



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

Academic Batch 2025 - 29(Autonomous)

Undergraduate Bachelor of Engineering Program – B.E

Outcome Based Education (OBE)

III SEM TO IV SEM

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

2026-27

III Semester

Probability, Distributions and Statistics			
Course Code	25CS31	CIE Marks	50
Teaching Hours/Week (L: T: P)	3:2:0	SEE Marks	50
Credits	04	Total Marks	100
Contact Hours	56	Exam Hours	3
Examination type (SEE)	Theory		
Prerequisites: The students should have knowledge of - Basics of Probability and Statistics - Understanding of Hypothesis - Basic Mathematics			
Course Objectives: This course will enable the students to: CLO1: 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: Provide the principles of statistical inferences and the basics of hypothesis testing with emphasis on some commonly encountered hypotheses. CLO3: Determine whether an input has a statistically significant effect on the system's response through ANOVA testing			
Teaching-Learning Process (General Instructions) Teachers can use following strategies to accelerate the attainment of the various course outcomes. 1. Chalk and Talk with Black Board 2. ICT based Teaching 3. Demonstration based Teaching.			
MODULE-1			12 Hours
Modular Arithmetic: Introduction of modular arithmetic and its applications in Computer Science and Engineering. Introduction to Congruences, Linear Congruences, The Remainder theorem, Solving Polynomials, Linear Diophantine Equation, System of Linear Congruences, Euler’s Theorem, Wilson Theorem and Fermat’s little theorem. Applications of Congruences-RSA algorithm. Text Book: 3 – Chapters 4, 5, 6, 7 and 9.			
MODULE-2			11 Hours
Statistics: Principles of least squares, Curve fitting by the method of least squares in the form: $y = a + bx$, $y = a + bx + cx^2$, and $y = ax^b$. Correlation, Coefficient of correlation, Lines of regression, Angle between regression lines, rank correlation.			

Text Book: 1 – Chapters 11 and 12. Text Book: 2 – Chapters 13 and 14.	
MODULE-3	11 Hours
Probability Distributions: Review of basic probability theory. Random variables (discrete and continuous), probability mass and density functions. Mathematical expectation: mean and variance. Binomial, Poisson and normal distributions-problems (derivations for mean and standard deviation for Binomial and Poisson distributions only). Text Book: 1 – Chapters 3, 4, 5, 6. Text Book: 2 – Chapters 6 and 7.	
MODULE-4	11 Hours
Joint Probability Distributions: 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. Text Book: 1 - Chapters 3, 4, 5, 6. Text Book: 4 – Chapter 8.	
MODULE-5	11 Hours
Statistical Inference: Sampling distribution, standard error. Levels of significance. Testing of hypothesis. Test of significances. Confidence limits, simple sampling of attributes. Sampling variables, central limit theorem and confidences limit for unknown mean. Test of significance for large samples (mean, proportion). Comparison of large samples (mean, proportion). Test of Significance for means of two small samples, students- 't' distribution, and Chi-square distribution as a test of goodness of fit. Text Book: 1 – Chapters 8 and 10. Text Book: 2 – Chapters 8, 9, 10 and 12.	
Course outcomes (Course Skill Set): At the end of the course, the student will be able to: CO1: Apply the concepts of modular arithmetic, congruence's, linear Diophantine equations, Euler's theorem, Fermat's theorem, Wilson's theorem, and the RSA cryptographic algorithm to solve engineering and computational problems. (PO – 1,2,3) CO2: Apply least squares curve fitting, correlation, regression analysis, and rank correlation techniques to analyse engineering data and establish relationships between variables. (PO –	

1,2,3)

CO3: Solve engineering problems involving discrete and continuous random variables using probability distributions, mathematical expectation, variance, and standard probability models such as Binomial, Poisson, and Normal distributions. (PO – 1,2,3)

CO4: Analyse joint probability distributions and Markov chains by determining expectations, covariance, correlation, transition probabilities, stationary distributions, and absorbing states for stochastic systems. (PO – 1,2,3)

CO5: Apply statistical inference techniques including hypothesis testing, confidence intervals, large and small sample tests, Student's *t*-test, Chi-square test, and the Central Limit Theorem to draw valid conclusions from engineering data. (PO – 1,2,3)

Assessment Details (both CIE and SEE):

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

Continuous Internal Evaluation:

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

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

Semester-End Examination:

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

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

3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks.

Suggested Learning Resources:

Text Books:

1. Ronald E. Walpole, Raymond H Myers, Sharon L Myers & Keying Ye “Probability and Statistics for Engineers and Scientists”, Pearson Education, Ninth edition, 2012.
2. Murray R. Spiegel, Larry J. Stephens, Statistics, Schaum’s outline series, Third edition.
3. Koshy, Thomas. *Elementary number theory with applications*. Academic press, 2nd Edition, 2009.
4. Seymour Lipschutz and Marc Lars Lipson, Probability, Schaum’s Outline Series, Second edition, 2011.

Reference Books:

1. Erwin Kreyszig, “Advanced Engineering Mathematics”, John Wiley & Sons, 9th Edition, 2006.
2. B. S. Grewal “Higher Engineering Mathematics”, Khanna publishers, 44th Ed., 2021.
3. Irwin Miller & Marylees Miller, John E. Freund’s “Mathematical Statistics with Applications” Pearson.
Dorling Kindersley Pvt. Ltd. India, 8th edition, 2014.
4. S C Gupta and V K Kapoor, “Fundamentals of Mathematical Statistics”, S Chand and Company, Latest edition.
5. P. G. Hoel, S. C. Port and C. J. Stone, “Introduction to Probability Theory”, Universal Book Stall, (Reprint), 2003.
6. S. Ross, “A First Course in Probability”, Pearson Education India, 6th Ed., 2002.
7. David M Burton: “Elementary Number Theory” Mc Graw Hill, 7th Ed., 2017

Web links and Video Lectures(e-Resources):

- Probability and statistics: <https://nptel.ac.in/courses/111105090>
- Introduction to Probability and Statistics for Machine Learning: <https://www.classcentral.com/course/codesignal-introduction-to-probability-and-statistics-for-machine-learning-358081>
- Probability and Statistics: <https://www.classcentral.com/course/probability-statistics-11755>
Introduction to probability, statistics, and random processes: <https://probabilitycourse.com/>
- Introduction to Probability and Statistics: <https://ocw.mit.edu/courses/18-05-introduction-to-probability-and-statistics-spring-2022/>
- VTU e-Shikshana Program
- VTU EDUSAT Program

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

Learning Activity – 1: Tutorial: Prating problems (Two objective type assessments for 5 marks each, total 10 marks) or Conduction of CIA (Continuous Internal Assessment) for 10 marks.

Learning Activity – 2: Assignments: Assigning two assignments each for 5 marks, total 10 marks.

Learning Activity – 3: Choose either Seminar or Project based learning activity with report for 5 marks.

OPERATING SYSTEMS			
Course Code	25CS32	CIE Marks	50
Teaching Hours/Week (L: T:P)	3:0:0	SEE Marks	50
Credits	03	Total Marks	100
Contact Hours	42	Exam Hours	3
Examination type (SEE)	Theory		
Prerequisite: The Students Should have knowledge of Computer Architecture / Organization			
Course objectives: CLO1: To provide students with a fundamental understanding of the structure, functions, and services of an operating system. CLO2: To enable students to understand and apply CPU scheduling algorithms for efficient process management. CLO3: To develop the ability to analyze process synchronization mechanisms and deadlock handling techniques used in operating systems. CLO4: To familiarize students with memory management strategies and virtual memory concepts, and enable them to apply paging and page replacement techniques. CLO5: To introduce file system organization, secondary storage management, and protection mechanisms, and develop the ability to apply disk scheduling techniques for efficient storage management.			
Teaching-Learning Process (General Instructions): 1. Lecture method (L) need not be only a traditional lecture method; alternative effective teaching methods may be adopted to attain the outcomes. 2. Use of video/animation to explain the functioning of various concepts. 3. Encourage collaborative (group learning) in the class. 4. Ask at least three HOT (Higher Order Thinking) questions in the class to promote critical thinking. 5. Adopt Problem Based Learning (PBL) to foster students' analytical and design thinking skills such as designing, evaluating, generalizing, and analyzing information rather than simple recall. 6. Use animations/videos to help students understand concepts. 7. Demonstrate concepts using a suitable programming language.			
MODULE-1			9 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 2.11	
MODULE-2	9 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
File System: File system: File concept; Access methods; Directory and Disk structure Implementing File system: File system structure; File system implementation; Directory implementation; Allocation methods; Free space management. Secondary Storage Structure: Mass storage structures; Disk structure; Disk attachment; Disk scheduling; Disk management; Protection: Goals of protection, Principles of protection, Domain of protection, Access matrix	

Textbook 1: Chapter -10(10.1-10.3),11(11.1-11.5),12(12.1-12.5),14(14.1-14.4)

Course outcome (Course Skill Set):

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

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

CO2: Apply appropriate CPU scheduling algorithms for the given problem. (PO-1,2,3,11, PSO-1,2)

CO3: Analyze the various techniques for process synchronization and deadlock handling. (PO-1,2,3,11, PSO-1,2)

CO4: Explain memory management strategies and virtual memory concepts, and apply paging and page replacement techniques for efficient memory management. (PO-1,2,3,11, PSO-1,2)

CO5: Explain file system organization and protection mechanisms, and apply disk scheduling algorithms for efficient disk access. (PO-1,2,3,11, PSO-1,2)

Assessment Details (both CIE and SEE)

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

Continuous Internal Evaluation (CIE):

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

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

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

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

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

Suggested Learning Resources:

Textbooks

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

Reference Books

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

Web links and Video Lectures(e-Resources):

- <https://youtu.be/mXw9ruZaxzQ> 14.09.2023 MKV-TEMPLATE for IPCC (26.04.2022) Annexure-III
- <https://youtu.be/vBURTt97EkA>
- https://www.youtube.com/watch?v=783KABtuE4&list=PLIemF3uozcAKTgsCJj82voMK3TMR0YE_f
- <https://www.youtube.com/watch?v=3-ITLMMeeXY&list=PL3pGy4HtqwD0n7bQfHjPnsWzkeRn6mkO>

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

- Case Study
- Assignments
- Seminars
- MOOC Certifications

Data Structures & Applications			
Course Code	25CS33	CIE Marks	50
Teaching Hours/Week (L: T:P)	3:0:0	SEE Marks	50
Credits	03	Total Marks	100
Contact Hours	42	Exam Hours	3
Examination type (SEE)	Theory		
Prerequisites: The students should have knowledge of; • Basic Programming Skills • Understanding of Algorithms • Basic Mathematics • Problem-Solving Skills			
Course Objectives: • To explain fundamentals of data structures and their applications. • To illustrate representation of Different data structures such as Stack, Queues. • To Design and Develop Solutions to problems using Linked Lists • To discuss applications of Nonlinear Data Structures in problem solving such as trees • To introduce advanced Data structure concepts such as Graphs and Hash			
Teaching-Learning Process (General Instructions) Teachers can use following strategies to accelerate the attainment of the various course outcomes. 1. Chalk and Talk with Black Board 2. ICT based Teaching 3. Demonstration based Teaching			
Module-1		9 Hours	
INTRODUCTION TO DATA STRUCTURES: Data Structures, Classifications (Primitive & Non- Primitive), Data structure Operations pointers and dynamic Memory Allocation ARRAYS and STRUCTURES: Arrays, Dynamic Allocated Arrays, Structures and Unions, Polynomials, Sparse Matrices, representation of Multidimensional Arrays, Strings Text Book: Chapter-1:1.2 Chapter-2: 2.1 to 2.7			

Module-2	8 Hours
Stacks and Queues: Stacks, Stacks Using Dynamic Arrays, Queues, Circular Queues Using Dynamic Arrays, Evaluation of Expressions, Multiple Stacks and Queues. Text Book: Chapter-3: 3.1,3.2,3.6 3.3, 3.4, 3.7	
Module-3	8 Hours
Linked Lists: Singly Linked lists and Chains, Representing Chains in C, Linked Stacks and Queues, Polynomials, Additional List operations, Sparse Matrices, Doubly Linked Lists. Text Book: Chapter-4: 4.1 to 4.4 4.5,4.7,4.8	
Module-4	8 Hours
TREES: Introduction to trees, Binary Trees, Binary Tree Traversals, Threaded Binary Trees. Binary Search trees, Selection Trees, Forests, Representation of Disjoint sets, Counting Binary Trees, Leftist Trees. Efficient Binary Search Trees: AVL Trees, Red Black Tree Text Book: Chapter-5: 5.1 to 5.3, 5.5 ,5.7 to 5.11	
Module-5	9 Hours
GRAPHS: The Graph Abstract Data Types, Elementary Graph Operations (BFS/DFS) HASHING: Introduction, Static Hashing, Dynamic Hashing Text Book Chapter-6: 6.1, 6.2 Chapter 8: 8.1 to 8.3	
Course outcomes (Course Skill Set): At the end of the course, the student will be able to: CO1: Apply the K–Map techniques to simplify various Boolean expressions. (PO – 1,2,3,5, PSO – 1,3) CO2: Design different types of combinational and sequential circuits along with Verilog programs. (PO – 1,2,3,5, PSO – 1,2) CO3: Describe the fundamentals of machine instructions, addressing modes and Processor performance. (PO – 1,2,3, PSO – 1,2) CO4: Explain the approaches involved in achieving communication between processor and I/O	

devices. (PO – 1,2,3, PSO – 1,2)

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

Assessment Details (both CIE and SEE):

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

Continuous Internal Evaluation:

- There are 25 marks for the CIE's Assignment component and 25 for the Internal Assessment 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.

