BE in Information Science & Engineering
Scheme of Teaching III Semester
Outcome Based Education and Choice Based Credit System (CBCS)
Effective from the academic year Batch - 2024-28

Sl. No	Course	Course Code	Course Title	Teaching Department (TD)/ Board	Teaching Hours /Week			Examination			Credits
					Theory	Tutorial	Practical	CIE Marks	SEE Marks	Total Marks	
					L	T	P				
1	BSC	24IS31	Mathematics III for CSE Stream	Mathematics	3	2	0	50	50	100	4
2	PCC	24IS32	Operating System	ISE	4	0	0	50	50	100	4
3	PCC	24IS33	Data Structures and Applications	ISE	3	0	0	50	50	100	3
4	IPCC	24IS34	Digital Design & Computer Organization	ISE	3	0	2	50	50	100	4
5	PCCL	24ISL35	Data Structure & Applications lab	ISE	0	0	2	50	50	100	1
6	ESC	24IS36X	**ESC/ETC/ PLC**	ISE	2	0	2	50	50	100	3
7	AEC	24ISL37X	Ability Enhancement Course - III	ISE dept/ IT Industry	0	0	2	50	50	100	1
8	MC	24NS38/ 24PE38/ 24YO38	NSS/ PE/ YOGA	NSS/YOGA/ PE Coordinator	0	0	2	100	-	100	-
Total								**450**	**350**	**800**	**20**

Engineering Science Course (ESC/ETC/PLC)– III	
24IS36A	Object Oriented Programming with Java
24IS36B	Object Oriented Programming with C++

Ability Enhancement Course – III			
24ISL37A	Data Analytics using Excel	24ISL37C	Prompt Engineering
24ISL37B	R Programming	24ISL37D	Introduction to Web Programming

MATHEMATICS-III FOR CSE STREAM			
Course Code	24IS31	**CIE Marks**	50
Teaching Hours/Week (L: T: P)	3:2:0	**SEE Marks**	50
Credits	04	**Total Marks**	100
Contact Hours	50	**Exam Hours**	3
Examination type (SEE)	Theory		

Prerequisites:

The students should have knowledge on

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

Course Objectives:

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

Teaching-Learning Process (General Instructions)

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

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

Module-1 **10 Hours**

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

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

Module-2 **10 Hours**

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

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

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

Module-3	10 Hours
Statistical Inference:1 Introduction, sampling distribution, standard error, testing of hypothesis, levels of significance, test of significances, confidence limits, simple sampling of attributes, test of significance for large samples, comparison of large samples **Text Book:2**, 27.1 to 27.8	
Module-4	**10 Hours**
Statistical Inference:2 Sampling variables, central limit theorem and confidences limit for unknown mean. Test of Significance for means of two small samples, students 't' distribution, Chi-square distribution as a test of goodness of fit,F-Distribution. **Text Book:1**, 8.1 to 8.5, and 9.4 **Text Book:2,** 27.13 to 27.19	
Module-5	**10 Hours**
Design of Experiments & ANOVA: Principles of experimentation in design, Analysis of completely randomized design, randomized block design. The ANOVA Technique, Basic Principle of ANOVA, One-way ANOVA, Two-way ANOVA, Latin-square Design ,and Analysis of Co-Variance. **Text Book:1,** 13.1 to 13.3, 13.11 **Reference Book:4**,12.4 to 12.6	

Course outcomes (Course Skill Set):

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

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

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(CIE):

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

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

Semester-End Examination: Theory SEE will be conducted as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.

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

Suggested Learning Resources:

Textbook:

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

Reference Books:

1. Erwin Kreyszig, **"Advanced Engineering Mathematics"**, John Wiley & Sons, 9th Edition, 2006.
2. G Haribaskaran **"Probability, Queuing Theory & Reliability Engineering",** Laxmi Publication, Latest Edition, 2006
3. B.V. Ramana: **"Higher engineering mathematics"** Tata McGraw-Hill Publishers, Fifth reprint 2008.
4. C R Kothari and Gaurav Garg **"Research Methodology Methods & Techniques"** New Age International Limited, 3rd Edition, 2014.
5. Irwin Miller & Marylees Miller, John E. Freund's "Mathematical Statistics with Applications" Pearson. Dorling Kindersley Pvt. Ltd. India, 8th edition, 2014.
6. S C Gupta and V K Kapoor, **"Fundamentals of Mathematical Statistics"**, S Chand and Company, Latest edition.
7. Robert V. Hogg, Joseph W. McKean & Allen T. Craig. **"Introduction to Mathematical Statistics"**, Pearson Education 7th edition, 2013.
8. Jim Pitman. **"Probability"**, Springer-Verlag, 1993.
9. Sheldon M. Ross, **"Introduction to Probability Models"** 11th edition. Elsevier, 2014.
10. A. M. Yaglom and I. M. Yaglom, **"Probability and Information",** D. Reidel Publishing Company. Distributed by Hindustan Publishing Corporation (India) Delhi, 1983.
11. P. G. Hoel, S. C. Port and C. J. Stone, **"Introduction to Probability Theory"**, Universal Book Stall, (Reprint), 2003.
12. S. Ross, **"A First Course in Probability"**, Pearson Education India, 6th Ed., 2002
13. N.P. Bali and Manish Goyal, **"A Textbook of Engineering Mathematics**", Laxmi Publications, Reprint, 2010.
14. Veerarajan T, **"Engineering Mathematics (for semester III)**", Tata McGraw-Hill, New Delhi, 2010

Web links and Video Lectures(e-Resources):

- http://nptel.ac.in/courses.php?disciplineID=111
- http://www.class-central.com/subject/math(MOOCs)
- http://academicearth.org/
- http://www.bookstreet.in.
- VTU EDUSAT PROGRAMME – 20

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

- Programming Assignment
- Seminars

OPERATING SYSTEMS			
Course Code	24IS32	**CIE Marks**	50
Teaching Hours/Week (L:T:P)	4:0:0	**SEE Marks**	50
Credits	04	**Total Marks**	100
Contact Hours	50	**Exam Hours**	3
Examination type (SEE)	Theory		

Prerequisite:

The Students Should have knowledge of

- Computer Architecture / Organization

Course objectives:

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

Teaching-Learning Process (General Instructions):

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

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

MODULE-1 **10 Hours**

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

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

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

MODULE-2 **10 Hours**

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

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

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

MODULE-3 **10 Hours**

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

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

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

MODULE-4 **10 Hours**

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

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

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

MODULE-5 **10 Hours**

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

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

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

Course outcome (Course Skill Set):

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

CO1: Explain the structure and functionality of operating system. (PO-1,2,3,9,11, 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)

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Continuous Internal Evaluation(CIE):

● For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.

● The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered

● Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.

● For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

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

Semester-End Examination: Theory SEE will be conducted as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

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

Suggested Learning Resources:

Textbooks

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

Reference Books

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

Web links and Video Lectures(e-Resources):

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

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

- Case Study
- Assignments

DATA STRUCTURES AND APPLICATIONS			
Course Code	24IS33	**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 H a s h

Teaching-Learning Process (General Instructions)

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

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

Module-1 **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 QueuesUsing 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, LinkedStacks 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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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_013501595428077568125 59/overview

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

- Role Play
- Flipped classroom
- AssessmentMethodsfor25 Marks (opt two Learning Activities)
  - Case Study
  - Programming Assignment
  - Gate Based Aptitude Test
  - MOOC Assignment for selected Module

DIGITAL DESIGN AND COMPUTER ORGANIZATION			
Course Code	24IS34	**CIE Marks**	50
Teaching Hours/Week (L: T: P)	3:0:2	**SEE Marks**	50
Credits	04	**Total Marks**	100
Contact Hours	40 Theory + 20 Practical	**Exam Hours**	3
Examination type (SEE)	Theory		

Prerequisites:

The students should have knowledge on

- Basic Electronics
- Digital Circuits
- Computer Architecture Concepts

Course Objectives:

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

Teaching-Learning Process (General Instructions)

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

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

Module-1 **8 Hours**

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

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

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

Module-2 **8 Hours**

Combinational Logic: Introduction, Combinational Circuits, Design Procedure, Binary Adder-Subtractor, Decoders, Encoders, Multiplexers. HDL Models of Combinational Circuits – Adder, Multiplexer, Encoder. **Sequential Logic**: Introduction, Sequential Circuits, Storage Elements: Latches, Flip-Flops.

