header nodes a. Represent and Evaluate a Polynomial P (x, y) = $6x^2 y^2$-4y +$3x^3y$+$2xy^5$ -2xy 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 Binary Search Tree (BST) of Integers. a. Create a BST of N Integers: 6, 9, 5, 2, 8, 15, 24, 14, 7, 8, 5, 2 b. Traverse the BST in In-order, Preorder and Post Order c. Search the BST for a given element (KEY)and report the appropriate message
11	Develop a Program in C for the following operations on Graph (G) of Cities a. Create a Graph of N cities using Adjacency Matrix. Print all the nodes reachable from a given starting node in a digraph using DFS/BFS method
12	Given a File of N employee records with a set K of Keys (4-digit) which uniquely determine the records in file F. Assume that file F is maintained in memory by a Hash Table (HT) of m memory locations with L as the set of memory addresses (2-digit) of locations in HT. Let the key sinK and addresses in Lare Integers. Develop a Program in C that uses Hash function H: K→LasH(K)=K modm (remainder method), and implement hashing technique to map a given key K to the address space L. Resolve the collision (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, PSO - 1,2)

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

CO3: Use appropriate searching and sorting algorithms for the given scenario. (PO - 1,2,3, PSO - 1,2)

CO4: Apply the appropriate data structure for solving real world problems. (PO - 1,2,3, PSO - 1,2)

CO5: Develop solutions to solve real world problems. (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 (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 03 hours.

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	24CI36A	**CIE Marks**	50
Teaching Hours/Week (L: T: P)	2:0:2	**SEE Marks**	50
Credits	03	**Total Marks**	100
Contact Hours	25 T + 15 P	**Exam Hours**	3
Examination nature (SEE)	Theory		

Prerequisites:

The students should have knowledge of

- Principles of Programming Concepts

Course Objectives:

- To learn primitive constructs JAVA programming language.
- To understand Object Oriented Programming Features of JAVA.
- To gain knowledge on: packages, multithreaded programming 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 programming examples.
3. Chalk and board, power point presentations.
4. Online material (Tutorials) and video lectures.

MODULE-1 5 **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 5 **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 5 **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

Practical component of IPCC:

S. No	Experiments
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 raise Salary (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 calculate Area () and calculate Perimeter (). 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 resize Width (int width) and resize Height (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 Division by Zero 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.

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 – 1,2,3,5,8,11, PSO – 1,2,3)

CO2: Design a class involving data members and methods for the given scenario. (PO – 1,2,3,5,8,11, PSO – 1,2,3)

CO3: Apply the concepts of inheritance and interfaces in solving real world problems. (PO – 1,2,3,5,8,11, PSO – 1,2,3)

CO4: Use the concept of packages and exception handling in solving complex problem. (PO – 1,2,3,5,8,11, PSO – 1,2,3)

CO5: Apply concepts of multithreading, autoboxing and enumerations in program development. (PO – 1,2,3,5,8,11, PSO – 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.

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 Book:

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)/ Practical Based learning:

1. Installation of Java (Refer: https://www.java.com/en/download/help/index_installing.html)
2. Demonstration of online IDEs like geeksforgeeks, jdoodle or any other Tools
3. Demonstration of class diagrams for the class abstraction, type visibility, composition and inheritance

Assessment Method:

- Programming Assignment / Course Project

Object Oriented Programming with C++			
Course Code	24CI36B	**CIE Marks**	50
Teaching Hours/Week (L: T: P)	2:0:2	**SEE Marks**	50
Credits	03	**Total Marks**	100
Contact Hours	25 T + 15 P	**Exam Hours**	3
Examination nature (SEE)	Theory		

Prerequisites:

The students should have knowledge of

- Basics of C Programming Concepts

Course Objectives:

- To understand object-oriented programming using C++and Gain knowledge about the capability to store information together in an object.
- To illustrate the capability of a class to rely upon another class and functions.
- To Create and process data in files using file I/O functions
- To understand the generic programming features of C++ including Exception handling.

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 **5 Hours**

An overview of C++: What is object-Oriented Programming? Introducing C++ Classes, The General Form of a C++ Program.

Classes and Objects: Classes, Friend Functions, Friend Classes, Inline Functions, Parameterized Constructors, Static Class Members, When Constructors and Destructors are Executed, The Scope Resolution Operator, Passing Objects to functions, Returning Objects, Object Assignment.

Text Book: 1 - Ch 11, Ch 12

MODULE-2 **5 Hours**

Arrays, Pointers, References, and the Dynamic Allocation Operators: Arrays of Objects, Pointers to Objects, The this Pointer, Pointers to derived types, Pointers to class members.

Functions Overloading, Copy Constructors: Functions Overloading, Overloading Constructor Functions. Copy Constructors, Default Function Arguments, Function Overloading and Ambiguity.

Text Book: 1 - Ch 13, Ch 14

MODULE-3 **5 Hours**

Operator Overloading: Creating a Member Operator Function, Operator Overloading Using a Friend Function, overloading new and delete.
Inheritance: Base-Class Access Control, Inheritance and Protected Members, Inheriting Multiple Base Classes, Constructors, Destructors and Inheritance, Granting Access, Virtual Base Classes.

Text Book: 1 - Ch 15, Ch 16

MODULE-4 **5 Hours**

Virtual Functions and Polymorphism: Virtual Functions, The Virtual Attribute is Inherited, Virtual Functions are Hierarchical, Pure Virtual Functions, Using Virtual Functions, Early vs Late Binding.
Templates: Generic Functions, Applying Generic Functions, Generic Classes. The type name and export Keywords. The Power of Templates.

Text Book: 1 - Ch 17, Ch 18

MODULE-5 **5 Hours**

Exception Handling: Exception Handling Fundamentals, Handling Derived-Class Exceptions, Exception Handling Options, Applying Exception Handling.
The C++ I/O System Basics: C++ Streams, The C++ Classes, Formatted I/O
File I/O: <fstream> and File Classes, Opening and Closing a File, Reading and Writing Text Files, Detecting EOF.

Text Book: 1 - Ch 19, Ch 20, Ch21

Practical component of IPCC:

S. No	Experiments
1	Develop a C++ program to find the largest of three numbers
2	Develop a C++ program to sort the elements in ascending and descending order.
3	Develop a C++ program using classes to display student name, roll number, marks obtained in two subjects and total score of students
4	Develop a C++ program for a bank employee to print name of the employee, account_no. & balance. Print invalid balance if amount<500, Display the same, also display the balance after withdraw and deposit.
5	Develop a C++ program to demonstrate function overloading for the following prototypes. Add (int a, int b) add (double a, double b
6	Develop a C++ program using Operator Overloading for overloading Unary minus operator.
7	Develop a C++ program to implement Multiple inheritance for performing arithmetic operation of two numbers
8	Develop a C++ program using Constructor in Derived classes to initialize alpha, beta and gamma and display corresponding values.
9	Develop 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.
10	Develop a C++ program to write and read time in/from binary file using fstream

11	Develop 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.
12	Develop a C++ program that handles array out of bounds exception using C++.

Course outcomes (Course Skill Set):

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

CO1: Illustrate the basic concepts of object-oriented programming. (PO – 1,2,3,5, PSO – 1,2,3)

CO2: Design appropriate classes for the given world scenario. (PO – 1,2,3,5, PSO – 1,2,3)

CO3: Apply the knowledge of compile-time/ run-time polymorphism to solve the given problem. (PO – 1,2,3,5, PSO – 1,2,3)

CO4: Use the knowledge of inheritance for developing optimized solutions. (PO – 1,2,3,5, PSO – 1,2,3)

CO5: Apply the concepts of templates and exception handling for the given problem. (PO – 1,2,3,5, PSO – 1,2,3)

CO6: Use the concepts of input output streams for file operations. (PO – 1,2,3,5, PSO – 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.