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, 2nd Ed, Cengage Learning, 2014.
3. Reema Thareja, Data Structures using C, 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 Robert Kruse, Data Structures and Program Design in C, 2nd Ed, 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-iiiith.vlabs.ac.in/exp/linked-list/basics/overview.html>
- <https://ds1-iiiith.vlabs.ac.in/List%20of%20experiments.html>
- <https://ds1-iiiith.vlabs.ac.in/exp/tree-traversal/index.html>
- <https://ds1-iiiith.vlabs.ac.in/exp/tree-traversal/depth-first-traversal/dft-practice.html>
- https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01350159542807756812559

[/overview](#)

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

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

Digital Design and Computer Organization			
Course Code	25CS34	CIE Marks	50
Teaching Hours/Week (L: T: P)	3:0:2	SEE Marks	50
Credits	04	Total Marks	100
Contact Hours	42 hours Theory + 28 Hours of Practical	Exam Hours	3
Examination type (SEE)	Theory		
Prerequisites: The students should have knowledge of • Basic Electronics • Digital Circuits • Computer Architecture Concepts			
Course Objectives: • To demonstrate the functionalities of binary logic system • To explain the working of combinational and sequential logic system • To realize the basic structure of computer system • To illustrate the working of I/O operations and processing unit			
Teaching-Learning Process (General Instructions) 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		9 Hours	
Introduction to Digital Design: Binary Logic, Basic Theorems and Properties of Boolean Algebra, Boolean Functions, Digital Logic Gates, Introduction, The Map Method, Four-Variable Map, Don't- Care Conditions, NAND and NOR Implementation, Other Hardware Description Language – Verilog Model of a simple circuit. Case Study: Design a solution for a Real Time Problem Using K-Maps. Text book 1: 1.9, 2.4, 2.5, 2.8, 3.1, 3.2, 3.3, 3.5, 3.6, 3.9			
Module-2		9 Hours	
Combinational Logic: Introduction, Combinational Circuits, Design Procedure, Binary Adder-Subtractor, Decoders, Encoders, Multiplexers. HDL Models of Combinational Circuits – Adder, Multiplexer, Encoder. Sequential Logic: Introduction, Sequential Circuits, Storage Elements: Latches, Flip-Flops. Case Study: Design a real-world control system based on Combinational and Sequential logic circuits to manage specific operational requirements effectively. Text book 1: 4.1, 4.2, 4.4, 4.5, 4.9, 4.10, 4.11, 4.12, 5.1, 5.2, 5.3, 5.4.			

Module-3		8 Hours
Basic Structure of Computers: Functional Units, Basic Operational Concepts, Bus structure, Performance – Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement. Machine Instructions and Programs: Memory Location and Addresses, Memory Operations, Instruction and Instruction sequencing, Addressing Modes. Text book 2: 1.2, 1.3, 1.4, 1.6, 2.2, 2.3, 2.4, 2.5		
Module-4		8 Hours
Input/output Organization: Accessing I/O Devices, Interrupts – Interrupt Hardware, Enabling and Disabling Interrupts, Handling Multiple Devices, Direct Memory Access: Bus Arbitration, Speed, size and Cost of memory systems. Cache Memories – Mapping Functions. Case Study: Optimizing Cache Mapping in an AI-Based System Text book 2: 4.1, 4.2.1, 4.2.2, 4.2.3, 4.4, 5.4, 5.5.1		
Module-5		8 Hours
Basic Processing Unit: Some Fundamental Concepts: Register Transfers, Performing ALU operations, fetching a word from Memory, Storing a word in memory. Execution of a Complete Instruction. Pipelining: Basic concepts, Role of Cache memory, Pipeline Performance. Case Study: Pipelining in AI-Powered Text book 2: 7.1, 7.2, 8.1		
PRACTICAL COMPONENT OF IPCC		
Sl. No	Experiments	
	Simulation packages preferred: Multisim, Model sim, 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.	Implement and simulate a 4-bit Full Adder using basic logic gates.	
3.	Implement and simulate a 4-bit Full Subtractor using basic logic gates.	
4.	Develop simple digital circuits using Verilog HDL based on Structural, Dataflow, and Behavioral modeling.	
5.	Design Verilog HDL to implement Binary Half Adder and Half Subtractor.	
6.	Design Verilog HDL to implement Binary Full Adder, and Full Subtractor.	
7.	Develop a Decimal Adder using Verilog HDL.	
8.	Design Verilog program to implement Different types of multiplexers like 2:1, 4:1 and 8:1.	
9.	Design Verilog program to implement types of De-Multiplexer.	
10.	Implement various types of Flip-Flops, such as SR, JK, and D Flip-Flops, using Verilog HDL.	

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 PSO – 1,3)

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

CO3: Describe the fundamentals of machine instructions, addressing modes and Processor performance. (PO – 1,2,3,5 PSO – 1)

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

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

Assessment Details (both CIE and SEE):

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

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

- IPCC means practical portion integrated with the theory of the course.
- CIE marks for the theory component are 25 marks and that for the practical component is 25 marks.
- 25 marks for the theory component are split into 15 marks for two Internal Assessment Tests (Two Tests, each of 15 Marks with 01-hour duration, are to be conducted) and 10 marks for other assessment methods 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 of all experiments' write- ups are added and scaled down to 15 marks.
4. The laboratory test (duration 02/03 hours) after completion of all the experiments shall be conducted for 50 marks and scaled down to 10 marks.
5. Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for 25 marks.
6. The student has to secure 40% of 25 marks to qualify in the CIE of the practical component of the IPCC.

Semester-End Examination:

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

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

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

Suggested Learning Resources:

Textbook:

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

Web links and Video Lectures(e-Resources):

- <https://elearning.vtu.ac.in/econtent/courses/web/CSE/15CS44.html>
- <https://cse11-iiith.vlabs.ac.in/>
- <https://infyspringboard.onwingspan.com>
- https://onlinecourses.nptel.ac.in/noc21_ee39/preview

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

- Role Play
- Flipped classroom

Assessment Methods for 25 Marks (opt two Learning Activities)

- Case Study
- Programming Assignment

Data Structures & Applications Laboratory			
Course Code	25CSL35	CIE Marks	50
Teaching Hours/Week (L: T:P)	0:0:2	SEE Marks	50
Credits	01	Total Marks	100
Contact Hours	28 Hours of Practical	Exam Hours	3
Examination type (SEE)	Practical		
Prerequisites: The students should have knowledge of • Basic Programming Skills • Understanding of Algorithms • Problem-Solving Skills			
Course Objectives: This laboratory courses enables students to get practical experience in design, develop, implement, analyze and evaluation/testing of • Dynamic memory management • Linear data structures and their applications such as stacks, queues and lists • Non-Linear data structures and their applications such as trees and graphs			
Teaching-Learning Process (General Instructions) Teachers can use following strategies to accelerate the attainment of the various course outcomes. 1. Chalk and Talk with Black Board 2. ICT based Teaching 3. Demonstration based Teaching			
Programs List:			
1.	Develop a Program in C for the following: 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. - Read a main String(STR),a Pattern String(PAT)and a Replace String(REP) - Perform Pattern Matching Operation: Find and Replace all occurrences of PAT in STR with REP if PAT exists in STR. Report suitable messages in case PAT does not exist in STR Support the program with functions for each of the above operations. Don't use Built-in functions.
3.	Develop a menu driven Program in C for the following operations on STACK of Integers (Array Implementation of Stack with maximum size MAX) - Push an Element on to Stack - Pop an Element from Stack - Demonstrate how Stack can be used to check Palindrome - Demonstrate Overflow and Underflow situations on Stack - Display the status of Stack - Exit Support the program with appropriate functions for each of the above operations
4	Develop a Program in C for converting an Infix Expression to Postfix Expression. Program should support for both parenthesized and free parenthesized expressions with the operators: +, -, *, /, %(Remainder), ^(Power) and alphanumeric operands.
5.	Develop a Program in C for the following Stack Applications - 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) - Insert an Element on to Circular QUEUE - Delete an Element from Circular QUEUE - Demonstrate Overflow and Underflow situations on Circular QUEUE - Display the status of Circular QUEUE

	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 LinkedList (SLL) of Student Data with the fields: <i>USN, Name, Programme, Sem, PhNo</i> - Create a SLL of N Students Data by using <i>front insertion</i>. - Display the status of SLL and count the number of nodes in it - Perform Insertion/Deletion at End of SLL Perform Insertion/Deletion at Front of SLL(Demonstration of stack)
8	Develop a menu driven Program in C for the following operations on Doubly LinkedList (DLL) of Employee Data with the fields: <i>SSN, Name, Dept, Designation, Sal, PhNo</i> - Create a DLL of N Employees Data by using <i>end insertion</i>. - Display the status of DLL and count the number of nodes in it - Perform Insertion and Deletion at End of DLL - Perform Insertion and Deletion at Front of DLL Demonstrate how this DLL can be used as Double Ended Queue.
9	Develop a Program in C for the following operations on Singly Circular Linked List(SCLL) with header nodes Represent and Evaluate a Polynomial $P(x, y) = 6x^2y^2 - 4y + 3x^3y + 2xy^5 - 2xy$ Find the sum of two polynomials POLY1(x,y) and POLY2(x,y) and store the result in POLYSUM(x, y)
10	Develop a menu driven Program in C for the following operations on Binary Search Tree (BST) of Integers. - Create a BST of N Integers :6,9,5,2,8,15,24,14,7,8,5,2 - Traverse the BST in In order, Preorder and Post Order Search the BST for a given element (KEY) and report the appropriate message
11	Develop a Program in C for the following operations on Graph(G) of Cities Create a Graph of N cities using Adjacency Matrix. Print all the nodes reachable from a given starting node in a digraph using DFS/BFS method
12.	Given a File of N employee records with a set K of Keys (4-digit) which uniquely determine the records in file F. Assume that file F is maintained in memory by a Hash Table (HT) of m memory locations with L as the set of memory addresses (2-digit) of locations in HT. Let the

	key sinKandaddressesinLareIntegers.DevelopaPrograminCthatusesHashfunctionH: $K \rightarrow L \text{ as } H(K) = K \bmod m$ (remainder method), and implement hashing technique to map a given key K to the addresss paceL.Resolve the collision (if any) using linear probing.
Course outcomes (Course Skill Set): At the end of the course, the student will be able to: CO1: Analyze various linear and non-linear data structures (PO – 1,2,3 PSO - 1,2) CO2: Demonstrate the working nature of different types of data structures and their applications (PO – 1,2,3 PSO - 1,2) CO3: Use appropriate searching and sorting algorithms for the given scenario (PO – 1,2,3 PSO - 1,2) CO4: Apply linked list data structures to solve real-world problems. (PO – 1,2,3 PSO - 1,2) CO5: Apply tree and graph techniques to develop solutions for real-world problems. (PO-1-4, PSO1-3)	
Assessment Details (both CIE and SEE): • Experiment distribution - o For laboratories having only one part: Students are allowed to pick one experiment from the lot with equal opportunity. - o 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 (<i>Need to change in accordance with university regulations</i>) c) For laboratories having only one part–Procedure+Execution+Viva-Voce:15+70+15= 100 Marks d) 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-iiiith.vlabs.ac.in/exp/stacks-queues/index.html • https://ds1-iiiith.vlabs.ac.in/exp/linked-list/basics/overview.html • https://ds1-iiiith.vlabs.ac.in/List%20of%20experiments.html • https://ds1-iiiith.vlabs.ac.in/exp/tree-traversal/index.html • https://ds1-iiiith.vlabs.ac.in/exp/tree-traversal/depth-first-traversal/dft-practice.html	

