Mathematics-III for Computer Science and Engineering Stream			
Course Code	24IC31	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	(3:2:0:0)	SEE Marks	50
Total Hours of Pedagogy	40 hours	Total Marks	100
Credits	04	Exam Hours	3
Examination nature (SEE)	Theory		

Prerequisite:

The students should have knowledge on

- Basic Mathematics Skills
- Logical Reasoning and Analytical Thinking
- Problem Solving Skills
- Clarity in Conceptual Thinking

Course objectives:

This course will enable the students to:

CLO1. 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.

CLO2. To provide the principles of statistical inferences and the basics of hypothesis testing with emphasis on some commonly encountered hypotheses.

CLO3. To Determine whether an input has a statistically significant effect on the system's response through ANOVA testing

Teaching-Learning Process (General Instructions):

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

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

Module-1: Probability Distributions. (12 Hrs)

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

Text Book:1, 3.1,3.2,3.3 and4.1,4.2.

Module-2: Joint probability distribution & Markov Chain (12 Hrs)

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: Statistical Inference 1 (12 Hrs)

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: Statistical Inference 2 (12 Hrs)

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 27.1

Module-5: Design of Experiments & ANOVA (12 Hrs)

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 to13.3, 13.11 Reference Book:4,12.4 to 12.6

Course outcomes (Course Skill Set):

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

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

CO2: Apply the notion of a discrete-time Markov chain and n-step transition probabilities to solve the given problem. (PO – 1,2,3,4, PSO - 1,3)

CO3: Use statistical methodology and tools in the engineering problem-solving process. (PO -1,2,3,4,5, PSO –-1,3)

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

CO5: Apply the ANOVA test related to engineering problems. (PO -1,2,3,4, 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:

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

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

Semester-End Examination:

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

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

Suggested Learning Resources:

Textbooks:

1. Ronald E. Walpole, Raymond H Myers, Sharon L Myers & Keying Ye "Probability & Statistics for Engineers & Scientists", Pearson Education, 9th edition, 2017.
2. 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, 9thEdition,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,
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

- Quizzes
- Assignments
- Seminar

Operating Systems			
Course Code	24IC32	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	4:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40 hours	Total Marks	100
Credits	04	Exam Hours	3
Examination nature (SEE)	Theory		

Prerequisite:

The students should have knowledge on

- Basic Programming Knowledge
- Understanding of Computer Organization
- Comfort with Command-Line Interface
- Data Structure Fundamentals

Course objectives:

This course will enable the students to:

CLO1. To Demonstrate the need for OS and different types of OS

CLO2.To discuss suitable techniques for management of different resources

CLO3.To demonstrate different APIs/Commands related to processor, memory, storage, file system management and Access Control.

CLO4. To Realize the different Concepts of OS in platform of usage through Case Studies.

Teaching-Learning Process (General Instructions):

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

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

Module-1 (8 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 (8 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 (8 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 (8 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 (8 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. **Case Study:** 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: **CO 1**: Explain the structure and functionality of operating system. (PO-1,2,3,9,11, PSO-1,2,3) **CO 2**: Apply appropriate CPU scheduling algorithms for the given problem. (PO-1,2,3,9,11, PSO-1,2,3) **CO 3**: Analyze the various techniques for process synchronization and deadlock handling. (PO-1,2,3,9,11, PSO-1,2,3) **CO 4**: Apply the various techniques for memory management. (PO-1,2,3,9,11, PSO-1,2,3) **CO 5**: Analyse File and Storage Structures and Implement Customized Case Studies. (PO-1,2,3,9,11, PSO-1,2,3)

Assessment Details (both CIE and SEE):

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

Continuous Internal Evaluation:

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

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

Semester-End Examination:

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

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

Suggested Learning Resources:

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
- https://youtu.be/vBURTt97EkA
- https://www.youtube.com/watch?v=783KAB-tuE4&list=PLIemF3uozcAKTgsCIj82voMK3TMR0YE_f
- https://www.youtube.com/watch?v=3- ITLMMeeXY&list=PL3pGy4HtqwD0n7bQfHjPnsWzkeRn6mkO

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

- Assessment Methods
  - Commands of Unix Operating Systems (15 Marks)
  - Seminar (5 Marks)
  - Quiz (5 Marks)
  - NPTEL Assignment for selected Module

Data Structures and Applications			
Course Code	24IC33	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	3
Examination type (SEE)	Theory		

Prerequisite:

The students should have knowledge on

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

Course objectives:

CLO1. To explain fundamentals of data structures and their applications.
CLO2. To illustrate representation of Different data structures such as Stack and Queues, Linked lists, Trees and Graphs.
CLO3. To Design and Develop Solutions to problems using Linear Data Structures.
CLO4. To discuss applications of Non-linear Data Structures in problem solving such as trees.
CLO5. To introduce advanced Data structure concepts such as Graphs and Hash and Optimal Binary Search Trees.

Teaching-Learning Process (General Instructions)

Teachers can use the 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
4. Virtual labs enhance learning

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
Textbook: chapter 1:1.2 chapter 2: 2.1 to 2.7

Module-2 **8 Hours**

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

Module-3 **8 Hours**

Linked Lists: Singly Linked lists and Chains, Representing Chains in C, Linked Stacks and Queues, Polynomials, Additional List operations, Sparse Matrices, Doubly Linked Lists.
Textbook: 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
Textbook: 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
Textbook Chapter 6: 6.1, 6.2 Chapter 8: 8.1 to 8.3

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

CO 1: Explain different data structures and their applications. (PO - 1,2,3,4,5, PSO - 1,3)
CO 2: Apply Arrays, Stacks and Queue data structures to solve the given problems. (PO -1,2,3, PSO - 1,2,3)
CO 3: Use the concept of linked list in problem solving. (PO -1,2,3,4,5 PSO -1,3)
CO 4: Develop solutions using trees and graphs to model the real-world problem. (PO -1,2,3,4,5 PSO - 1,3)
CO 5: Explain the advanced Data Structures concepts such as Hashing Techniques and Optimal Binary Search Trees. (PO - 1,2,3,4,5 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:

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

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

Semester-End Examination:

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

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

Suggested Learning Resources:

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-code approach with C, 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 Program Design in C, 2ndEd, PHI,1996.

Web links and Video Lectures(e-Resources):

- http://elearning.vtu.ac.in/econtent/courses/video/CSE/06CS35.html
- https://nptel.ac.in/courses/106/105/106105171/
- http://www.nptelvideos.in/2012/11/data-structures-and-algorithms.html
- https://www.youtube.com/watch?v=3Xo6P_V-qns&t=201s
- https://ds2-iiith.vlabs.ac.in/exp/selection-sort/index.html
- https://nptel.ac.in/courses/106/102/106102064/
- https://ds1-iiith.vlabs.ac.in/exp/stacks-queues/index.html
- https://ds1-iiith.vlabs.ac.in/exp/linked-list/basics/overview.html
- https://ds1-iiith.vlabs.ac.in/List%20of%20experiments.html
- https://ds1-iiith.vlabs.ac.in/exp/tree-traversal/index.html
- https://ds1-iiith.vlabs.ac.in/exp/tree-traversal/depth-first-traversal/dft-practice.html
- https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013501595428077568125559/overview

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

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

Digital Design & Computer Organization

Course Code	24IC34	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	3:0:2:0	SEE Marks	50
Total Hours of Pedagogy	40 Hours Theory + 20 Hours of Practical	Total Marks	100
Credits	04	Exam Hours	3
Examination nature (SEE)	Theory		

Prerequisites:

The students should have knowledge on

- Understanding of Binary Number System
- Familiarity with Boolean Algebra
- Basic Electronic Circuits
- Logical Reasoning Ability

Course objectives:

CLO1. To demonstrate the functionalities of binary logic system
CLO2. To explain the working of combinational and sequential logic system
CLO3. To realize the basic structure of computer system
CLO4. To illustrate the working of I/O operations and processing unit
CLO5. Use simulation tools to verify for digital circuit functionality

Teaching-Learning Process (General Instructions)

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

1. Chalk and Talk
2. Live Demo with experiments
3. Power Point presentation
4. Virtual labs enhance learning

MODULE-1 — 12 Hrs

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.

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

MODULE-2 — 12 Hrs

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.

Textbook 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	12 Hrs

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.

Textbook 2: 1.2, 1.3, 1.4, 1.6, 2.2, 2.3, 2.4, 2.5

MODULE-4	12 Hrs

Input/output Organization: Accessing I/O Devices, 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

Textbook 2: 4.1, 4.2.1, 4.2.2, 4.2.3, 4.4, 5.4, 5.5.1

MODULE- 5	12Hrs

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

Textbook 2: 7.1, 7.2, 8.1

PRACTICAL COMPONENT OF IPCC:

SL. NO	Experiments on Simulation packages preferred: Multisim, Modelsim, PSpice or any other relevant
1	Given a 4-variable logic expression, simplify it using appropriate technique and simulate the same using basic gates.
2	Design a 4 bit full adder and subtractor and simulate the same using basic gates.
3	Design Verilog HDL to implement simple circuits using structural, Data flow and Behavioral model.
4	Design Verilog HDL to implement Binary Adder-Subtractor – Half and Full Adder, Half and Full Subtractor.
5	Design Verilog HDL to implement Decimal adder.
6	Design Verilog program to implement Different types of multiplexers like 2:1, 4:1 and 8:1.
7	Design Verilog program to implement types of De-Multiplexer.
8	Design Verilog program for implementing various types of Flip-Flops such as SR, JK and D.

Course outcomes (Course Skill Set):

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

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

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

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

CO4: Explain the approaches involved in achieving communication between processors 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

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

Semester-End Examination:

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

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

3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored by the student shall be proportionally scaled down to 50 Marks

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

Suggested Learning Resources:

Text Books

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://cse11-iiith.vlabs.ac.in/

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

Assign the group task to Design the various types of counters and display the output according to Assessment Methods

- Lab Assessment (25 Marks)
- GATE Based Aptitude Test
- Quiz
- NPTEL Certification

Data Structures Laboratory

Course Code	24ICL35	Data Structure & Applications lab	50
Number of Contact Hours/Week	0:0:2	SEE Marks	50
Total Number of Lab Contact Hours	28	Exam Hours	03
Credits	1		

Prerequisite: The students should have knowledge on

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

Course objectives:

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

CLO1.Dynamic memory management
CLO2.Linear data structures and their applications such as stacks, queues and lists
CLO3.Non-Linear data structures and their applications such as trees and graphs
CLO4.Solve real-world problems using appropriate data structure

Programs List

Implement all the programs in "C" and Linux OS.

1. Develop a Program in C for the following:
   a. Declare a calendar as an array of 7 elements (A dynamically Created array) to represent 7 days of a week. Each Element of the array is a structure having three fields. The first field is the name of the Day (A dynamically allocated String), The second field is the date of the Day (A integer), the third field is the description of the activity for a particular day (A dynamically allocated String).
   b. Write functions create (), read () and display (); to create the calendar, to read the data from the keyboard and to print weeks activity details report on screen.

2. Develop a Program in C for the following operations on Strings.
   a. Read a main String (STR), a Pattern String (PAT) and a Replace String (REP)
   b. Perform Pattern Matching Operation: Find and Replace all occurrences of PAT in STR with REP if PAT exists in STR. Report suitable messages in case PAT does not exist in STR
   Support the program with functions for each of the above operations. Don't use Built-in functions.

3. Develop a menu driven Program in C for the following operations on STACK of Integers (Array Implementation of Stack with maximum size MAX)
   a. Push an Element on to Stack
   b. Pop an Element from Stack
   c. Demonstrate how Stack can be used to check Palindrome
   d. Demonstrate Overflow and Underflow situations on Stack
   e. Display the status of Stack
   f. Exit
   Support the program with appropriate functions for each of the above operations

4	Develop a Program in C for converting an Infix Expression to Postfix Expression. Program should support for both parenthesized and free parenthesized expressions with the operators: +, -, *, /, % (Remainder), ^ (Power) and alphanumeric operands.
5.	Develop a Program in C for the following Stack Applications a. Evaluation of Suffix expression with single digit operands and operators: +, -, *, /, %, ^ Solving Tower of Hanoi problem with n disks
6.	Develop a menu driven Program in C for the following operations on Circular QUEUE of Characters (Array Implementation of Queue with maximum size MAX) a. Insert an Element on to Circular QUEUE b. Delete an Element from Circular QUEUE c. Demonstrate Overflow and Underflow situations on Circular QUEUE d. Display the status of Circular QUEUE e. Exit Support the program with appropriate functions for each of the above operations
7	Develop a menu driven Program in C for the following operations on Singly Linked List (SLL) of Student Data with the fields: USN, Name, Programme, Sem, PhNo a. Create a SLL of N Students Data by using front insertion. b. Display the status of SLL and count the number of nodes in it c. Perform Insertion / Deletion at End of SLL Perform Insertion / Deletion at Front of SLL(Demonstration of stack) Exit
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 a. Create a DLL of N Employees Data by using end insertion. b. Display the status of DLL and count the number of nodes in it c. Perform Insertion and Deletion at End of DLL d. Perform Insertion and Deletion at Front of DLL e. Demonstrate how this DLL can be used as Double Ended Queue. f. Exit
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 d. Exit
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. b. 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.