Case Study: Design a real-world control system based on Combinational and Sequential logic circuits to manage specific operational requirements effectively.

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

Module-3 **8 Hours**

Basic Structure of Computers: Functional Units, Basic Operational Concepts, Bus structure, Performance – Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement.

Machine Instructions and Programs: Memory Location and Addresses, Memory Operations, Instruction and Instruction sequencing, Addressing Modes.

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

Module-4 **8 Hours**

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

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

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

Module-5 **8 Hours**

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

Case Study: Pipelining in AI-Powered

Text book 2: 7.1, 7.2, 8.1

PRACTICAL COMPONENT OF IPCC

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 Behavioural model.
4.	Design Verilog HDL to implement Binary Adder-Subtractor – Half and Full Adder, Half and Full Subtractor.
5.	Design Verilog HDL to implement Decimal adder.
6.	Design Verilog program to implement Different types of multiplexer like 2:1, 4:1 and 8:1.
7.	Design Verilog program to implement types of De-Multiplexer.
8.	Design Verilog program for implementing various types of Flip-Flops such as SR, JK and D.

Course outcomes (Course Skill Set):

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

CO1: Apply the K–Map techniques to simplify various Boolean expressions. (PO – 1,2,3,5,11, 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 (maximum marks 50)

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

CIE for the practical component of the IPCC

- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report.
- 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.
- 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 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 as per the scheduled timetable, with common question papers for the course (duration 03 hours)

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

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

Suggested Learning Resources:

Textbook:

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

Web links and Video Lectures(e-Resources):

- https://elearning.vtu.ac.in/econtent/courses/web/CSE/15CS44.html
- https://cse11-iiith.vlabs.ac.in
- https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_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 STRUCTURE AND APPLICATIONS LAB			
Course Code	24ISL35	**CIE Marks**	50
Teaching Hours/Week (L: T: P)	0:0:2	**SEE Marks**	50
Credits	01	**Total Marks**	100
Contact Hours	28	**Exam Hours**	3
Examination type (SEE)	Practical		

Prerequisites:

The students should have knowledge on

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

Course Objectives:

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

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

Teaching-Learning Process (General Instructions)

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

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

Programs List:

1.	Develop a Program in C for the following: 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). 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) 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) Push an Element on to Stack Pop an Element from Stack Demonstrate how Stack can be used to check Palindrome Demonstrate Overflow and Underflow situations on Stack Display the status of Stack 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) Insert an Element on to Circular QUEUE Delete an Element from Circular QUEUE Demonstrate Overflow and Underflow situations on Circular QUEUE Display the status of Circular QUEUE 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* Create a SLL of N Students Data by using *front insertion*. Display the status of SLL and count the number of nodes in it Perform Insertion / Deletion at End of SLL 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, PhNo* Create a DLL of N Employees Data by using *end insertion*. Display the status of DLL and count the number of nodes in it Perform Insertion and Deletion at End of DLL Perform Insertion and Deletion at Front of DLL 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 $P(x, y) = 6x^2 y^2 - 4y + 3x^3 y + 2xy^5 - 2xy$ 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 Inorder, 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 keys in K and addresses in L are Integers. Develop a Program in C that uses Hash function H: K →L as H(K)=K mod m (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 (PO1,2,3, PSO-1,3)

CO2: Demonstrate the working nature of different types of data structures and their applications (PO1,2,3, PSO-1,3)

CO3: Use appropriate searching and sorting algorithms for the give scenario. (PO1,2,3, PSO-1,3)

CO4: Apply the appropriate data structure for solving real world problems(PO1,2,3, 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 marks for the practical course are 50 Marks. The split-up of CIE marks for record/ journal and test are in the ratio 60:40.
- Each experiment is to be evaluated for conduction with an observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments are designed by the faculty who is handling the laboratory session and are made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.

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

Semester-End Examination:

SEE marks for the practical course are 50 Marks.

● SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the Head of the Institute.

● The examination schedule and names of examiners are informed to the university before the conduction of the examination. These practical examinations are to be conducted between the schedule mentioned in the academic calendar of the University

All laboratory experiments are to be included for practical examination.

● (Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. OR based on the course requirement evaluation rubrics shall be decided jointly by examiners.