Object Oriented Programming with JAVA			
Course Code	25CS36A	CIE Marks	50
Teaching Hours/Week (L: T:P)	2:0:2	SEE Marks	50
Credits	03	Total Marks	100
Contact Hours	28 Hours of Theory + 28 Hours of Practical	Exam Hours	3
Examination type (SEE)	Theory		
Pre requisite: The student should have knowledge of • Basic Programming Concepts • Familiarity with C or Python helps understand structured programming before moving to OOP			
Course Objectives: • To learn primitive constructs JAVA programming language. • To understand Object Oriented Programming Features of JAVA. • To gain knowledge on: packages, multithreaded programing and exceptions.			
Teaching-Learning Process (General Instructions) These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes and make Teaching –Learning more effective 1. Use Online Java Compiler IDE: https://www.jdoodle.com/online-java-compiler/oranyother. 2. Demonstration of programming examples. 3. Chalk and board, power point presentations 4. Online material (Tutorials) and video lectures.			
Module-1		6 Hours	
An Overview of Java: Object-Oriented Programming (Two Paradigms, Abstraction, The Three OOP Principles), Using Blocks of Code, Lexical Issues (Whitespace, Identifiers, Literals, Comments, Separators, The Java Keywords).			
Data Types, Variables, and Arrays: The Primitive Types (Integers, Floating-Point Types, Characters, Booleans), Variables, Type Conversion and Casting, Automatic Type Promotion in Expressions, Arrays, Introducing Type Inference with Local Variables.			
Operators: Arithmetic Operators, Relational Operators, Boolean Logical Operators, The Assignment Operator, The? Operator, Operator Precedence, Using Parentheses.			
Chapter 2,3,4			

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

Autoboxing (Autoboxing and Methods, Autoboxing/Unboxing Occurs in Expressions, Autoboxing/Unboxing Boolean and Character Values).

Chapter 11,12

Course Outcomes (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 (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 problems. (PO – 2,3,5 PSO - 1,2)
5. Apply concepts of multithreading, autoboxing and enumerations in program development. (PO – 2,3,5 PSO1,2)

Programming Experiments (Suggested and are not limited to):

1. Develop a JAVA program to add TWO matrices of suitable order N (The value of N should be read from command line arguments).
2. Develop a stack class to hold a maximum of 10 integers with suitable methods. Develop a JAVA main method to illustrate Stack operations.
3. A class called Employee, which models an employee with an ID, name, and salary, is designed as shown in the following class diagram. The method raise Salary(percent) increases the salary by the given percentage. Develop the Employee class and suitable main method for demonstration.
4. A class called My Point, 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 constructs a point at the default location of (0,0).
 - An overloaded constructor that constructs a point with the given x and y coordinates.
 - A method set XY() to set both x and y.
 - A method get XY() which returns the x and y in a 2-element int array.
 - A to String() 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(My Point another) that returns the distance from this point to the given My Point instance (called another). Develop the code for the class My Point. 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 subclasses namely: Circle, Triangle and Square. Each class has two member functions named draw() and erase(). Demonstrate polymorphism concepts by developing suitable methods, defining member data and main program.
 6. Develop a JAVA program to create an abstract class Shape with abstract methods calculate Area() and calculate Perimeter(). Create subclasses Circle and Triangle that extend the Shape class and implement the respective methods to calculate the area and perimeter of each shape.
 7. Develop a JAVA program to create an interface Resizable with methods resize Width (int width) and resize Height (int height) that allow an object to be resized. Create a class Rectangle that implements the Resizable interface and implements the resize methods.
 8. Develop a JAVA program to create an outer class with a function display. Create another class inside the outer class named Inner with a function called display and call the two functions in the main class.
 9. Develop a JAVA program to raise a custom exception (user defined exception) for Division By Zero using try, catch, throw and finally.
 10. Develop a JAVA program to create a package named mypack and import & implement it in a suitable class.
 11. Write a program to illustrate creation of threads using Runnable class. (The start method starts each of the newly created threads. Inside the run method there is sleep() to suspend the thread for 500 milliseconds).
 12. Develop a program to create a class MyThread. In this class, a constructor should call the base class constructor using super and start the thread. The run method of the class starts after this.

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 (maximum marks 50)

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

CIE for the Practical Component

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

SEE for IPCC

- Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (duration 03 hours).
- The question paper will have ten questions. Each question is set for 20 marks.
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.
- The students have to answer 5 full questions, selecting one full question from each module. Marks scored by the students shall be proportionally scaled down to 50 Marks.

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

Suggested Learning Resources:

Textbook

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

Reference Books

1. **Programming with Java**, 6th Edition, by E Balagurusamy, Mar-2019, McGraw Hill Education, ISBN: 9789353162337.
2. **Thinking in Java**, Fourth Edition, by Bruce Eckel, Prentice Hall, 2006, is available at: Thinking in Java 4th Edition.

Web links and Video Lectures(e-Resources):

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

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

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

Assessment Method

Programming Assignment/ Course Project

C#.Net Programming Language			
Course Code	25CS36B	CIE Marks	50
Teaching Hours/Week (L: T:P)	2:2:0	SEE Marks	50
Credits	03	Total Marks	100
Contact Hours	28 Hours of Theory + 28 Hours of Practical	Exam Hours	3
Examination type (SEE)	Theory		
Pre requisite: The students should have knowledge of: • Basic Coding Knowledge: A fundamental understanding of programming concepts is beneficial. • Basic Data Structures: Familiarity with lists, arrays, and dictionaries can be helpful. • Syntax and Basic Constructs: Variables, data types, operators, control flow statements (if-else, switch, loops like while, do-while, for). • Object-Oriented Programming (OOP): Concepts such as classes, objects, inheritance, and polymorphism. • Exception Handling: Understanding try, catch, throw, and finally blocks for managing errors.			
Course Objectives: This course will enable to, • To learn the technologies of the .NET framework. • To cover all segments of programming in C# starting from the language basics, followed by the object-oriented programming concepts. • To update and enhance skills in writing Windows applications, ADO.NET and ASP .NET. • To implement mobile applications using .Net compact framework			
Teaching-Learning Process (General Instructions) Teachers can use following strategies to accelerate the attainment of the various course outcomes. 1. Chalk and Talk with Black Board 2. ICT based Teaching 3. Demonstration based Teaching			
Module 1			6 Hours

C# LANGUAGE BASICS

.Net Framework Overview- Architecture-.Net Framework class Libraries-CLR-Meta data Interoperability-Assemblies-the .net Packaging system-CLR-MSIL, Introduction to Visual Studio .Net C# Programming Concepts-Predefined Types- Value types and reference type, Classes and Objects, Constructors and methods, Conditional statements, loops, arrays, Collection classes: Array List, Hash Table, Stack, Queue, indexers and properties.

Module 2

6 Hours

C# ADVANCED FEATURES

String class: methods and properties of string class, enumerations, boxing and unboxing, OOPS concepts: Encapsulation, data hiding, inheritance, interfaces, polymorphism, operator overloading, overriding Methods, Static Class members, Delegates and events. Exception Handling, garbage collector, generics and collection.

Module-3

5 Hours

WINDOWS PROGRAMMING

Basics of Windows Programming- Event Driven Programming, Windows Forms, using common controls- Labels, textboxes, buttons, check boxes, radio button, progress bar, combo box, list box. Components-timer, image list, Menus, Modal and Modeless Dialog Boxes, MDI, Mouse and keyboard event handling.

Module-4

6 Hours

ADO.NET FRAMEWORK

Introduction to ADO.Net-Object Model- System. Data Namespace- Data Bound Controls- Connected Mechanism-Disconnected mechanism-.Net Data Providers

Module-5

5 Hours

WWF AND NETWORKING APPLICATIONS

.Net Remoting - Windows Service – Windows Workflow Foundation (WWF) – Activities – Workflows -
.Net Security - Localization - Peer-to-Peer Networking - Building P2P Applications – Signal – Chat application - Testing and Debugging- Optimizing performance - Packaging and Deployment

Course outcomes (Course Skill Set):

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

1. Apply the basic features of C# language. (PO- 1,2,3, PSO – 1,2)
2. Create applications using advanced features of C# language. (PO- 1,2,3, PSO – 1,2)
3. Create web applications using ADO.NET & ASP.NET (PO- 1,2,3 PSO – 1,2)
4. Develop WWF applications. (PO- 1,2,3, PSO – 1,2)
5. Develop Network applications. (PO- 1,2,3, PSO – 1,2)

Programming Experiments (Suggested and are not limited to)

- 1 Write a program to C# to find the smallest single digit factor for a given value.
- 2 Write a program in C# to find the magnitude of a number
- 3 Write a C# program to which reads a set of strings into the rows a two-dimensional array and then prints the string having a greater number of vowels.
- 4 Write a C# programs to demonstrate the concepts of Structures and Enumerations.
- 5 Write a C# programs to demonstrate the concepts of Constructors and Inheritance.
- 6 Write a C# programs to demonstrate the concepts of Delegates
- 7 Write a C# programs to demonstrate the concepts of Label, Text Box and Button controls
- 8 Create a Windows application in C# for registration form and fill the details and when you click the submit button it displays the details in the message box.
- 9 Create a ADO.NET application in C# to verify if the connection is established with OLEDB and MS- ACCESS. Create a ADO.NET applications in C# to demonstrate the Data Reader, Data Set, Data Adapter and Data View Objects.
- 11 Write a C# program to implement Assemblies.
- 12 Write a C# program to implement Multithreading and Thread Synchronization.

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 (maximum marks 50)

1. IPCC means practical portion integrated with the theory of the course.
2. CIE marks for the theory component are 25 marks and that for the practical component is 25 marks.
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The student has to secure 40% of 25 marks to qualify in the CIE of the theory component of IPC

CIE for the Practical Component

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.

SEE for IPCC

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

- The question paper will have ten questions. Each question is set for 20 marks.
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.
- The students have to answer 5 full questions, selecting one full question from each module. Marks scored by the students shall be proportionally scaled down to 50 Marks.
- The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper may include questions from the practical component.

Suggested Learning Resources:

Textbook

1. **C# 4.0 The Complete Reference** by Herbert Schildt .
2. Andrew Troelsen, Phil Japikse, " **Pro C# 10 with .NET 6: Foundational Principles and Practices in Programming** ", Apress publication, 2022.