Laboratory Outcomes:

The student should be able to:

CO1: Analyze various linear and non-linear data structures (PO - 1,2,3, PSO - 1,2)
CO2: Demonstrate the working nature of different types of data structures and their applications (PO - 1,2,3, PSO - 1,2)
CO3: Apply the appropriate data structure for solving real world problems. (PO - 1,2,3, PSO - 1,2)
CO4: Analyze time and space complexity of the algorithms (PO -1,2,3, PSO - 1,2)

Conduct of Practical Examination:

- Experiment distribution
  - For laboratories having only one part: Students are allowed to pick one experiment from the lot with equal opportunity.
  - For laboratories having PART A and PART B: Students are allowed to pick one experiment from PART A and one experiment from PART B, with equal opportunity.
- Change of experiment is allowed only once and marks allotted for procedure to be made zero of the changed part only.
- Marks Distribution *(Need to change in accordance with university regulations)*
  a) For laboratories having only one part – Procedure + Execution + Viva-Voce: 15+70+15 = 100 Marks
  b) For laboratories having PART A and PART B
     i. Part A – Procedure + Execution + Viva = 6 + 28 + 6 = 40 Marks
     ii. Part B – Procedure + Execution + Viva = 9 + 42 + 9 = 60 Marks

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

- Lab Assessment
- GATE Based Aptitude Test
- Quiz
- NPTEL Certification

Object Oriented Programming with JAVA			
Course Code	24IC36A	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	2:0:2:0	SEE Marks	50
Total Hours of Pedagogy	28 Hours Theory + 20 Hours Practical	Total Marks	100
Credits	03	Exam Hours	03
Examination nature (SEE)	Theory		

Prerequisite:

The students should have knowledge on

- Basic Programming Skills
- Build Tools and IDE
- Graphical User Interface
- Concept of C++

Course objectives:

CLO 1: To learn primitive constructs JAVA programming language.

CLO 2: Develop Java programs using classes, objects, constructors, and methods

CLO 3: Apply exception handling and packages mechanism in java

CLO 4: To understand Object Oriented Programming Features of JAVA.

CLO 5: To gain knowledge on: packages, multithreaded programming and exceptions.

Teaching-Learning Process (General Instructions):

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

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

MODULE-1 **(5 Hrs)**

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).

Chapter 2, 3, 4, 5

MODULE-2 (5 Hrs)
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. **Chapter 6, 7**
MODULE-3 (6 Hrs)
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. **Chapter 8, 9**
MODULE-4 (6 Hrs)
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. **Chapter 9, 10**
MODULE-5 (6 Hrs)
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). **Chapter 11, 12**
Course outcome (Course Skill Set) At the end of the course, the student will be able to: 1. Demonstrate proficiency in writing simple programs involving branching and looping structures. (PO - 2,3,5, PSO - 1,2) 2. Design a class involving data members and methods for the given scenario. (PO -2,3,5, PSO - 1,2) 3. Apply the concepts of inheritance and interfaces in solving real world problems. (PO - 2,3,5, PSO - 1,2) 4. Use the concept of packages and exception handling in solving complex problem. (PO -2,3,5, PSO - 1,2) 5. Apply concepts of multithreading, autoboxing and enumerations in program development. (PO - 2,3,5, PSO - 1,2)

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

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

Assessment Details (both CIE and SEE)

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

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

- IPCC means practical portion integrated with the theory of the course.
- CIE marks for the theory component are **25 marks** and that for the practical component is **25 marks**.
- 25 marks for the theory component are split into **15 marks** for two Internal Assessment Tests (Two Tests, each of 15 Marks with 01-hour duration, are to be conducted) and **10 marks** for other assessment methods mentioned in 22OB4.2. The first test at the end of 40-50% coverage of the syllabus and the second test after covering 85-90% of the syllabus.
- Scaled-down marks of the sum of two tests and other assessment methods will be CIE marks for the theory component of IPCC (that is for **25 marks)**.
- The student has to secure 40% of 25 marks to qualify in the CIE of the theory component of IPCC. **CIE for the practical component of the IPCC**
- **15 marks** for the conduction of the experiment and preparation of laboratory record, and **10 marks** for the test to be conducted after the completion of all the laboratory sessions.
- On completion of every experiment/program in the laboratory, the students shall be evaluated including viva-voce and marks shall be awarded on the same day.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to **15 marks**.

- The laboratory test **(duration 02/03 hours)** after completion of all the experiments shall be conducted for 50 marks and scaled down to **10 marks.**
- Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **25 marks**.
- The student has to secure 40% of 25 marks to qualify in the CIE of the practical component of the IPCC.

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

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

Java: The Complete Reference, Twelfth Edition, by Herbert Schildt, November 2021, McGraw-Hill, ISBN: 9781260463422 Reference Books
Programming with Java, 6th Edition, by E Balagurusamy, Mar-2019, McGraw Hill Education, ISBN: 9789353162337.

Web links and Video Lectures

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

Activity Based Learning (Suggested Activities)/ Practical Based learning

- Installation of Java (Refer: https://www.java.com/en/download/help/index_installing.html)
- Demonstration of online IDEs like geeksforgeeks, jdoodle or any other Tools
- Demonstration of class diagrams for the class abstraction, type visibility, composition and inheritance
- Assessment Method
- Programming Assignment / Course Project

Object Oriented Programming with C++			
Course Code	24IC36B	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	2:0:2:0	SEE Marks	50
Total Hours of Pedagogy	28 Hours Theory + 20 Hours Practical	Total Marks	100
Credits	03	Exam Hours	03
Examination nature (SEE)	Theory		

Prerequisite:

The students should have knowledge on

- Basic Programming Knowledge
- Problem Solving and logical Thinking
- Familiarity with Procedural Programming
- Basic Understanding of Algorithms and Flow Control

Course objectives:

CLO1.To understand object-oriented programming using C++and Gain knowledge about the capability to store information together in an object.

CLO2.To illustrate the capability of a class to rely upon another class and functions.

CLO3.To Create and process data in files using file I/O functions

CLO4. To understand the generic programming features of C++ including Exception handling

Teaching-Learning Process (General Instructions):

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

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

MODULE-1 **(5 Hrs)**

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

Ch 11, Ch 12

MODULE-2 **(5 Hrs)**

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.

Ch 13, Ch 14

MODULE-3 **(5 Hrs)**

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

Ch 15, Ch 16

MODULE-4 **(5 Hrs)**

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

Ch 17, Ch 18

MODULE-5 **(5 Hrs)**

Exception Handling: Exception Handling Fundamentals, Handling Derived-Class Exceptions, Exception Handling Options, Applying Exception Handling.

The C++ I/O System Basics: C++ Streams, The C++ Classes, Formatted I/O

File I/O: <fstream> and File Classes, Opening and Closing a File, Reading and Writing Text Files, Detecting EOF.

Ch 19, Ch 20, Ch21

Course outcome (Course Skill Set)

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

1. Illustrate the basic concepts of object-oriented programming. (PO - 2,3,5, PSO - 1,2)
2. Design appropriate classes for the given real-world scenario. (PO -2,3,5, PSO - 1,2)
3. Apply the knowledge of compile-time / run-time polymorphism to sole the given problem (PO -2,3,5, PSO - 1,2)
4. Use the knowledge of inheritance for developing optimized solutions (PO -2,3,5, PSO - 1,2)
5. Apply the concepts of templates and exception handling for the given problem (PO -2,3,5, PSO - 1,2)
6. Use the concepts of input output streams for file operations (PO -2,3,5, 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.

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- Scaled-down marks of the sum of two tests and other assessment methods will be CIE marks for the theory component of IPCC (that is for **25 marks)**.

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

CIE for the practical component of the IPCC

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

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

SEE for IPCC

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

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

3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored by the student shall be proportionally scaled down to 50 Marks

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

Suggested Learning Resources:

Text Books

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

Reference Books

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

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)/ Practical Based learning

- Innovation Problems Case Studies
- Demonstration of online GitHub Projects
- Demonstration of class diagrams for the class abstraction, type visibility, composition and inheritance

Assessment Method

- Programming Assignment / Mini Project

Python Programming for Data Science			
Course Code	24IC36C	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	2:0:2:0	SEE Marks	50
Total Hours of Pedagogy	28 Hours Theory + 20 Hours Practical	Total Marks	100
Credits	03	Exam Hours	03
Examination nature (SEE)	Theory		

Prerequisite:

The students should have knowledge on

- Basic Programming Concepts
- Logical Thinking and Problem-Solving Skills
- Basic Mathematics and Statistics
- Analytical Reasoning

Course Learning objectives:

CLO 1: To understand Python constructs and use them to build the programs.
CLO 2: To analyse different conditional statements and their applications in programs.
CLO 3: To learn and use basic data structures in python language.
CLO 4: To learn and demonstrate array manipulations by reading data from files
CLO 5: To understand and use different data in a data analytics context.

Teaching-Learning Process (General Instructions)

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

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

Module-1 **6 Hrs**

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

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

Module-2 **6 Hrs**

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

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

Module-3	5 Hrs
Lists: lists, operation on list, Tuples: introduction, creating, indexing and slicing, operations on tuples. sets: creating, operation in sets, introduction dictionaries, creating, operations, nested dictionary, looping over dictionary. **Text Book 1: Chapter 7 (7.2 to 7.3), Chapter 8 (8.1 to 8.4) and Chapter 9(9.1 to 9.3, 9.7 to 9.12)**	
Module-4	**5 Hrs**
The NumPy Library: ND array: the heart of the library, Basic operations, indexing, slicing and iterating, conditions and Boolean arrays, array manipulation, general concepts, reading and writing array data on files. **The pandas Library:** an introduction to Data structure, other functionalities on indexes, operations between data structures, function application and mapping. **Text Book 2: Chapter 3 and Chapter 4.**	
Module-5	**5 Hrs**
The pandas: Reading and Writing data: i/o API tools, CSV and textual files, reading data in CSV or text files, reading and writing HTML files, reading data from XML files, Microsoft excel files, JSON data, Pickle python object serialization. **Pandas in Depth: data manipulation:** data preparation, concatenating data transformation discretization binning, permutation, string manipulation, data aggregation group iteration. **Text Book 2: Chapter 5 and Chapter 6**	
Course outcome (Course Skill Set) At the end of the course, the student will be able to: **CO1**: Describe the constructs of python programming (PO - 1,2,3, 5,11, PSO -1,3) **CO2**: Use looping and conditional constructs to build programs. (PO -1,2,3, 5,11, PSO -1,3) **CO3**: Apply the concept of data structure to solve the real-world problem (PO -1,2,3, 5,11, PSO -1,3) **CO4:** Use the NumPy constructs for matrix manipulations (PO -1,2,3, 5,11, PSO -1,3) **CO5**: Apply the Panda constructs for data analytics. (PO -1,2,3, 5,11, PSO - 1,3)	

PRACTICAL COMPONENT:

Sl. No	Experiments
1	Develop a python program to read **n** digit integer number, and separate the integer number and display each digit. [Hint: input:5678 output: 5 6 7 8, use: floor and mod operators)
2	Develop a python program to accept 4 numbers and display them in sorted order using a minimum number of **if else** statements.
3	Develop python scripts to Calculate the mean, median, mode, variance and standard deviation of **n** integer numbers.
4	Develop a program for checking if a given **n** digit number is palindrome or not. [hint: input 1221 output: palindrome, use //and % operator with loop statement]
5	Develop a python script to display a multiplication table for given integer **n**.
6	Develop a python script to rotate right about a given position in that list and display them. [hint: input [1,4,5, -10] position: 2, output: [-10,5,4,1]]
7	Develop write a python script to interchange the digits of a given integer number. [hint: input: 23456, interchange: 3 and 5 output: 25436]
8	Develop a python program to capitalize a given list of strings. [hint: [hello, good, how, simple] output: [Hello, Good, How, Simple]

9	lictionary, develop a python program to determine and print the number of duplicate words in a sentence.
10	Develop python program to read Numpy array and print row (sum, mean std) and column (sum, mean, std)
11	Develop a python program to read and print in the console CSV file.
12	Develop a python program to read a HTML file with basic tags, and construct a dictionary and display the same in the console.