● Students can pick one question from PART-A and one question from PART-B (experiment) from the questions lot prepared by the examiners jointly and 50% weightage for each part.

● Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

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

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

OBJECTED ORIENTED PROGRAMMING WITH JAVA			
Course Code	24IS36A	**CIE Marks**	50
Teaching Hours/Week (L:T:P)	2:0:2	**SEE Marks**	50
Credits	03	**Total Marks**	100
Contact Hours	30 Theory + 20 Lab	**Exam Hours**	3
Examination type (SEE)	Theory		

Prerequisite:

The students should have knowledge of

- Basic Programming Skills:
- Knowledge of C & C++

Course objectives:

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

Teaching-Learning Process (General Instructions):

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

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

Module-1 **6 Hours**

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).

Textbook: Chapter 2, 3, 4, 5

Module-2	6 Hours

Introducing Classes: Class Fundamentals, Declaring Objects, Assigning Object Reference Variables, Introducing Methods, Constructors, The this Keyword, Garbage Collection.

Methods and Classes: Overloading Methods, Objects as Parameters, Argument Passing, Returning Objects, Recursion, Access Control, Understanding static, Introducing final, Introducing Nested and Inner Classes.

Textbook: Chapter 6, 7

Module-3	6 Hours

Inheritance: Inheritance Basics, Using super, Creating a Multilevel Hierarchy, When Constructors Are Executed, Method Overriding, Dynamic Method Dispatch, Using Abstract Classes, Using final with Inheritance, Local Variable Type Inference and Inheritance, The Object Class.

Interfaces: Interfaces, Default Interface Methods, Use static Methods in an Interface, Private Interface Methods.

Textbook: Chapter 8, 9

Module-4	6 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.

Textbook: Chapter 9, 10

Module-5	6 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).

Textbook: Chapter 11, 12

PRACTICAL COMPONENT

1. Develop a JAVA program to add TWO matrices of suitable order N (The value of N should be read from command line arguments).
2. Develop a stack class to hold a maximum of 10 integers with suitable methods. Develop a JAVA main method to illustrate Stack operations.
3. A class called Employee, which models an employee with an ID, name and salary, is designed as shown in the following class diagram. The method raiseSalary (percent) increases the salary by the given percentage. Develop the Employee class and suitable main method for demonstration.

4. A class called MyPoint, which models a 2D point with x and y coordinates, is designed as follows:
   - Two instance variables x (int) and y (int).
   - A default (or "no-arg") constructor that construct a point at the default location of (0, 0).
   - A overloaded constructor that constructs a point with the given x and y coordinates.
   - A method setXY() to set both x and y.
   - A method getXY() which returns the x and y in a 2-element int array.
   - A toString() method that returns a string description of the instance in the format "(x, y)".
   - A method called distance(int x, int y) that returns the distance from this point to another point at the given (x, y) coordinates
   - An overloaded distance(MyPoint another) that returns the distance from this point to the given MyPoint instance (called another)
   - Another overloaded distance() method that returns the distance from this point to the origin (0,0)

Develop the code for the class MyPoint. Also develop a JAVA program (called TestMyPoint) to test all the methods defined in the class.

5. Develop a JAVA program to create a class named shape. Create three sub classes namely: circle, triangle and square, each class has two member functions named draw () and erase (). Demonstrate polymorphism concepts by developing suitable methods, defining member data and main program.

6. Develop a JAVA program to create an abstract class Shape with abstract methods calculateArea() and 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 resizeWidth(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 DivisionByZero using try, catch, throw and finally.

10. Develop a JAVA program to create a package named mypack and import & implement it in a suitable class.

11. Write a program to illustrate creation of threads using runnable class. (start method start each of the newly created thread. Inside the run method there is sleep() for suspend the thread for 500 milliseconds).

12. Develop a program to create a class MyThread in this class a constructor, call the base class constructor, using super and start the thread. The run method of the class starts after this. It can be observed that both main thread and created child thread are executed concurrently.

