SAHYADRI
COLLEGE OF ENGINEERING & MANAGEMENT
An Autonomous Institution
MANGALURU

COMPUTATIONAL DISCRETE MATHEMATICS
(Effective from the Academic Year 2023- 2024)
SEMESTER - III

Course Code	**MA322T1C**	**CIA Marks**	**50**
Number of Contact Hours/Week (L: T:P:S)	**3:0:0:1**	**SEE Marks**	**50**
Total Hours of Pedagogy	**40 L**	**Exam Hours**	**3 Hours**

CREDITS – 3

Prerequisites:

- Basics of Permutation and combination and Set theory

Course Objectives:

- Enable the students to apply basic concepts of Logic and Graph theory on developing algorithms.
- Understand the Principle of Inclusion and Exclusion in solving combinatorial counting problems.
- Develop a strong conceptual understanding of relations and functions, enabling their application in computer science.

Teaching - Learning Strategy:

These are some sample strategies; which course faculty members can incorporate in the Teaching Learning Process:

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses

COURSE CONTENTS

Module-I	
Fundamentals of Logic: Basic Connectives and Truth Tables, Logic Equivalence – The Laws of Logic, Logical Implication – Rules of Inference. Fundamentals of Logic contd.: The Use of Quantifiers, Quantifiers, Definitions and the Proofs of Theorems.	**8 Hours**
Module-II	
Properties of the Integers: The Well Ordering Principle – Mathematical Induction, **Fundamental Principles of Counting:** The Rules of Sum and Product, Permutations, Combinations – The Binomial Theorem, Combinations with Repetition.	**8 Hours**
Module-III	
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.	**8 Hours**
Module-IV	
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.	**8 Hours**
Module -V	
Introduction to Graph Theory: Definitions and Examples, Sub graphs, Complements, and Graph Isomorphism, Definitions, Trees, Types of Trees, Rooted Trees, Trees and Sorting, Weighted Trees, Optimal prefix codes.	**8 Hours**

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COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Apply Logic principles and Quantifiers to solve complex problems in computer science.	CL3
CO2	Demonstrate proficiency in combinatorial analysis to apply counting techniques in computer science engineering applications.	CL3
CO3	Develop understanding of relations and functions to apply on data Modelling and optimization of algorithms.	CL3
CO4	Apply fundamental counting principles to solve diverse combinatorial problems, demonstrating advanced analytical and problem-solving skills	CL3
CO5	Interpret fundamental graph theory and Trees.	CL2

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2	1	2		1		2		1		1	1		
CO2	1	1										1	2	1	
CO3	2	2	1					1				1	1	1	
CO4	2			1								1	1	1	
CO5	3	2	1					1				1	2	1	

3: Substantial (High)	2: Moderate (Medium)	1: Poor (Low)

ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Continuous Internal Evaluation (CIE)	60 %	30
	Assignments	40 %	20
2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT DETAILS

Continuous Internal Assessment (CIA) (50%)				Semester End Exam (SEE) (50%)
Continuous Internal Evaluation (CIE) (60%)			Assignment/ Activities (40%)	
I	II	III		
Syllabus Coverage			Syllabus Coverage	Syllabus Coverage
40%	30%	30%	100%	100%
MI			MI	MI
MII	MII		MII	MII
	MIII		MIII	MIII
		MIV	MIV	MIV
		MV	MV	MV

Note: For Examinations (both CIE and SEE), the question papers shall contain the questions mapped to the appropriate Bloom's Level. Any COs mapped with higher cognitive Bloom's Level may also be assessed through the assignments.

ASSIGNMENT TYPES WITH WEIGHTAGES

Sl. No.	Assignment Description	Max. Weightage (%)	Max. Marks
1	Written Assignments	25 %	05
2	Quiz	10 %	02
3	Case Studies	25 %	05
4	Seminar/Presentation	15 %	03
5	Peer - to - Peer Learning	10 %	02
6	Activity Based Learning	50 %	10
7	Project Based Learning	50 %	10
8	Field Work + Report	50 %	10
9	Industry Visit + Report	50 %	10
10	NPTEL/MOOC Courses – Registration and Assignment Submissions	50 %	10
	NPTEL Certification	75 %	15
11	Any other Innovative Assignments (CL4 and above)	50 %	10
Note: The assignments mentioned above may be provided appropriately to the students belonging to different bands			

See Question Paper Pattern:

- The question paper will have **TEN** full questions from **FIVE** Modules
- There will be 2 full questions from each module. Every question will carry a maximum of 20 marks.
- Each full question may have a maximum of four sub-questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting one full question from each module.

REFERENCE BOOKS:

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

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LOGIC DESIGN AND EMBEDDED SYSTEMS
(Effective from the Academic Year 2023- 2024)
III SEMESTER

Course Code	**CS322I2C**	**CIA Marks**	**50**
Number of Contact Hours/Week (L: T:P:S)	**3:0:2:0**	**SEE Marks**	**50**
Total Hours of Pedagogy	**40 L + 20 P**	**Exam Hours**	**3 Hours**

CREDITS – 4

Prerequisites:

- Basic logic design principles and various functions of digital computers.

Course Objectives:

This course will enable students to:

- Illustrate combinational digital circuits.
- Demonstrate the use of flip flops and apply for registers and counters.
- Understand the fundamentals of ARM based systems, basic hardware components, selection methods and attributes of an embedded system.
- Program ARM controller using the various instructions.
- Identify the applicability of the embedded system.

Teaching - Learning Strategy:

These are some sample strategies, which course faculty members can incorporate in the Teaching Learning Process:

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem/Laboratory Based Learning
- Case Studies
- MOOC/NPTEL Courses

COURSE CONTENTS

MODULE - 1

Module Contents	**Lecture Hours**
Combinational Logic design: Karnaugh Map**,** Minimization of complete and incomplete Boolean expressions using K-Map, Three state buffers, Decoders and Encoders, Programmable Logic devices.	**8 Hours**

MODULE - 2	
Sequential Logic Design: Flip-Flops and its Applications**:** Master Slave Flip-Flops, Edge-Triggered Flip-Flops, Registers, Counters.	**8 Hours**
MODULE - 3	
ARM Embedded Systems: RISC, ARM Design Philosophy, Embedded System Hardware and Software. **ARM Processor Fundamentals:** Registers, Current Program Status Register, Pipeline, Exceptions, Interrupts, and Vector Table.	**8 Hours**
MODULE - 4	
ARM Instructions Set: Data Processing Instructions, Branch Instructions, Load-Store Instructions, Software Interrupt Instructions, Program Status Register Instruction.	**8 Hours**
MODULE - 5	
Embedded System Components: Embedded Vs General computing system, Classification, Major applications areas. Interfacing Sensors, Actuators, stepper motor, Keyboard, Push button switch, Communication Interface (onboard and external types), Embedded firmware, other system components.	**8 Hours**