Reference Books

1. Roger Ye, ".NET MAUI Cross-Platform Application Development", Second Edition Packt Publishing, O'Reilly, 2024
2. Mark J. Price, "C# 12 and .NET 8 – Modern Cross-Platform Development Fundamentals: Start building websites and services with ASP.NET Core 8, Blazor, and EF Core 8", Eighth Edition, Packt Publishing, 2023
3. Christian Nagel, "Professional C# and .NET ", Wiley, 2021

Abraham, Isaac. Get Programming with F#: A Guide for .NET Developers, Manning, 2018

Web links and Video Lectures(e-Resources):

- <https://learn.microsoft.com/en-us/dotnet/csharp/> (C# documentation)
- <https://learn.microsoft.com/en-us/dotnet/> (.NET documentation and tutorials)
- <https://learn.microsoft.com/en-us/training/> (Structured learning paths)
- <https://www.geeksforgeeks.org/c-sharp-tutorial/>

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

- Installation of .NET SDK and Development Environment:
- Demonstration of Online C# IDEs/Tools:

- o .NET Fiddle
- o Programiz C# Online Compiler
- o One Compiler C#
- Demonstration of Class Diagrams for C# Concepts:
- Understand how to represent C# class concepts using UML class diagrams, covering:

Class Abstraction (abstract classes and interfaces)

- o Type Visibility (public, private, protected, internal access modifiers)
- o Composition (has-a relationships)
- o Inheritance (is-a relationships)

Assessment Method

Programming Assignment/ Course Project

Python Programming for Data Science			
Course Code	25CS36C	CIE Marks	50
Teaching Hours/Week (L: T: P)	2:0:2	SEE Marks	50
Credits	03	Total Marks	100
Contact Hours	28 T + 28 P	Exam Hours	3
Examination nature (SEE)	Theory		
Prerequisites: Basic knowledge of a programming language and Statistics			
Course Objectives:			
• To understand Python constructs and use them to build the programs. • To analyze different conditional statements and their applications in programs. • To learn and use basic data structures in python language. • To learn and demonstrate array manipulations by reading data from files. • To understand and use different data in a data analytics context.			
Teaching-Learning Process (General Instructions)			
These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.			
1. Chalk and board, power point presentations. 2. Online Material (Tutorials) and video lectures. 3. Demonstration of programming examples.			
MODULE-1		5 Hours	
Introduction to Data Science: Introduction, Knowledge domains of the data analyst, understanding the nature of data, the data analysis process, Quantitative and Qualitative Data Analysis, Python and Data Analysis			
Textbook3: Chapter 1			
MODULE-2		6 Hours	
Python for Data Science: variables and assignment statement, data types in python, operators and expressions, control statements (if, for, while).			
Data Structures: Lists (operations on list), Tuples (creating, indexing and slicing, operations on tuples), sets (creating, operations in sets), dictionaries (creating, operations, nested dictionaries)			
Textbook1: 3.4, 3.6, 3.7, 4.3, 4.4,4.5, 4.6,5.3			
Textbook2: 3.1			
MODULE-3		6 Hours	
Array manipulation using NumPy: Numpy array: Creating Numpy arrays; datatypes for ndarray , indexing and slicing, Transposing Arrays and Swapping Axes, Universal Functions			

(ufuncs), Random Number Generation.

Textbook2: 4.1, 4.2, 4.3

MODULE-4

6 Hours

Data Manipulation using Pandas: Introduction to Pandas, Series and DataFrames, Reindexing, Data Selection and Filtering, Indexing and Sorting

Textbook2: 5.1, 5.2

MODULE-5

5 Hours

Data Preparation: Merging, concatenating, Pivoting, Data Transformation, Discretization and Binning, Detecting and Filtering Outliers, Data aggregation

Case Study: Data Analysis for the Iris Dataset

Textbook3: Chapter 6

Practical component of IPCC:

Sl. No.	Experiment
1	A college wants to automate the process of analyzing student marks. The system should accept marks of n students, calculate the total, average, highest mark, lowest mark, and assign grades based on the average.
2	An electricity board charges consumers based on the following slab rates: first 100 units at ₹3/unit, next 200 units at ₹5/unit, and remaining units at ₹7/unit. Read the consumer's name and units consumed, calculate the total bill amount, and display the result.
3	A small library stores book details such as Book ID, Title, Author, and Number of Copies. Create a menu-driven Python program to add books, search books by ID, update copies, and display all books.
4	A weather station records temperatures for 30 days. Store the temperatures in a NumPy array and find the average temperature, highest temperature, lowest temperature, and number of days with temperature above the average.
5	Rainfall data of three cities for four months is given in matrix form. Create a 3×4 NumPy array and perform row-wise totals, column-wise averages, transpose of the matrix, and identify the city with maximum rainfall.
6	A retail store records daily sales for different products. The manager wants to identify the best-selling product and calculate the total revenue.
7	An organization maintains employee details in a CSV file containing EmployeeID, Department, Salary, and Experience. Read the file using Pandas and display department-wise average salary, highest-paid employee, employees with salary greater than ₹50,000, and employees sorted by salary.
8	An organization maintains attendance records in a CSV file. HR wants a report showing employees with low attendance (<75%) and the overall attendance percentage.
9	Exploratory Data Analysis (EDA) and Data Preparation of the Titanic Dataset.
10	Exploratory Data Analysis (EDA) and Data Preparation of the Diabetes Dataset.

Course outcomes (Course Skill Set):

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

- CO1:** Explain the fundamentals of data science and apply Python programming constructs to solve basic computational problems.
- CO2:** Develop Python programs using control statements and built-in data structures such as lists, tuples, sets, and dictionaries.
- CO3:** Perform numerical computations and array manipulations using the NumPy library.
- CO4:** Manipulate, filter, sort, and analyze datasets using Pandas Data Frames and Series.
- CO5:** Apply data preparation techniques such as merging, transformation, aggregation, pivoting, discretization, and outlier detection to support data analysis.

Assessment Details (both CIE and SEE):

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

CIE for the theory component of the IPCC

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

CIE for the practical component of the IPCC

- **15 marks** for the conduction of the experiment and preparation of laboratory record, and **10 marks** for the test to be conducted after the completion of all the laboratory sessions.
- On completion of every experiment/program in the laboratory, the students shall be evaluated including viva-voce and marks shall be awarded on the same day.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for

10 marks. Marks of all experiments' write-ups are added and scaled down to **15 marks**.

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

SEE for IPCC

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

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

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

Suggested Learning Resources:

Text Books:

1. S. Sridhar, J. Indumathi, V.M. Hariharan "Python Programming", Pearson publishers, 1st edition 2023.
2. Wes McKinney, Python for Data Analysis: Data Wrangling with Pandas, NumPy, and Jupyter, 3rd Edition, O'Reilly Media, 2022.
3. Fabio Nelli, "Python Data Analytics", Apress, Publishing, 1st Edition, 2015.

Web links and Video Lectures (e-Resources):

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

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

Assessment Methods

- Programming Assignment (10 Marks)

Data Analytics with Excel			
Course Code	25CS37A	CIE Marks	50
Teaching Hours/Week (L: T: P)	0:0:2	SEE Marks	50
Credits	01	Total Marks	100
Contact Hours	28 hrs. of Practical	Exam Hours	3
Examination type (SEE)	Practical		
Prerequisites: The students should have knowledge on • Working with Windows • File management (saving, organizing, navigating folders) C Programming • Basic Math and Statistics			
Course Objectives: • To Apply analysis techniques to datasets in Excel • Learn how to use Pivot Tables and Pivot Charts to streamline your workflow in Excel • Understand and identify the principles of data analysis • Become adept at using Excel functions and techniques for analysis • Build presentation ready dashboards in Excel			
Teaching-Learning Process (General Instructions) Teachers can use following strategies to accelerate the attainment of the various course outcomes. 1. ICT based Teaching 2. Demonstration based Teaching			
Course outcomes (Course Skill Set): At the end of the course, the student will be able to: CO1: Explain the structure and functionality of operating system. (PO 3,5,6,12) CO 2: Apply appropriate CPU scheduling algorithms for the given problem. (PO 1,2,3,11,12) CO 3: Analyze the various techniques for process synchronization and deadlock handling. (PO 1,2,3,11,12) CO 4: Apply the various techniques for memory management. (PO 1,2,3,4,12)			

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

Course outcomes (Course Skill Set):

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

- CO1: Use advanced functions and productivity tools to assist in developing worksheets. (PO 3,5,11,12 PSO-1,2)
- CO2: Manipulate data lists using Outline and PivotTables. (PO 3,5,11,12 PSO-1,2)
- CO3: Use Consolidation to summarize and report results from multiple worksheets. (PO 1,3,5,11,12 PSO-1,2)
- CO4: Apply Macros and Auto filter to solve the given real-world scenario. (PO 1,3,5,11,12 PSO-1,2)

Assessment Details (both CIE and SEE)

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

Continuous Internal Evaluation (CIE):

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

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

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

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

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

Semester End Evaluation (SEE):

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

Suggested Learning Resources:

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

Project Management with Git			
Course Code	25CSL37B	CIE Marks	50
Teaching Hours/Week (L: T: P)	0:0:2	SEE Marks	50
Credits	01	Total Marks	100
Contact Hours	28 hours of Practical	Exam Hours	2
Examination nature (SEE)	Practical		
Prerequisites: NIL			
Course Objectives:			
- To become familiar with basic Git commands for version control. - To create and manage branches for effective code organization. - To understand how to collaborate and work with remote repositories. - To master version control commands for efficient project management.			
List of Experiments:			
Sl. No	Experiments		
1	Setting up and using basic Git commands - Create a new repository and configure it with essential settings. - Track changes to files by adding them to the staging area and committing with descriptive messages.		
2	Creating and Managing Branches Create a new branch named "feature-branch." Switch to the "master" branch. Merge the "feature-branch" into "master."		
3	Merging and Conflict Resolution Write the commands to merge a branch into the main branch and resolve any merge conflicts.		
4	Collaboration and Remote Repositories Clone a remote Git repository to your local machine.		
5	Collaboration and Remote Repositories Fetch the latest changes from a remote repository and rebase your local branch onto the updated remote branch. Write the command to merge "feature-branch" into "master" while providing a custom commit message for the merge.		
6	Pulling Changes Write the command to pull the latest changes from the remote "origin" repository.		
7	Git Tags and Releases Write the command to create a lightweight Git tag named "v1.0" for a commit in your local repository.		

8	Advanced Git Operations Write the command to cherry-pick a range of commits from "source-branch" to the current branch.
9	Analyzing and Changing Git History Given a commit ID, how would you use Git to view the details of that specific commit, including the author, date, and commit message?
10	Reviewing and Modifying Git Commit History Write the command to list all commits made by the author "Pressman" between "2024-01-01" and "2024-12-31."
11	Inspecting and Editing Git History Write the command to display the last five commits in the repository's history.
12	Exploring and Refining Git Commit Logs Write the command to undo the changes introduced by the commit with the ID "xyz12345".

Course outcomes (Course Skill Set):

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

CO1: Use the basic commands related to git repository. (PO – 1,2,3,5,9,10,11 PSO – 1,2)

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

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

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

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

Assessment Details (both CIE and SEE):

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

Continuous Internal Evaluation (CIE):

CIE marks for the practical course are 50 Marks.

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

- Each experiment is to be evaluated for conduction with an observation sheet and record write-up.

Rubrics for the evaluation of the journal/write-up for hardware/software experiments are designed by the faculty who is handling the laboratory session and are made known to students

at the beginning of the practical session.

- Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be made zero.

The minimum duration of SEE is 02 hours.