Assessment Details (both CIE and SEE)

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

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

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

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

CIE for the practical component of the IPCC

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

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

SEE for IPCC

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

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

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

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.

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

- **Assessment Methods**
- **Programming Assignment**
- **NPTEL MOOC Learning Enhancement**

IoT Case Studies and Future Trends			
Course Code	24IC37A	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	(0:0:2:0)	SEE Marks	50
Total Hours of Pedagogy	20	Total Marks	100
Credits	01	Exam Hours	3
Examination nature (SEE)	Theory		

Prerequisite:

The students should have knowledge on

- Basic Knowledge of IoT Concepts
- Fundamentals of Networking
- Data Handling and Cloud Basics
- Embedded Systems and Programming

Course objectives:

CLO1.Understand and Explore Internet of Things (IoT)

CLO2.Analyse different components roles in making of Internet of Things.

CLO3.Explore different available options with the component available for designing the IOT applications.

CLO4.Analyse the supportive systems that assist in drawing intelligent inference of the IOT systems.

Teaching-Learning Process (General Instructions):

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

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

MODULE-1 **4 Hrs**

Introduction, Evolution of IoT, Enabling IoT and the Complex Interdependence of Technologies, IoT Networking Components, Emergence of IoT.

MODULE-2 **4 Hrs**

IoT Sensing and Actuation:
Introduction, Sensors, Sensor Characteristics, Sensorial Deviations, Sensing Types, Sensing Considerations, Actuators, Actuator Types, Actuator Characteristics.

MODULE-3	4 Hrs
IoT Processing Topologies and Types: Data Format, Importance of Processing in IoT, Processing Topologies, IoT Device Design and Selection Considerations, Processing Offloading.	
MODULE-4	**4 Hrs**
IOT CASE STUDIES Agricultural IoT –Introduction and Case Studies Vehicular IoT –Introduction.	
MODULE-5	**4 Hrs**
IOT CASE STUDIES AND FUTURE TRENDS Healthcare IoT –Introduction, Case Studies on Emerging Pillars of IoT, IoT Analytics –Introduction.	

Course outcome (Course Skill Set):

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

1. Understand the evolution, components, and enabling technologies of IoT. (PO -1,2,3,5,11 PSO -1,3)
2. Identify and explain the working, types, and characteristics of sensors and actuators used in IoT systems. (PO -1,2,3, 4,5,11 PSO -1,2,3)
3. Describe IoT data processing approaches, topologies, and device design considerations. (PO -1,3, 4,5,11, PSO -1,2,3)
4. Analyse real-world applications of IoT in fields like agriculture and transportation through case studies. (PO -2,3,4, 5,11 PSO -1,3)
5. Evaluate the use of IoT in healthcare, explore IoT analytics, and recognize emerging trends and technologies in the IoT domain. (PO - 2,3, 4,5,11 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:

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

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

Semester-End Examination:

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

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

Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

1. Sudip Misra, Anandarup Mukherjee, Arijit Roy, "Introduction to IoT", Cambridge University Press 2021.

   Textbook 1: Chapter 1-1.1 to 1.3 Chapter 4 –4.1 to 4.4 Textbook 1: Chapter 5 –5.1 to 5.9

   Textbook 1: Chapter 6 –6.1 to 6.5 Textbook 1: Chapter 12-12.1-12.2, Chapter 13–13.1. Chapter 14-14.1-14.2; 15.4 Chapter 17-17.1

Reference:

1. S. Misra, C. Roy, and A. Mukherjee, 2020. Introduction to Industrial Internet of Things and Industry 4.0. CRC Press.
2. Vijay Madisetti and Arshdeep Bhaga, "Internet of Things (A Hands-on-Approach)",1st Edition, VPT, 2014.

Web links and Video Lectures (e-Resources):

- https://archive.nptel.ac.in/courses/106/105/106105195/
- https://archive.nptel.ac.in/courses/106/106/106106223/
- https://nptelvideos.com/course.php?id=717
- https://www.coursera.org/learn/iot
-

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

- Use of open-source IoT simulators like Cisco Packet Tracer, Node-RED, or Tinker cad for hands on learning.
- Conduct mini-projects or case studies on Agricultural, Healthcare, or Vehicular IoT applications.
- Perform sensor and actuator interfacing experiments using Arduino or Raspberry Pi.
- Assign real-time data processing tasks using cloud platforms like Things peak or Google Firebase.
- Assignments

IOT with ARDUINO			
Course Code	24IC37B	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	(0:0:2:0)	SEE Marks	50
Total Hours of Pedagogy	20	Total Marks	100
Credits	01	Exam Hours	3
Examination nature (SEE)	Practical		

Prerequisite:

The Students should have knowledge of

- Programming using (Python/C/C++)
- Computer Networks.

Course objectives:

CLO1: Learn the fundamental concept of Internet of Things**.**
CLO2: Learn the connections and working of Arduino board.
CLO3: To encourage innovation and problem-solving using IoT

Teaching-Learning Process (General Instructions):

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

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

Practical Lab Programs Assessments:

Sl. No	Experiment Description
1	Develop a program to illustrate the working of LED with a push button.
2	Develop a program to illustrate the working of traffic lights for pedestrians.
3	Develop a program for fading the LED.

4	Develop a program to blink 6 LEDs in ODD and Even Fashion.
5	Develop a program to rotate servo motor both in clockwise and anticlockwise direction.
6	Develop a program to simulate the interfacing of LDR with Arduino and control the intensity of LED using LDR.
7	Develop a program to simulate the working of potentiometer and LED by varying the intensity of LED using potentiometer.
8	Develop a program to simulate the working of LCD and print the room temperature value on LCD.
9	Develop a program for scrolling 5 LEDs back and forth.
10	Develop a program to calculate the distance of an object using ultrasonic sensor.
11	Develop a program to detect the collision using infrared sensor.
12	Develop a program to interface temperature sensor to read the room temperature, humidity and heat index and print the readings on the serial monitor.

Practical Components of IPCC:

Course outcome (Course Skill Set):

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

1. Design the experiment for a given problem using concepts of IoT (PO -1,2,3,5,11 PSO -1,2,3)
2. Develop the solution for the given real-world problem using IoT tools and techniques (PO - 1,2,3,5,11 PSO - 1,2,3)
3. Analyse the results and produce substantial written documentation. (PO – 1,2,3, 5,11 PSO - 1,2,3)

Assessment Details (both CIE and SEE)

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

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

- IPCC means practical portion integrated with the theory of the course.
- CIE marks for the theory component are **25 marks** and that for the practical component is **25 marks**.
- 25 marks for the theory component are split into **15 marks** for two Internal Assessment Tests (Two Tests, each of 15 Marks with 01-hour duration, are to be conducted) and **10 marks** for other assessment

methods mentioned in 22OB4.2. The first test at the end of 40-50% coverage of the syllabus and the second test after covering 85-90% of the syllabus.

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

Semester-End Examination:

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

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

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

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

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

- Conduct mini-projects or case studies on Agricultural, Healthcare, or Vehicular IoT applications.
- Perform sensor and actuator interfacing experiments using Arduino or Raspberry Pi.

Prompt Engineering			
Course Code	24IC37C	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	(0: 0: 2: 0)	SEE Marks	50
Credits	01	Exam Hours	100
Examination nature (SEE)	Practical		

Prerequisite:

The students should have knowledge on

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

Course objectives:

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

Sl.NO	Experiments
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 InstructGPT 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	**Analyze the impact of small prompt changes** on output by modifying wording, tone, or context and documenting the effect.
10	**Implement Chain-of-Thought (CoT) prompting** for solving multi-step reasoning or problem-solving tasks.
11	**Use Tree-of-Thoughts or ReAct prompting techniques** to model step-by-step decision-making in complex tasks.
12	**Explore Automatic Prompt Engineering (APE)** by using tools or code to automatically generate or refine effective prompts.

Course outcomes (Course Skill Set):

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

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

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

CO 3: Use APIs and tools to implement prompt-based solutions and analyse output consistency. (PO -1,2,3,4,5 ,11 PSO - 1,2,3)

CO 4: Apply frameworks and strategies to craft effective and adaptive prompts. (PO -1,2,3,5,8,11 PSO -1,2,3)

CO 5: Demonstrate the ability to use advanced prompt techniques and ethical practices in AI. (PO -1,2,3, 4,5,11 PSO - 1,2,3)

Assessment Details (both CIE and SEE)

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

Continuous Internal Evaluation (CIE):

CIE marks for the practical course are 50 Marks.

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

- Each experiment is to be evaluated for conduction with an observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments are designed by the faculty who is handling the laboratory session and are made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled down to 30 marks (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct 02 tests for 100 marks; the first test shall be conducted after the 8th week of the

semester and the second test shall be conducted after the 14th week of the semester.

- In a test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability.
- The average of 02 tests is scaled down to **20 marks** (40% of the maximum marks).

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

Semester End Evaluation (SEE):

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

Suggested Learning Resources:

ChatGPT (OpenAI)	Generative AI model for prompt testing	https://chat.openai.com
OpenAI API Platform	Programmatic access to GPT models	https://platform.openai.com
Claude (Anthropic)	LLM for safe and interpretable prompts	https://claude.ai
Google Gemini (Bard)	AI chatbot by Google	https://gemini.google.com
Google Colab	Cloud-based Jupyter notebook	https://colab.research.google.com
PromptPerfect	Prompt optimization tool	https://promptperfect.jina.ai
FlowGPT	Prompt sharing and community exploration	https://flowgpt.com
PromptBase	Marketplace of engineered prompts	https://promptbase.com
LangChain	Framework for LLM-based applications	https://www.langchain.com
LlamaIndex	Data framework for connecting LLMs	https://www.llamaindex.ai
PromptLayer	Logs, tracks, and evaluates prompt usage via API	https://www.promptlayer.com

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

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

Cyber Security and Its Applications			
Course Code	24IC37D	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	(0:0:2:0)	SEE Marks	50
Total Hours of Pedagogy	20	Total Marks	100
Credits	01	Exam Hours	3
Examination nature (SEE)	Practical		

Prerequisite:

- Networking Fundamentals
- Knowledge of Databases
- Familiarity with Operating Systems

Course objectives:

CLO1. Interpret the basic concepts of cyber security.
CLO2. Demonstrate using proper tools knowledge on the cyber security.
CLO3. Analyse software vulnerabilities and security solutions to reduce the risk of exploitation.

Teaching-Learning Process (General Instructions):

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

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

Sl. No	Part A
1	Securing accounts using strong password
2	Changing file and folder ownership

3	How to protect MS word/ pdf document
4	How to encrypt files in windows
5	Steps to recover permanently deleted files within folders
	Part B
1	Exploring information gathering tool hping3
2	Perform an Experiment to demonstrate the use of Nmap tool for port scanning
3	Installation and demonstration of Wireshark Network Analyzer tool
4	Demonstrate the working of password attack tool John the ripper
5	Intrusion detection system using snort tool

Course outcome (Course Skill Set):

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

1. Apply basic security practices such as setting strong passwords, protecting documents, and encrypting files. (PO - 1,2,3,5,7,11 PSO -1,2,3)
2. Perform administrative operations like changing file/folder ownership and recovering deleted files in Windows. (PO - 1,2,3,5,7,11 PSO -1,2,3)
3. Demonstrate the use of information gathering and network scanning tools like hping3 and Nmap. (PO - 1,2,3,5,7,11 PSO -1,2,3)
4. Analyse network traffic using Wireshark and understand packet-level communication. (PO - 1,2,3,5,11 PSO -1,2,3)
5. Evaluate the functionality of password cracking tools (John the Ripper) and intrusion detection systems (Snort). (PO - 1,2,3,5,7,11 PSO -1,2,3)

Suggested Learning Resources:

1. **William Stallings**, *Computer Security: Principles and Practice*, 4th Edition, Pearson, 2018.
   Chapter 2 – User Authentication
   Chapter 3 – Access Control
   Chapter 7 – Cryptographic Applications
   Chapter 10 – Intrusion Detection
   Chapter 16 – Network Security Tools

Reference:

1. Behrouz A. Forouzan, Cryptography and Network Security, McGraw-Hill Education, 2011.
2. Michael T. Goodrich & Roberto Tamassia, Introduction to Computer Security, Pearson, 2011.
3. Nina Godbole & Sunit Belapure, Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley, 2011.

Web links and Video Lectures (e-Resources):

- https://www.wireshark.org/docs/
- https://nmap.org/book/man-briefoptions.html
- https://www.snort.org/
- https://www.kali.org/docs/

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

- Use open-source IoT simulators such as Cisco Packet Tracer, Node-RED, or Tinkercad to provide students with hands-on experience in simulating IoT environments.
- Implement mini-projects or case studies focused on real-world IoT applications in domains like Agriculture, Healthcare, or Vehicular systems to enhance practical understanding.
- Interface sensors and actuators using platforms such as Arduino or Raspberry Pi to demonstrate the working of IoT hardware components.