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 Book:

1. Herbert schildt, "The Complete Reference C++", 4th edition, TMH, 2005.

Reference Books:

1. Balagurusamy E, "Object Oriented Programming with C++", Tata McGraw Hill Education Pvt. Ltd., Sixth Edition 2016.
2. Bhave, "Object Oriented Programming with C++", Pearson Education, 2004.
3. A K Sharma, "Object Oriented Programming with C++", Pearson Education, 2014.

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

- Group Assignment to develop small projects and demonstrate using C++

Python Programming for Data Science			
Course Code	24CI36C	**CIE Marks**	50
Teaching Hours/Week (L: T: P)	2:0:2	**SEE Marks**	50
Credits	03	**Total Marks**	100
Contact Hours	25 T + 15 P	**Exam Hours**	3
Examination nature (SEE)	Theory		

Prerequisites:

The students should have knowledge of

- Basics of Python Programming Concepts

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 **5 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 **5 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 **5 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 – 1,2,3,5,8,11, PSO – 1,2,3)

CO2: Use looping and conditional constructs to build programs. (PO – 1,2,3,5,8,11, PSO – 1,2,3)

CO3: Apply the concept of data structure to solve the real-world problem. (PO – 1,2,3,5,8,11, PSO – 1,2,3)

CO4: Use the NumPy constructs for matrix manipulations. (PO – 1,2,3,5,8,11, PSO – 1,2,3)

CO5: Apply the Panda constructs for data analytics. (PO – 1,2,3,5,8,11, PSO – 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.

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

Data Visualization			
Course Code	24CI37A	**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:

The students should have knowledge of

- Data analytics
- MS Excel
- Statistics
- Computer skills

Course Objectives:

- Understand the Importance of data Visualization for business intelligence and decision making.
- Learn different approaches to understand the importance of visual perception.
- Learn different data visualization techniques and tools.
- Gain knowledge of effective data visuals to solve workplace problems.

List of Experiments:

S. No	Experiments
1	**Getting Started -** Tableau Workspace, Tableau terminologies, basic functionalities.
2	**Connecting to Data Source –** Connecting to Database, Different types of Tableau Joins.
3	**Creating a View -** formatting charts, adding filters, creating calculated fields and defining parameters.
4	**Dashboard Design and Storytelling –** Components of Dashboard, understanding how to place worksheets in Containers, Action filters and its types.
5	**Introducing Power BI –**Components and the flow of work. Power BI Desktop Interface-The Report has five main areas.
6	**Querying Data from CSV -** Query Editor, Connecting the data from the Excel Source, Clean, Transform the data.
7	**Creating Reports & Visualizations -** Different types of charts, Formatting charts with Title, Colors.
8	**Dashboards -** Filters in Power BI, Formatting dashboards.
9	Analysis of revenue in sales dataset: i) Create a choropleth map (fill the map) to spot the special trends to show the state which has the highest revenue. ii) Create a line chart to show the revenue based on the month of the year. iii) Create a bin of size 10 for the age measure to create a new dimension to show the revenue. iv) Create a donut chart view to show the percentage of revenue per region by creating zero

	access in the calculated field. v) Create a butterfly chart by reversing the bar chart to compare female & male revenue based on product category. vi) Create a calculated field to show the average revenue per state & display profitable & non-profitable state. vii) Build a dashboard.
10	Analysis of GDP dataset: i) Visualize the countries data given in the dataset with respect to latitude and longitude along with country name using symbol maps. ii) Create a bar graph to compare GDP of Belgium between 2006 – 2026. iii) Using pie chart, visualize the GDP of India, Nepal, Romania, South Asia, Singapore by the year 2010. iv) Visualize the countries Bhutan & Costa Rica competing in terms of GDP. v) Create a scatter plot or circle views of GDP of Mexico, Algeria, Fiji, Estonia from 2004 to 2006. vi) Build an interactive dashboard
11	Analysis of HR Dataset: i) Create KPI to show employee count, attrition count, attrition rate, attrition count, active employees, and average age. ii) Create a Lollipop Chart to show the attrition rate based on gender category. iii) Create a pie chart to show the attrition percentage based on Department Category iv) Drag department into colours and change automatic to pie. Entire view, Drag attrition count to angle. Label attrition count, change to percent, add total also, edit label. v) Create a bar chart to display the number of employees by Age group. vi) Create a highlight table to show the Job Satisfaction Rating for each job role based on employee count. vii) Create a horizontal bar chart to show the attrition count for each Education field, Education field wise attrition – drag education field to rows, sum attrition count to col. viii) Create multiple donut chart to show the Attrition Rate by Gender for different Age group.
12	Analysis of Amazon Prime Dataset: i) Create a Donut chart to show the percentage of movie and tv shows ii) Create an area chart to shows by release year and type iii) Create a horizontal bar chart to show Top 10 genre iv) Create a map to display total shows by country v) Create a text sheet to show the description of any movie/movies. vi) Build an interactive Dashboard.

Course outcomes (Course Skill Set):

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

CO1: Design the experiment to create basic charts and graphs using Tableau and Power BI. (PO – 1,3,5,8,9,11, PSO – 1,2,3)

CO2: Develop the solution for the given real-world problem. (PO – 1,2,3,5,8,11, PSO – 1,2,3)

CO3: Analyze the results and produce substantial written documentation. (PO – 1,2,3,5,8,11, PSO – 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 (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:

- "Microsoft Power BI Dashboards Step by Step", by Errin O'Connor, 2019 by Pearson Education, Inc
- "Information Dashboard Design: Displaying Data for At-a-glance Monitoring" by Stephen Few
- https://help.tableau.com/current/guides/get-started-tutorial/en-us/get-started-tutorial- home.htm
- https://www.tutorialspoint.com/tableau/index.htm
- https://www.simplilearn.com/tutorials/power-bi-tutorial/power-bi-vs-tableau

Project Management with Git			
Course Code	24CI37B	**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** • Create a new repository and configure it with essential settings. • 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** Write the commands to merge a branch into the main branch and resolve any merge conflicts.
4	**Collaboration and Remote Repositories** Clone a remote Git repository to your local machine.
5	**Collaboration and Remote Repositories** • Fetch the latest changes from a remote repository and rebase your local branch onto the updated remote branch. 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 – 1,2,3,5,8,11, PSO – 1,2,3)

CO2: Create and manage the branches. (PO – 1,2,3,5,8,11, PSO – 1,2,3)

CO3: Apply commands related to collaboration and remote repositories. (PO – 1,2,3,5,8,11, PSO – 1,2,3)

CO4: Use the commands related to Git tags, releases and advanced git operations. (PO – 1,2,3,5,8,11, PSO – 1,2,3)

CO5: Analyse and change the git history. (PO – 1,2,3,5,8,11, PSO – 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 (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_013094443347369984278 2_shared /overview
- https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013301347121774592119 26_share d/overview

Prompt Engineering			
Course Code	24CI37C	**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:

The students should have knowledge of

- Basic Programming Skills (Python preferred)
- Comfort with Using Chatbots or AI Tools
- Internet Research Skills
- Understanding of Ethics in AI Usage

Course Objectives:

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

List of Experiments:

S. 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:

CO1: Identify and classify different types of prompts and their use cases in AI systems. (PO -1,2,3, PSO -1,2,3)

CO2: Develop and evaluate prompts for various NLP and generative AI applications. (PO -1,2,3,4, PSO -1,2,3)

CO3: Use APIs and tools to implement prompt-based solutions and analyse output consistency. (PO - 1,2,3,4,5, PSO - 1,2,3)

CO4: Apply frameworks and strategies to craft effective and adaptive prompts. (PO -1,2,3,5,8, PSO - 1,2,3)

CO5: Demonstrate the ability to use advanced prompt techniques and ethical practices in AI. (PO - 1,2,3, PSO - 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 (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.com
Claude (Anthropic)	LLM for safe and interpretable prompts	https://claude.ai
Google Gemini (Bard)	AI chatbot by Google	https://gemini.google.com
Google Colab	Cloud-based Jupyter notebook	https://colab.research.google.com
PromptPerfect	Prompt optimization tool	https://promptperfect.jina.ai
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.