Course outcome (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 PSO-1,3)

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

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

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

CO5: Apply concepts of multithreading, autoboxing and enumerations in program development(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 (maximum marks 50)

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

CIE for the practical component of the IPCC

- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report.
- 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.
- 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 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 as per the scheduled timetable, with common question papers for the course (duration 03 hours)

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

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

Suggested Learning Resources

Text Books:

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):

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

Tutorial Link:

- https://www.w3schools.com/cpp/cpp_intro.asp
- https://www.edx.org/course/introduction-to-c-3
- 3.https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013843642506788864433 75_shared/overview

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

- Flipped classroom
- Assessment Methods for 25 Marks (opt two Learning Activities)
  - Case Study
  - Programming Assignment
  - MOOC Assignment for selected Module

OBJECT ORIENTED PROGRAMMING WITH C++			
Course Code	24IS36B	**CIE Marks**	50
Teaching Hours/Week (L:T:P)	2:0:2	**SEE Marks**	50
Credits	03	**Total Marks**	100
Contact Hours	30 Theory + 20 Lab	**Exam Hours**	3
Examination type (SEE)	Theory		

Prerequisite:

The students should have knowledge of

- Basic Programming Skills:
- Knowledge of C

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):

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

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

Module-1 **6 Hours**

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: Ch 11, Ch 12

Module-2 **6 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: Ch 13, Ch 14

Module-3 **6 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: Ch 15, Ch 16

Module-4	6 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: Ch 17, Ch 18	
Module-5	**6 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: and File Classes, Opening and Closing a File, Reading and Writing Text Files, Detecting EOF. Text book: Ch 19, Ch 20, Ch21	

PRACTICAL COMPONENT

SNO	EXPERIMENT NAME
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 student
4	Develop a C++ program for a bank empolyee 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 outcome (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-1,2,5,11, PSO-1,2,3)

CO2: Design appropriate classes for the given real world scenario. (PO-1,2,5,11, PSO-1,2,3)
CO3: Apply the knowledge of compile-time / run-time polymorphism to solve the given problem. (PO-1,2,5,11, PSO-1,2,3)
CO4: Use the knowledge of inheritance for developing optimized solutions(PO-1,2,5,11, PSO-1,2,3)
CO5: Apply the concepts of templates and exception handling for the given problem(PO-1,2,5,11, PSO-1,2,3)
CO6: Use the concepts of input output streams for file operations (PO-1,2,5,11, 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.

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

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

CIE for the practical component of the IPCC

- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report.
- 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.
- 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 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 as per the scheduled timetable, with common question papers for the course (duration 03 hours)

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

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

Suggested Learning Resources:

Textbooks

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

Reference Books

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

Web links and Video Lectures (e-Resources):

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

Tutorial Link:

1. https://www.w3schools.com/cpp/cpp_intro.asp
2. https://www.edx.org/course/introduction-to-c-3
3. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013843642506788864433 75_shared/overview

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

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

DATA ANALYTICS WITH EXCEL			
Course Code	24ISL37A	**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 Excel Skills
- Knowledge of Basic Statistics and Logic
- Basic Knowledge of Pivot Tables
- Familiarity with Charts and Visualizations

Course Objectives:

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

Teaching-Learning Process (General Instructions)

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

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

LIST OF PROGRAMS

1. Getting Started with Excel: Creation of spread sheets, Insertion of rows and columns, Drag & Fill, use of Aggregate functions.
2. Working with Data : Importing data, Data Entry & Manipulation, Sorting & Filtering.
3. Working with Data: Data Validation, Pivot Tables & Pivot Charts.
4. Data Analysis Process: Conditional Formatting, What-If Analysis, Data Tables, Charts & Graphs.
5. Cleaning Data with Text Functions: use of UPPER and LOWER, TRIM function, Concatenate.
6. Cleaning Data Containing Date and Time Values: use of DATEVALUE function, DATEADD and DATEDIF, TIMEVALUE functions.
7. Conditional Formatting: formatting, parsing, and highlighting data in spreadsheets during data analysis.
8. Working with Multiple Sheets: work with multiple sheets within a workbook is crucial for organizing and managing data, perform complex calculations and create comprehensive reports.
9. Create worksheet with following fields: Empno, Ename, Basic Pay(BP), Travelling

Allowance(TA), Dearness Allowance(DA), House Rent Allowance(HRA), Income Tax(IT), Provident Fund(PF), Net Pay(NP). Use appropriate formulas to calculate the above scenario. Analyse the data using appropriate chart and report the data.