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

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

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

General Instructions - Pedagogy :

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

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

National Service Scheme (NSS) – Contents

1. Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing.
2. Waste management– Public, Private and Govt organization, 5 R's.
3. Setting of the information imparting club for women leading to contribution in social and economic issues.
4. Water conservation techniques – Role of different stakeholders– Implementation.

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

NOTE:

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

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

Distribution of Activities - Semester wise from 3rd to 6th semester

Sem	Topics / Activities to be Covered
3rd Sem for 25 Marks	1. Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing. 2. Waste management– Public, Private and Govt organization, 5 R's. 3. Setting of the information imparting club for women leading to contribution in social and economic issues.
4th Sem for 25 Marks	4. Water conservation techniques – Role of different stakeholders– Implementation. 5. Preparing an actionable business proposal for enhancing the village income and approach for implementation. 6. Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education.
5th Sem for 25 Marks	7. Developing Sustainable Water management system for rural areas and implementation approaches. 8. Contribution to any national level initiative of Government of India. Foreg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc.

	9. Spreading public awareness under rural outreach programs.(minimum5 programs). 10. Social connect and responsibilities.
6th Sem for 25 Marks	11. Plantation and adoption of plants. Know your plants. 12. Organize National integration and social harmony events /workshops /seminars. (Minimum 02 programs). 13. Govt. school Rejuvenation and helping them to achieve good infrastructure.

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

Sl No	Topic	Group size	Location	Activity execution	Reporting	Evaluation Of the Topic
1.	Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing.	May be individual or team	Farmersland/Villages / roadside/ community area/ College campus etc…..	Site selection /proper consultation/Continu ous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
2.	Waste management– Public, Private and Govt organization, 5 R's.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Governme nt Schemes officers/campus etc…..	Site selection /proper consultation/Continu ous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
3.	Setting of the information imparting club for women leading to contribution in social and economic issues.	May be individual or team	Women empowerment groups/ Consulting NGOs & Govt Teams / College campus etc…..	Group selection/pro per consultation/Continu ous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer

4.	Water conservation techniques – Role of different stakeholders– Implementation.	May be individual or team	Villages/ City Areas / Gramapanchayat/ public associations/Government Schemes officers/campus etc…..	site selection / proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
5.	Preparing an actionable business proposal for enhancing the village income and approach for implementation.	May be individual or team	Villages/ City Areas / Gramapanchayat/ public associations/Government Schemes officers/campus etc…..	Group selection/pro per consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
6.	Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education.	May be individual or team	Local government / private/ aided schools/Government Schemes officers/ etc…..	School selection/proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
7.	Developing Sustainable Water management system for rural areas and implementation approaches.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	site selection/proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
8.	Contribution to any national level initiative of Government of India. For eg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	Group selection/pro per consultation/Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer

9.	Spreading public awareness under rural outreach programs.(minimum5 programs). ///// Social connect and responsibilities.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	Group selection/pro per consultation/Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
10.	Plantation and adoption of plants. Know your plants.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/campus etc…..	Place selection/proper consultation/Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
11.	Organize National integration and social harmony events /workshops/seminars. (Minimum 02 programs).	May be individual or team	Villages/ City Areas Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	Place selection/proper consultation/Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
12.	Govt. school Rejuvenation and helping them to achieve good infrastructure.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	Place selection/proper consultation/Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer

Plan of Action (Execution of Activities For Each Semester)

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

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

Course outcomes (Course Skill Set):

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

CO1: Understand the importance of his / her responsibilities towards society.

CO2: Analyse the environmental and societal problems/issues and will be able to design solutions for the same.

CO3: Evaluate the existing system and to propose practical solutions for the same for sustainable development.

CO4: Implement government or self-driven projects effectively in the field.

CO5: Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony in general.

Assessment Details for CIE (both CIE and SEE)

Weightage	**CIE – 100%**	• Implementation strategies of the project (NSS work). • The last report should be signed by NSS Officer, the HOD and principal. • At last report should be evaluated by the NSS officer of the institute. • Finally the consolidated marks sheet should be sent to the university and also to be made available at LIC visit.
Presentation - 1 Selection of topic, PHASE - 1	10 Marks	
Commencement of activity and its progress - PHASE - 2	10 Marks	
Case study based Assessment Individual performance	10 Marks	
Sector wise study and its consolidation	10 Marks	
Video based seminar for 10 minutes by each student At the end of semester with Report.	10 Marks	
Total marks for the course in each semester	**50 Marks**	

Marks scored for 50 by the students should be Scale down to 25 marks In each semester for CIE entry in the VTU portal.

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

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

Suggested Learning Resources:

Books :

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

Course outcomes (Course Skill Set):

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

CO1: Understand the importance of his / her responsibilities towards society.

CO2: Analyse the environmental and societal problems/issues and will be able to design solutions for the same.

CO3: Evaluate the existing system and to propose practical solutions for the same for sustainable development.

CO4: Implement government or self-driven projects effectively in the field.

CO5: Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony in general.

YOGA			
Course Code	24YO38	**CIE Marks**	100
Teaching Hours/Week (L: T:P)	0:0:2	**SEE Marks**	-
Credits	NCMC – Non Credit Mandatory Course (Completion of the course shall be mandatory for the award of degree)	**Total Marks**	100
Contact Hours	28	**Exam Hours**	-
Examination type (SEE)	NA		

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

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

The Health Benefits of Yoga

The benefits of various yoga techniques have been supposed to improve

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

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

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

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

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

- Physical

1. Improved body flexibility and balance
2. Improved cardiovascular endurance (stronger heart)
3. Improved digestion
4. Improved abdominal strength
5. Enhanced overall muscular strength
6. Relaxation of muscular strains
7. Weight control
8. Increased energy levels
9. Enhanced immune system

- Mental

1. Relief of stress resulting from the control of emotions

2. Prevention and relief from stress-related disorders
3. Intellectual enhancement, leading to improved decision-making skills

- Spiritual

1. Life with meaning, purpose, and direction
2. Inner peace and tranquility
3. Contentment

SEMESTER III

Yoga, its origin, history and development. Yoga, its meaning, definitions. Different schools of yoga, Aim and Objectives of yoga, importance of prayer Yogic practices for common man to promote positive health
Rules to be followed during yogic practices by practitioner Yoga its misconceptions,
Difference between yogic and non yogic practices
Suryanamaskar prayer and its meaning, Need, importance and benefits of Suryanamaskar12 count, 2 rounds

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

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

2. Ardhahalasana

SEMESTER IV

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

rounds of practice

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

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

Meaning, importance and benefits of Kapalabhati. 40 strokes/min
3 rounds
Meaning, Need, importance of Pranayama. Different types. Meaning by name, technique, precautionary measures and benefits of each Pranayama
Pranayama – 1. Suryanuloma –Viloma 2. Chandranuloma-Viloma 3. Suryabhedana

4. Chandra Bhedana 5. Nadishodhana

SEMESTER V

Patanjali'sAshtanga Yoga its need and importance. Ashtanga Yoga

1. Asana
2. Pranayama
3. Pratyahara

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

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

60 strokes/min 3 rounds

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

1. Ujjayi 2. Sheetali 3. Sheektari

SEMESTER VI

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

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

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

Revision of Kapalabhati practice 80 strokes/min - 3 rounds

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

Meaning, Need, importance of Shatkriya. Different types. Meaning by name, technique, precautionary measures

and benefits of each Kriya 1. Jalaneti & sutraneti 2. Nouli (only for men) 3. Sheetkarma Kapalabhati

Course outcomes (Course Skill Set):

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

CO1: Understand the meaning, aim and objectives of Yoga.

CO2: Perform Suryanamaskar and able to Teach its benefits.

CO3: Understand and teach different Asanas by name, its importance, methods and benefits.

CO4: Instruct Kapalabhati and its need and importance.

CO5: Teach different types of Pranayama by its name, precautions, procedure and uses

CO6: Coach different types of Kriyas , method to follow and usefulness.

Assessment Details for CIE (both CIE and SEE)

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

Suggested Learning Resources:

Books:

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

Web links and Video Lectures (e-Resources): Refer links

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

PHYSICAL EDUCATION (SPORTS & ATHLETICS) – I			
Course Code	24PE38	**CIE Marks**	100
Teaching Hours/Week (L: T:P)	0:0:2	**SEE Marks**	-
Credits	NCMC – Non Credit Mandatory Course (Completion of the course shall be mandatory for the award of degree)	**Total Marks**	100
Contact Hours	28	**Exam Hours**	-
Examination type (SEE)	NA		

Course objectives:

- Demonstrate understanding of the importance of physical fitness and wellness
- Apply principles of exercise, training, and nutrition
- Participate in a variety of physical activities

MODULE 1	**6 Hours**

Orientation

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

MODULE 2	**6 Hours**

General Fitness & Components of Fitness

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

MODULE 3	**16 Hours**

Specific games (Any one to be selected by the student)

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

Course outcomes (Course Skill Set):

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

CO1: Understand the fundamental concepts and skills of Physical Education, Health, Nutrition and Fitness
CO2: Familiarization of health-related Exercises, Sports for overall growth and development
CO3: Create a foundation for the professionals in Physical Education and Sports
CO4: Participate in the competition at regional/state / national / international levels.
CO5: Create consciousness among the students on Health, Fitness and Wellness in developing and maintaining a healthy lifestyle.
CO6: Understand and practice of Traditional Games

Assessment Details for CIE (both CIE and SEE)

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

PHYSICAL EDUCATION (SPORTS & ATHLETICS) – II			
Course Code	24PE48	**CIE Marks**	100
Teaching Hours/Week (L: T:P)	0:0:2	**SEE Marks**	-
Credits	NCMC – Non Credit Mandatory Course (Completion of the course shall be mandatory for the award of degree)	**Total Marks**	100
Contact Hours	28	**Exam Hours**	-
Examination type (SEE)	NA		

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

- Demonstrate understanding of the importance of physical fitness and wellness
- Apply principles of exercise, training, and nutrition
- Participate in a variety of physical activities

MODULE 1 **6 Hours**

Ethics and Moral Values

D. Ethics in Sports
E. Moral Values in Sports and Games

MODULE 2 **16 Hours**

Specific Games (Any one to be selected by the student)

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

MODULE 3 **6 Hours**

Role of Organization and administration

Course outcomes (Course Skill Set):

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

CO1: Understand the ethics and moral values in sports and athletics
CO2: Perform in the selected sports or athletics of student's choice.
CO3: Understand the roles and responsibilities of organization and administration of sports and games.

Assessment Details for CIE (both CIE and SEE)

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

Design and Analysis Algorithms			
Course Code	24IC41	CIE Marks	50
Teaching Hours/Week (L: T: P)	3:0:0:0	SEE Marks	50
Credits	03	Total Marks	100
Contact Hours	40 hours Theory	Exam Hours	3
Examination type (SEE)	Theory		

Prerequisites:

The students should have knowledge on

- Strong programming skills in C++, Java, or Python.
- Solid understanding of data structures like arrays, trees, and graphs.
- Knowledge of mathematical concepts like recursion, logarithms, and Big-O notation.
- Basic discrete math and problem-solving abilities are essential.

Course objectives:

CLO1- To learn the methods for analyzing algorithms and evaluating their performance.
CLO2-To demonstrate the efficiency of algorithms using asymptotic notations.
CLO3-To solve problems using various algorithm design methods, including brute force, greedy, divide and conquer, decrease and conquer, transform and conquer, dynamic programming, backtracking, and branch and bound.
CLO4-To use modern tool(s) for program development and recording of results/observations.

Teaching-Learning Process (General Instructions)

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

- Chalk and Talk with Black Board
- ICT based Teaching
- Demonstration based Teaching

Module-1 **8 Hours**

INTRODUCTION: What is an Algorithm? Fundamentals of Algorithmic Problem Solving.
FUNDAMENTALS OF THE ANALYSIS OF ALGORITHM EFFICIENCY: Analysis Framework, Asymptotic Notations and Basic Efficiency Classes, Mathematical Analysis of Non recursive Algorithms, Mathematical Analysis of Recursive Algorithms.
BRUTE FORCE APPROACHES: Selection Sort and Bubble Sort, Sequential Search and Brute Force String Matching.
Chapter 1 (Sections 1.1,1.2), Chapter 2(Sections 2.1,2.2,2.3,2.4), Chapter 3(Section 3.1,3.2)

Module-2 **8 Hours**

BRUTE FORCE APPROACHES (contd..): Exhaustive Search (Travelling Salesman problem and Knapsack Problem).
DECREASE-AND-CONQUER: Insertion Sort, Topological Sorting.
DIVIDE AND CONQUER: Merge Sort, Quick Sort, Binary Tree Traversals, Multiplication of Large

Integers and Strassen's Matrix Multiplication.