Data Analytics with Excel			
Course Code	24CI37D	**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:

The students should have knowledge of

- Basics of Excel

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

List of Experiments:

S. 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 Auto filter & 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 – 1,2,3,5,8,11, PSO – 1,2,3)

CO2: Manipulate data lists using outline and pivot tables. (PO – 1,2,3,5,8,11, PSO – 1,2,3)

CO3: Use consolidation to summarize and report results from multiple worksheets. (PO – 1,2,3,5,8,11, PSO – 1,2,3)

CO4: Apply macros and Auto filter to solve the given real-world scenario. (PO – 1,2,3,5,8,11, PSO – 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 (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:

Text Books:

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

National Service Scheme (NSS)		Semester	3rd to 6th
Course Code	24NS38 / 24NS49 / 24NS58 / 24NS68	**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	14 Hours Practical Session per Semester		
Examination type (SEE)	Report Evaluation by College NSS Officer at the end of every semester (3rd to 6th semester)		

Course objectives:

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

1. Understand the community in general in which they work.
2. Identify the needs and problems of the community and involve them in problem –solving.
3. Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems.
4. 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.

1. 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.
2. State the need for NSS activities and its present relevance in the society and provide real-life examples.
3. Support and guide the students for self-planned activities.
4. You will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress in real activities in the field.
5. 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.
9. 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.
10. Spreading public awareness under rural outreach programs. (minimum5 programs).
11. Social connect and responsibilities.
12. Plantation and adoption of plants. Know your plants.
13. Organize National integration and social harmony events /workshops /seminars. (Minimum 02 programs).
14. 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	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	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	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	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.

Sl No	Topic	Group size	Location	Activity execution	Reporting	Evaluation Of the Topic
1.	Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing.	May be individual or team	Farmers land/Villages/ roadside / Community area/ College campus etc…..	Site selection /proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
2.	Waste management– Public, Private and Govt organization, 5 R's.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	Site selection /proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer

3.	Setting of the information imparting club for women leading to contribution in social and economic issues.	May be individual or team	Women empowerment groups/ Consulting NGOs & Govt Teams / College campus etc…..	Group selection/pro per consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
4.	Water conservation techniques – Role of different stakeholders– Implementation.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	site selection / proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
5.	Preparing an actionable business proposal for enhancing the village income and approach for implementation.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	Group selection/pro per consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
6.	Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education.	May be individual or team	Local government / private/ aided schools/Government Schemes officers/ etc…..	School selection/proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer

7.	Developing Sustainable Water management system for rural areas and implementation approaches.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	site selection/proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
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.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	Group selection/pro per consultation/Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
9.	Spreading public awareness under rural outreach programs. (minimum5 programs). Social connect and responsibilities.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	Group selection/pro per consultation/Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
10.	Plantation and adoption of plants. Know your plants.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	Place selection/proper consultation/Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS

						officer
11.	Organize National integration and social harmony events /Workshops /Seminars. (Minimum 02 programs).	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	Place selection/proper consultation/Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
12.	Govt. school Rejuvenation and helping them to achieve good infrastructure.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/ Government Schemes officers/ campus etc…..	Place selection/proper consultation/Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer

Plan of Action (Execution of Activities for Each Semester):

Sl.NO	Practice Session Description
1	Lecture session by NSS Officer
2	Students Presentation on Topics
3	Presentation - 1, Selection of topic, PHASE - 1
4	Commencement of activity and its progress - PHASE - 2
5	Execution of Activity
6	Execution of Activity
7	Execution of Activity
8	Execution of Activity
9	Execution of Activity
10	Case study-based Assessment, Individual performance
11	Sector wise study and its consolidation
12	Video based seminar for 10 minutes by each student At the end of semester with Report.

- In every semester from 3rd semester to 6th semester, each student should do activities according to the scheme and syllabus.

- At the end of every semester student performance has to be evaluated by the NSS officer for the assigned activity progress and its completion.
- At last, in 6th semester consolidated report of all activities from 3rd to 6th semester, compiled report should be submitted as per the instructions.

Course outcomes (Course Skill Set):

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

CO1: Understand the importance of his / her responsibilities towards society. (PO – 6,7,8,9)

CO2: Analyse the environmental and societal problems/issues and will be able to design solutions for the same. (PO – 6,7,8,9)

CO3: Evaluate the existing system and to propose practical solutions for the same for sustainable development. (PO – 6,7,8,9)

CO4: Implement government or self-driven projects effectively in the field. (PO – 6,7,8,9)

CO5: Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony in general. (PO – 6,7,8,9)

Assessment Details for CIE (both CIE and SEE):

Weightage	**CIE – 100%**
Presentation - 1 Selection of topic, PHASE - 1	20 Marks
Commencement of activity and its progress - PHASE - 2	20 Marks
Case study-based Assessment Individual performance	20 Marks
Sector wise study and its consolidation	20 Marks
Video based seminar for 10 minutes by each student at the end of semester with Report.	20 Marks
Total marks for the course in each semester	**100 Marks**

- Implementation strategies of the project (NSS work).
- The last report should be signed by NSS Officer, the HOD and principal.
- At last report should be evaluated by the NSS officer of the institute.
- Finally, the consolidated marks sheet should be sent to the university and also to be made available at LIC visit.

100 marks CIE entry will be entered in IA marks portal at the end of each semester 3rd to 6th sem, Report and assessment copy should be made available in the department semester wise.

Students should present the progress of the activities as per the schedule in the prescribed practical session in the field. There should be positive progress in the vertical order for the benefit of society in general.

Suggested Learning Resources:

- **NSS Course Manual,** Published by NSS Cell, VTU Belagavi.
- Government of Karnataka, NSS cell, activities reports and its manual.
- Government of India, nss cell, Activities reports and its manual.

Physical Education (Sports & Athletics)		Semester	3rd to 6th Sem
Course Code	24PE38 / 24PE49 / 24PE58 / 24PE68	**CIE Marks**	100
Teaching Hours/Week (L: T: P)	0:0:2	**SEE Marks**	-
Credits	-	**Total Marks**	100
Contact Hours	14 Hours Practical per Semester	**Exam Hours**	-
Examination type (SEE)	Report Evaluation by College PE Coordinator at the end of every semester (3rd to 6th semester)		

Prerequisites: NIL

Semester - III

Module – I: Orientation

A. Lifestyle
B. Fitness
C. Food & Nutrition
D. Health & Wellness
E. Pre-Fitness test

Module – II: General Fitness & Components of Fitness

A. Warming up (Free Hand Exercises)
B. Strength – Push-up/ Pull-ups
C. Speed – 30 Mtr Dash
D. Agility – Shuttle Run
E. Flexibility – Sit and Reach
F. Cardiovascular Endurance – Harvard Step Test

Module – III: Recreational Activities

A. Postural deformities
B. Stress management
C. Aerobics
D. Traditional Games

Course outcomes (Course Skill Set):

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

CO1: Understand the fundamental concepts and skills of Physical Education, Health, Nutrition and Fitness. (PO – 6,7,8,9)

CO2: Familiarization of health-related exercises, sports for overall growth and development. (PO – 6,7,8,9)

CO3: Create a foundation for the professionals in physical education and sports. (PO – 6,7,8,9)

CO4: Participate in the competition at regional/ state/ national/ international levels. (PO – 6,7,8,9)

CO5: Create consciousness among the students on health, fitness and wellness in developing and

maintaining a healthy lifestyle. (PO – 6,7,8,9)

Scheme and Assessment for Auditing the Course and Grades:

Sl. No	Activity	Marks
1	Participation of students 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**

Semester – IV

Module – I: Ethics and Moral Values

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

Module – II: Specific Games (Any-one to be selected by the Student)

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

Course outcomes (Course Skill Set):

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

CO1: Understand the ethics and moral values in sports and athletics. (PO – 6,7,8,9)
CO2: Perform in the selected sports or athletics of students' choice. (PO – 6,7,8,9)
CO3: Understand the roles and responsibilities of organization and administration of sports and games. (PO – 6,7,8,9)

Scheme and Assessment for Auditing the Course and Grades:

Sl. No	Activity	Marks
1	Participation of students 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**

Semester - V

Module – I: Orientation

A. Fitness
B. Food & Nutrition

Module – II: General Fitness & Components of Fitness

A. Agility – Shuttle run
B. Flexibility – Sit & reach
C. Cardiovascular Endurance – Harvard step test

Module – III: Specific Games (Any-one to be selected by the Student)

A. Badminton (Fore hand low/ high service, back hand service, smash, drop)
B. Basketball (Dribbling, passing, shooting, etc)
C. Athletics (Field events – Throws)

Course outcomes (Course Skill Set):

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

CO1: Understand the fundamental concepts and skills of physical education, health, food, nutrition and general fitness. (PO – 6,7,8,9)
CO2: Familiarization of health-related exercises, sports for overall growth and development. (PO – 6,7,8,9)
CO3: Create a foundation for the professionals in physical education and sports. (PO – 6,7,8,9)
CO4: Participate in the competition at regional/ state/ national/ international levels. (PO – 6,7,8,9)
CO5: Understand and practice of specific games and athletic throwing events. (PO – 6,7,8,9)

Scheme and Assessment for Auditing the Course and Grades:

Sl. No	Activity	Marks
1	Participation of students 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	50

	the students	
Total		**100**

Semester – VI

Module – I: Orientation

A. Postural deformities
B. Stress management

Module – II: Specific Games (Any-one to be selected by the Student)

A. Throwball
B. Table Tennis
C. Athletics (Field events – Jumps) – Any event as per availability of ground

Module – III: Aerobics

Course outcomes (Course Skill Set):

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

CO1: Understand the postural deformities and stress management in sports and athletics. (PO – 6,7,8,9)
CO2: Participate in the competition at regional/ state/ national/ international levels. (PO – 6,7,8,9)
CO3: Understand and practice of specific games and athletic jumping events. (PO – 6,7,8,9)
CO4: Understand and practice of Aerobics. (PO – 6,7,8,9)

Scheme and Assessment for Auditing the Course and Grades:

Sl. No	Activity	Marks
1	Participation of students 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		Semester	3rd to 6th Sem
Course Code	24YO38 / 24YO49 / 24YO58 / 24YO68	**CIE Marks**	100
Teaching Hours/Week (L: T: P)	0:0:2	**SEE Marks**	-
Credits	-	**Total Marks**	100
Contact Hours	14 Hours Practical per Semester	**Exam Hours**	-
Examination type (SEE)	Report Evaluation by College Yoga Coordinator at the end of every semester (3rd to 6th semester)		

Prerequisites: NIL

Course Objectives:

- To enable the student to have good health.
- To practice mental hygiene.
- To possess emotional stability.
- To integrate moral values.
- To attain higher level of consciousness.

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

Yoga Syllabus

Semester III

Yoga, its origin, history and development. Yoga, its meaning, definitions. Different schools of yoga, Aim and Objectives of yoga, importance of prayer Yogic practices for common man to promote positive health.

Rules to be followed during yogic practices by practitioner Yoga its misconceptions, Difference between yogic and non-yogic practices, Suryanamaskar prayer and its meaning, Need, importance and benefits of Suryanamaskar 12 count, 2 rounds

Asana, 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

a. Sitting	1. Padmasana
	2. Vajrasana
b. Standing	1. Vrikshana
	2. Trikonasana
c. Prone line	1. Bhujangasana
	2. Shalabhasana
d. Supine line	1. Utthitadvipadasana
	2. Ardhahalasana

Semester IV

Patanjali's Ashtanga Yoga, its need and importance.
Yama: Ahimsa, satya, asteya, brahmacarya, aparigraha
Niyama: shoucha, santosh, tapa, svaadhyaya, Eshvarapranidhan
Suryanamaskar12 count- 4 rounds of practice

Asana, 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

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

Meaning, importance and benefits of Kapalabhati.

40 strokes/min 3 rounds

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

Pranayama – 1. Suryanuloma –Viloma 2. Chandranuloma-Viloma 3. Suryabhedana 4. Chandra Bhedana 5. Nadishodhana

Semester V

Patanjali's Ashtanga Yoga its need and importance. Ashtanga Yoga

1. Asana
2. Pranayama
3. Pratyahara

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

a. Sitting	1. Ardha Ushtrasana
	2. Vakrasana
	3. Yogamudra in Padmasana
b. Standing	1. Urdhva Hastothanasana
	2. Hastapadasana
	3. ParivrittaTrikonasana
	4. Utkatasana
c. Prone line	1. Padangushtha Dhanurasana
	2. Poorna Bhujangasana / Rajakapotasana
d. Supine line	1. Sarvangasana
	2. Chakraasana
	3. Navasana/Noukasana
	4. Pavanamuktasana

Revision of practice 60 strokes/min 3 rounds

Meaning by name, technique, precautionary measures and benefits of each Pranayama

1. Ujjayi 2. Sheetali 3. Sheektari

Semester VI

Ashtanga Yoga 1. Dharana 2. Dhyana (Meditation) 3. Samadhi

Asana by name, technique, precautionary measures and benefits of each asana Different types of Asanas

a. Sitting	1. Bakasana
	2. Hanumanasana
	3. Ekapada Rajakapotasana
	4. Yogamudra in Vajrasana
b. Standing	1. Vatayanasana
	2. Garudasana
c. Balancing	1. Veerabhadrasana
	2. Sheershasana
d. Supine line	1. Sarvangasana
	2. Setubandha Sarvangasana

3. Shavasanaa (Relaxation poisture).

Revision of Kapalabhati practice 80 strokes/min - 3 rounds

Different types. Meaning by name, technique, precautionary measures and benefits of each Pranayama 1. Bhastrika 2. Bhramari

Meaning, Need, importance of Shatkriya. Different types. Meaning by name, technique, precautionary measures and benefits of each Kriya 1. Jalaneti & sutraneti 2. Nouli (only for men) 3. Sheetkarma Kapalabhati

Course outcomes (Course Skill Set):

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

CO1: Understand the meaning, aim and objectives of Yoga. (PO – 6,7,8,9)

CO2: Perform Suryanamaskar and able to Teach its benefits. (PO – 6,7,8,9)

CO3: Understand and teach different Asanas by name, its importance, methods and benefits. (PO – 6,7,8,9)

CO4: Instruct Kapalabhati and its need and importance. (PO – 6,7,8,9)

CO5: Teach different types of Pranayama by its name, precautions, procedure and uses. (PO – 6,7,8,9)

CO6: Coach different types of Kriyas, method to follow and usefulness. (PO – 6,7,8,9)

Assessment Details (both CIE and SEE):

- Students will be assessed with internal test by a. Multiple choice questions b. Descriptive type questions (Two internal assessment tests with 25 marks/test)
- Final test shall be conducted for whole syllabus for 50 marks.
- Continuous Internal Evaluation shall be for 100 marks (including IA test)

Suggested Learning Resources:

Text Books:

1. Yogapravesha in Kannada by Ajitkumar
2. Light on Yoga by BKS Iyengar
3. Teaching Methods for Yogic practices by Dr. M L Gharote & Dr. S K Ganguly
4. Yoga Instructor Course hand book published by SVYASA University, Bengaluru
5. Yoga for Children –step by step – by Yamini Muthanna

Web links and Video Lectures (e-Resources):

- https://youtu.be/KB-TYlgd1wE
- https://youtu.be/aa-TG0Wg1Ls

IV SEMESTER

Analysis and Design of Algorithms			
Course Code	24CI41	**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

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

Course Objectives:

- To learn the methods for analysing 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):

These are sample Strategies that 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.
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 outcomes (Course Skill Set):

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

CO1: Apply asymptotic notational method to analyze the performance of the algorithms in terms of time complexity (PO – 1,2,3,4, PSO – 1)

CO2: Demonstrate divide & conquer approaches and decrease & conquer approaches to solve computational problems. (PO – 1,2,3,4,5, PSO – 1)

CO3: 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)

CO4: Apply greedy and input enhancement methods to solve graph & string based computational problems. (PO – 1,2,3,4,5, PSO – 1)

CO5: Analyse various classes (P, NP and NP Complete) and 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:

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

Reference Books:

2. “Computer Algorithms/C++”, Ellis Horowitz, Satraj Sahni and Rajasekaran, 2nd Edition, 2014, Universities Press.
3. “Introduction to Algorithms”, Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Cliffordtein, 3rd Edition, PHI.
4. “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)
   o Gate Based Aptitude Test

Database Management System			
Course Code	24CI42	**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

- 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 **8 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**

MODULE-2 **8 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

MODULE-3 **8 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.