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Design combinational logics digital circuits	CL3
CO2	Apply sequential logic design principles using flip flops to design digital circuits like counters and registers.	CL3
CO3	Understand the ARM processor design Philosophy, and ARM processor fundamentals.	CL2
CO4	Develop programs using ISA (Instruction set architecture) of ARM controllers.	CL3
CO5	Interface the peripheral devices to ARM microcontrollers.	CL3

LABORATORY CONTENTS			
Exp. No.	**Experiment Description**	**CO No.**	**Bloom's Taxonomy Level**
1.	Given a 4-variable logic expression, simplify it using appropriate technique and realize the simplified logic expression using 8:1 multiplexer IC.	CO1	CL4
2.	Design and implement code converter I) Binary to Gray (II) Gray to Binary Code.	CO1	CL4
3.	Design and implement a mod-n (n<8) synchronous up counter using J-K Flip-Flop ICs and demonstrate its working.	CO2	CL4
4.	Design and implement an asynchronous counter using decade counter IC to count up from 0 to n (n<=9) and demonstrate on a 7-segment display.	CO2	CL4
5.	Implement an ALP to find the square of a number (1 to 10) using a look-up table.	CO3	CL4
6.	Implement an ALP to arrange a series of 32-bit numbers in ascending/descending order.	CO4	CL4
7.	Implement an ALP to count the number of ones and zeros in two consecutive memory locations.	CO4	CL4
8.	Display "Hello World" message using Internal UART.	CO5	CL4
9.	Interface (a) Stepper motor (b) DC motor to rotate it in a clockwise and anti-clockwise direction.	CO5	CL4
10	Interface a DAC and generate the following waveforms: a. square wave b. Triangular wave	CO5	CL4

CO-PO-PSO MAPPING

CO No.	**Programme Outcomes (PO)**												**Programme Specific Outcome (PSO)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	3	2					2			3	3	2
CO2	3	3	3	3	2					2			3	3	2
CO3	3	3	2	3	3					2			3	3	2
CO4	3	4	2	2	3					2			3	3	2
CO5	3	3	3	3	3					2			3	3	2

3: Substantial (High)	**2: Moderate (Medium)**	**1: Poor (Low)**

CO - Assessment Mapping:

Course Outcomes	Continuous Internal Assessment (CIA) (50%)				Semester End Exam (SEE) (50%)
	Continuous Internal Evaluation (CIE) (60%)			Practical Sessions (40%)	
	I	II	III		
	Syllabus Coverage				
	40%	30%	30%	100%	100%
CO1	X			x	x
CO2	X			x	x
CO3		x		x	x
CO4		x	x	x	x
CO4			x	x	x

Assessment Strategy:

- Assessment will be both CIA and SEE.
- The practical sessions of the IPCC shall be for CIE only.
- The theory component of the IPCC shall be for both CIA and SEE respectively.
- The questions from the practical sessions may also be included for Theory SEE.

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Continuous Internal Evaluation (CIE)	60 %	30
	Practical Sessions (Laboratory Component)	40 %	20
2	**Semester End Examination (SEE)**	**100 %**	**50**

SEE Question Paper Pattern:

- The question paper will have **TEN** full questions.
- Each full question consisting of 20 marks.
- There will be 2 full questions from all the FIVE modules.
- Each full question will have a maximum of four sub-questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

REFERENCE BOOKS:

1. Charles H Roth and Larry L Kinney, Analog and Digital Electronics, Cengage Learning,2019.
2. Andrew N Sloss, Dominic Symes and Chris Wright, ARM system developers guide, Elsevier, Morgan Kaufman publishers,2008.
3. Shibu K V, “Introduction to Embedded Systems”, Tata McGraw Hill Education, Private Limited, 2 nd Edition.
4. Digital Principles and Design, Donald D. Givone, 1st Edition, 2002, Tata McGraw-Hill Publishers.

5. Raj Kamal, Embedded System, Tata McGraw-Hill Publishers, 2nd Edition, 2008.
6. Raghunandan.G.H, Microcontroller (ARM) and Embedded System, Cengage learning Publication,2019
7. David A. Bell, Electronic Devices and Circuits, 5th Edition, Oxford University Press, 2008bbbbb

OBJECT ORIENTED PROGRAMMING CONCEPTS
(Effective from the Academic Year 2023 - 2024)
III SEMESTER

Course Code	**CS322I3C**	**CIA Marks**	**50**
Number of Contact Hours/Week (L: T: P:S)	**3:0:2:0**	**SEE Marks**	**50**
Total Hours of Pedagogy	**40L + 20P**	**Exam Hours**	**03**

CREDITS – 4

COURSE PREREQUISITES:

- Fundamental knowledge of Programming.

COURSE OBJECTIVES:

- Learn fundamental Object-Oriented features of Java, classes, objects and its methods.
- Set up Java JDK environment to create, debug and run simple Java programs.
- Explore the concepts of Inheritance, Packages and Interfaces.
- Create Multi-threaded programs, Event handling mechanisms

TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

COURSE CONTENTS

MODULE - I

Introduction to Object Oriented Concepts: A Review of structures, Procedure–Oriented Programming system, Object Oriented Programming System, Comparison of Object-Oriented Language with C, Console I/O, variables and reference variables, Function Prototyping, Function Overloading. **Class and Objects:** Introduction, member functions and data, objects and functions, objects and arrays, Namespaces, Nested classes, Constructors, Destructors	**8 Hours**

MODULE - II

Introduction to Java: Java's magic: the Byte code, Java Development Kit (JDK), The Java Buzzwords, Object-oriented programming, Simple Java programs. Data types, variables and arrays, Operators, Control Statements.	**8 Hours**

MODULE - III	
Classes, Inheritance, Exceptions, Packages and Interfaces: Classes: Classes fundamentals; Declaring objects; Constructors, this keyword, garbage collection. **Inheritance: I**nheritance basics, using super, creating multi-level hierarchy, method overriding. **Exception handling:** Exception handling in Java. Packages, Access Protection, Importing Packages, Interfaces.	**8 Hours**
MODULE - IV	
Multi-Threaded Programming: Multi-Threaded Programming: What are threads? How to make the classes threadable Extending threads; Implementing runnable; Synchronization; Changing state of the thread; Bounded buffer problems, read write problem, producer consumer problems.	**8 Hours**
MODULE - V	
Event Handling: Two event handling mechanisms; The delegation event model; Event classes; Sources of events; Event listener interfaces; Using the delegation event model; Adapter classes; Inner classes. **Swings:** The origins of Swing; Two key Swing features; Components and Containers; The Swing Packages; A simple Swing Application	**8 Hours**