Suggested Learning Resources:

- “Version Control with Git”, 3rd Edition, by Prem Kumar Ponuthorai, Jon Loeliger Released October 2022, Publisher(s): O'Reilly Media, Inc.
- “Pro Git book”, written by Scott Chacon and Ben Straub and published by Apress,
- <https://git scm.com/book/en/v2>
- https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0130944433473699842782_shared/overview?utm_source=chatgpt.com
- https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01330134712177459211926_shared/overview?utm_source=chatgpt.com

Prompt Engineering			
Course Code	25CSL37C	CIE Marks	50
Teaching Hours/Week (L: T: P)	0: 0: 2	SEE Marks	50
Credits	01	Exam Hours	100
Contact Hours	28 hours of Practical		
Examination nature (SEE)	Practical		
Prerequisite: The students should have knowledge of • Knowledge on Basic Programming Skills (Python preferred) • Knowledge on Comfort with Using Chatbots or AI Tools • Knowledge on Internet Research Skills • Knowledge on Understanding of Ethics in AI Usage			
Course objectives: CLO 1: Understand the fundamentals and types of prompts used in generative AI models. CLO 2: Explore the role of prompt engineering in shaping AI outputs and model 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	Experiment Description		
1	Design and compare different types of prompts including zero-shot, one-shot, few-shot, and instructional prompts using a generative AI model.		
2	Evaluate and validate prompt quality by testing multiple prompt variants for the same task and analyzing output consistency and clarity.		
3	Develop prompts for common NLP tasks such as sentiment analysis, summarization, translation, and text classification.		
4	Optimize a basic prompt by refining it step-by-step using prompt tuning techniques to improve response accuracy and relevance.		
5	Test the same prompt across multiple generative AI models (e.g., ChatGPT, Claude, Gemini) and analyse variations in output.		

6	Use the OpenAI Chat Completion API to simulate a structured interaction using system, user, and assistant roles.
7	Compare outputs from Instruct and ChatGPT for the same prompts and identify Behavioral differences in response generation.
8	Apply the CLEAR Framework (Concise, Logical, Explicit, Adaptive, Reflective) to improve poorly performing prompts.
9	Analyse the impact of small prompt changes on output by modifying wording, tone, or context and documenting the effect.
10	Implement Chain-of-Thought (CoT) prompting for solving multi-step reasoning or problem- solving tasks.
11	Use Tree-of-Thoughts or React prompting techniques to model step-by-step decision-making in complex tasks.
12	Explore Automatic Prompt Engineering (APE) by using tools or code to automatically generate or refine effective prompts.

Course outcomes (Course Skill Set):

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

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

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

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

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

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

Assessment Details (both CIE and SEE)

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

Continuous Internal Evaluation (CIE):

CIE marks for the practical course are 50 Marks.

- The split-up of CIE marks for record/ journal and test is 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 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:

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

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

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

IV Semester

Analysis & Design of Algorithms			
Course Code	25CS41	CIE Marks	50
Teaching Hours/Week (L: T: P)	3: 0: 0	SEE Marks	50
Credits	03	Total Marks	100
Contact Hours	42	Exam Hours	3
Examination type (SEE)	Theory		
Prerequisites: The students should have knowledge of; ● Fundamental of Data Structures ● Understanding of Algorithms ● Basic Mathematics ● Problem-Solving Skills			
Course Objectives: • To learn the methods for analyzing algorithms and evaluating their performance. • To demonstrate the efficiency of algorithms using asymptotic notations. • To solve problems using various algorithm design methods, including brute force, greedy, divide and conquer, decrease and conquer, transform and conquer, dynamic programming, backtracking, and branch and bound. • To learn the concepts of P and NP complexity classes.			
Teaching-Learning Process (General Instructions) These are sample strategies; which teachers can use to accelerate the attainment of the various course outcomes. 1. Lecturer method (L) does not mean only the traditional lecture method, but different types of teaching methods may be adopted to achieve the outcomes. 2. Utilize video/animation films to illustrate the functioning of various concepts. 3. Promote collaborative learning (Group Learning) in the class. 4. Pose at least three HOT (Higher Order Thinking) questions in the class to stimulate critical thinking. 5. Incorporate Problem-Based Learning (PBL) to foster students' analytical skills and develop their ability to evaluate, generalize, and analyze information rather than merely recalling it. 6. Introduce topics through multiple representations. 7. Demonstrate various ways to solve the same problem and encourage students to devise their own creative solutions. 8. Discuss the real-world applications of every concept to enhance students' comprehension.			
Module-1			9 Hours

Introduction: What is an Algorithm? Fundamentals of Algorithmic Problem Solving. 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 Approach: 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	9 Hours
Brute Force Approach: (contd.): Exhaustive Search (Travelling Salesman problem and Knapsack Problem). Decrease-and-Conquer: Insertion Sort, Topological Sorting. Divide and Conquer: Merge Sort, Quick Sort, Binary Tree Traversals, Multiplication of Large Integers and Strassen's Matrix Multiplication.	
Module-3	8 Hours
Transform-and-Conquer: Balanced Search Trees, Heaps and Heapsort. Space-Time Tradeoffs: Sorting by Counting: Comparison counting sort, Input Enhancement in String Matching: Horspool's Algorithm. Chapter 6 (Sections 6. 3, 6. 4), Chapter 7 (Sections 7. 1, 7. 2)	
Module-4	8 Hours
Dynamic Programming: Three basic examples, The Knapsack Problem and Memory Functions, Warshall's and Floyd's Algorithms. The Greedy Method: Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm, Huffman Trees and Codes. Chapter 8 (Sections 8. 1, 8. 2, 8. 4), Chapter 9 (Sections 9. 1, 9. 2, 9. 3, 9. 4)	
Module-5	8 Hours
Limitations Of Algorithmic Power: Decision Trees, P, NP, and NP-Complete Problems. Coping With Limitations of Algorithmic Power: Backtracking (n-Queens problem, Subset-sum problem), Branch-and-Bound (Knapsack problem), Approximation algorithms for NP-Hard problems (Knapsack problem). Chapter 11 (Section 11. 2, 11. 3), Chapter 12 (Sections 12. 1, 12. 2, 12. 3)	
Course outcome (Course Skill Set) At the end of the course, the student will be able to: 1. Apply asymptotic notational method to analyze the performance of the algorithms in terms of time complexity. (PO 1,2,3,4, PSO 1,2) 2. Demonstrate divide & conquer approaches and decrease & conquer approaches to solve computational problems. (PO 1,2,3,4, 5 PSO 1,2) 3. Make use of transform & conquer and dynamic programming design approaches to solve the given real world or complex computational problems. (PO 1,2,3,4,5, PSO 1,2) 4. Apply greedy and input enhancement methods to solve graph & string based computational problems. (PO 1,2,3,4, 5, PSO 1,2) 5. Analyze various classes (P, NP and NP Complete) of problems Illustrate backtracking, branch & bound and approximation methods. (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:

- 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 can be planned by the CI, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

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

Semester-End Examination:

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

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

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

Suggested Learning Resources:

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 using C, 3rd Ed, Oxford press, 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):

- <https://www.youtube.com/watch?v=tSo9yzBUTHA>
- https://www.youtube.com/watch?v=5_5oE5lgrhw
- <https://www.youtube.com/watch?v=STL8ESuETmM>
- <https://www.youtube.com/watch?v=Y2A8RzxegSA>
- <https://www.youtube.com/watch?v=gBz44smaa9A>
- <https://www.youtube.com/watch?v=8TVaEGeGGc>
- <https://www.youtube.com/watch?v=kPRA0W1kECg>
- <https://www.youtube.com/watch?v=v0eQ4nXJjsk>
- https://www.youtube.com/watch?v=MtQL_1l5KhQ
- <https://www.youtube.com/watch?v=jsmMtJpPnhU>
- <https://www.youtube.com/watch?v=tKwnms5iRBU>
- <https://www.youtube.com/watch?v=oBt53YbR9Kk>
- https://www.youtube.com/watch?v=OQ5jsbhAv_M
- <https://www.youtube.com/watch?v=Aa2sqUhIn-E>
- <https://www.youtube.com/watch?v=SZXXnB7vSm4>
- <https://www.youtube.com/watch?v=MHXR4PCY8c0>
- <https://www.youtube.com/watch?v=kJuKy5FqhrE>
- <https://www.youtube.com/watch?v=TtuNf6XMhiw>

DATABASE MANAGEMENT SYSTEMS

Course Code	25CS42	CIE Marks	50
Teaching Hours/Week (L: T: P)	(3:0:0)	SEE Marks	50
Credits	03	Total Marks	100
Contact Hours	42	Exam Hours	3
Examination type (SEE)	Theory		

Prerequisites:

Students should have a basic understanding of programming concepts, data structures, computer organization, and operating systems. Familiarity with software development principles and problem-solving techniques is desirable for studying database design, SQL, transaction management, and MongoDB-based application development.

Course Objectives:

CLO1: Understand the fundamental concepts of database systems, data models, database architecture, schemas, and Entity-Relationship (ER) modelling.

CLO2: Learn the principles of the relational data model, relational algebra, and database schema design techniques.

CLO3: Apply various Structured Query Language (SQL) statements for database manipulation.

CLO4: Understand normalization techniques and transaction management to design efficient, reliable, and consistent database systems.

CLO5: To provide knowledge of MongoDB concepts and database operations.

Teaching-Learning Process (General Instructions)

1. Lecture method (L) need not be only a traditional lecture method; alternative effective teaching methods may be adopted to attain the outcomes.
2. Use of video/animation to explain the functioning of various concepts.
3. Encourage collaborative (group learning) in the class.
4. Ask at least three HOT (Higher Order Thinking) questions in the class to promote critical thinking.
5. Adopt Problem-Based Learning (PBL) by assigning real-world database design and querying problems.
6. Demonstrate database application development using MongoDB and the Node.js Driver through practical examples and mini-projects.

Module-1

9 Hours

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

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

Module-2	8 Hours
Relational Model: Relational Model Concepts, Relational Model Constraints and relational database schemas, Update operations, transactions, and dealing with constraint violations. Relational Algebra: Unary and Binary relational operations, additional relational operations (aggregate, grouping, etc.) Examples of Queries in relational algebra. Mapping Conceptual Design into a Logical Design: Relational Database Design using ER-to-Relational mapping. Textbook 1: Ch 5.1 to 5.3, Ch 8.1 to 8.5; Ch 9.1 to 9.2 Textbook 2: 3.5	
Module-3	8 Hours
SQL: SQL data definition and data types, Schema change statements in SQL, SQL Languages (DML, DDL, TCL) specifying constraints in SQL, retrieval queries in SQL, INSERT, DELETE, and UPDATE statements in SQL, Additional features of SQL. SQL: Advanced Queries: More complex SQL retrieval queries, Specifying constraints as assertions and action triggers, Cursor, Stored Procedure, Views in SQL. Textbook 1: Ch 6.1 to 6.5 and Ch 7.1 to 7.3, Ch 10.2.2 and 10.4.1	
Module-4	9 Hours
Normalization: Database Design Theory — Introduction to Normalization using Functional and Multivalued Dependencies: Informal design guidelines for relation schema, Functional Dependencies, Normal Forms based on Primary Keys, Second and Third Normal Forms, Boyce-Codd Normal Form, Multivalued Dependency and Fourth Normal Form, Join Dependencies and Fifth Normal Form. Transaction Processing: Introduction to Transaction Processing, Transaction and System concepts, Desirable properties of Transactions, characterizing schedules based on recoverability, characterizing schedules based on Serializability, Concurrency Control in Databases: Two-phase locking techniques for Concurrency control. Textbook 1: Ch 14.1 to 14.7 and Ch 20.1 to 20.6	
Module-5	8 Hours
MongoDB: Basics, Documents, Collections, Databases, Query Language, Installation, The Mongo Shell, MongoDB CRUD Operations, Create, Read, Projection, Update, Delete, Aggregate, MongoDB Node.js Driver, Schema Initialization. Textbook 2: Chapter 6	
Course outcome (Course Skill Set): At the end of the course, the student will be able to: CO1: Describe database concepts, data models, schemas, and ER modelling. (PO – 1,2,3,4,5, PSO – 1,2,3) CO2: Apply relational model concepts and relational algebra for schema design. (PO – 1,2,3,4,5, PSO – 1,2,3) CO3: Use SQL for database creation, manipulation, and advanced querying. (PO – 1,2,3,4,5, PSO – 1,2,3) CO4: Normalize relations and explain transaction management techniques. (PO – 1,2,3,4,5, PSO – 1,2,3) CO5: Implement MongoDB databases using CRUD operations, aggregation, and application integration. (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):

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

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

Semester-End Examination:

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

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

Suggested Learning Resources:

TEXTBOOKS:

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

REFERENCES:

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, *Database System Concepts*, McGraw Hill, 7th Edition, 2020.
2. Database management systems, Ramakrishnan, and Gehrke, 3rd Edition, 2014, McGraw Hill.
3. C.J. Date, *An Introduction to Database Systems*, Pearson Education, 8th Edition.
4. Amol Nayak, *MongoDB for Developers*, Packt Publishing.