Textbook 1: Ch 6.1 to 6.5 and Ch 7.1 to 7.3

MODULE-4 **8 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.
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

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 and Textbook 4: Chapter 4

Course outcome (Course Skill Set):

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

CO1: Describe database concepts, data models, schemas, and ER modeling. (PO – 1,2,3,4,5, PSO – 1,2,3)

CO2: Apply relational model concepts and relational algebra for schema design. (PO – 1,2,3,4,5, PSO – 1,2,3)

CO3: Use SQL for database creation, manipulation, and advanced querying. (PO – 1,2,3,4,5, PSO – 1,2,3)

CO4: Normalize relations and explain transaction management techniques. (PO – 1,2,3,4,5, PSO – 1,2,3)

CO5: Implement NoSQL operations using MongoDB and integrate with applications. (PO – 1,2,3,4,5, PSO – 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:

Text Books:

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.

Reference Books:

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

Web links and Video Lectures (e-Resources):

- 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

Introduction to Artificial Intelligence and Machine Learning			
Course Code	24CI43	**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

- Python
- Probability
- Trees
- Graphs
- Propositional & Predicate 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)

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

1. Chalk and Talk
2. Animated videos to demonstrate the applications
3. Power point presentation

Module-1 **8 Hours**

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

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 1- 1.1, Chapter 2- 2.1, 2.2, 2.3, 2.4, Chapter 3- 3.1, 3.2, 3.3, 3.4**

Module-2 **8 Hours**

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

Adversarial Search: Games, Optimal decision in games, Alpha-Beta Pruning.

Logical Agents: Knowledge–based agents, The Wumpus world.

Propositional Logic: A very simple logic.

First Order Logic: Syntax and Semantics of First Order logic, Using First Order logic.

Text book 1: Chapter 3- 3.5, 3.6; Chapter 4 – 4.1, 4.2; Chapter 7- 7.1, 7.2, 7.4; Chapter 8- 8.2, 8.3

Module-3	8 Hours

Inference in First Order Logic: Propositional Versus First Order Inference, Unification, Forward Chaining, Backward Chaining, Resolution.

Uncertain Knowledge and Reasoning: Quantifying Uncertainty: Acting under Uncertainty, Basic Probability Notation, Inference using Full Joint Distributions, Independence, Baye's Rule and its use.

Expert Systems: Representing and using domain knowledge, ES shells. Explanation, knowledge acquisition.

Text book 1: Chapter 9- 9.1, 9.2, 9.3, 9.4, 9.5; Chapter 12-12.1, 12.2, 12.3, 12.4, 12.5
Text Book 2: Chapter 20

Module-4	8 Hours

Overview of Machine Learning: Introduction, What Is Machine Learning? Examples of Machine Learning Applications: Association Rules, Classification, Regression, Unsupervised Learning, Reinforcement Learning.

Text Book 3: Chapter 1 - 1.1, 1.2.1, 1.2.3, 1.2.4, 1.2.5, 1.3

Module-5	8 Hours

Supervised Learning: Learning a Class from Examples, Vapnik - Chervonenkis Dimension, Probably Approximately Correct Learning, Noise, Learning Multiple Classes, Regression, Model Selection and Generalization, Dimensions of a Supervised Machine Learning Algorithm.

Text Book 3: Chapter 2- 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8

Course outcomes (Course Skill Set):

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

CO1: Develop the structure and behavior of intelligent agents and apply uninformed search algorithms, including iterative deepening, to solve computational problems. (PO – 1,2,3,5,11, PSO – 1,2,3)

CO2: Apply informed search strategies and logical reasoning methods to design intelligent decision-making agents. (PO – 1,2,3,5,11, PSO – 1,2,3)

CO3: Apply inference techniques in first-order logic and probabilistic reasoning, to develop knowledge-based and expert systems for intelligent decision-making. (PO – 1,2,3,5,11, PSO – 1,2,3)

CO4: Describe the fundamental concepts of machine learning and distinguish between key learning paradigms,

with real-world examples. (PO – 1,2,3,5,11, PSO – 1,2,3)

CO5: Apply the principles of supervised learning to build models for classification and regression, and evaluate their performance using theoretical and empirical metrics. (PO – 1,2,3,5,11, PSO – 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:

Textbooks:

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.
3. Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, Prentice Hall of India, 2021.

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):

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

Data Analytics with R			
Course Code	24CI44	**CIE Marks**	50
Teaching Hours/Week (L: T: P)	3:0:2	**SEE Marks**	50
Credits	04	**Total Marks**	100
Contact Hours	40 L + 15 P	**Exam Hours**	3
Examination type (SEE)	Theory		

Prerequisites:

The students should have knowledge of

- Data Visualization Concepts

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):

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

MODULE-1 **8 Hours**

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

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

MODULE-2 **8 Hours**

Basics of R Continued:
Matrices and Arrays, Lists, Data Frames, Factors, Strings, Dates and Times

Chapter 2: 2.3, 2.4, 2.5, 2.6, 2.7, 2.8.1, 2.8.2

MODULE-3 **8 Hours**

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

Chapter 3: 3.1, 3.2, 3.3, 3.4

MODULE-4 **8 Hours**

Graphics using R:
Exploratory Data Analysis, Main Graphical Packages, Pie Charts, Scatter Plots, Line Plots, Histograms, Box Plots, Bar Plots, Other Graphical packages.

Chapter 4: 4.1 to 4.9

MODULE-5 **8 Hours**

Statistical Analysis using R:
Basic Statistical Measures, Normal distribution, Binomial distribution, Correlation Analysis, Regression Analysis-Linear Regression Analysis of Variance.

Chapter 5: 5.1, 5.3, 5.4, 5.5, 5.6.1, 5.7

Practical component of IPCC

Sl. No	Experiments
1	Demonstrate the steps for installation of R and R Studio. Perform the following: a) 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. b) Demonstrate Arithmetic and Logical Operations with simple examples. c) Demonstrate generation of sequences and creation of vectors. d) Demonstrate Creation of Matrices e) Demonstrate the Creation of Matrices from Vectors using Binding Function. f) 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

<table>
<tr><td>4</td><td>Develop a program to find the factorial of given number using recursive function calls.</td></tr>
<tr><td>5</td><td>Develop an R Program using functions to find all the prime numbers up to a specified number by the method of Sieve of Eratosthenes</td></tr>
<tr><td>6</td><td>The built-in data set mammals contain data on body weight versus brain weight. Develop R commands to:
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.
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 Miles/(US) gallon, [2] cyl Number of cylinders [3] disp Displacement (cu.in.), [4] hp Gross horsepower [5] drat Rear axle</td></tr>
</table>

		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.

Course outcome (Course Skill Set):

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

CO1: Describe the structures of R programming. (PO – 1,2,3,5,8,11, PSO – 1,2,3)

CO2: Illustrate the basics of data preparation with real world examples. (PO – 1,2,3,5,8,11, PSO – 1,2,3)

CO3: Apply the graphical packages of R for visualization. (PO – 1,2,3,5,8,11, PSO – 1,2,3)

CO4: Apply various statistical analysis methods for data analytics. (PO – 1,2,3,5,8,11, PSO – 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.

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 regulations. 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**)

- The question paper will have ten questions. Each question is set for 20 marks.
- 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.
- 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 Book:

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

Reference Books:

2. "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).
3. 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):

- URL: 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 (Suggested Activities in Class)/ Practical Based Learning:

- Programming Assignments (10 marks)

Analysis and Design of Algorithms Laboratory			
Course Code	24CIL45	**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 of

- 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.
- To check the real-world algorithmic problem belongingness.