10. Create worksheet on Inventory Management: Sheet should contain Product code, Product name, Product type, MRP, Cost after % of discount, Date of purchase. Use appropriate formulas to calculate the above scenario. Analyse the data using appropriate chart and report the data.
11. Create worksheet on Sales analysis of Merchandise Store: data consisting of Order ID, Customer ID, Gender, age, date of order, month, online platform, Category of product, size, quantity, amount, shipping city and other details. Use of formula to segregate different categories and perform a comparative study using pivot tables and different sort of charts.
12. Generation of report & presentation using Autofilter &macro.

Course outcomes (Course Skill Set):

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

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

CO2: Manipulate data lists using Outline and PivotTables. (PO-1,4,5, PSO-1,2)

CO3: Use Consolidation to summarize and report results from multiple worksheets. (PO-1,4,5, PSO-1,2)

CO4: Apply Macros and Auto filter to solve the given real-world scenario. (PO-1,3,5, 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 marks for the practical course are 50 Marks. The split-up of CIE marks for record/ journal and test are in the ratio 60:40.
- Each experiment is to be evaluated for conduction with an observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments are designed by the faculty who is handling the laboratory session and are made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled down to 30 marks (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct a test of 100 marks after the completion of all the experiments listed in the syllabus.
- In a test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability.
- The marks scored shall be scaled down to 20 marks (40% of the maximum marks). The Sum of scaled-down marks scored in the report write-up/journal and marks of a test is the total CIE marks scored by the

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

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

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:
1. 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):
- 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

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning
- Assessment Methods
  - Programming Assignment (10 Marks)

R PROGRAMMING			
Course Code	24ISL37B	**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 Understanding of Mathematics and Statistics
- Knowledge of Programming Fundamentals
- Familiarity with Data Handling concepts like Data Structures and file handling (CSV, Excel)

Course Objectives:

- To explore and understand how R and R Studio interactive environment.
- To understand the different data Structures, data types in R.
- To learn and practice programming techniques using R programming.
- To import data into R from various data sources and generate visualizations.
- To draw insights from datasets using data analytics techniques

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

LIST OF PROGRAMS

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

Suggested Reading – Text Book 1 – Chapter 1 (What is R, Installing R, Choosing an IDE – RStudio, How to Get Help in R, Installing Extra Related Software), Chapter 2 (Mathematical Operations and Vectors, Assigning Variables, Special Numbers, Logical Vectors), Chapter 3 (Classes, Different Types of Numbers, Other Common Classes, Checking and Changing Classes, Examining Variables)

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.
Suggested Reading – Text Book 1 – Chapter 4 (Vectors, Combining Matrices)

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
Suggested Reading – Text Book 1 – Chapter 4 (Matrices and Arrays – Array Arithmetic)

4. Develop a program to find the factorial of given number using recursive function calls.
Suggested Reading – Reference Book 1 – Chapter 5 (5.5 – Recursive Programming)
Text Book 1 – Chapter 8 (Flow Control and Loops – If and Else, Vectorized If, while loops, for loops), Chapter 6 (Creating and Calling Functions, Passing Functions to and from other functions)

5. Develop an R Program using functions to find all the prime numbers up to a specified number by the method of Sieve of Eratosthenes.
Suggested Reading – Reference Book 1 - Chapter 5 (5.5 – Recursive Programming)
Text Book 1 – Chapter 8 (Flow Control and Loops – If and Else, Vectorized If, while loops, for loops), Chapter 6 (Creating and Calling Functions, Passing Functions to and from other functions)

6. 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.
Suggested Reading – Text Book 1 –Chapter 12 – (Built-in Datasets) Chapter 14 – (Scatterplots)
Reference Book 2 – 13.2.5 (Covariance and Correlation)

7. Develop R program to create a Data Frame with following details and do the following operations.

itemCode	itemCategory	itemPrice
1001	Electronics	700
1002	Desktop Supplies	300
1003	Office Supplies	350
1004	USB	400
1005	CD Drive	800

a) Subset the Data frame and display the details of only those items whose pr
ice 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
Suggested Reading –Textbook 1: Chapter 5 (Lists and Data Frames)