Web links and Video Lectures(e-Resources):

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

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

Assessment Methods for 25 Marks (opt two Learning Activities)

- Case Study
- Mini Project
- Quiz

Introduction to Artificial Intelligence and Machine Learning			
Course Code	25CS43	CIE Marks	50
Teaching Hours/Week (L: T:P)	3:0:0	SEE Marks	50
Credits	03	Total Marks	100
Contact Hours	42	Exam Hours	3
Examination type (SEE)	Theory		
Prerequisites: The students should have knowledge of • Python • Probability • Trees • Graphs • Propositional & Predicate Logic.			
Course Objectives: • Gain a historical perspective of AI and its foundations. • Become familiar with basic principles of AI toward problem solving. • Get to know approaches of inference, perception, knowledge representation, and learning.			
Teaching-Learning Process (General Instructions) These are sample Strategies that teachers can use to accelerate the attainment of the various course outcomes. 1. Chalk and Talk 2. Animated videos to demonstrate the applications 3. Power point presentation			
Module-1		9 Hours	
Intelligent Agents: What is AI? Agents and environment, Concept of Rationality, The nature of environment, The structure of agents.			
Problem-solving: Problem-solving agents, Example problems, Searching for Solutions.			
Uninformed Search Strategies: Breadth First search, Depth First Search, Iterative deepening depth first search.			
Text book 1: Chapter 1- 1.1, Chapter 2- 2.1, 2.2, 2.3, 2.4, Chapter 3- 3.1, 3.2, 3.3, 3.4			
Module-2		8 Hours	

Informed Search Strategies: Heuristic functions, Greedy best first search, A*search. Adversarial Search: Games, Optimal decision in games, Alpha-Beta Pruning. Logical Agents: Knowledge-based agents, The Wumpus world. Propositional Logic: A very simple logic. First Order Logic: Syntax and Semantics of First Order logic, Using First Order logic. Text book 1: Chapter 3-3.5,3.6; Chapter 4 – 4.1, 4.2; Chapter 7- 7.1, 7.2, 7.4; Chapter 8- 8.2, 8.3	
Module-3	9 Hours
Inference in First Order Logic: Propositional Versus First Order Inference, Unification, Forward Chaining, Backward Chaining, Resolution. Uncertain Knowledge and Reasoning: Quantifying Uncertainty: Acting under Uncertainty, Basic Probability Notation, Inference using Full Joint Distributions, Independence, Baye’s Rule and its use. Expert Systems: Representing and using domain knowledge, ES shells. Explanation, knowledge acquisition. Text book 1: Chapter 9- 9.1, 9.2, 9.3, 9.4, 9.5; Chapter 12-12.1, 12.2, 12.3, 12.4, 12.5 Text Book 2: Chapter 20	
Module-4	8 Hours
Overview of Machine Learning: Introduction, What Is Machine Learning? Examples of Machine Learning Applications: Association Rules, Classification, Regression, Unsupervised Learning, Reinforcement Learning. Text Book 3: Chapter 1 - 1.1, 1.2.1, 1.2.3, 1.2.4, 1.2.5, 1.3	
Module-5	8 Hours
Supervised Learning: Learning a Class from Examples, Vapnik-Chervonenkis Dimension, Probably Approximately Correct Learning, Noise, Learning Multiple Classes, Regression, Model Selection and Generalization, Dimensions of a Supervised Machine Learning Algorithm. Text Book 3: Chapter 2- 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8	
Course outcomes (Course Skill Set): At the end of the course, the student will be able to: CO1: Develop the structure and behavior of intelligent agents and apply uninformed search algorithms, including iterative deepening, to solve computational problems. (PO – 1,2,3,4,5,11, PSO – 1,2,3)	

- CO2:** Apply informed search strategies and logical reasoning methods to design intelligent decision- making agents. (PO – 1,2,3,4,5,11, PSO – 1,2,3)
- CO3:** Apply inference techniques in first-order logic and probabilistic reasoning, to develop knowledge- based and expert systems for intelligent decision-making. (PO – 1,2,3,4,5,11, PSO – 1,2,3)
- CO4:** Describe the fundamental concepts of machine learning and distinguish between key learning paradigms, with real-world examples. (PO – 1,2,3,4,5,11, PSO – 1,2,3)
- CO5:** Apply the principles of supervised learning to build models for classification and regression, and evaluate their performance using theoretical and empirical metrics. (PO – 1,2,3,4,5,11, 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:

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

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

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

Semester-End Examination:

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

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

Suggested Learning Resources:

Textbooks:

1. Stuart J. Russell and Peter Norvig, "Artificial Intelligence", 3rd Edition, Pearson, 2015.
2. Elaine Rich, Kevin Knight, "Artificial Intelligence", 3rd edition, Tata McGraw Hill, 2013.
3. Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, Prentice Hall of India, 2021.

Reference Books:

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

Web links and Video Lectures(e-Resources):

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

Microcontroller			
Course Code	25CS44	CIE Marks	50
Teaching Hours/Week (L: T: P)	3:0:2	SEE Marks	50
Credits	04	Total Marks	100
Contact Hours	42 hrs. Theory + 28 hrs. Practical	Exam Hours	3
Examination type (SEE)	Theory		
Prerequisites: The students should have knowledge on • Microcontroller Fundamentals • Basic Programming (C preferred) • IoT Communication Protocols			
Course Objectives: • To understand the fundamentals of ARM-based systems and basic architecture of CISC and RISC. • To familiarize with ARM programming modules along with registers, CPSR and Flags. • To develop ALP using various instructions to program the ARM controller and understand Cache memory Policies • To understand Cache memory Policies • To interpret the basic hardware components and their selection method based on the characteristics and attributes of an embedded system.			
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		9 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
C Compilers and Optimization: Basic C Data Types, C Looping Structures, Register Allocation, Function Calls, Structure Arrangement, Pointer Aliasing and Portability Issues. Textbook 1: Chapter 5.1 to 5.7 and 5.13	
Module – 4	9 Hours
CACHES: The Memory Hierarchy and Cache Memory, Caches and Memory Management Units: CACHE Architecture: Basic Architecture of a Cache Memory, Basic Operation of a Cache Controller, The Relationship between Cache and Main Memory, Set Associativity, Write Buffers, Measuring Cache Efficiency, CACHE POLICY: Write Policy—Writeback or Writethrough, Cache Line Replacement Policies, Allocation Policy on a Cache Miss. Coprocessor 15 and caches. Textbook 1: Chapter 12.1 to 12.4	
Module - 5	8 Hours
Emergence of IoT: Introduction, Evolution of IoT, Enabling IoT and the Complex Interdependence of Technologies, IoT Networking Components, Addressing Strategies in IoT. IoT Sensing and Actuation: Introduction, Sensors, Sensor Characteristics, Sensorial Deviations, Sensing Types, Sensing Considerations, Actuators, Actuator Types, Actuator Characteristics. Textbook 2: Chapter 4 – 4.1 to 4.5 Chapter 5 – 5.1 to 5.9	
PRACTICAL COMPONENT OF IPCC	
Sl. No.	Experiments
1.	Using Keil software, observe the various Registers, Dump, CPSR, with a simple Assembly Language Programs (ALP).
2.	Develop and simulate ARM ALP for Data Transfer, Arithmetic and Logical operations (Demonstrate with the help of a suitable program).
3.	Develop an ALP to multiply two 16-bit binary numbers.
4.	Develop an ALP to find the sum of first 10 integer numbers.
5.	Develop an ALP to find the largest/smallest number in an array of 32 numbers.

6.	Develop an ALP to count the number of ones and zeros in two consecutive memory locations.
7.	Simulate a program in C for ARM microcontroller using KEIL to sort the numbers in ascending/descending order using bubble sort.
8.	Simulate a program in C for ARM microcontroller to find factorial of a number.
9.	Simulate a program in C for ARM microcontroller to demonstrate case conversion of characters from upper to lowercase and lower to uppercase.

Course outcomes (Course Skill Set):

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

CO1: Explain the ARM Architectural features and Instructions.

(PO – 1,2,3,4,5 PSO – 1,2,3)

CO2: Develop programs using ARM instruction set for an ARM Microcontroller.

(PO – 1,2,3,4,5 PSO– 1,2,3)

CO3: Explain C-Compiler Optimizations and portability issues in ARM Microcontroller

(PO – ,2,3,4,5 PSO – 1,2,3)

CO4: Demonstrate the role of Cache management and Firmware in Microcontrollers.

(PO – 1,2,3 PSO – 2)

CO5: Describe the evolution of IoT and its under lying networking and addressing technologies and identify and explain the roles, characteristics, and selection criteria of sensors and actuators in IoT systems.

(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.

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.

Semester-End Examination:

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

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

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

Suggested Learning Resources:

Textbook:

1. M. Morris Mano & Michael D. Ciletti, Digital Design with an Introduction to Verilog Design, 5e, Pearson Education.
2. Introduction to IoT by Sudip Misra, Anandarup 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.

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://elearning.vtu.ac.in/econtent/courses/web/CSE/15CS44.html>
- <https://www.youtube.com/watch?v=9uJ9WCIVL6M>
- <https://www.youtube.com/watch?v=9uJ9WCIVL6M>
- <https://www.youtube.com/watch?v=JWCcl6TZKDw>
- https://www.youtube.com/watch?v=3Xo6P_V-qns&t=201s

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

Analysis & Design of Algorithms Lab			
Course Code	25CSL45	CIE Marks	50
Teaching Hours/Week (L: T: P)	0: 0: 2	SEE Marks	50
Credits	01	Total Marks	100
Contact Hours	28 hrs. of Practical	Exam Hours	3
Examination type (SEE)	Practical		
Prerequisites: The students should have knowledge of; • Fundamental of Data Structures and Programming Language • Understanding of Algorithms • Basic Mathematics • Problem-Solving Skills			
Course Objectives: • To design and implement various algorithms in C/C++ programming using suitable development tools to address different computational challenges. • To apply diverse design strategies for effective problem-solving. • To Measure and compare the performance of different algorithms to determine their efficiency and suitability for specific tasks. • To check the real world algorithmic problem belongingness.			
Sl. No	Experiments		
1	Design and implement C/C++ Program to find Minimum Cost Spanning Tree of a given connected undirected graph using Kruskal's algorithm.		
2	Design and implement C/C++ Program to find Minimum Cost Spanning Tree of a given connected undirected graph using Prim's algorithm.		
3	a. Design and implement C/C++ Program to solve All-Pairs Shortest Paths problem using Floyd's algorithm. b. Design and implement C/C++ Program to find the transitive closure using Warshal's algorithm.		
4	Design and implement C/C++ Program to find shortest paths from a given vertex in a weighted		

	connected graph to other vertices using Dijkstra's algorithm.
5	Design and implement C/C++ Program to obtain the Topological ordering of vertices in a given digraph.
6	Design and implement C/C++ Program to solve 0/1 Knapsack problem using Dynamic Programming method.
7	Design and implement C/C++ Program to solve discrete Knapsack and continuous Knapsack problems using greedy approximation method.
8	Design and implement C/C++ Program to find a subset of a given set $S = \{s_1, s_2, \dots, s_n\}$ 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:

1. Develop programs to solve computational problems using suitable algorithm design strategy .(PO 1,2,3,4,PSO 1,2)
2. Compare algorithm design strategies by developing equivalent programs and observing running times for analysis (Empirical) .(PO 1,2,3,4,PSO 1,2)
3. Make use of suitable integrated development tools to develop programs .(PO 1,2,3,4,PSO 1,2)
4. Choose appropriate algorithm design techniques to develop solution to the computational and complex problems .(PO 1,2,3,4,PSO 1,2)
5. Demonstrate and present the development of program, its execution and running time(s) and record the results/inferences. .(PO 1,2,3,4,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)
 - c) For laboratories having only one part – Procedure + Execution + Viva-Voce:
 $15+70+15 = 100$ Marks
 - d) For laboratories having PART A and PART B
 - i. Part A – Procedure + Execution + Viva = $6 + 28 + 6 = 40$ Marks
 - ii. Part B – Procedure + Execution + Viva = $9 + 42 + 9 = 60$ Marks

Assessment Details (both CIE and SEE)

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

Continuous Internal Evaluation (CIE):

CIE marks for the practical course are 50 Marks.