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.
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 algorithms 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)

Conduct of Practical Examination:

- **Experiment distribution**
  - For laboratories having only one part: Students are allowed to pick one experiment from the lot with equal opportunity.
  - For laboratories having PART A and PART B: Students are allowed to pick one experiment from PART A and one experiment from PART B, with equal opportunity.
- Change of experiment is allowed only once and marks allotted for procedure to be made zero of the changed part only.
- Marks Distribution (Need to change in accordance with university regulations)
  - For laboratories having only one part – Procedure + Execution + Viva-Voce: 15+70+15 = 100 Marks
  - For laboratories having PART A and PART B

i. Part A – Procedure + Execution + Viva = 6 + 28 + 6 = 40 Marks
ii. Part B – Procedure + Execution + Viva = 9 + 42 + 9 = 60 Marks

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 03 hours.

Suggested Learning Resources:

- Virtual Labs (CSE): http://cse01-iiith.vlabs.ac.in/

Linear Algebra			
Course Code	24CI46A	**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 of

- Basics of Vectors
- Basic Mathematics

Course Objectives:

The objectives of the course are to facilitate the learners to:

- To equip the students with standard concepts and tools in Linear algebra which will find them useful in their disciplines.
- Gain the knowledge of linear algebra tools and concepts to implement 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.

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

MODULE-1 **8 Hours**

Vector Spaces: Introduction, Vector spaces, Subspaces, Linear Combinations, Linear Spans, row space and column space of a Matrix, Linear Dependence and Independence, Basis and Dimension, Problems.

Text Book:1, 3.1,3.2,3.3,3.4 and 3.5

MODULE-2 **8 Hours**

Linear Transformations: Introduction, Linear Mappings, Geometric linear transformation of i2, Kernel and Image of a linear transformations, Rank-Nullity Theorem (No proof), Matrix representation of linear transformations, Singular and Non-singular linear transformations, Invertible linear transformations, Problems.

Text Book:1, 8.1,8.2 and 8.3

MODULE-3 **8 Hours**

Eigen Values and Eigen Vectors: Introduction, Polynomials of Matrices, Applications of Cayley-Hamilton Theorem, Eigen spaces of a linear transformation, Characteristic and Minimal Polynomials of Block Matrices, Jordan Canonical form.

Text Book:1, 6.1,6.2,6.3,6.4 and 6.5

MODULE-4 **8 Hours**

Inner Product Spaces: Inner products, inner product spaces, length and orthogonality, orthogonal sets and Bases, projections, Gram- Schmidt process, QR-factorization, least squares problem and least square error.

Text Book:1, 3.4 Text Book:2, 6.7

MODULE-5 **8 Hours**

Optimization Techniques in Linear Algebra: Diagonalization and Orthogonal diagonalization of real symmetric matrices, quadratic forms and its classifications, Hessian Matrix, Method of steepest descent, Singular value decomposition. Dimensionality reduction – Principal component analysis.

Text Book:2, 9.1,9.2,9.3 and 9.4

Course outcomes (Course Skill Set):

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

CO1: Explain the concepts of vector spaces, subspaces, bases, dimension and their properties. (PO – 1,2,3)
CO2: Use matrices and linear transformations to solve the given problem. (PO – 1,2,3)
CO3: Compute Eigenvalues and Eigenvectors for the linear transformations. (PO – 1,2,3)
CO4: Determine orthogonality of linear product spaces. (PO – 1,2,3)
CO5: Apply the optimization techniques to solve the 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:

Text Books:

1. David C. Lay, Steven R. Lay, Judi J Mc. Donald: "Linear Algebra and its applications", Pearson Education, 6th Edition, 2021.
2. Gilbert Strang: "Linear Algebra and its applications", Brooks Cole, 4th edition 2005.

Reference Books:

1. Richard Bronson & Gabriel B. Costa: "Linear Algebra: An Introduction", 2nd edition. Academic Press, 2014.
2. Seymour Lipschutz, Marc Lipso: "Theory and problems of linear algebra", Schaum's outline series - 6th edition, 2017, McGraw-Hill Education.
3. Marc Peter Deisennroth, A. Aldo Faisal, Cheng Soon Ong: "Mathematics for Machine learning", Cambridge University Press, 2020.

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/
- VTU e-Shikshana Program
- VTU EDUSAT Program.

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

- Quizzes
- Assignments
- Seminar

Discrete Mathematical Structures			
Course Code	24CI46B	**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 of

- Basics of Logics
- Understanding Algebraic Properties
- Basic Mathematics

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 (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**

Fundamentals of Logic: 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.

Text Book:2 - 2.1,2.2 and 2.3

MODULE-2 **8 Hours**

Properties of the Integers: 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.

Text Book:2 - 1.1,1.2,1.3 ,1.4 ,4.1 and 4.2

MODULE-3 **8 Hours**

Relations and Functions: 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 ‐ Hasse Diagrams, Equivalence Relations and Partitions.

Text Book:2 - 5.1,5.2,5.3,5.5 ,5.6,7.1,7.2,7.3 and 7.4

MODULE-4 **8 Hours**

The Principle of Inclusion and Exclusion: 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.

Text Book:2 - 8.1,8.2,8.3,8.4,10.1 and 10.2

MODULE-5 **8 Hours**

Introduction to Groups Theory: 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, Subgroups, cyclic groups, Cosets, Lagrange's Theorem.

Text Book:1 - 7.1,7.2 and 7.3

Course outcomes (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 - 1,2,3).

CO2: Demonstrate the application of discrete structures in different fields of computer science **(**PO - 1,2,3).

CO3: Apply the basic concepts of relations, functions and partially ordered sets for computer representations **(**PO - 1,2,3).

CO4: Solve problems involving recurrence relations and generating functions **(**PO - 1,2,3).

CO5: Illustrate the fundamental principles of Algebraic structures with the problems related to computer science & engineering **(**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:

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.

4.

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/
- VTU e-Shikshana Program
- VTU EDUSAT Program
- http://www.themathpage.com/
- http://www.abstractmath.org/
- http://www.ocw.mit.edu/courses/mathematics/

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

- Quizzes
- Assignments
- Seminar

Graph Theory			
Course Code	24CI46C	**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 of

- Basics of Graphs
- Basic Mathematics

Course Objectives:

- Understand the basic concepts of graphs and their properties, and operations of graphs.
- Hamiltonian and Euler graphs, trees and matrix representation of the graph.
- Apply the concepts of a planar graph, matching and colouring in computer science engineering.

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 Graphs: Introduction- Basic definition – Application of graphs – finite, infinite and bipartite graphs – Incidence and Degree – Isolated vertex, pendant vertex and Null graph. Paths and circuits – Isomorphism, sub-graphs, walks, paths and circuits, connected graphs, disconnected graphs and components.

Text Book:1 - 1.1 ,1.2,1.3,1.4,1.5,2.1,2.2,2.3,2.4 and 2.5; Text Book:2 - 1.2

MODULE-2 **8 Hours**

Eulerian and Hamiltonian graphs: Euler graphs, Operations on graphs, Hamiltonian paths and circuits, Travelling salesman problem. Directed graphs – types of digraphs, Digraphs and binary relation.

Text Book:1 - 2.6,2.7,2.8,2.9,2.10,9.2 and 9.3

MODULE-3 **8 Hours**

Trees – properties, pendant vertex, Distance and centres in a tree - Rooted and binary trees, counting trees, spanning trees.

Connectivity Graphs: Vertex Connectivity, Edge Connectivity, Cut-set and Cut Vertices, Fundamental circuits.

Text Book:1 - 3.1,3.2,3.3,3.4,3.5,3.6,3.7,4.1,4.2,4.3,4.4 and 4.5

MODULE-4 **8 Hours**

Planar Graphs: Planar graphs, Kuratowski's theorem (proof not required), Different representations of planar graphs, Euler's theorem, Geometric dual.