8. 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

Suggested Reading –Reference Book 2 – Chapter 7 (7.4 – The ggplot2 Package), Chapter 24 (Smoothing and Shading)

9. Design a data frame in R for storing about 20 employee details. Create a CSV file named "input.csv" that defines all the required information about the employee such as id, name, salary, start_date, dept. Import into R and do the following analysis.
   a) Find the total number rows & columns
   b) Find the maximum salary
   c) Retrieve the details of the employee with maximum salary
   d) Retrieve all the employees working in the IT Department.
   e) Retrieve the employees in the IT Department whose salary is greater than 20000 and write these steps

Reading – Text Book 1 – Chapter 12(CSV and Tab Delimited Files)

10. 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 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.

Suggested Reading – Reference Book 2 – Chapter 20 (General Concepts, Statistical Inference, Prediction)

Course outcomes (Course Skill Set):

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

CO1: Explain the fundamental syntax of R data types, expressions and the usage of the R-Studio IDE. (PO-1,5, PSO-1)

CO2: Develop a program in R with programming constructs: conditionals, looping and functions. (PO-1,2,3,5, PSO-1,3)

CO3: Apply the list and data frame structure of the R programming language. (PO-1,4,5, PSO-1,2)

Assessment Details (both CIE and SEE):

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

Continuous Internal Evaluation:

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

Semester-End Examination:

SEE marks for the practical course are 50 Marks.

- SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the Head of the Institute.
- The examination schedule and names of examiners are informed to the university before the conduction of the examination. These practical examinations are to be conducted between the schedule mentioned in the academic calendar of the University

All laboratory experiments are to be included for practical examination.

- (Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. OR based on the course requirement evaluation rubrics shall be decided jointly by examiners.

● Students can pick one question from PART-A and one question from PART-B (experiment) from the questions lot prepared by the examiners jointly and 50% weightage for each part.
● Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.
● General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners) Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be made zero. The minimum duration of SEE is 02 hours

Reference Books:

1. Cotton, R. (2013). Learning R: A Step by Step Function Guide to Data Analysis. 1st ed. O'Reilly Media Inc.
2. Jones, O., Maillardet. R. and Robinson, A. (2014). Introduction to Scientific Programming and Simulation , Using R. Chapman & Hall/CRC, The R Series.
3. Davies, T.M. (2016) The Book of R: A First Course in Programming and Statistics. No Starch Press.

Web links and Video Lectures(e-Resources):

- https://www.kaggle.com/learn/r-programming
- **R Programming for Absolute Beginners :** https://www.youtube.com/watch?v=FY8BISK5DpM
- **Learn R in 39 Minutes (Crash Course):** https://www.youtube.com/watch?v=yZ0bV2Afkjc
- **Beginner's Guide to R Programming: R and RStudio Overview :**https://www.youtube.com/watch?v=12djwJEucos

PROMPT ENGINEERING			
Course Code	24ISL37C	**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		

Prerequisite:
The students should have knowledge on

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

Course objectives:

- 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.

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

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

Course outcomes (Course Skill Set):

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

CO1: Identify and classify different types of prompts and their use cases in AI systems. (PO -1,2,3,5, PSO - 1,2,3)
CO2: Develop and evaluate prompts for various NLP and generative AI applications. (PO -1,2,3,4,5, 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, PSO -1,2,3)
CO5: Demonstrate the ability to use advanced prompt techniques and ethical practices in AI. (PO -1,2,3,5,7, 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
Prompt Perfect	Prompt optimization tool	https://promptperfect.jina.ai
Flow GPT	Prompt sharing and community exploration	https://flowgpt.com
Prompt Base	Marketplace of engineered prompts	https://promptbase.com
Lang Chain	Framework for LLM-based applications	https://www.langchain.com
Llama Index	Data framework for connecting LLMs	https://www.llamaindex.ai
Prompt Layer	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.

INTRODUCTION TO WEB PROGRAMMING			
Course Code	24ISL37D	**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 Understanding of Computers and the Internet
- Knowledge of HTML, CSS, and JavaScript.
- Logical Thinking and Programming Fundamental.