COURSE OUTCOMES

	Upon completion of this course, the students will be able to:	
CO No.	**Course Outcome Description**	**Bloom's Taxonomy Level**
CO1	Develop C++ programs by using different Object-Oriented concepts like inheritance, polymorphism, nested classes, Constructors, Destructors.	CL3
CO2	Analyze and understand the basic Object-Oriented concepts using Java with the help of Data types, variables and arrays, Operators, Control Statements.	CL3
CO3	Inspect inheritances, exceptions, packages concepts and exception handling using JAVA.	CL3
CO4	Utilize the concept of Threading and multi-thread programming in real time applications.	CL3
CO5	Illustrate JAVA Event handling mechanism and simple applications using swings.	CL3

LABORATORY COMPONENTS

Exp. No.	**Experiment Description**	**CO No.**	**Bloom's Taxonomy Level**
1.	Implement a C++ Program to demonstrate the concepts of Class, Object and Constructors by creating a class that holds the basic information of students belonging to an Engineering College.	CO1	CL3
2.	Develop a C++ Program to simulate a calculator that performs basic arithmetic operations on integer and floating-point numbers using the concepts of function overloading.	CO1	CL3
3.	Write a Java Program for demonstrating creation of Java classes, objects, constructors, declaration and initialization of variables.	CO2	CL3
4.	Demonstrate the for, for-each, while and do-while loops using a Java Program	CO2	CL3
5.	Implement a Java Program to illustrate the concept of Inheritance, polymorphism	CO3	CL3

6.	Develop a Java Program to create Java package and illustrate the process of importing a user defined Java Package.	CO3	CL3
7.	Implement a Java Program to demonstrate of Bounded buffer problems using Java Multi-Threading concepts	CO4	CL3
8.	Implement a Java Program to demonstration of producer-consumer problems	CO4	CL3
9.	Develop a Java program to simulate Key Event and Mouse Event	CO5	CL3
10.	Develop a Java program to demonstrate the java swings	CO5	CL3

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	3	2	2							3			
CO2	3	2	3	2	2							3			
CO3	3	3	3	2	2							3			
CO4	3	3	3	2	2							3			
CO5	3	3	3	2	2							3			

3: Substantial (High) | **2: Moderate (Medium)** | | **1: Poor (Low)**

ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)		Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**		**50**
	Continuous Internal Evaluation (CIE)	60 %		30
	Practical Session (Laboratory Component)	40 %		20
2	**Semester End Examination (SEE)**	**100 %**		**50**

ASSESSMENT DETAILS

Continuous Internal Assessment (CIA) (50%)					**Semester End Exam (SEE) (50%)**
Continuous Internal Evaluation (CIE) (60%)			**Practical Sessions (40%)**		
I	**II**	**III**			
Syllabus Coverage			**Syllabus Coverage**		**Syllabus Coverage**
40%	**30%**	**30%**	**100%**		**100%**
MI			MI		MI
MII	MII		MII		MII

	MIII		MIII		MIII
		MIV	MIV		MIV
		MV	MV		MV

NOTE:

- Assessment will be both CIA and SEE.
- The practical sessions of the IPCC shall be for CIE only.
- The Theory component of the IPCC shall be for both CIA and SEE respectively.
- The questions from the practical sessions shall be included in Theory SEE.

Note: For Examinations (both CIE and SEE), the question papers shall contain the questions mapped to the appropriate Bloom's Level. Any COs mapped with higher cognitive Bloom's Level may also be assessed through the assignments.

SEE QUESTION PAPER PATTERN:

1. The question paper will have **TEN** full questions from **FIVE** Modules
2. There will be 2 full questions from each module. Every question will carry a maximum of 20 marks.
3. Each full question may have a maximum of four sub-questions covering all the topics under a module.
4. The students will have to answer FIVE full questions, selecting one full question from each module.

REFERENCE BOOKS:

1. Sourav Sahay, Object Oriented Programming with C++, 2nd Ed, Oxford University Press,2006
2. Herbert Schildt, Java the Complete Reference, 7th Edition, Tata McGraw Hill, 2007.
3. Sourav Sahay, Object Oriented Programming with C++, 2nd Ed, Oxford University Press,2006
4. E Balagurusamy, Programming with Java, McGraw Hill, 6th Edition, 2019.
5. Mahesh Bhave and Sunil Patekar, "Programming with Java", First Edition, Pearson Education,2008, ISBN:9788131720806

DATA STRUCTURES AND APPLICATIONS
(Effective from the Academic Year 2023 - 2024)
III SEMESTER

Course Code	**CS322T4C**	**CIA Marks**	**50**
Number of Contact Hours/Week (L: T: P: S)	**3:0:0:0**	**SEE Marks**	**50**
Total Hours of Pedagogy	**40L**	**Exam Hours**	**03**

CREDITS – 3

COURSE PREREQUISITES:

- Knowledge of Mathematics and C Programming

COURSE OBJECTIVES:

This course will enable students to:

- Explain the fundamental knowledge of various types of data structures and their applications essential for implementing solutions to problems.
- Illustrate representations and implementations of various linear and non-linear data structures such as Stack, Queues, Linked list, Trees, Graphs and Hashing.

TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

COURSE CONTENTS

MODULE – I

Introduction to Data Structures: Classifications, Data structure Operations, Demonstration of Sparse Matrices with arrays, Strings: Operations and Pattern Matching Algorithms. **Stack:** Concepts and Operations, Array Representation of Stacks, Stacks using Dynamic Arrays. **Applications of Stack:** Infix to Postfix Conversion, Evaluation of Postfix expression, Recursion**:** Ackermann function.	**8 Hours**

MODULE – II

Queues: Introduction to Queues, Array and Linked Representation of Queues, Operations on queues, Circular queues Operations, Circular queues using Dynamic arrays, Dequeues, Priority Queues. **Applications of Queues:** Job Scheduling.	**8 Hours**

MODULE – III

Linked List: Introduction to Linked Lists, Representation of linked lists in Memory, Dynamic Memory allocation functions, Singly Linked list Operations: Traversing, Searching, Insertion and Deletion, Header linked lists, Doubly Linked lists Operations, Circular linked lists, Linked Stacks and Queues. **Applications of Linked Lists:** Polynomials, Sparse matrix representation.	**8 Hours**