Graph Representations: Matrix representation of graphs-Adjacency matrix, Incidence Matrix, Circuit Matrix, Path Matrix.

Text Book:1 - 5.2,5.3,5.4,5.6,7.1,7.3,7.8 and 7.9

MODULE-5 **8 Hours**

Graph Colouring: Colouring- Chromatic number, Chromatic polynomial, Matchings, Coverings, four colour problem and Five colour problem. Greedy colouring algorithm

Text Book:1 - 8.1,8.2,8.3,8.4,8.5 and 8.6; Reference Book:3 - 5.2

Course outcomes (Course Skill Set):

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

CO1: Explain the fundamental concepts of properties and representation of graphs (PO – 1,2,3).

CO2: Solve the problems involving characterization and operations on graphs (PO – 1,2,3).

CO3: Apply concepts of trees and graph connectivity to solve real world problems (PO – 1,2,3).

CO4: Apply the concepts of planar graph and graph representations to solve the given problem (PO – 1,2,3).

CO5: Use the concepts of matching and coloring of graphs to solve the real-world 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:

Text Books:

1. Narsingh Deo, Graph theory with the applications to engineering & Computer Science, Dovers Publications, 2016
2. J.A. Bondy and U.S.R. Murty. Graph theory with Applications, Springer, 1st edition, 2008.

Reference Books:

1. Garry Chartand and Ping Zhang, Introduction to Graph Theory, Tata McGraw-Hill, 2006.
2. Frank Harary, Graph Theory, Narosa Publishing House, Latest edition.
3. R. Diestel, Graph Theory, free online edition, 2016: diestel-graph-theory.com/basic.html.
4. Douglas B. West, Introduction to Graph Theory, Prentice Hall India Ltd.,2001
5. Robin J. Wilson, Introduction to Graph Theory, Longman Group Ltd.,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/
- VTU e-Shikshana Program
- VTU EDUSAT Program

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

- Quizzes
- Assignments
- Seminar

UX / UI Design			
Course Code	24CI47A	**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: NIL

Course Objectives:

- To explore and understand the nuances of User Experience and User Interface.
- To gain mastery over the usage of Figma for designing and prototyping UI/UX.
- To understand user requirement and translate it into UI/UX protype.
- To analyse apps and websites and understand how they can be continually improved.
- To understand the UI components and interactions being used in different apps and websites.

List of Experiments:

S. No	Experiments
1	Chat App Redesign: Create a Wireframe and redesign any popular chat app.
2	Food App: Create a wireframe, Design and Prototype the UI Pages for the food application.
3	Social Media App: Create a wireframe, Design and Prototype social media photo sharing app.
4	Product Website: Design and prototype a product website page. Create web pages and rollovers for the web pages
5	Travel Agency Website: Create a wireframe, Design and prototype the UI for the website including design for Home Page with search bar, Activities page, Client Testimonial Page, Image Gallery
6	UI/UX Designer Portfolio Design: Create a wireframe, Design and prototype a UI for a portfolio including design for About page, Work showcase page, Blog page, contact page
7	Dashboard Design: Create a wireframe, Design and Prototype Dashboard UI page, add some Dashboard details, statistics and graphs, Add dropdown options for some dashboard details
8	E-Commerce Website: Create a wireframe, Design and prototype Web pages including product category pages (example: mobiles, gaming consoles, Speakers), product pages in each category, buynow page, add to cart page
9	Educational Website: Create a wireframe, Design and Prototype the UI for an educational website – Include a Homepage with footer, About Us Page, Programs page, Instructors page, Pricing page, Payment's page with radial buttons. Design dropdowns for programs button
10	Music Player App: Create a wireframe, Design and prototype the pages with a background and a Rollover button, and Song selection Page with a Home Rollover button. The third page may include animated play and pause button, play music animation, timer animation.

Course outcomes (Course Skill Set):

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

CO1: Apply the basics of wireframing in designing apps and websites. (PO – 1,9, PSO – 1)

CO2: Make use of Figma for designing and prototyping UX/UI for different types of apps and websites. (PO – 2,5,9, PSO – 1)

CO3: Analyse user requirements and translate the requirements to design prototypes. (PO – 1,3,5,9, PSO – 1)

CO4: Demonstrate the UX/UI concepts applied when designing the prototype of apps and websites. (PO – 1,3,5,6, PSO – 1,3)

CO5: Develop (redesign) the existing apps and websites with customized design. (PO – 2,4,5,9, 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 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:

- https://www.figma.com/
- UX Programming for Beginners, August, 2022
- https://www.udemy.com/course/learn-figma-web-design
- https://www.udemy.com/course/figma-2023-master-class-realtime-uiux-web-projects

Technical Writing Using LaTeX			
Course Code	24CI47B	**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 of

- Familiarity with Document Preparation
- Typing and Editing Skills
- Basic Understanding of Mathematical Notation
- Logical and Structured Thinking

Course Objectives:

- To introduce the basic syntax and semantics of the LaTeX scripting language.
- To understand the presentation of tables and figures in the document.
- To illustrate the LaTeX syntax to represent the theorems and mathematical equations.
- To make use of the libraries (Tikz, algorithm) to design the diagram and algorithms in the document.

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) needs not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyse information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem with different approaches and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

List of Experiments:

S. No	Experiments

<table>
<tr><td>1</td><td>Develop a LaTeX script to create a simple document that consists of 2 sections [Section 1, Section 2], and a paragraph with dummy text in each section. And also include header [title of document] and footer [institute name, page number] in the document.</td></tr>
<tr><td>2</td><td>Develop a LaTeX script to create a document that displays the sample Abstract/Summary</td></tr>
<tr><td>3</td><td>Develop a LaTeX script to create a simple title page of the VTU project Report [Use suitable Logos and text formatting]</td></tr>
<tr><td>4</td><td>Develop a LaTeX script to create the Certificate Page of the Report [Use suitable commands to leave the blank spaces for user entry]</td></tr>
<tr><td>5</td><td>Develop a LaTeX script to create a document that contains the following table with proper labels.
<table>
<tr><th rowspan="2">S.No</th><th rowspan="2">USN</th><th rowspan="2">Student Name</th><th colspan="3">Marks</th></tr>
<tr><th>Subject 1</th><th>Subject 2</th><th>Subject 3</th></tr>
<tr><td>1</td><td>4XX22XX001</td><td>Name 1</td><td>89</td><td>60</td><td>90</td></tr>
<tr><td>2</td><td>4XX22XX002</td><td>Name 2</td><td>78</td><td>45</td><td>98</td></tr>
<tr><td>3</td><td>4XX22XX003</td><td>Name 3</td><td>67</td><td>55</td><td>59</td></tr>
</table></td></tr>
<tr><td>6</td><td>Develop a LaTeX script to include the side-by-side graphics/pictures/figures in the document by using the subgraph concept</td></tr>
<tr><td>7</td><td>Develop a LaTeX script to create a document that consists of the following two mathematical equations
$$x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$$
$$= \frac{-2 \pm \sqrt{2^2-4*(1)*(-8)}}{2*1}$$
$$= \frac{-2 \pm \sqrt{4+32}}{2}$$
$$\varphi_\sigma^\lambda A_t = \sum_{\pi \in C_t} \operatorname{sgn}(\pi) \varphi_\sigma^\lambda \varphi_\pi^\lambda$$
$$= \sum_{\tau \in C_{\sigma t}} \operatorname{sgn}(\sigma^{-1}\tau\sigma) \varphi_\sigma^\lambda \varphi_{\sigma^{-1}\tau\sigma}^\lambda$$
$$= A_{\sigma t} \varphi_\sigma^\lambda$$</td></tr>
<tr><td>8</td><td>Develop a LaTeX script to demonstrate the presentation of Numbered theorems, definitions, corollaries, and lemmas in the document</td></tr>
<tr><td>9</td><td>Develop a LaTeX script to create a document that consists of two paragraphs with a minimum of 10 citations in it and display the reference in the section</td></tr>
<tr><td>10</td><td>Develop a LaTeX script to design a simple tree diagram or hierarchical structure in the document with appropriate labels using the Tikz library</td></tr>
<tr><td>11</td><td>Develop a LaTeX script to present an algorithm in the document using algorithm/algorithmic/algorithm2e library</td></tr>
<tr><td>12</td><td>Develop a LaTeX script to create a simple report and article by using suitable commands and formats of user choice.</td></tr>
</table>