Course Objectives:

- To use the syntax and semantics of HTML and XHTML
- To develop different parts of a web page
- To understand how CSS can enhance the design of a webpage.
- To create and apply CSS styling to a webpage
- To get familiarity with the JavaScript language and understand Document Object Model handling of Java Script

Teaching-Learning Process (General Instructions)

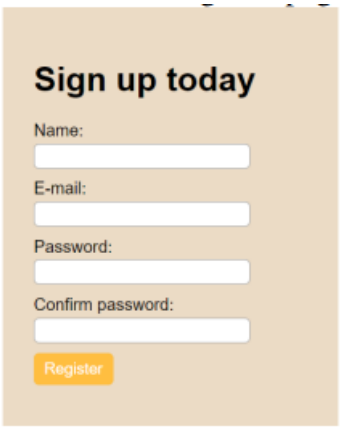
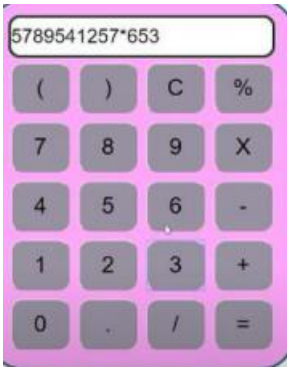
Teachers can use following strategies to accelerate the attainment of the various course outcomes.

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

LIST OF PROGRAMS

1	Create an XHTML page using tags to accomplish the following: (i) A paragraph containing text "All that glitters is not gold". Bold face and italicize this text (ii) Create equation: $x = 1/3(y_1^2 + z_1^2$ (iii) Put a background image to a page and demonstrate all attributes of background image (iv) Create unordered list of 5 fruits and ordered list of 3 flowers
2	Create following table using XHTML tags. Properly align cells, give suitable cell padding and cell spacing, and apply background color, bold and emphasis necessary

Department	**Sem1**	*SubjectA*
		SubjectB
		SubjectC
	Sem2	*SubjectE*
		SubjectF
		SubjectG
	Sem3	*SubjectH*
		SubjectI
		SubjectJ

3	Use HTML5 for performing following tasks: (i) Draw a square using HTML5 SVG , fill the square with green color and make 6px brown stroke width (ii) Write the following mathematical expression by using HTML5 MathML. $d=x^2-y^2$ (iii) Redirecting current page to another page after 5 seconds using HTML5 meta tag
4	Demonstrate the following HTML5 Semantic tags- <article>, <aside>, <details>, <figcaption>, <figure>, <footer>, <header>, <main>, <mark>, <section> for a webpage that gives information about travel experience.
5	Create a class called income, and make it a background color of #0ff. Create a class called expenses, and make it a background color of #f0f. Create a class called profit, and make it a background color of #f00. Throughout the document, any text that mentions income, expenses, or profit, attach the appropriate class to that piece of text. Further create following line of text in the same document: The current price is 50₹ and new price is 40₹
6	Change the tag li to have the following properties: A display status of inline A medium, double-lined, black border No list style type Add the following properties to the style for li: Margin of 5px Padding of 10px to the top, 20px to the right, 10px to the bottom, and 20px to the left Also demonstrate list style type with user defined image logos
7	Create following web page using HTML and CSS with tabular layout 
8	Create following calculator interface with HTML and CSS 

9	Write a Java Script program that on clicking a button, displays scrolling text which moves from left to right with a small delay
10	Create a webpage containing 3 overlapping images using HTML, CSS and JS. Further when the mouse is over any image, it should be on the top and fully displayed.

Course outcomes (Course Skill Set):

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

CO1: Explain the historical context and justification for HTML over XHTML. (PO-1, 2,9, PSO-1,2,3)
CO2: Develop HTML5 documents and adding various semantic markup tags. (PO-1,3,5, PSO-1,2,3)
CO3: Analyse various attributes, values and types of CSS. (PO-1,2,3,4,5, PSO-1,2,3)
CO4: Implement core constructs and event handling mechanisms of JavaScript. (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 (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: 1. TextBook-1: HTML & CSS: The Complete Reference Thomas A. Powell, , Fifth Edition, Tata McGraw Hill, 2. TextBook-2: WEB PROGRAMMING with HTML5, CSS and JavaScript, John Dean, Jones & Bartlett Learning, First Edition
Web links and Video Lectures(e-Resources): • https://onlinecourses.swayam2.ac.in/aic20_sp11/preview