Chapter 3(Section 3.4), Chapter 4 (Sections 4.1,4.2), Chapter 5 (Section 5.1,5.2,5.3, 5.4)

Module-3 **8 Hours**

TRANSFORM-AND-CONQUER: Balanced Search Trees, Heaps and Heapsort.

SPACE-TIME TRADEOFFS: Sorting by Counting: Comparison counting sort, Input Enhancement in String Matching: Horspool's Algorithm.

Chapter 6 (Sections 6.3,6.4), Chapter 7 (Sections 7.1,7.2)

Module-4 **8 Hours**

DYNAMIC PROGRAMMING: Three basic examples, The Knapsack Problem and Memory Functions, Wars hall's and Floyd's Algorithms.

THE GREEDY METHOD: Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm, Huffman Trees and Codes.

Chapter 8 (Sections 8.1,8.2,8.4), Chapter 9 (Sections 9.1,9.2,9.3,9.4)

Module-5 **8 Hours**

LIMITATIONS OF ALGORITHMIC POWER: Decision Trees, P, NP, and NP-Complete Problems.

COPING WITH LIMITATIONS OF ALGORITHMIC POWER: Backtracking (n-Queens problem, Subset- sum problem), Branch-and-Bound (Knapsack problem), Approximation algorithms for NP-Hard problems (Knapsack problem).

Chapter 11 (Section 11.2, 11.3), Chapter 12 (Sections 12.1,12.2,12.3)

Course outcomes (Course Skill Set):

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

CO1: Explain different data structures and their applications. (PO 1,2,3,4, PSO 1,2)

CO2: Apply Arrays, Stacks and Queue data structures to solve the given problems. (PO 1,2,3,4, 5 PSO 1,2)

CO3: Use the concept of linked list in problem solving. (PO 1,2,3,4, 5 PSO 1,2)

CO4: Develop solutions using trees and graphs to model the real-world problem. (PO 1,2,3,4, 5 PSO 1,2)

CO5: Explain the advanced Data Structures concepts such as Hashing Techniques and Optimal Binary Search Trees. (PO 1,2,3,4, 5 PSO 1,2)

Assessment Details (both CIE and SEE):

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

Continuous Internal Evaluation:

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

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

Semester-End Examination:

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

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

Suggested Learning Resources:

Textbooks

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

Reference books

1. Computer Algorithms/C++, Ellis Horowitz, Satraj Sahni and Rajasekaran, 2nd Edition, 2014, Universities Press.
2. Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, 3rd Edition, PHI.
3. Design and Analysis of Algorithms, S. Sridhar, Oxford (Higher Education)

Web links and Video Lectures (e-Resources):

- Design and Analysis of Algorithms: https://nptel.ac.in/courses/106/101/106101060/
- Virtual Labs (CSE): http://cse01-iiith.vlabs.ac.in/

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

- Promote real-world problem-solving and competitive problem solving through group discussions to engage students actively in the learning process.
- Encourage students to enhance their problem-solving skills by implementing all algorithms and solutions through additional programming exercises, fostering practical application of theoretical concepts.

Assessment Methods -

- Problem Solving Assignments (Hacker Rank/ Hacker Earth / Leetcode)
- Gate Based Aptitude Test
- NPTEL MOOC learning Enhancement.

Database Management System			
Course Code	24IC42	CIE Marks	50
Teaching Hours/Week (L: T: P)	3:0:0:0	SEE Marks	50
Credits	03	Total Marks	100
Contact Hours	40 hours Theory	Exam Hours	3
Examination type (SEE)	Theory		

Prerequisites:

The students should have knowledge on

- Basic understanding of computer systems and programming languages like C/C++.
- Knowledge of data structures (arrays, linked lists, trees, etc.).
- Familiarity with basic mathematics and logic concepts.
- Understanding of file systems and operating system fundamentals is helpful.

Course objectives:

CLO1-To Provide a strong foundation in database concepts, technology, and practice.
CLO2-To Practice SQL programming through a variety of database problems.
CLO3-To Understand the relational database design principles.
CLO4-To Demonstrate the use of concurrency and transactions in database.
CLO5-To Design and build database applications for real world problems.
CLO6-To become familiar with database storage structures and access techniques.

Teaching-Learning Process (General Instructions)

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

- Chalk and Talk with Black Board
- ICT based Teaching
- Demonstration based Teaching

Module-1 **8 Hours**

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

Textbook 1: Ch 1.1 to 1.8, 2.1 to 2.6, 3.1 to 3.10 RBT: L1, L2, L3

Module-2	8 Hours
Relational Model: Relational Model Concepts, Relational Model Constraints and relational database schemas, Update operations, transactions, and dealing with constraint violations. **Relational Algebra:** Unary and Binary relational operations, additional relational operations (aggregate, grouping, etc.) Examples of Queries in relational algebra. **Mapping Conceptual Design into a Logical Design:** Relational Database Design using ER-to-Relational mapping. **Textbook 1: Ch 5.1 to 5.3, Ch 8.1 to 8.5; Ch 9.1 to 9.2 Textbook 2: 3.5, RBT: L1, L2, L3**	
Module-3	**8 Hours**
Normalization: Database Design Theory – Introduction to Normalization using Functional and Multivalued Dependencies: Informal design guidelines for relation schema, Functional Dependencies, Normal Forms based on Primary Keys, Second and Third Normal Forms, Boyce-Codd Normal Form, Multivalued Dependency and Fourth Normal Form, Join Dependencies and Fifth Normal Form. **SQL:** SQL data definition and data types, Schema change statements in SQL, specifying constraints in SQL, retrieval queries in SQL, INSERT, DELETE, and UPDATE statements in SQL, Additional features of SQL **Textbook 1: Ch 14.1 to 14.7, Ch 6.1 to 6.5, RBT: L1, L2, L3**	
Module-4	**8 Hours**
SQL: Advanced Queries: More complex SQL retrieval queries, Specifying constraints as assertions and action triggers, Views in SQL. **Transaction Processing:** Introduction to Transaction Processing, Transaction and System concepts, Desirable properties of Transactions, characterizing schedules based on recoverability, characterizing schedules based on Serializability, Transaction support in SQL. **Textbook 1: Ch 7.1 to 7.3, Ch 20.1 to 20.6, RBT: L1, L2, L3**	
Module-5	**8 Hours**
Concurrency Control in Databases: Two-phase locking techniques for Concurrency control, Concurrency control based on Timestamp ordering, Multi-version Concurrency control techniques, Validation Concurrency control techniques, Granularity of Data items and Multiple Granularity Locking. **NOSQL Databases and Big Data Storage Systems:** Introduction to NOSQL Systems, The CAP Theorem, Document-Based NOSQL Systems and MongoDB, NOSQL Key-Value Stores, Column-Based or Wide Column NOSQL Systems, NOSQL Graph Databases and Neo4j **Textbook 1: Chapter 21.1 to 21.5, Chapter 24.1 to 24.6, RBT: L1, L2, L3**	
Course outcomes (Course Skill Set): At the end of the course, the student will be able to: **CO1**-Describe the basic elements of a relational DBMS (PO - 1,2,3, 4,5 PSO -1,2,3) **CO2**-Design entity relationship for the given scenario. (PO - 1,2,3, 4,5 PSO -1,2,3) **CO3**-Apply various Structured Query Language (SQL) statements for database manipulation. (PO - 1,2,3, 4,5 PSO -1,2,3) **CO4**-Analyse various normalization forms for the given application. (PO - 1,2,3, 4,5 PSO -1,2,3) **CO5**-Develop database applications for the given real-world problem. (PO - 1,2,3, 4,5 PSO -1,2,3) **CO6**-Understand the concepts related to NoSQL databases. (PO - 1,2,3, 4,5 PSO -1,2,3)	

Assessment Details (both CIE and SEE):

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

Continuous Internal Evaluation:

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

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

Semester-End Examination:

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

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

Suggested Learning Resources:

Text Books:

1. Fundamentals of Database Systems, Ramez Elmasri and Shamkant B. Navathe, 7th Edition, 2017, Pearson.
2. Database management systems, Ramakrishnan, and Gehrke, 3rd Edition, 2014, McGraw Hill

Web links and Video Lectures (e-Resources):

- **Free Code Camp - DBMS Tutorial**
  https://www.freecodecamp.org/news/database-management-systems-dbms-tutorial/
- **Geeks for Geeks - DBMS Basics**
  https://www.geeksforgeeks.org/dbms-database-management-system/
- **Khan Academy - Intro to SQL & Databases**
  https://www.khanacademy.org/computing/computer-programming/sql
- **Coursera - Databases by Stanford University** (Free to audit)
  https://www.coursera.org/learn/databases
- **Tutorials Point - DBMS Tutorial**
  https://www.tutorialspoint.com/dbms/index.htm

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

- Project Based Learning
- Certifications
- Quiz
- Case Study

Python for Web Security			
Course Code	24IC43	CIE Marks	50
Teaching Hours/Week (L: T: P)	3:0:0	SEE Marks	50
Credits	03	Total Marks	100
Contact Hours	40 hours Theory	Exam Hours	3
Examination type (SEE)	Theory		

Prerequisites:

The students should have knowledge on

- Basic Python programming skills: syntax, data types, functions, and modules.
- Understanding of web technologies: HTTP, HTML, and REST APIs.
- Familiarity with libraries like requests, Beautiful Soup, and Selenium for web interaction.
- Knowledge of networking concepts, encryption basics, and common web vulnerabilities (like XSS, SQLi).

Course objectives:

CLO1-Understand fundamental Python programming concepts relevant to security tasks.
CLO2-Learn how to interact with web protocols and automate web requests using Python.
CLO3-Identify and exploit common web vulnerabilities through Python-based tools and scripts.
CLO4-Develop skills to create security testing scripts for web applications and APIs.
CLO5-Gain practical experience in web scraping, penetration testing, and vulnerability assessment using Python libraries.

Teaching-Learning Process (General Instructions)

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

- Chalk and Talk with Black Board
- ICT based Teaching
- Demonstration based Teaching

Module-1 **8 Hours**

Python Basics for Security Automation:

Python syntax, data types, variables, and operators; control flow using loops and conditionals; functions, modules, and packages; file I/O (input/output) and exception handling; regular expressions for pattern matching; working with JSON and CSV data; and using Python libraries such as OS, sys, and subprocess for system interaction.

References Text book 1; Chapter 1

Module-2 **8 Hours**

Network Communication and Web Protocols

Networking fundamentals and protocols overview including TCP/IP (Transmission Control Protocol /Internet protocol)and UDP(Uder Datagram Protocol); Python socket programming basics and creating custom clients and servers; HTTP and HTTPS request and response structures; crafting and modifying

HTTP requests with Python; handling headers, cookies, sessions, and authentication; using libraries like requests and scapy for packet crafting and sniffing; and basics of SSL/TLS and encryption concepts.
Reference: Text book 1 – Chapters 2 & 3

Module-3 **8 Hours**

Common Web Vulnerabilities and Exploitation Techniques
SQL Injection including types, detection, and exploitation; Cross-Site Scripting (XSS) including reflected, stored, and DOM(Document Object Model)-based variants; Cross-Site Request Forgery (CSRF) and defense mechanisms; command injection and remote code execution; session hijacking and fixation attacks; input validation and sanitization best practices; and writing Python scripts to automate vulnerability detection.
Reference: – Text book 2 Chapters 5, 6 & 7

Module-4 **8 Hours**

Web Application Reconnaissance and Automation
Automated web crawling and scraping techniques; parsing HTML and XML using Beautiful Soup and LXML (Python Library); browser automation with Selenium WebDriver; managing sessions and cookies programmatically; rate limiting and avoiding detection while scraping; using APIs for data collection and enumeration; and ethical scraping and legal considerations.
Reference: Text book 1– Chapter 6

Module-5 8 **Hours**

Developing Custom Security Tools with Python
Building fuzzers (Software Testing tool) for input testing and vulnerability discovery; creating network sniffers and packet analyzers; automating brute-force and credential stuffing attacks; writing scanners for open ports and services; integration with existing security tools such as Metasploit; modular tool design for reuse extensibility; and logging, reporting, and exception handling in security tools.
Reference: Text book 1– Chapters 4, 5 & 7

Course outcomes (Course Skill Set):

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

CO1-Apply Python programming skills to automate security-related tasks, including file handling, data processing, and system interactions (PO1,2,3,4 5,8,11, PSO 1,3)

CO2-Demonstrate proficiency in network communication using Python, including socket programming and manipulating HTTP requests and responses. (PO1,2,3,4 5,8,11, PSO 1,3)

CO3-Identify and exploit common web application vulnerabilities such as SQL Injection, XSS, and CSRF through Python-based scripting. (PO1,2,3,4 5,8,11, PSO 1,3)

CO4-Use Python tools and libraries to perform web scraping and automated reconnaissance on web applications for security assessments. (PO1,2,3,4 5,7,8,11, PSO 1,3)

CO5-Develop custom security tools using Python, including fuzzers, sniffers, scanners, and Brute- force automation tools. (PO1,2,3,4 5,7,8,11, 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:

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

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

Semester-End Examination:

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

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

Suggested Learning Resources:

Textbooks

- Black Hat Python **Author:** Justin Seitz, **Publisher:** No Starch Press
- The Web Application Hacker's Handbook**, Authors**: Dafydd Stuttard and Marcus Pinto **Publisher**: Wiley

Web links and Video Lectures (e-Resources):

- **OWASP Web Security Testing Guide**
  https://owasp.org/www-project-web-security-testing-guide/
  (Covers common web vulnerabilities and testing methodologies.)
- **Python Official Documentation**
  https://docs.python.org/3/
  (For syntax, libraries, and built-in modules.)
- **Requests Library (Python HTTP for Humans)**
  https://requests.readthedocs.io/en/latest/
  (Used for sending HTTP requests in Python.)
- **Beautiful Soup Documentation**
  https://www.crummy.com/software/BeautifulSoup/bs4/doc/
  (Used for web scraping and HTML/XML parsing.)
- **Scapy – Network Packet Manipulation Tool**
  https://scapy.readthedocs.io/en/latest/
  (Used for crafting and analyzing network packets.)
- **OWASP Top 10 Security Risks**
  https://owasp.org/www-project-top-ten/
  (Industry-standard list of common web security flaws.)