MODULE - IV	
Trees: Terminologies, Binary Trees, Properties of Binary trees, Array and linked representation of Binary Trees, Binary Tree Traversals, threaded binary trees, Binary Search Trees: Definition, Insertion, Deletion, Traversal, Searching, AVL tree, B-Tree. **Application of Trees:** Evaluation of Arithmetic Expression.	**8 Hours**
MODULE – V	
Graphs: Terminologies, Graph representations, Traversal methods: Breadth First Search and Depth First Search. **Hashing:** Introduction, Hash Table organizations, Hashing Functions, Static and Dynamic Hashing	**8 Hours**

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Demonstrate the fundamental knowledge of various types of data structures and apply stack data structure for problem solving.	CL3
CO2	Apply the concept of queues, circular queue for solving various problems.	CL3
CO3	Illustrate the operations such as insertion, deletion and searching on singly linked lists, circular linked lists and doubly linked list.	CL3
CO4	Make use of tree data structure with different traversal methods to evaluate arithmetic expression.	CL3
CO5	Illustrate the concept of graphs with applications and the usage of hashing techniques.	CL3

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3		1			2	2			3	3	3	2
CO2	3	3	3		1			2	2			3	3	3	2
CO3	3	3	3		1			2	2			3	3	3	2
CO4	3	3	3		1			2	2			3	3	3	2
CO5	3	3	3		1			2	2			3	3	3	2

3: Substantial (High) | **2: Moderate (Medium)** | **1: Poor (Low)**

ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Continuous Internal Evaluation (CIE)	60 %	30
	Assignments	40 %	20
2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT DETAILS

Continuous Internal Assessment (CIA) (50%)				Semester End Exam (SEE) (50%)
Continuous Internal Evaluation (CIE) (60%)			Assignment/ Activities (40%)	
I	II	III		
Syllabus Coverage			Syllabus Coverage	Syllabus Coverage

40%	30%	30%	100%	100%
MI			MI	MI
MII	MII		MII	MII
	MIII		MIII	MIII
		MIV	MIV	MIV
		MV	MV	MV

Note: For Examinations (both CIE and SEE), the question papers shall contain the questions mapped to the appropriate Bloom's Level. Any COs mapped with higher cognitive Bloom's Level may also be assessed through the assignments.

ASSIGNMENT TYPES WITH WEIGHTAGES

Sl. No.	Assignment Description	Max. Weightage (%)	Max. Marks
1	Written Assignments	25 %	05
2	Quiz	10 %	02
3	Case Studies	25 %	05
4	Seminar/Presentation	15 %	03
5	Peer - to - Peer Learning	10 %	02
6	Activity Based Learning	50 %	10
7	Project Based Learning	50 %	10
8	Field Work + Report	50 %	10
9	Industry Visit + Report	50 %	10
10	NPTEL/MOOC Courses – Registration and Assignment Submissions	50 %	10
	NPTEL Certification	75 %	15
11	Any other Innovative Assignments (CL4 and above)	50 %	10

Note: The assignments mentioned above may be provided appropriately to the students belonging to different bands

SEE QUESTION PAPER PATTERN:

- The question paper will have **TEN** full questions from **FIVE** Modules
- There will be 2 full questions from each module. Every question will carry a maximum of 20 marks.
- Each full question may have a maximum of four sub-questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting one full question from each module.

REFERENCE BOOKS:

1. Ellis Horowitz and Sartaj Sahni, Fundamentals of Data Structures in C, 2nd Ed, Universities Press, 2014.
2. Seymour Lipschutz, Data Structures Schaum's Outlines, Revised 1st Ed, McGraw Hill, 2014.
3. Gilberg and Forouzan, Data Structures: A Pseudo-code approach with C, 2nd Ed, Cengage Learning, 2014.
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,2nd Ed, PHI,1996.

DATA STRUCTURES LABORATORY WITH C
(Effective from the Academic Year 2023 - 2024)
III SEMESTER

Course Code	**CS322L5C**	**CIA Marks**	**50**
Number of Contact Hours/Week (L: T: P: S)	**0:0:2:0**	**SEE Marks**	**50**
Total Hours of Pedagogy	**20P**	**Exam Hours**	**03**

CREDITS – 1

COURSE PREREQUISITES:

- Basic Maths and Fundamentals of C Programming.
- Usage of IDEs like NetBeans.

COURSE OBJECTIVES:

This course will enable students:

- To get practical experience in design, develop, implement, analyze and testing of various algorithms.
- To visualize and understand linear/nonlinear data structures with their applications such as Stack, Queues, Linked List, Trees, Graphs and Hashing.

TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

LIST OF EXPERIMENTS

Exp. No.	Description
1	Design and implement a program in C on Frequency Histogram, which builds a frequency array for data values in the range 1 to n and then prints their histogram. The program should, a. Read, Store and Print the data in an array. b. Analyze the data in the array, one element at a time. Add 1 to the corresponding element in a frequency array based on the data value. c. Print a histogram using asterisks for each occurrence of an element.
2	Design and implement a program in C for the following Stack Applications, a. Evaluation of Suffix expression with single digit operands and operators: +, -, *, /, %, ^ b. Conversion of Arithmetic Expressions

3	Design and implement a program in C for the following operations on QUEUES, a. Categorize the numbers (Range 1 to 100) without losing the original ordering as mentioned below: Group 1: Less than 10 Group 2: Between 10 and 19 Group 3: Between 20 and 29 Group 4: Between 30 and 99 b. Sort the categorized data using any sorting algorithm
4	Design and implement a menu driven Program in C for the following operations on Circular QUEUE of Characters, a. Insert an Element on to Circular QUEUE b. Delete an Element from Circular QUEUE c. Demonstrate Overflow and Underflow situations on Circular QUEUE d. Display the status of Circular QUEUE
5	Design and Implement a menu driven program in C for the following operations on Doubly Linked List (DLL) of Student Data with the fields: USN, Name, Department, Marks, Ph.No, a. Create a DLL of N Students Data by using end insertion. b. Display the status of DLL and count the number of nodes in it c. Perform Insertion and Deletion at End of DLL d. Perform Insertion and Deletion at Front of DLL e. Display the total and average marks for each student
6	Design and implement a program in C for the following operations on Singly Circular Linked List (SCLL) with header nodes, a. Represent and Evaluate a Polynomial $P(x,y,z) = 6x^2y^2z - 4yz^5 + 3x^3yz + 2xy^5z - 2xyz^3$. b. Find the sum of two polynomials POLY1(x,y,z) and POLY2(x,y,z) and store the result in POLYSUM(x,y,z).
7	Design and implement a program in C that reads a list of names and telephone numbers to inserts them into a Binary Search Tree for the following operations, a. Search the list for a specified name. b. Insert a new name. c. Delete an existing name. d. Traverse using In-order, Preorder and Post-order.
8	A company has seven top officers working for it. They are each fluent in at least one language according to the following sample table,

Officer	Hindi	Malayalam	Kannada	Telugu
01	-	-	Y	-
02	-	-	Y	Y
03	-	-	-	Y
04	-	Y	-	Y
05	Y	Y	-	-
06	Y	-	Y	-
07	-	Y	-	-

Design and implement a program in C for the following operations on Graphs (G),

a. Create a graph using adjacency matrix indicating people who can communicate directly with each other.

b. Print all the officers which are reachable from a given officer as a starting node in a digraph.