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

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

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

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

The minimum duration of SEE is 02 hours.

Suggested Learning Resources:**Text Books**

1. 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, Ronald 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/>

LINEAR ALGEBRA			
Course Code	25CS46A	CIE Marks	50
Teaching Hours/Week (L: T:P)	2:2:0	SEE Marks	50
Credits	03	Total Marks	100
Contact Hours	28 T + 28 P	Exam Hours	3
Examination type (SEE)	Theory		
Prerequisites: The students should have knowledge of - Basics of Vectors - Basic Mathematics - Problem-Solving Skills			
Course objectives: The objectives of the course are to facilitate the learners to: - To equip the students with standard concepts and tools in Linear algebra which will find the useful in their disciplines. - Gain the knowledge of linear algebra tools and concepts to implement them in their core domain. - Improve their mathematical thinking and acquire skills required for sustained lifelong learning			
Teaching-Learning Process (General Instructions) Teachers can use following strategies to accelerate the attainment of the various course outcomes. - Chalk and Talk with Black Board - ICT based Teaching - Demonstration based Teaching			
Module-1		9 Hours	
VECTOR SPACES: Introduction, Vector spaces, Subspaces, Linear Combinations, Linear Spans, row space and column space of a Matrix, Linear Dependence and Independence, Basis and Dimension, Problems.			
Text Book: 1, 3.1,3.2,3.3,3.4 and 3.5			
Module-2		9 Hours	

LINEAR TRANSFORMATIONS: Introduction, Linear Mappings, Geometric linear transformation of $\mathbb{R}^2$, Kernel and Image of a linear transformations, Rank-Nullity Theorem (No proof), Matrix representation of linear transformations, Singular and Non-singular linear transformations, Invertible linear transformations, Problems Text Book:1 , 8.1,8.2 and 8.3	
Module – 3	8 Hours
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 Hours
INNER PRODUCT SPACES: Inner products, inner product spaces, length and orthogonality, orthogonal sets and Bases, projections, Gram-Schmidt process, QR-factorization, least squares problem and least square error Text Book:1 , 3.4 Text Book:2 , 6.7	
Module-5	8 Hours
OPTIMIZATION TECHNIQUES IN LINEAR ALGEBRA: Diagonalization and Orthogonal diagonalization of real symmetric matrices, quadratic forms and its classifications, Hessian Matrix, Method of steepest descent, Singular value decomposition. Dimensionality reduction – Principal component analysis. Text Book:2 ,9.1,9.2,9.3 and 9.4	
Course 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.

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 Deisenroth, 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://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	25CS46B	CIE Marks	50
Teaching Hours/Week (L: T:P)	2:2:0	SEE Marks	50
Credits	03	Total Marks	100
Contact Hours	28 T + 28 P	Exam Hours	3
Examination type (SEE)	Theory		
Prerequisites: The students should have knowledge of; • Basics of Logics • Understanding Algebraic Properties • Basic Mathematics • Problem-Solving Skills			
Course Objectives: • To help students to understand discrete and continuous mathematical structures. • To impart basics of relations and functions. • To facilitate students in applying principles of Recurrence Relations to find the generating functions and solve the Recurrence relations. • To have the knowledge of groups and their properties to understand the importance of algebraic properties relative to various number systems.			
Teaching-Learning Process (General Instructions) Teachers can use following strategies to accelerate the attainment of the various course outcomes. 1. Chalk and Talk with Black Board 2. ICT based Teaching 3. Demonstration based Teaching			
Module-1			9 Hours
Fundamentals of Logic: Basic Connectives and Truth Tables, Logic Equivalence – The Laws of Logic, Logical Implication – Rules of Inference. The Use of Quantifiers, Quantifiers, Definitions and the Proofs of Theorems. Text Book: 2,2.1,2.2 and 2.3			
Module-2			9 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, 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 outcome (Course Skill Set) At the end of the course, the student will be able to: CO.1. Apply concepts of logical reasoning and mathematical proof techniques in proving theorems and statements (PO- 1,2,3). CO.2. Demonstrate the application of discrete structures in different fields of computer science (PO- 1,2,3) CO.3. Apply the basic concepts of relations, functions and partially ordered sets for computer representations (PO- 1,2,3). CO.4. Solve problems involving recurrence relations and generating functions (PO- 1,2,3). CO.5. Illustrate the fundamental principles of Algebraic structures with the problems related to computer science & engineering (PO- 1,2,3).	

Assessment Details (both CIE and SEE):

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

Continuous Internal Evaluation:

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

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

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

Semester-End Examination:

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

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

Marks scored shall be proportionally reduced to 50 marks.

Suggested Learning Resources:

Text Books:

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

Reference Books:

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

Web links and Video Lectures(e-Resources):

- <http://nptel.ac.in/courses.php?disciplineID=111>
- [http://www.class-central.com/subject/math\(MOOCs\)](http://www.class-central.com/subject/math(MOOCs))
- <http://academicearth.org/>
- VTU e-Shikshana Program
- VTU EDUSAT Program.
- <http://www.themathpage.com/>
- <http://www.abstractmath.org/>
- <http://www.ocw.mit.edu/courses/mathematics/>

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

- Quizzes
- Assignments
- Seminar

GRAPH THEORY			
Course Code	25CS46C	CIE Marks	50
Teaching Hours/Week (L: T:P)	2:2:0	SEE Marks	50
Credits	03	Total Marks	100
Contact Hours	28 T + 28 P	Exam Hours	3
Examination type (SEE)	Theory		
Prerequisites: The students should have knowledge of; - Basics of Graphs - Basic Mathematics - Problem-Solving Skills			
Course objectives: - Understand the basic concepts of graphs and their properties, and operations of graphs. - Hamiltonian and Euler graphs, trees and matrix representation of the graph. - Apply the concepts of a planar graph, matching and coloring in computer science engineering.			
Teaching-Learning Process (General Instructions) Teachers can use 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		9 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		9 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, Kuratowski's theorem (proof not required), Different representations of planar graphs, Euler's theorem, Geometric dual. Graph Representations: Matrix representation of graphs-Adjacency matrix, Incidence Matrix, Circuit Matrix, Path Matrix. Text Book:1, 5.2,5.3,5.4,5.6,7.1,7.3,7.8 and 7.9	

Module-5	8 Hours
Graph Coloring: Coloring- Chromatic number, Chromatic polynomial, Matchings, Coverings, Four color problem and Five color problem. Greedy coloring 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:

CO.1. Explain the fundamental concepts of properties and representation of graphs

(PO – 1,2,3)

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

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

CO.4. Apply the concepts of planar graph and graph representations to solve the given problem (PO – 1,2,3).

CO.5. Use the concepts of matching and coloring of graphs to solve the real-world problems (PO – 1,2,3)

Assessment Details (both CIE and SEE):

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

Continuous Internal Evaluation:

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

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

Semester-End Examination:

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

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

Suggested Learning Resources:**Textbook:**

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

Reference Books:

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

Web links and Video Lectures(e-Resources):

- <http://nptel.ac.in/courses.php?disciplineID=111>
- [http://www.class-central.com/subject/math\(MOOCs\)](http://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

UI/UX Design Tool			
Course Code	25CSL47A	CIE Marks	50
Teaching Hours/Week (L: T:P)	0:0:2	SEE Marks	50
Credits	01	Total Marks	100
Contact Hours	28 hrs. of Practical	Exam Hours	3
Examination type (SEE)	Practical		
Prerequisites: The students should have knowledge of - Familiarity with Digital Tools and Navigation - Basic Knowledge of HTML/CSS - Awareness of User-Centered Design			
Course Objectives: - Understand and differentiate core concepts of usability, user experience (UX), and user interface (UI) design. - Conduct user research and develop personas to define user-centered design requirements. - Apply design thinking and ideation techniques to create effective conceptual designs. - Design and prototype low- to high-fidelity user interfaces using Figma. - Evaluate and refine UX designs using metrics, usability testing, and integration with software development workflows.			
Teaching-Learning Process (General Instructions) Teachers can use following strategies to accelerate the attainment of the various course outcomes. - Chalk and Talk with Black Board - ICT based Teaching - Demonstration based Teaching			
LIST OF PROGRAMS - Figma Interface Familiarization Create a sample art board with text, shapes, and icons using the Figma workspace, tools, frames, layers, and properties. - Color Theory and Typography Practice Create a design sheet showcasing color palettes and a typography hierarchy (H1, H2, Body text). - Designing UI Components Create reusable buttons, input fields, radio buttons, and dropdown menus using components and variants.			

4. Wire framing a Landing Page (Low Fidelity)

Create a low-fidelity wireframe for a landing page using placeholders and basic layout techniques.

5. Building User Personas

Design at least two user personas using frames, text, icons, and avatars in Figma.

6. User Journey Mapping

Design a user journey map including touch points, pain points, and user actions for a selected app or service.

7. Storyboarding a User Scenario. Create a 4–6 frame storyboard of a user performing a task in a digital product.

8. Creating a Mobile App Wireframe

Design wireframes for a mobile app flow such as login → home → profile using Figma's auto layout feature.

9. Designing and Linking Interactive Prototypes

Add navigation links, hover states, and transitions to screens to simulate a working prototype.

10. UI Redesign Challenge

Redesign a poorly designed website or app screen and provide the improved version with justifications.

11. Usability Testing and Feedback Integration

Share the prototype, collect feedback from peers or users, and iterate on the design based on usability principles.

12. Final Project – Complete App or Website UI

Design and prototype a complete user interface flow for a selected application, including personas, wireframes, and interaction design.

Course Outcomes (CO)

CO1: Differentiate between usability, user experience (UX), and user interface (UI) design principles. (PO-1,9, PSO-1)

CO2: Conduct user research and develop personas to identify and define user-centered design requirements. (PO-2,5,9, PSO-1)

CO3: Use design thinking and ideation methods to create effective conceptual and interaction designs. (PO-1,3,5,9, PSO-1)

CO4: Develop low- to high-fidelity prototypes and UI layouts using Figma and related design tools. (PO-1,3,5,6, PSO-1,3)

CO5: Evaluate UX designs using usability principles, UX metrics, and integrate feedback into improvements. (PO-2,4,5,9, PSO-1)

Assessment Details (both CIE and SEE):

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

Continuous Internal Evaluation:

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

Total marks scored by the students are scaled down to 30 marks (60% of maximum marks).

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

Semester-End Examination:

- SEE marks for the practical course are 50 Marks.
- SEE shall be conducted jointly by the two examiners of the same institute; examiners are appointed by the Head of the Institute.
- The examination schedule and names of examiners are informed to the university before the

conduction of the examination. These practical examinations are to be conducted between the schedule mentioned in the academic calendar of the University

- All laboratory experiments are to be included for practical examination.
- (Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. OR based on the course requirement evaluation rubrics shall be decided jointly by examiners.
- Students can pick one question from PART-A and one question from PART-B (experiment) from the questions lot prepared by the examiners jointly and 50% weightage for each part.
- Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

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

Suggested Learning Resources:

Text Books:

1. **UI Design with Figma: From Beginner to Pro by D-Libro (2025)**, A step-by-step guide covering fundamentals of wireframing, mockups, typography, prototyping, and real-world UI design workflows using Figma.