Activity Based Learning (Suggested Activities in Class)

Assessment Methods:

- **Mini Projects**
  Individual or group-based mini-projects (e.g., building a basic vulnerability scanner or brute-force tool) to assess applied problem-solving and integration of multiple concepts.
- **Case Studies / Report Writing**
  Analysis of real-world web attacks, vulnerabilities, or Python-based tools with written reports on detection, mitigation, and lessons learned.

Microcontroller & IoT			
Course Code	24IC44	CIE Marks	50
Teaching Hours/Week (L: T: P)	3:0:2	SEE Marks	50
Credits	04	Total Marks	100
Contact Hours	40 Hrs Theory + 20Hrs Practical	Exam Hours	3
Examination type (SEE)	Theory		

Prerequisites:

The students should have knowledge on

- Microcontroller Fundamentals
- Basic Programming (C preferred)
- Basic of Internet of Things
- Basics of IoT Communication Protocols

Course Objectives:

CLO1. To understand the fundamentals of ARM-based systems and basic architecture of CISC and RISC.
CLO2. To familiarize with ARM programming modules along with registers, CPSR and Flags.
CLO3. Interpret the basic hardware components and their selection method based on the characteristics and attributes of an embedded system.
CLO4. Understand how to IoT evolved and why it is important
CLO5. Explore real-life uses of IoT in different fields

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**

Microprocessors versus Microcontrollers, ARM Embedded Systems: The RISC design philosophy, The ARM Design Philosophy, Embedded System Hardware, Embedded System Software, ARM Processor Fundamentals: Registers, Current Program Status Register, Pipeline, Exceptions, Interrupts, and the Vector Table, Core Extensions.

Textbook 1: Chapter 1 - 1.1 to 1.4, Chapter 2 - 2.1 to 2.5

Module-2	8 Hours
Introduction to the ARM Instruction Set: Data Processing Instructions, Programmer Instructions, Software Interrupt Instructions, Program Status Register Instructions, Coprocessor Instructions, Loading Constants ARM programming using Assembly language: Writing Assembly code, Profiling and cycle counting, instruction scheduling, Register Allocation, Conditional Execution, Looping Constructs. **Textbook 1: Chapter 3: Sections 3.1 to 3.6 (Excluding 3.5.2), Chapter 6(Sections 6.1 to 6.6)**	
Module-3	**8 Hours**
Emergence of IoT: Introduction, Evolution of IoT, Enabling IoT and the Complex Interdependence of Technologies, IoT Networking Components, Addressing Strategies in IoT. **Textbook 2: Chapter -4 :4.1 to 4.5**	
Module-4	**8 Hours**
IoT Sensing and Actuation: Introduction, Sensors, Sensor Characteristics, Sensorial Deviations, Sensing Types, Sensing Considerations, Actuators, Actuator Types, Actuator Characteristics. **Textbook 2: Chapter 5 – 5.1 to 5.9**	
Module-5	**8 Hours**
IoT Processing Topologies and Types: Data Format, Importance of Processing in IoT, Processing Topologies, IoT Device Design and Selection Considerations, Processing Offloading. **Textbook 2: Chapter 6 – 6.1 to 6.5**	

PRACTICAL COMPONENT OF IPCC

Sl.No.	Experiments
1.	Develop a program to multiply two 16-bit binary numbers.
2.	Write a program to find the sum of first 10 integer numbers
3.	Write a program to find factorial of a number.
4.	Write a program to add an array of 16-bit numbers and store the 32-bit result in internal RAM
5	Write a program to find the square of a number (1 to 10) using look-up table

6.	Interface a Stepper motor and rotate it in clockwise and anticlockwise direction
7.	Led Control Using Arduino Board
8.	Potentiometer And IR Sensor Interfacing with Arduino
9.	Controlling Two Actuators Using Arduino
10.	IOT Based Air Pollution Control System

Course outcomes (Course Skill Set):

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

CO1: Explain the architecture, design philosophy, and core components of ARM-based embedded Systems (PO - 1,2,3, PSO - 1,2)

CO2: Demonstrate the use of ARM instruction set and write basic assembly programs with performance considerations. (PO - 1,2,3,4,5 PSO- 1,2)

CO3: To explain the evolution and foundational concepts of IoT (PO - 1,2,3 PSO - 1,2)

CO4: Identify and explain the roles, characteristics, and selection criteria of sensors and actuators in IoT systems. (PO - 1,2,3 PSO - 1,2)

CO5: Analyze the real-world applications and the impact of IoT across various domains. (PO - 1,2,3, PSO - 1,2,3)

Assessment Details (both CIE and SEE):

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

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.

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

CIE for the practical component of the IPCC

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

Suggested Learning Resources:

Textbook:

1. ARM System Developer's Guide by Andrew N. Sloss, Dominic Symes, and Chris Wright was published by Morgan Kaufmann (Elsevier) in 2008.
2. Introduction to IoT by Sudip Misra, Anand Arup Mukherjee, and Arijit Roy was published by Cambridge University Press in 2021.

Reference Books:

1. Microcontroller (ARM) and Embedded System by Raghunandan G. H. was published by Cengage Learning in 2019.
2. Introduction to Industrial Internet of Things and Industry 4.0 by S. Misra, C. Roy, and A. Mukherjee was published by CRC Press in 2020.

Web links and Video Lectures(e-Resources):

- https://www.youtube.com/watch?v=GZAg9XSIs_Q
- https://www.youtube.com/watch?v=6ptZr9VRxPs
- https://www.youtube.com/watch?v=GrX4WfT5FI4
- https://www.youtube.com/watch?v=Vx6VwdhDCEc
- https://www.youtube.com/watch?v=6hqExG7mL5c

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

Design and Analysis Algorithms lab			
Course Code	24ICL45	CIE Marks	50
Teaching Hours/Week (L: T: P)	0:0:2:0	SEE Marks	50
Credits	01	Total Marks	100
Contact Hours	28 Hrs	Exam Hours	3
Examination type (SEE)	Practical/Others		

Prerequisites:

The students should have knowledge on

- Strong programming skills in C++, Java, or Python.
- Solid understanding of data structures like arrays, trees, and graphs.
- Knowledge of mathematical concepts like recursion, logarithms, and Big-O notation.
- Basic discrete math and problem-solving abilities are essential.

Course objectives:

CLO1-To learn the methods for analyzing algorithms and evaluating their performance.
CLO2-To demonstrate the efficiency of algorithms using asymptotic notations.
CLO3-To solve problems using various algorithm design methods, including brute force, greedy, divide and conquer, decrease and conquer, transform and conquer, dynamic programming, backtracking, and branch and bound.
CLO4-To use modern tool(s) for program development and recording of results/observations.

PRACTICAL COMPONENT OF LAB *(May cover all / major modules)*

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

7	Design and implement C/C++ Program to solve discrete Knapsack and continuous Knapsack problems using greedy approximation method.
8	Design and implement C/C++ Program to find a subset of a given set S = {sl , s2, s3,sn} of n positive integers whose sum is equal to a given positive integer d.
9	Design and implement C/C++ Program to sort a given set of n integer elements using Selection Sort method and compute its time complexity. Run the program for varied values of n> 5000 and record the time taken to sort. Plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.
10	Design and implement C/C++ Program to sort a given set of n integer elements using Quick Sort method and compute its time complexity. Run the program for varied values of n> 5000 and record the time taken to sort. Plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.
11	Design and implement C/C++ Program to sort a given set of n integer elements using Merge Sort method and compute its time complexity. Run the program for varied values of n> 5000, and record the time taken to sort. Plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.
12	Design and implement C/C++ Program for N Queen's problem using Backtracking.

Course outcomes (Course Skill Set):

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

- **CO1:** Explain different data structures and their applications. (PO 1,2,3,4, PSO 1,2)
- **CO2:** Apply Arrays, Stacks and Queue data structures to solve the given problems. (PO 1,2,3,4, PSO 1,2)
- **CO3:** Use the concept of linked list in problem solving. (PO 1,2,3,4, PSO 1,2)
- **CO4:** Develop solutions using trees & graphs to model real-world problems. (PO 1,2,3,4, PSO 1,2)
- **CO5:** Explain the advanced DS concepts such as Hashing Techniques and Optimal BST. (PO 1,2,3,4, PSO 1,2)

Assessment Details (both CIE and SEE)

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

Continuous Internal Evaluation (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.

- The 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.

Suggested Learning Resources:

Textbooks

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

Reference books

1. Computer Algorithms/C++, Ellis Horowitz, Satra Sahni and Rajasekaran, 2nd Edition, 2014, Universities Press.
2. Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, 3rd Edition, PHI.

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

Web links and Video Lectures (e-Resources):

- **Design and Analysis of Algorithms:** **https://nptel.ac.in/courses/106/101/106101060/**
- **Virtual Labs (CSE): http://cse01-iiith.vlabs.ac.in/**

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

- Promote real-world problem-solving and competitive problem solving through group discussions to engage students actively in the learning process.
- Encourage students to enhance their problem-solving skills by implementing all algorithms and solutions through additional programming exercises, fostering practical application of theoretical concepts.

Assessment Methods -

- Problem Solving Assignments (Hacker Rank/ Hacker Earth / Lead code)
- Gate Based Aptitude Test

Linear Algebra			
Course Code	24IC46A	CIE Marks	50
Teaching Hours/Week (L: T: P)	2:2:0	SEE Marks	50
Credits	03	Total Marks	100
Contact Hours	40	Exam Hours	3
Examination type (SEE)	Theory		

Prerequisites:

The students should have knowledge on

- Basic Mathematics Skills
- Logical Reasoning and Analytical Thinking
- Problem Solving Skills
- Clarity in Conceptual Thinking

Course Objectives:

This course will enable the students to:

CLO1: To equip the students with standard concepts and tools in Linear algebra which will find them useful in their disciplines
CLO2: Gain the knowledge of linear algebra tools and concepts to implement them in their core domain.
CLO3: Improve their mathematical thinking and acquire skills required for sustained lifelong learning
CLO4: Knowledge on Computing Eigen values and Eigenvectors for the linear transformations
CLO5: Knowing to Determine orthogonality of inner product spaces.

Module-1 **8 Hrs**

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

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

Module-2 **8 Hrs**

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

Text Book:1, 8.1,8.2 and 8.3

Module-3 **8 Hrs**

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

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

Module-4 **8 Hrs**

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

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

Module-5	8 Hrs

OPTIMIZATION TECHNIQUES IN LINEAR ALGEBRA: Diagonalization and Orthogonal diagonalization of real symmetric matrices, quadratic forms and its classifications, Hessian Matrix, Method of steepest descent, Singular value decomposition. Dimensionality reduction – Principal component analysis.
Text Book:2, 9.1,9.2,9.3 and 9.4

Course outcome (Course Skill Set)

At the end of the course, the student will be able to:
CO.1. Explain the concepts of vector spaces, subspaces, bases, dimension and their properties (PO -1,2,3)
CO.2. Use matrices and linear transformations to solve the given problem (PO - 1,2,3)
CO.3. Compute Eigenvalues and Eigenvectors for the linear transformations (PO -1,2,3)
CO.4. Determine orthogonality of inner product spaces (PO - 1,2,3)
CO.5. Apply the optimization techniques to solve the problems (PO -1,2,3)

Assessment Details (both CIE and SEE):

The weightage of Continuous Internal Evaluation (CIE) is 50% and f Determine orthogonality of inner product spaces.