Example: An officer wants to send a message to each other officer: A message comes to an officer; he reads it and transmits it to another officer possibly after translation to someone who has not read it.

9 Design and Implement a program in C that uses Hash Function H:K->L as H(K)=K mod m(reminder method) and implement hashing technique to map a given key K to the address space L. Resolve the collision (if any) using linear probing.

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Design and implement array and stack data structures for a given application.	CL2
CO2	Design and implement queue data structures for a given application.	CL2
CO3	Design and implement the concepts of DLL and SCLL.	CL2
CO4	Utilize the concepts of trees and graphs to solve the real-world problems.	CL2
CO5	Illustrate the application of hashing techniques to analyze the collision problems and develop suitable functions to resolve collision.	CL3

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	2		2			1	1			3	3	3	3
CO2	3	2	2		2			1	1			3	3	3	3
CO3	3	2	2		2			1	1			3	3	3	3
CO4	3	2	2		2			1	1			3	3	3	3
CO5	3	2	2		2			1	1			3	3	3	3

3: Substantial (High) | **2: Moderate (Medium)** | **1: Poor (Low)**

ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Laboratory Work (A)	50 %	25
	Laboratory Test (B)	30 %	15
	Open Ended Experiments /Mini Projects (C)	20 %	10
2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT STRATEGY:

I. In Laboratory Courses where (B) and (C) are not the components of the assessment pattern, then (A) will have 100% weightage (50 Marks).

Assessment Mode: Weekly Assessment of Laboratory Work (50 Marks) - the marks will be awarded based on the Continuous Internal Assessment (Weekly Assessment, each of 25 marks) of the students in each laboratory session. The average of all the marks obtained across the sessions will be the Final CIA marks.

II. In Laboratory Courses where (C) is not a component of the assessment pattern, then (A) will have 50% weightage (25 Marks), and (B) will have 50% weightage (25 Marks).

Assessment Mode: The marks will be awarded based on the Continuous Internal Assessment (Weekly Assessment) (A) and One Laboratory Test (B).

- In Weekly Assessment, the student will be evaluated in each laboratory session for 25 marks. The average marks obtained across all the experiments will be the marks obtained for (A).
- A Laboratory Test, similar to the SEE exam is conducted towards the end of the Semester/Course, whichever is earlier. The obtained marks are scaled down to 25 Marks (B)

The Sum of marks obtained across (A) and (B) will be the Final CIA marks.

III. In Laboratory Courses where (C) is a component of the assessment pattern, then assessment will be done by considering the weightages given above, i.e. (A) – 25 Marks (Weekly Assessment), (B) – 15 Marks (Laboratory Examination), (C) – 10 marks (Open Ended Experiments/Mini Projects)

- The respective course instructor will design the assessment criteria for the said assessment components.

- The assessment components will be made known to the students by the respective Course Coordinators prior to the commencement of the Laboratory Work.

In all the cases, the assessments will be done based on the criteria designed by the Course Coordinator.

SEE QUESTION PAPER PATTERN:

1. All laboratory experiments should be included for practical examination, from which students are allowed to pick one experiment from the lot.
2. SEE shall be conducted for 100 Marks and the marks will be scaled down to 50.
3. General Marks Distribution: Procedure + Conduction + Viva = 20% + 50% + 30%.
4. Change of experiment is allowed only once and 20% of the marks allotted to the Procedure will be made ZERO (if a question carries two experiments, both should be changed). The evaluation will be done for 80% of the total maximum marks.

LEARNING RESOURCES:

1. Ellis Horowitz and Sartaj Sahni, Fundamentals of Data Structures in C, 2nd Ed, Universities Press, 2014.
2. Seymour Lipschutz, Data Structures Schaum's Outlines, Revised 1st Ed, McGraw.
3. Gilberg & Forouzan, Data Structures: A Pseudo - Code Approach with C, 2nd Ed, Cengage Learning, 2014.
4. Michael J. Folk, Bill Zoellick and Greg Riccardi, “File Structures - An Object-Oriented Approach with C++”, Pearson Education, 2004.

PROGRAMMING WITH PYTHON
(Effective from the Academic Year 2023 - 2024)
III SEMESTER

Course Code	**CS322T6CA**	**CIA Marks**	**50**
Number of Contact Hours/Week (L: T: P: S)	**3:0:0:0**	**SEE Marks**	**50**
Total Hours of Pedagogy	**40L**	**Exam Hours**	**03**

CREDITS – 3

COURSE PREREQUISITES:

- Fundamental knowledge of C Programming

COURSE OBJECTIVES:

- Learn the syntax and semantics of the Python programming language.
- Illustrate the process of structuring the data using lists, tuples
- Appraise the need for working with various documents like Excel, PDF, Word and Others.
- Demonstrate the use of built-in functions to navigate the file system.
- Implement the Object-Oriented Programming concepts in Python.

TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

COURSE CONTENTS

MODULE - I	
Python Basics: Entering Expressions into the Interactive Shell, The Integer, Floating-Point, and String Data Types, String Concatenation and Replication, Storing Values in Variables, Your First Program, Dissecting Your Program, **Flow control**: Boolean Values, Comparison Operators, Boolean Operators, Mixing Boolean and Comparison Operators, Elements of Flow Control, Program Execution, Flow Control Statements, Importing Modules, Ending a Program Early with sys.exit(), **Functions**: def Statements with Parameters, Return Values and return Statements, The None Value, Keyword Arguments and print(), Local and Global Scope, The global Statement, Exception Handling, A Short Program: Guess the Number.	**8 Hours**
MODULE - II	
Lists: The List Data Type, Working with Lists, Augmented Assignment Operators, Methods, Example Program: Magic 8 Ball with a List, List-like Types: Strings and Tuples, References, **Dictionaries and Structuring Data:** The Dictionary Data Type, Pretty Printing, Using Data Structures to Model Real-World Things.	**8 Hours**
MODULE - III	
Manipulating Strings: Working with Strings, Useful String Methods, Project: Password Locker, Project: Adding Bullets to Wiki Markup **Reading and Writing Files:** Files and File Paths, The os.path Module, The File Reading/Writing Process, Saving Variables with the shelve Module, Saving Variables with the print.format() Function, Project: Generating Random Quiz Files, Project: Multiclipboard.	**8 Hours**
MODULE - IV	
Organizing Files: The shutil Module, walking a Directory Tree, Compressing Files with the zipfile Module, Project: Renaming Files with American-Style Dates to European-Style Dates, Project: Backing Up a Folder into a ZIP File. **Debugging:** Raising Exceptions, Getting the Traceback as a String, Assertions, Logging, IDLE‟s Debugger.	**8 Hours**