Reference Book:

1. **Figma Handbook by Meng To (Design + Code)**: A digital manual with 102 sections and ~6 hours of video content—covers everything from interface basics to advanced prototyping, plugins, responsive layouts, and component systems.

Web links and Video Lectures(e-Resources):

- Figma Official Site <https://www.figma.com> Design tool access and tutorials
- Figma Learn <https://help.figma.com> Step-by-step learning guides
- Material Design by Google <https://material.io> UI/UX guidelines and components
- Nielsen Norman Group :<https://www.nngroup.com>
- UX principles, heuristics, articles Adobe XD Ideas <https://xd.adobe.com/ideas>

DBMS with SQL and Mongo DB			
Course Code	25CSL47B	CIE Marks	50
Teaching Hours/Week (L: T: P)	0:0:2	SEE Marks	50
Credits	01	Total Marks	100
Contact Hours	28 hrs. of Practical	Exam Hours	3
Examination type (SEE)	Lab		
Prerequisites: The students should have knowledge on • Basic Programming Skills • Understanding of Algorithms • Basic Mathematics • Problem-Solving Skills			
Course Objectives: • Practice relational (SQL) and NoSQL (MongoDB) database operations. • Develop skills in schema creation, data manipulation, and complex queries. • Work with real-world data examples.			
Teaching-Learning Process (General Instructions) Teachers can use following strategies to accelerate the attainment of the various course outcomes. 1. Chalk and Talk with Black Board 2. ICT based Teaching 3. Demonstration based Teaching			
General Instructions The laboratory exercises are organized into Part A and Part B programs covering different concepts and applications of Database Management Systems. Each student is required to execute programs from both Part A and Part B as part of the laboratory requirements. The programs shall be executed, tested, and verified with appropriate inputs and outputs. Students are expected to understand the underlying concepts, develop the required database operations, and demonstrate the successful execution of both programs during the laboratory sessions.			
PART-A			

Sl. No	Programs
1	Creating Tables, Users, and Constraints Table: Employee(EMPNO, ENAME, JOB, MANAGER_NO, SAL, COMMISSION) - Create a new user and grant all permissions to the user. - Create the Employee table. - Insert three records into Employee table using INSERT. - Use ROLLBACK to undo the transaction. - Check the results after rollback. - Add PRIMARY KEY and NOT NULL constraints to the Employee table. - Try to insert NULL values and verify the constraint enforcement.
2	Altering Tables and DML Operations Table: Employee (EMPNO, ENAME, JOB, MGR, SAL) - Add a new column COMMISSION with appropriate data type. - Insert five records into the Employee table. - Update JOB column details for any employee. - Rename a column in the Employee table using the ALTER command. - 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	

Course outcomes (Course Skill Set):

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

CO1: Design, implement, and query relational schemas. PO- 1,2,3,5,9,10 PSO - 1,2

CO2: Perform CRUD and aggregation with MongoDB. PO- 1,2,3,5,9,10 PSO - 1,2

CO3: Demonstrate proficiency with SQL joins, views, indexing, and transactions. PO- 1,2,3,5,9,10
PSO - 1,2

CO4: Apply database concepts in small applications. PO- 1,2,3,5,9,10 PSO - 1,2

Assessment Details (both CIE and SEE):

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

Continuous Internal Evaluation:

- CIE marks for the practical course are 50 Marks. The split-up of CIE marks for record/ journal and test is in the ratio 60:40.
- Each experiment is to be evaluated for conduction with an observation sheet and record write-up.

Rubrics for the evaluation of the journal/write-up for hardware/software experiments are designed by the faculty who is handling the laboratory session and are made known to students at the beginning of the practical session.

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

Semester-End Examination:

SEE marks for the practical course are 50 Marks.

- SEE shall be conducted jointly by the two examiners of the same institute; examiners are appointed by the Head of the Institute.
- The examination schedule and names of examiners are informed to the university before the

conduction of the examination. These practical examinations are to be conducted between the schedule mentioned in the academic calendar of the University

All laboratory experiments are to be included for practical examination.

- (Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. OR based on the course requirement evaluation rubrics shall be decided jointly by examiners.
- Students can pick one question from PART-A and one question from PART-B (experiment) from the questions lot prepared by the examiners jointly and 50% weightage for each part.
- Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

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

Reference Books:

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

Website Links / Useful Videos:

- Installation of MongoDB: <https://www.youtube.com/watch?v=dEm2AS5amyA>
Aggregation in MongoDB: <https://www.youtube.com/watch?v=vx1C8EyTa7Y> Additional Resources:
- MongoDB in Action — Source Code Download:
<https://www.manning.com/downloads/529> MongoDB Practice Exercises:
<https://www.w3resource.com/mongodb-exercises/>

Technical Writing using LaTeX			
Course Code	25CSL47C	CIE Marks	50
Teaching Hours/Week (L:T:P)	(0:0:2)	SEE Marks	50
Total Hours of Pedagogy	28 hrs. of Practical	Total Marks	100
Credits	01	Exam Hours	3
Examination nature (SEE)	Practical		

Prerequisite:

The students should have knowledge of;

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

Course objectives:

CLO1: To introduce the basic syntax and semantics of the LaTeX scripting language CLO2: To understand the presentation of tables and figures in the document

CLO3: To illustrate the LaTeX syntax to represent the theorems and mathematical equations

CLO4: To make use of the libraries (Tikz, algorithm) to design the diagram and algorithms in the document

Teaching-Learning Process (General Instructions):

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

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

improve the students' understanding.

Sl. No	Experiment Description																											
1	Develop a LaTeX script to create a simple document that consists of 2 sections [Section1, Section2], and a paragraph with dummy text in each section. And also include header[title of document]and footer [institute name, page number] in the document.																											
2	Develop a LaTeX script to create a document that displays the sample Abstract/Summary																											
3	Develop a LaTeX script to create a simple title page of the VTU project Report [Use suitable Logos and text formatting]																											
4	Develop a LaTeX script to create the Certificate Page of the Report [Use suitable commands to leave the blank spaces for user entry]																											
5	Develop a LaTeX script to create a document that contains the following table with proper labels. <table><tr><th rowspan="2">S. No</th><th rowspan="2">USN</th><th rowspan="2">Student Name</th><th colspan="3">Marks</th></tr><tr><th>Subject1</th><th>Subject2</th><th>Subject3</th></tr><tr><td>1</td><td>4XX22XX001</td><td>Name1</td><td>89</td><td>60</td><td>90</td></tr><tr><td>2</td><td>4XX22XX002</td><td>Name2</td><td>78</td><td>45</td><td>98</td></tr><tr><td>3</td><td>4XX22XX003</td><td>Name3</td><td>67</td><td>55</td><td>59</td></tr></table>	S. No	USN	Student Name	Marks			Subject1	Subject2	Subject3	1	4XX22XX001	Name1	89	60	90	2	4XX22XX002	Name2	78	45	98	3	4XX22XX003	Name3	67	55	59
S. No	USN				Student Name	Marks																						
		Subject1	Subject2	Subject3																								
1	4XX22XX001	Name1	89	60	90																							
2	4XX22XX002	Name2	78	45	98																							
3	4XX22XX003	Name3	67	55	59																							
6	Develop a LaTeXscript to include the side-by-side graphics/pictures/figures in the document by using the subgraph concept																											
7	$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$= \frac{-2 \pm \sqrt{2^2 - 4*(1)*(-8)}}{2*1}$$= \frac{-2 \pm \sqrt{4+32}}{2}$ $\varphi_{\sigma}^{\lambda} A_t = \sum_{\pi \in C_t} \text{sgn}(\pi) \varphi_{\sigma}^{\lambda} \varphi_{\pi}^{\lambda}$$= \sum_{\tau \in C_{\sigma t}} \text{sgn}(\sigma^{-1} \tau \sigma) \varphi_{\sigma}^{\lambda} \varphi_{\sigma^{-1} \tau \sigma}^{\lambda}$$= A_{\sigma t} \varphi_{\sigma}^{\lambda}$																											
8	Develop a LaTeX script to demonstrate the presentation of Numbered theorems, definitions, corollaries, and lemmas in the document																											
9	Develop a LaTeX script to create a document that consists of two paragraphs with a minimum of 10 citations in it and display the reference in the section																											
10	Develop a LaTeX script to design a simple tree diagram or hierarchical structure in the document with appropriate labels using the Tikz library																											
11	Develop a LaTeX script to present an algorithm in the document using algorithm /algorithmic /algorithm2e library																											
12	Develop a LaTeX script to create a simple report and article by using suitable commands and formats of user choice.																											

Course outcome (Course Skill Set):

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

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

CO2: Develop LaTeX script to present the tables and figures in the document.

(PO -1,2,3, PSO -1,3)

CO3: Illustrate LaTeX script to present theorems and mathematical equations in the document.

(PO-1,2,3, PSO -1,3)

CO4: Develop programs to generate the complete report with citations and a bibliography.

(PO- 1,2,3, PSO - 1,2,3)

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

Assessment Details (both CIE and SEE)

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

Continuous Internal Evaluation (CIE):

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

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

- The suitable rubrics can be designed to evaluate each student's performance and learning ability.
- The marks scored shall be scaled down to 20 marks (40% of the maximum marks). The Sum of scaled- down marks scored in the report write-up/journal and marks of a test is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

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

General rubrics suggested for SEE are mentioned here: write-up - 20%, Conduction procedure and result - 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:

- 1: "A Short Introduction to LaTeX" by Firuza Karmali (AIBARA), A book for beginners, 2019.
- 2: "Formatting Information: A Beginner's Introduction to Typesetting with LaTeX," by Peter Flynn, Comprehensive TeX Archive Network (2005).

LaTeX TUTORIAL: <https://latex-tutorial.com/tutorials/>

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

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

Universal Human Values			
Course Code	25UH48	CIE Marks	50
Teaching Hours/Week (L: T: P)	1:0:0	SEE Marks	50
Credits	01	Total Marks	100
Contact Hours	14:0:0	Exam Hours	03
Examination type (SEE)	Theory		
Prerequisites: NIL			
Course Objectives:			
This course is intended to:			
• To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings. • To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way. • To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human 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		2 Hours	
Introduction to Value Education:			
Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of			

Education) Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Happiness and Prosperity – Current Scenario, Method to Fulfil the Basic Human Aspirations	
Module- 2	3 Hours
Harmony in the Human Being: Understanding Human being as the Co-existence of the Self and the Body, distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health	
Module- 3	3 Hours
Harmony in the Family and Society: Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order	
Module- 4	3 Hours
Harmony in the Nature/Existence: Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence	
Module- 5	3 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 Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession	
Course outcomes (Course Skill Set): At the end of the course, students are expected to become more aware of themselves, and their surroundings (family, society, nature): CO1: Apprehend the need of Value Education over Human aspirations (PO-6, PO-7) CO2: Assimilate Harmony over the physical needs and to overcome the self- needs for a prosperous life. (PO-6, PO-7) CO3: Recognize the need of Harmony in the Family and Society for a better World. (PO-6, PO-7) CO4: Explain the need of mutual understanding for Holistic Harmony in all the Levels of Human Existence. (PO-6, PO-7) CO5: Explain the Holistic understanding of Harmony and Professional Ethics at Individual Level and Society. (PO-6, PO-7)	
Assessment Details (both CIE and SEE): The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). The student is declared as a pass in the course if he/she secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.	

Continuous Internal Evaluation:

- 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, 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.

The sum of two tests, two assignments, will be out of 100 marks and will be scaled down to 50 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:

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.

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
2. The Teacher's Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G

Reference Books:

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2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj – Pandit Sunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

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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=PLWDeKF97v9SP7wSlapZcQRrT7OH0ZIGC4>
3. **Course handouts:**
https://drive.google.com/drive/folders/1zioX_4L2fCNX4Agw282PN86pcZZT3Osr?usp=sharing
4. **Presentation slides:**
https://drive.google.com/drive/folders/1rMUKh1s0HPRBlpp_b1mpS-duNRcwS6YH?usp=sharing