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

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

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

Semester-End Examination:

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

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

Suggested Learning Resources:

Textbook:

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

Reference Books:

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

Web links and Video Lectures(e-Resources):

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

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

- Quizzes
- Assignments
- Seminar

Discrete Mathematical Structures			
Course Code	24IC46B	CIE Marks	50
Teaching Hours/Week (L: T: P)	2:2:0	SEE Marks	50
Credits	03	Total Marks	100
Contact Hours	40	Exam Hours	3
Examination type (SEE)	Theory		

Prerequisites:

The students should have knowledge on

- Basics of Logics
- Understanding Algebraic Properties
- Basic Mathematics
- Problem-Solving Skills

Course Objectives:

This course will enable the students to:

CLO1: To help students to understand discrete and continuous mathematical structures.

CLO2: To impart basics of relations and functions.

CLO3: To facilitate students in applying principles of Recurrence Relations to find the generating functions and solve the Recurrence relations.

CLO4: To have the knowledge of groups and their properties to understand the importance of algebraic properties relative to various number systems.

Module-1 **8 Hours**

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

T**ext Book:2**,2.1,2.2 and 2.3

Module-2 **8 Hours**

Properties of the Integers: Mathematical Induction, The Well Ordering Principle – Mathematical Induction, Recursive Definitions.

Fundamental Principles of Counting: The Rules of Sum and Product, Permutations, Combinations – The Binomial Theorem, Combinations with Repetition.

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

Module-3 **8 Hours**

Relations and Functions: Cartesian Products and Relations, Functions – Plain and One-to-One, Onto Functions. The Pigeon-hole Principle, Function Composition and Inverse Functions.

Properties of Relations: Computer Recognition – Zero-One Matrices and Directed Graphs, Partial Orders – Hasse Diagrams, Equivalence Relations and Partitions.

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

Module-4 **8 Hours**

The Principle of Inclusion and Exclusion: The Principle of Inclusion and Exclusion, Generalizations of the Principle, Derangements –Nothing is in its Right Place, Rook Polynomials.

Recurrence Relations: First Order Linear Recurrence Relation, The Second Order Linear Homogeneous Recurrence Relation with Constant Coefficients.

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

Module-5	8 Hours

Introduction to Groups Theory: Definitions and Examples of Particular Groups Klein 4-group, Additive group of Integers modulo n, Multiplicative group of Integers modulo-p and permutation groups, Properties of groups, Subgroups, cyclic groups, Cosets, Lagrange's Theorem.

Text Book:1, 7.1,7.2 and 7.3

Course outcomes (Course Skill Set):

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

CO1: Apply concepts of logical reasoning and mathematical proof techniques in proving theorems and statements. (PO - 1,2,3, PSO -1,3)

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

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

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

CO5: Illustrate the fundamental principles of Algebraic structures with the problems related to computer science & engineering. (PO - 1,2,3, PSO - 1,2,3)

Assessment Details (both CIE and SEE):

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

Continuous Internal Evaluation:

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

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

Semester-End Examination:

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

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

Suggested Learning Resources:

Text Books:

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

Reference Books:

1. Basavaraj S Anami and Nankana S Madali: "Discrete Mathematics – A Concept based approach", Universities Press, 2016
2. Kenneth H. Rosen: "Discrete Mathematics and its Applications", 6th Edition, McGraw Hill, 2007.
3. Jayant Ganguly: "A Treatise on Discrete Mathematical Structures", Sanguine Pearson, 2010.
4. D.S. Malik and M.K. Sen: "Discrete Mathematical Structures Theory and Applications, Latest Edition, Thomson, 2004.

Thomas Koshy: "Discrete Mathematics with Applications", Elsevier, 2005, Reprint 2008.

Web links and Video Lectures(e-Resources):

1. http://nptel.ac.in/courses.php?disciplineID=111
2. http://www.class-central.com/subject/math(MOOCs)
3. http://academicearth.org/
4. VTU e-Shikshana Program
5. VTU EDUSAT Program.
6. http://www.themathpage.com/
7. http://www.abstractmath.org/
8. http://www.ocw.mit.edu/courses/mathematics/

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

Graph Theory			
Course Code	24IC46C	CIE Marks	50
Teaching Hours/Week (L: T: P)	2:2:0	SEE Marks	50
Credits	03	Total Marks	100
Contact Hours	40	Exam Hours	3
Examination type (SEE)	Theory		

Prerequisites:

The students should have knowledge on

- Basics of Graphs
- Basic Mathematics
- Problem-Solving Skills

Course Objectives:

CLO1: Understand the basic concepts of graphs and their properties, and operations of graphs.
CLO2: Hamiltonian and Euler graphs, trees and matrix representation of the graph.
CLO3: Apply the concepts of a planar graph, matching and colouring in computer science engineering.

Teaching-Learning Process (General Instructions)

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

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

Module-1 **8 Hours**

Introduction to Graphs: Introduction- Basic definition – Application of graphs – finite, infinite and bipartite graphs – Incidence and Degree – Isolated vertex, pendant vertex and Null graph. Paths and circuits – Isomorphism, sub-graphs, walks, paths and circuits, connected graphs, disconnected graphs and components.
Text Book:1, 1.1 ,1.2,1.3,1.4,1.5,2.1,2.2,2.3,2.4 and 2.5 Text Book:2, 1.2

Module-2	8 Hours
Eulerian and Hamiltonian graphs: Euler graphs, Operations on graphs, Hamiltonian paths and circuits, Travelling salesman problem. Directed graphs – types of digraphs, Digraphs and binary relation. Text Book:1, 2.6,2.7,2.8,2.9,2.10,9.2 and 9.3	
Module-3	**8 Hours**
Trees – properties, pendant vertex, Distance and centers in a tree - Rooted and binary trees, counting trees, spanning trees. Connectivity Graphs: Vertex Connectivity, Edge Connectivity, cut set and Cut Vertices, Fundamental circuits. Text Book:1, 3.1,3.2,3.3,3.4,3.5,3.6,3.7,4.1,4.2,4.3,4.4 and 4.5	
Module-4	**8 Hours**
Planar Graphs: Planar graphs, Krakowski's theorem (proof not required), Different representations of planar graphs, Euler's theorem, Geometric dual. Graph Representations: Matrix representation of graphs-Adjacency matrix, Incidence Matrix, Circuit Matrix, Path Matrix. Text Book:1, 5.2,5.3,5.4,5.6,7.1,7.3,7.8 and 7.9	
Module-5	**8 Hours**
Graph Colouring: Colouring- Chromatic number, Chromatic polynomial, Matchings, Coverings, Four colour problem and Five colour problem. Greedy colouring algorithm **Text Book:1,** 8.1,8.2,8.3,8.4,8.5 and 8.6 **Reference Book:3**, 5.2	

Course outcome (Course Skill Set)

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

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

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

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

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

CO5: Use the concepts of matching and colouring of graphs to solve the real-world problems. (PO - 1,2,3, PSO - 1,2,3)

Assessment Details (both CIE and SEE):

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

Continuous Internal Evaluation:

• There are 25 marks for the CIE's Assignment component and 25 for the Internal Assessment Test

component.

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

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

Semester-End Examination:

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

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

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

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

Suggested Learning Resources:

Text Books:

1. Books (Name of the author/Title of the Book/Name of the publisher/Edition and Year)
2. Narsingh Deo, Graph theory with the applications to engineering & Computer Science, Dover's Publications, 2016
3. J.A. Bondy and U.S.R. Murty. Graph theory with Applications, Springer, 1st edition, 2008.

Reference Books:

1. Garry Chartand and Ping Zhang, Introduction to Graph Theory, Tata McGraw-Hill, 2006.
2. Frank Harary, Graph Theory, Narosa Publishing House, Latest edition.
3. R. Diestel, Graph Theory, free online edition, 2016: diestel-graph-theory.com/basic.html.
4. Douglas B. West, Introduction to Graph Theory, Prentice Hall India Ltd.,2001
5. Robin J. Wilson, Introduction to Graph Theory, Longman Group Ltd.,2010

Web links and Video Lectures(e-Resources):

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

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

- Quizzes
- Assignments
- Seminar
- NPTEL MOOC Course

Optimization Technique			
Course Code	24IC46D	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	2:2:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Examination nature (SEE)	Theory		

Prerequisites:

The students should have knowledge on

- Understand basic calculus (derivatives, gradients) and linear algebra (matrices, vectors).
- Learn convex functions, optimization problem types (linear, nonlinear, etc.).
- Gain programming skills in Python or MATLAB with tools like SciPy or CVXPY.
- Know key algorithms (gradient descent, Newton's method) and how to set up constraints.

Course Objectives:

CLO1: Appreciate the importance of linear algebra in computer science and allied engineering science.

CLO2: Gain the knowledge of linear algebra tools and concepts to implement them in their core domain.

CLO3: Improve their mathematical thinking and acquire skills required for sustained lifelong learning.

Teaching-Learning Process (General Instructions)

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

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

MODULE-1 **8 Hours**

VECTOR CALCULUS

Functions of several variables, Differentiation and partial differentials, gradients of vector valued functions, gradients of matrices, useful identities for computing gradients, linearization and multivariate Taylor series.

(RBT Levels: L1, L2 and L3)

MODULE-2	8 Hours

APPLICATIONS OF VECTOR CALCULUS

Backpropagation and automatic differentiation, gradients in a deep network, The Gradient of Quadratic Cost, Descending the Gradient of Cost, The Gradient of Mean Squared Error

(RBT Levels: L1, L2 and L3)

MODULE-3	8 Hours

Convex Optimization-1

Local and global optima, convex sets and functions separating hyperplanes, application of Hessian matrix in optimization, Optimization using gradient descent, Sequential search 3-point search and Fibonacci search.

(RBT Levels: L1, L2 and L3)

MODULE-4	8 Hours

Convex Optimization-2

Unconstrained optimization -Method of steepest ascent/descent, NR method, Gradient descent, Mini batch gradient descent, Stochastic gradient descent.

(RBT Levels: L1, L2 and L3)

MODULE-5	8 Hours

Advanced Optimization

Momentum-based gradient descent methods: Adagrad, RMSprop and Adam.
Non-Convex Optimization: Convergence to Critical Points, Saddle-Point methods**.**

(RBT Levels: L1, L2 and L3)

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, PSO - 1,3)

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

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

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

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

Assessment Details (both CIE and SEE):

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

Continuous Internal Evaluation:

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

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

Semester-End Examination:

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

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

Suggested Learning Resources:

Textbook:

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

Reference Books:

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

Web links and Video Lectures (e-Resources):

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

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

- **Quizzes**
- **Assignments**
- **Seminar**

Workplace Security Practices			
Course Code	24IC47A	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	(0:0:2:0)	SEE Marks	50
Total Hours of Pedagogy	20	Total Marks	100
Credits	01	Exam Hours	3
Examination nature (SEE)	Practical		

Prerequisite:

- Basics of Computer Networks
- Basics of Operating System

Course objectives:

This course will enable the students to:

CLO1: Understand various techniques for providing workspace security to secure file & password.

CLO2: Apply appropriate tools for network packet sniffing, attack detection and security incident reporting.

Teaching-Learning Process (General Instructions):

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

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

SL NO	Experiments
	PART A
1	Explore Compare It Tool Compare of two file for Forensic Investigation
2	Explore the Snow tool for hiding the information in Text file
3	Write a program to illustrate Buffer overflow attack

4	Write the steps to download a website using Website copier tool to perform passive reconnaissance
5	Analyse and scan the system vulnerability using Microsoft Baseline Security Analyzer (MBSA) tool
	PART B
1	Password Strength Checker: Develop a Python script that assesses the strength of passwords based on criteria such as length, complexity, and the presence of common patterns
2	File Encryption and Decryption: Create a Python program that encrypts and decrypts files using cryptographic algorithm such as AES
3	Network Packet Sniffer: Build a packet sniffing tool in the Python that captures and analyses network traffic on a local network.
4	Brute Force Attack Detector: Develop a Python script that detects and logs brute force login attempts on a server or application.
5	Security Incident Reporting Tool: Develop a Python-based incident reporting tool where employees can report security incidents such as lost devices, suspicious emails, or physical security breaches.