MODULE - V	
Classes and objects: Programmer-defined types, Attributes, Rectangles, Instances as return values, Objects are mutable, Copying. **Classes and functions:** Time, Pure functions, Modifiers, Prototyping versus planning, **Classes and methods:** Object-oriented features, Printing objects, Another example, A more complicated example, The init method, The __str__ method, Operator overloading, Type-based dispatch, Polymorphism, Interface and implementation,	**8 Hours**

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Demonstrate proficiency in handling loops and creation of functions.	CL3
CO2	Identify the methods to create and manipulate lists, tuples and dictionaries.	CL3
CO3	Demonstrate the commonly used operations involving string processing.	CL3
CO4	Demonstrate the use of built-in functions to navigate the file system.	CL3
CO5	Interpret the concepts of Object-Oriented Programming as used in Python.	CL3

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	1		3							3	2	2	3
CO2	3	3	1		3							3	2	2	3
CO3	3	3	1		3							3	2	2	3
CO4	3	3	1		3							3	2	2	3
CO5	3	3	1		3							3	2	2	3

3: Substantial (High) | **2: Moderate (Medium)** | **1: Poor (Low)**

ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Continuous Internal Evaluation (CIE)	60 %	30
	Assignments	40 %	20
2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT DETAILS

Continuous Internal Assessment (CIA) (50%)				Semester End Exam (SEE) (50%)
Continuous Internal Evaluation (CIE) (60%)			Assignment/ Activities (40%)	
I	II	III		
Syllabus Coverage			Syllabus Coverage	Syllabus Coverage
40%	30%	30%	100%	100%
MI			MI	MI
MII	MII		MII	MII
	MIII		MIII	MIII

		MIV	MIV	MIV
		MV	MV	MV

Note: For Examinations (both CIE and SEE), the question papers shall contain the questions mapped to the appropriate Bloom's Level. Any COs mapped with higher cognitive Bloom's Level may also be assessed through the assignments.

ASSIGNMENT TYPES WITH WEIGHTAGES

Sl. No.	Assignment Description	Max. Weightage (%)	Max. Marks
1	Written Assignments	25 %	05
2	Quiz	10 %	02
3	Case Studies	25 %	05
4	Seminar/Presentation	15 %	03
5	Peer - to - Peer Learning	10 %	02
6	Activity Based Learning	50 %	10
7	Project Based Learning	50 %	10
8	Field Work + Report	50 %	10
9	Industry Visit + Report	50 %	10
10	NPTEL/MOOC Courses – Registration and Assignment Submissions	50 %	10
	NPTEL Certification	75 %	15
11	Any other Innovative Assignments (CL4 and above)	50 %	10

Note: The assignments mentioned above may be provided appropriately to the students belonging to different bands

SEE QUESTION PAPER PATTERN:

- The question paper will have **TEN** full questions from **FIVE** Modules
- There will be 2 full questions from each module. Every question will carry a maximum of 20 marks.
- Each full question may have a maximum of four sub-questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting one full question from each module.

REFERENCE BOOKS:

1. Al Sweigart, "Automate the Boring Stuff with Python",1st Edition, No Starch Press, 2015. (Available under CC-BY-NC-SA license at https://automatetheboringstuff.com/)
2. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd Edition, Green Tea Press, 2015. (Available under CC-BY-NC license at http://greenteapress.com/thinkpython2/thinkpython2.pdf
3. Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, 3rd Edition, PHI.
4. Design and Analysis of Algorithms, S. Sridhar, Oxford (Higher Education).

MOBILE APPLICATION DEVELOPMENT
(Effective from the Academic Year 2023 - 2024)
III SEMESTER

Course Code	**CS322T6CB**	**CIA Marks**	**50**
Number of Contact Hours/Week (L: T: P: S)	**3:0:0:0**	**SEE Marks**	**50**
Total Hours of Pedagogy	**40L**	**Exam Hours**	**03**

CREDITS – 3

COURSE PREREQUISITES:

- Fundamentals of Java Programming

COURSE OBJECTIVES:

- Learn to setup Android application development environment
- Illustrate user interfaces for interacting with apps and triggering actions
- Interpret tasks used in handling multiple activities
- Identify options to save persistent application data
- Appraise the role of security and performance in Android applications

TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

COURSE CONTENTS

MODULE – I

Getting Started with Android Programming: What is Android? Features of Android, Android Architecture, obtaining the required tools, launching your first android application **Activities, Fragments and Intents:** Understanding activities, linking activities using intents, fragments.	**8 Hours**

MODULE – II

Getting to know the Android User Interface: Understanding the Components of a Screen: Views and View Groups, FrameLayout, LinearLayout, TableLayout, RelativeLayout, ScrollView. **Adapting to Display Orientation**: Anchoring Views. Utilizing the Action Bar: Adding Action Items to the Action Bar/	**8 Hours**

MODULE – III	
Designing User Interface with Views: **Using Basic Views**: Reference View view – Button, Image Button, Edit Reference, Checkbox, Toggle Button, Radio Button and Radio Group Views, Progress Bar View. **Using Picker Views:** TimePicker View, Date Picker View. Using List Views to Display Long Lists: List View View, Using the Spinner View	**8 Hours**
MODULE – IV	
Displaying Pictures and Menus with Views: Using Image Views to Display Pictures: Image View View, Image Switcher, Grid View. **Using Menus with Views**: Creating the Helper Methods, Options Menu, Context Menu. **Using WebView**: WebView.	**8 Hours**
MODULE – V	
Data Persistence: Saving and Loading User Preferences: Accessing Preferences Using an Activity, Programmatically Retrieving and Modifying the Preference Values. **Creating and Using Databases**: Creating the DBAdapter Helper Class, Using the Database Programmatically.	**8 Hours**

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Discuss the features, architecture and activities of Android application development	CL2
CO2	Explain the role of various components and action bar in Android application	CL2
CO3	Discuss the basic views used in Android application development	CL2
CO4	Explain the methods involved in handling images and menus in Android platform	CL2
CO5	Discuss various features available for user data management in Android application	CL2