Course outcomes (Course Skill Set):

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

CO1: Apply basic LaTeX command to develop simple document. (PO -1,2,3, PSO -1,3)

CO2: Develop LaTeX script to present the tables and figures in the document. (PO -1,2,3, PSO -1,3)

CO3: Illustrate LaTeX script to present theorems and mathematical equations in the document. (PO -1,2,3, PSO -1,3)

CO4: Develop programs to generate the complete report with citations and bibliography. (PO -1,2,3, PSO -1,2,3)

CO5: Illustrate the use of Tikz and algorithm libraries to design graphics and algorithms in the document. (PO -1,2,3, PSO -1,3)

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 (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:

- **Book:** "A Short Introduction to LaTeX" by Firuza Karmali (Aibara), A book for beginners, 2019.
- **Book:** "Formatting Information: A Beginner's Introduction to Typesetting with LaTeX", by Peter Flynn, Comprehensive TeX Archive Network (2005).
- LaTeX TUTORIAL: [https://latex-tutorial.com/tutorials/]
- LaTeX TUTORIAL: [https://www.javatpoint.com/latex]

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

- Basic Document Creation
- Text Formatting Practice
- Project reports template

Scala			
Course Code	24CI47C	**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: NIL

Course Objectives:

- Model data using algebraic data types, represented in Scala as families of sealed traits and case classes.
- Use structural recursion and pattern matching to traverse and transform data.
- Learn programming with the common data structures of Scala.
- Learn object-oriented programming in Scala.

List of Experiments:

S. No	Experiments
1	a. Write a Scala program to compute the sum of the two given integer values. If the two values are the same, then return triples their sum. b. Write a Scala program to check two given integers, and return true if one of them is 22 or if their sum is 32.
2	a. Write a Scala program to remove the character in a given position of a given string. The given position will be in the range 0...string length -1 inclusive. b. Write a Scala program to create a new string taking the first 5 characters of a given string and return the string with the 5 characters added at both the front and back.
3	a. Write a Scala program to print the multiplication table of a given number using a for loop. b. Write a Scala program to find the largest element in an array using pattern matching.
4	a. Write a Scala function to calculate the product of digits in a given number b. Write a Scala function to check if a given number is a perfect square
5	a. Write a Scala program that creates a subclass Student that extends the Person class. Add a property called grade and implement methods to get and set it. b. Write a Scala program that creates a class Triangle with properties side1, side2, and side3. Implement a method is Equilateral to check if the triangle is equilateral.
6	a. Write a Scala program that creates an enum class Color with values for different colors. Use the enum class to represent an object's color. b. Write a Scala program that creates a class ContactInfo with properties name, email, and address. Create a class Customer that includes a ContactInfo object.
7	a. Write a Scala program to create a set and find the difference and intersection between two sets. b. Write a Scala program to create a set and find the second largest element in the set.
8	a. Write a Scala program to create a list in different ways. Note: Use Lisp style, Java style, Range list, Uniform list, Tabulate list b. Write a Scala program to flatten a given List of Lists, nested list structure.

9	a. Write a Scala program to add each element n times to a given list of integers. b. Write a Scala program to split a given list into two lists.
10	a. Write a Scala program to swap the elements of a tuple Further print no swapping required if elements are same. b. Write a Scala program to find non-unique elements in a tuple.

Course outcomes (Course Skill Set):

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

CO1: Get familiar with the Scala syntax and object-oriented principles. (PO – 1,2,3,5,8,11, PSO – 1,2,3)

CO2: Learn advanced concepts – loops, expressions, inheritance, pattern matching. (PO – 1,2,3,5,8,11, PSO – 1,2,3)

CO3: Learn to write clean and functional Scala codes and test it. (PO – 1,2,3,5,8,11, PSO – 1,2,3)

CO4: Learn functional programming using Scala. (PO – 1,2,3,5,8,11, PSO – 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 (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:

- Programming Scala, Third Edition, O'Reilly Media.
- Paul Chiusano, Rúnar Bjarnason, Functional Programming in Scala 1st Edition, Manning Publications
- https://docs.scala-lang.org/tutorials/scala-for-java-programmers.html
- https://www.javatpoint.com/scala-tutorial

DBMS with SQL and MongoDB			
Course Code	24CI47D	**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 of

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

Course Objectives:

- Practice relational (SQL) and NoSQL (MongoDB) database operations.
- Develop skills in schema creation, data manipulation, and complex queries.
- 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. Basic CRUD Operations in MongoDB

a. Execute basic commands and operations in MongoDB:

- Insert documents
- Query documents
- Update documents
- Delete documents
- Apply Projection to select specific fields

Note: Use any sample collection

Reference: Book 1, Chapter 4

b. Illustrate the use of WHERE, AND, and OR operators in MongoDB queries.

7. Selecting and Limiting Fields

a. Develop a query to select specific fields and exclude other fields from any collection.
b. Use limit and find to display only the first 5 documents from the results of (a).

References: Book 1, Chapter 4; Book 2, Chapter 5

8. Using Query Selectors

a. Execute queries using comparison and logical selectors; list the results from any collection.
b. Execute queries using geospatial and bitwise selectors; list the results from any collection.

Reference: Book 3, Chapter 13

9. Using Projection Operators

Create and demonstrate the use of projection operators:

- $ (Positional Operator)
- $elemMatch
- $slice

Reference: Book 3, Chapter 14

10. Aggregation Operators

Execute aggregation operations using the following operators:

- $avg
- $min
- $max
- $push
- $addToSet

Students should run multiple queries to demonstrate the various aggregation operators.
Reference: Book 3, Chapter 15

11. Aggregation Pipeline

Develop an aggregation pipeline that includes the following stages:

- $match
- $group
- $sort
- $project
- $skip

Students should demonstrate multiple queries using these pipeline operators.
Reference: Book 2, Chapter 6

12. Real-World Query Examples

a. Find all listings with listing_url, name, address, and host_picture_url in the Listings And Reviews collection where the host has a picture URL.
b. Using an E-commerce collection, write a query to display the reviews summary.
Reference: Book 2, Chapter 6

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 – 1,2,3,5,8,11, PSO – 1,2,3)
CO2: Perform CRUD and aggregation with MongoDB**.** (PO – 1,2,3,5,8,11, PSO – 1,2,3)
CO3: Demonstrate proficiency with SQL joins, views, indexing, and transactions. (PO – 1,2,3,5,8,11, PSO – 1,2,3)

CO4: Apply database concepts in small applications. (PO – 1,2,3,5,8,11, PSO – 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 (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:

Reference Books:

BOOK 1: MongoDB: The Definitive Guide — Kristina Chodorow, 2nd Edition, O'Reilly, 2013.
BOOK 2: MongoDB in Action — Kyle Banker et al., 2nd Edition, Manning Publications, 2016.
BOOK 3: MongoDB Complete Guide — Manu Sharma, 1st Edition, BPB Publications, 2023.

Useful Videos:

Installation of MongoDB: https://www.youtube.com/watch?v=dEm2AS5amyA
Aggregation in MongoDB: https://www.youtube.com/watch?v=vx1C8EyTa7Y

Additional Resources:

MongoDB in Action — Source Code Download: https://www.manning.com/downloads/529
MongoDB Practice Exercises: https://www.w3resource.com/mongodb-exercises/

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**	3
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)

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

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

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

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_4L2fCNX4Agw282PN86pcZZT3 Osr?usp=sharing
4. **Presentation slides:**
   https://drive.google.com/drive/folders/1rMUKh1s0HPRBlpp_b1mpS-duNRcwS6YH?usp=sharing