Course outcome (Course Skill Set):

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

CO1 Implement python program to assess the strength of password for complexity measures (PO - 1,2,3,4,5 PSO - 1,3)

CO2. Apply cryptographic algorithms for a given file (PO - 1,2,34,5, PSO - 1, 2,3)

CO3. Apply appropriate python modules for network packet sniffing, attack detection and security incident reporting (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 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:

Reference Books:

1.Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, **Author**: Nina Godbole, Sunit Belapure, **Publisher**: Wiley India

2. Computer Security: Principles and Practice, **Authors**: William Stallings & Lawrie Brown, **Publisher:** Pearson

Web links and Video Lectures(e-Resources):

- Compare It Tool Demo
  https://www.youtube.com/watch?v=t6LbAZl2_fA
- Snow Tool - Steganography in Text
  https://www.youtube.com/watch?v=TkRXDQFeNnM
  Website Copier & Reconnaissance
  HTTrack Website Copier
  https://www.youtube.com/watch?v=6RgGWLK0C2w
- MBSA Tool (Microsoft Baseline Security Analyzer)
  MBSA Overview and Demo
  https://www.youtube.com/watch?v=ZflKUpw0ozs
- Brute Force Attack Detector Concept
  https://www.youtube.com/watch?v=FGdiKzSY77g
- Security Incident Reporting System in Python
  https://www.youtube.com/watch?v=i4PddpL_pZ8

DBMS with SQL and Mongo DB			
Course Code	24IC47B	CIE Marks	50
Teaching Hours/Week (L: T: P)	0:0:2:0	SEE Marks	50
Credits	01	Total Marks	100
Contact Hours	30	Exam Hours	3
Examination type (SEE)	Practical		

Prerequisite:

The students should have knowledge of

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

Course Objectives:

This course will enable the students to:

CLO1.Practice relational (SQL) and NoSQL (MongoDB) database operations.

CLO2.Develop skills in schema creation, data manipulation, and complex queries.

CLO3.Work with real-world data examples.

Teaching-Learning Process (General Instructions)

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

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

PART-A

1. Creating Tables, Users, and Constraints

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

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

2. Altering Tables and DML Operations

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

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

3. Queries using Aggregate Functions

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

- Create the Employee table with specified attributes.
- Count the number of employees in the table.
- Find the maximum age of employees.
- Find the minimum age of employees.
- Display salaries in ascending order.
- Find grouped salaries using GROUP BY.

4. Triggers

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

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

5. Cursors

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

Create a cursor for the Employee table:

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

PART-B

6. **Basic CRUD Operations in MongoDB**

a. Execute basic commands and operations in MongoDB:

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

Note: Use any sample collection

Reference: Book 1, Chapter 4

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

7. Selecting and Limiting Fields

a. Develop a query to select specific fields and exclude other fields from any collection.

b. Use limit and find to display only the first 5 documents from the results of (a).

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

8. Using Query Selectors

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

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

Reference: Book 3, Chapter 13

9. **Using Projection Operators**

Create and demonstrate the use of projection operators:

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

Reference: Book 3, Chapter 14

10. Aggregation Operators

Execute aggregation operations using the following operators:

•$avg

•$min

•$max

•$push

•$addToSet

Students should run multiple queries to demonstrate the various aggregation operators.

Reference: Book 3, Chapter 15

11. Aggregation Pipeline

Develop an aggregation pipeline that includes the following stages:

•$match

•$group

•$sort

•$project

•$skip

Students should demonstrate multiple queries using these pipeline operators.

Reference: Book 2, Chapter 6

12. Real-World Query Examples

a. Find all listings with listing URL, name, address, and host_picture_url in the Listings and Reviews collection where the host has a picture URL.

b. Using an E-commerce collection, write a query to display the reviews summary.

Reference: Book 2, Chapter 6

13. Text Search

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

b. Develop queries to exclude documents containing certain words or phrases.
Reference: Book 2, Chapter 9

14. Aggregation Pipeline for Text Search
Develop an aggregation pipeline to demonstrate text search on a Catalog data collection.
Reference: Book 2, Chapter 9

Assessment Details (both CIE and SEE):

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

Continuous Internal Evaluation:

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

Semester-End Examination:

SEE marks for the practical course are 50 Marks.

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

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

Text Books:

1: MongoDB: The Definitive Guide — Kristina Chodorow, 2nd Edition, O'Reilly, 2013.

2: MongoDB in Action — Kyle Banker et al., 2nd Edition, Manning Publications, 2016.

Reference Book:

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

Web links and Video Lectures(e-Resources):

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

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

Additional Resources:

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

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

Data Analytics for IOT			
Course Code	24IC47C	CIE Marks	50
Teaching Hours/Week (L: T: P)	1:0:0:0	SEE Marks	50
Credits	01	Total Marks	100
Contact Hours	14	Exam Hours	01
Examination type (SEE)	Theory (MCQ)		

Prerequisites:

The students should have knowledge on

- Basic Programming Knowledge
- Logical Thinking and Problem-Solving Skills

Course Objectives:

This course will enable the students to:

CLO1: Understand the basics of IoT analytics
CLO2: Understand Elastic analytics concepts
CLO3: Exploring and Visualizing data
CLO4: Learn about the basic concepts of Machine Learning
CLO5: Know about Linked analytical Datasets

Teaching-Learning Process (General Instructions)

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

1. Lecturer method (L) need not to be only traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes Critical thinking.
5. Adopt Case study Based Learning (CBL), which fosters students' analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyse information rather than simply recall it
6. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1	**3 Hours**
The situation, Defining IoT analytics, IoT analytics challenges. Chapter 1 (Except Business value concerns)	
Module-2	**3 Hours**

Building Elastic analytics, Elastic analytics concepts, Designing for scale, Cloud security and analytics
Chapter 3 (Only the above-mentioned topics)

Module-3 **3 Hours**

Exploring and Visualizing Data-The Tableau Overview, Techniques to understand data quality, Basic time series analysis, Get to know categories in the data, Bring in Geography, Using R for statistical Analysis.
Chapter 6 (Only the above-mentioned topics)

Module-4 **3 Hours**

Machine Learning Basics: What is machine learning, Generalization, Feature Engineering with IoT data, Validation methods, Random Forest model using R.
Chapter 10 (Only the above-mentioned topics)

Module-5 **2 Hours**

Linked analytical Datasets, Managing Data lakes, The Data retention strategy.
Chapter 11

Course outcomes (Course Skill Set):

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

CO1: Identify the requirement and measurements for capacity planning by considering the goal, issues, and processes. (PO - 1,2,3, PSO - 1,2)

CO2: Explain capacity measurement and monitoring**.** (PO -1,2,3, PSO -1)

CO3: Make use of measurement data for prediction towards the overall planning process. (PO -1,2,3, PSO - 1,3)

CO4: Explain the concepts related to deployment, installation, configuration, and management. (PO - 1,2,3, PSO -1,3)

CO5: Demonstrate how the virtualization and cloud services fit into a capacity plan**.** (PO - 1,2,3, PSO - 1,2,3)

Assessment Details (both CIE and SEE):

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

Continuous Internal Evaluation:

- 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:

Semester End Examinations (SEE) SEE paper shall be set for 50 questions, each of the 01 marks. The pattern of the question paper is MCQ (multiple choice questions). The time allotted for SEE is 01 hour. The student has to secure a minimum of 35% of the maximum marks meant for SEE.

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

- Solving Industry specific analysis problems (Chapter 6)
- Learn and use basics of R Programming concepts Role Play

Problem Management in Cyber Security			
Course Code	24IC47D	CIE Marks	50
Teaching Hours/Week (L: T: P)	1:0:0	SEE Marks	50
Credits	01	Total Marks	100
Contact Hours	14	Exam Hours	1
Examination type (SEE)	Theory		

Prerequisites:

The students should have knowledge on

- Explain how incidents lead to problems
- Recognize the importance of tracking IT assets
- Apply simple root cause analysis methods
- Understand the need for teamwork and policies

Course Objectives:

CLO1: Understand importance of problem management in cyber security.
CLO2: Distinguish between Incident Management, Problem Management and Change management
CLO3: Learn different approaches and methods to implement Problem Management in organization

Teaching-Learning Process (General Instructions)

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

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

Module-1 **8 Hours**

Introduction to Problem Management: Definition and importance of Problem Management. Difference between Incident Management and Problem Management. Difference between Change Management and Problem Management. Benefits of Problem Management.

Module-2	8 Hours
Problem Management Process - Problem Detection, Categorization and Prioritization, Investigation and Diagnosis, Creation of Known error record, Creation of work around if necessary and resolution and closure of the problem.	
Module-3	**8 Hours**
Root Cause Analysis (RCA) - When is RCA is required? Objectives of RCA, Different types of RCA, Key principles of RCA, RCA process and best practices.	
Module-4	**8 Hours**
Problem management best practices – Introduction to Brain Storming, Kepner-Tregoe (K-T) method, Ishikawa analysis or Fish bone diagram analysis, Pareto Analysis	
Module-5	**8 Hours**
Problem management practice in Industry – Introduction to Proactive and Reactive Problem Management. Introduction to role of ITSM (IT Service Management) and ITIL (Information Technology Infrastructure Library) in Problem Management.	

Course outcomes (Course Skill Set):

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

CO1: Compare Incident Management, Problem Management and Change Management. (PO - 1,2,3, PSO -1,3)

CO2: Illustrate the importance of Problem management in cyber security. (PO - 1,2,3, PSO -1,3)

CO3: Explain best practices in Problem management. (PO -1,2,3, PSO - 1,3)

Assessment Details (both CIE and SEE):

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

Continuous Internal Evaluation:

- There are 25 marks for the CIE's Assignment component and 25 for the Internal Assessment Test component.
- Each test shall be conducted for 25 marks. The first test will be administered after 40-50% of the coverage of the syllabus, and the second test will be administered after 85-90% of the coverage of the syllabus. The average of the two tests shall be scaled down to 25 marks.
- Any two assignment methods mentioned in the regulations; if an assignment is project-based then only one assignment for the course shall be planned. The schedule for assignments shall be planned

properly by the course teacher. The teacher should not conduct two assignments at the end of the semester if two assignments are planned. Each assignment shall be conducted for 25 marks. (If two assignments are conducted then the sum of the two assignments shall be scaled down to 25 marks)

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

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

Semester-End Examination:

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

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

Suggested Learning Resources:

Textbook:

1. Cyber Incident and Crisis Management: A Guide for Managers, by Dr.IshaiDror, EAN/UPC, ISBN: 9781090168962, 2019.

Reference Books:

1. Root Cause Analysis: Simplified Tools And Techniques, by Bjorn Anderson and Tom Fagerhaug, Second Edition, ISBN-0873896920, AsqPr, 2006

Web links and Video Lectures(e-Resources):

- https://www.youtube.com/watch?v=SBlKdEFAnlM - Problem Management | ITIL V3 Foundation | ITIL Basics | Simplilearn

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

- Learn and Practice RCA.
- Understand Problem Management Process.

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

Prerequisites:

- Openness to self-reflection and willingness to explore inner thoughts and emotions.
- Basic understanding of human relationships, society, and ethical behavior.
- Interest in value-based living, peace, harmony, and well-being for all.
- Ability to engage in dialogue, critical thinking, and respectful listening.

Course Objectives:

This course is intended to:

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

This course is intended to provide a much-needed orientation input in value education to the young enquiring minds.

Teaching-Learning Process (General Instructions):

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

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

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

Course outcomes (Course Skill Set):

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

CO1: Apprehend the need of Value Education over Human aspirations (PO-6)
CO2: Assimilate Harmony over the physical needs and to overcome the self- needs for a prosperous life. (PO-6)
CO3: Recognize the need of Harmony in the Family and Society for a better World. (PO-6)
CO4: Explain the need of mutual understanding for Holistic Harmony in all the Levels of Human Existence. (PO-6)
CO5: Explain the Holistic understanding of Harmony and Professional Ethics at Individual Level and Society. (PO-6, PO-7)

Assessment Details (both CIE and SEE):

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

Continuous Internal Evaluation:

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

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

Semester-End Examination:

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

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

Suggested Learning Resources:

Text Books:

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

Reference Books:

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

Web links and Video Lectures (e-Resources):

1. https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw
2. https://www.youtube.com/watch?v=P4vjfE-YnVk&list=PLWDeKF97v9SP7wSlapZcQRrT7OH0ZlGC4

Course handouts:

https://drive.google.com/drive/folders/1zioX_4L2fCNX4Agw282PN86pcZZT3 Osr?usp=sharing

Presentation slides:

https://drive.google.com/drive/folders/1rMUKh1s0HPRBlpp_b1mpS-duNRcwS6YH?usp=sharing