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1		2							1	3		1
CO2	3	2	1		2							1	3		1
CO3	3	2	1		2							1	3		1
CO4	3	2	1		2							1	3		1
CO5	3	2	1		2							1	3		1

3: Substantial (High)	2: Moderate (Medium)	1: Poor (Low)

ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Continuous Internal Evaluation (CIE)	60 %	30
	Assignments	40 %	20
2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT DETAILS

Continuous Internal Assessment (CIA) (50%)				**Semester End Exam (SEE) (50%)**
Continuous Internal Evaluation (CIE) (60%)			**Assignment/ Activities (40%)**	
I	**II**	**III**		
Syllabus Coverage			**Syllabus Coverage**	**Syllabus Coverage**
40%	**30%**	**30%**	**100%**	**100%**
MI			MI	MI
MII	MII		MII	MII
	MIII		MIII	MIII
		MIV	MIV	MIV
		MV	MV	MV

Note: For Examinations (both CIE and SEE), the question papers shall contain the questions mapped to the appropriate Bloom's Level. Any COs mapped with higher cognitive Bloom's Level may also be assessed through the assignments.

ASSIGNMENT TYPES WITH WEIGHTAGES

Sl. No.	Assignment Description	Max. Weightage (%)	Max. Marks
1	Written Assignments	25 %	05
2	Quiz	10 %	02
3	Case Studies	25 %	05
4	Seminar/Presentation	15 %	03
5	Peer - to - Peer Learning	10 %	02
6	Activity Based Learning	50 %	10
7	Project Based Learning	50 %	10
8	Field Work + Report	50 %	10
9	Industry Visit + Report	50 %	10
10	NPTEL/MOOC Courses – Registration and Assignment Submissions	50 %	10
	NPTEL Certification	75 %	15

11	Any other Innovative Assignments (CL4 and above)	50 %	10

Note: The assignments mentioned above may be provided appropriately to the students belonging to different bands

SEE QUESTION PAPER PATTERN:

- The question paper will have **TEN** full questions from **FIVE** Modules
- There will be 2 full questions from each module. Every question will carry a maximum of 20 marks.
- Each full question may have a maximum of four sub-questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting one full question from each module.

UNIX SHELL PROGRAMMING
(Effective from the Academic Year 2023 - 2024)
III SEMESTER

Course Code	**CS322T6CC**		CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	0:0:2:0		SEE Marks	50
Total Hours of Pedagogy	20P		Exam Hours	03

CREDITS – 1

COURSE PREREQUISITES:

- Basic Knowledge of UNIX commands

COURSE OBJECTIVES:

- To learn about the file processing commands
- To Learn about how to create directories
- To Learn about various permissions on a file
- To Learn about the meta characters

TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

LIST OF EXPERIMENTS

Sl. No.	Description
1	a) Write a shell that takes a valid directory name as an argument and recursively descend all the subdirectories, finds the maximum length of any file in that hierarchy and writes this maximum value to the standard output
2	Write a shell script that accepts a path name creates all the components in that path name as directories. For example, if the script is named mpc, then command mpc a/b/c/d should create directories a, a/b, a/b/c, a/b/c/d.
3	Write a shell script that accepts two file names as arguments, checks if the permissions for these files are identical and if the permission are identical, output common permission and otherwise output each file name followed by its permissions
4	Write a shell script which accepts valid log in names as arguments and prints their corresponding home directories, if no arguments are specified, print a suitable error message.
5	Write a shell script that accept one or more filenames as argument and convert all of them to uppercase, provided they exist in current directory
6	Write a shell script that accepts as filename as argument and display its creation time if file exist and if it does not send output error message
7	Write a shell script to display the calendar for current month with current date replaced by * or ** depending on whether the date has one digit or two digits
8	Write a shell script to find a file/s that matches a pattern given as command line argument in the home directory, display the contents of the file and copy the file into the directory ~/mydir
9	Write a shell script to list all the files in a directory whose filename is at least 10 characters. (Use expr command to check the length)

	10	Write a shell script that determine the period for which a specified user is working on system and display appropriate message.

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.		Course Outcome Description	Bloom's Taxonomy Level
CO1		Apply basic commands for file system navigation	CL2
CO2		Create File Permissions on various files	CL2
CO3		Demonstrate to automate various command line arguments by using shell script	CL2
CO4		Demonstrate pattern matching using meta characters for file processing	CL2

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	3		2							1			
CO2	3	2	3		2							1			
CO3	3	2	3		2							1			
CO4	3	2	3		2							1			
CO5	3	2	3		2							1			

3: Substantial (High)	2: Moderate (Medium)		1: Poor (Low)

ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)		Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**		**50**
	Laboratory Work (A)	50 %		25
	Laboratory Test (B)	30 %		15
	Open Ended Experiments /Mini Projects (C)	20 %		10
2	**Semester End Examination (SEE)**	**100 %**		**50**

ASSESSMENT STRATEGY:

I. In Laboratory Courses where (B) and (C) are not the components of the assessment pattern, then (A) will have 100% weightage (50 Marks).

Assessment Mode: Weekly Assessment of Laboratory Work (50 Marks) - the marks will be awarded based on the Continuous Internal Assessment (Weekly Assessment, each of 25 marks) of the students in each laboratory session. The average of all the marks obtained across the sessions will be the Final CIA marks.

II. In Laboratory Courses where (C) is not a component of the assessment pattern, then (A) will have 50% weightage (25 Marks), and (B) will have 50% weightage (25 Marks).

Assessment Mode: The marks will be awarded based on the Continuous Internal Assessment (Weekly Assessment) (A) and One Laboratory Test (B).

- In Weekly Assessment, the student will be evaluated in each laboratory session for 25 marks. The average marks obtained across all the experiments will be the marks obtained for (A).
- A Laboratory Test, similar to the SEE exam is conducted towards the end of the Semester/Course, whichever is earlier. The obtained marks are scaled down to 25 Marks (B)

The Sum of marks obtained across (A) and (B) will be the Final CIA marks.

III. In Laboratory Courses where (C) is a component of the assessment pattern, then assessment will be done by considering the weightages given above, i.e. (A) – 25 Marks (Weekly Assessment), (B) – 15 Marks (Laboratory

	Examination), (C) – 10 marks (Open Ended Experiments/Mini Projects) ● The respective course instructor will design the assessment criteria for the said assessment components. ● The assessment components will be made known to the students by the respective Course Coordinators prior to the commencement of the Laboratory Work. In all the cases, the assessments will be done based on the criteria designed by the Course Coordinator.
	SEE QUESTION PAPER PATTERN: 1. All laboratory experiments should be included for practical examination, from which students are allowed to pick one experiment from the lot. 2. SEE shall be conducted for 100 Marks and the marks will be scaled down to 50. 3. General Marks Distribution: Procedure + Conduction + Viva = 20% + 50% + 30%. 4. Change of experiment is allowed only once and 20% of the marks allotted to the Procedure will be made ZERO (if a question carries two experiments, both should be changed). The evaluation will be done for 80% of the total maximum marks.

ETHICAL HACKING
(Effective from the Academic Year 2023 - 2024)
III SEMESTER

Course Code	**CS322T6CD**	**CIA Marks**	**50**
Number of Contact Hours/Week (L: T: P: S)	**3:0:0:0**	**SEE Marks**	**50**
Total Hours of Pedagogy	**40L**	**Exam Hours**	**03**

CREDITS – 3

COURSE PREREQUISITES:

- Fundamental knowledge of Ethical Hacking.

COURSE OBJECTIVES:

- To understand the basics of computer-based vulnerabilities.
- To explore different foot printing, reconnaissance and scanning methods.
- To expose the enumeration and vulnerability analysis methods.
- To understand hacking options available in Web and wireless applications.
- To explore the options for network protection.
- To practice tools to perform ethical hacking to expose the vulnerabilities.

TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

COURSE CONTENTS

MODULE – I	
Introduction to Ethical Hacking: Ethical Hacking Overview, Role of Security and Penetration Testers, Penetration, Testing Methodologies, Laws of the Land, Overview of TCP/IP, The Application Layer, The Transport Layer, The Internet Layer, IP Addressing, Network and Computer Attacks, Malware, Protecting Against Malware Attacks, Intruder Attacks, Addressing Physical Security.	**8 Hours**
MODULE – II	
Foot Printing, Reconnaissance and scanning Networks: Foot printing Concepts, Foot printing through Search Engines, Web Services, Social Networking Sites, Website, Email, Competitive Intelligence, Foot printing through Social Engineering, Foot printing Tools, Network Scanning Concepts, Port-Scanning Tools, Scanning Techniques, Scanning Beyond IDS and Firewall.	**8 Hours**
MODULE – III	
Enumeration and Vulnerability Analysis: Enumeration Concepts, NetBIOS Enumeration, SNMP, LDAP, NTP, SMTP and DNS Enumeration, Vulnerability Assessment Concepts, Desktop and Server OS Vulnerabilities, Windows OS Vulnerabilities, Tools for Identifying Vulnerabilities in Windows- Linux OS Vulnerabilities, Vulnerabilities of Embedded Oss.	**8 Hours**

MODULE – IV	
System Hacking: Hacking Web Servers, Web Application Components, Vulnerabilities, Tools for Web Attackers and Security Testers Hacking Wireless Networks, Components of a Wireless Network, Wardriving, Wireless Hacking, Tools of the Trade.	**8 Hours**

MODULE – V	
Network Protection Systems: Access Control Lists, Cisco Adaptive Security Appliance Firewall, Configuration and Risk Analysis Tools for Firewalls and Routers, Intrusion Detection and Prevention Systems, Network Based and Host Based IDSs and IPSs, Web Filtering, Security Incident Response Teams, Honeypots.	**8 Hours**

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	To express knowledge on basics of computer-based vulnerabilities	CL2
CO2	To gain understanding on different foot printing, reconnaissance and scanning methods.	CL2
CO3	To demonstrate the enumeration and vulnerability analysis methods.	CL3
CO4	To gain knowledge on hacking options available in Web and wireless applications.	CL2
CO5	To acquire knowledge on the options for network protection.	CL2

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	1											1	2	1
CO2	2	1	3										1	2	1
CO3	2	1	3										1	1	1
CO4	2	1	3										1	1	1
CO5	2	1											1	1	1

3: Substantial (High) | **2: Moderate (Medium)** | **1: Poor (Low)**

ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Continuous Internal Evaluation (CIE)	60 %	30
	Assignments	40 %	20
2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT DETAILS

Continuous Internal Assessment (CIA) (50%)				Semester End Exam (SEE) (50%)
Continuous Internal Evaluation (CIE) (60%)			Assignment/ Activities (40%)	
I	II	III		
Syllabus Coverage			Syllabus Coverage	Syllabus Coverage
40%	30%	30%	100%	100%
MI			MI	MI
MII	MII		MII	MII
	MIII		MIII	MIII
		MIV	MIV	MIV
		MV	MV	MV

Note: For Examinations (both CIE and SEE), the question papers shall contain the questions mapped to the appropriate Bloom's Level. Any COs mapped with higher cognitive Bloom's Level may also be assessed through the assignments.

ASSIGNMENT TYPES WITH WEIGHTAGES

Sl. No.	Assignment Description	Max. Weightage (%)	Max. Marks
1	Written Assignments	25 %	05
2	Quiz	10 %	02
3	Case Studies	25 %	05
4	Seminar/Presentation	15 %	03
5	Peer - to - Peer Learning	10 %	02
6	Activity Based Learning	50 %	10
7	Project Based Learning	50 %	10
8	Field Work + Report	50 %	10
9	Industry Visit + Report	50 %	10
10	NPTEL/MOOC Courses – Registration and Assignment Submissions	50 %	10
	NPTEL Certification	75 %	15
11	Any other Innovative Assignments (CL4 and above)	50 %	10

Note: The assignments mentioned above may be provided appropriately to the students belonging to different bands

SEE QUESTION PAPER PATTERN:

- The question paper will have **TEN** full questions from **FIVE** Modules
- There will be 2 full questions from each module. Every question will carry a maximum of 20 marks.
- Each full question may have a maximum of four sub-questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting one full question from each module.

REFERENCE BOOKS:

1. Michael T. Simpson, Kent Backman, and James E. Corley, Hands-On Ethical Hacking and Network Defense, Course Technology, Delmar Cengage Learning, 2010.
2. The Basics of Hacking and Penetration Testing - Patrick Engebretson, SYNGRESS, Elsevier, 2013.
3. The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws, Dafydd Stuttard and Marcus Pinto, 2011.
4. Black Hat Python: Python Programming for Hackers and Pentesters, Justin Seitz, 2014.

SAHYADRI
COLLEGE OF ENGINEERING & MANAGEMENT
An Autonomous Institution
MANGALURU

UHV -1: SOCIAL CONNECT AND RESPONSIBILITIES
(Effective from the Academic Year 2023 - 2024)
III SEMESTER

Course Code	**HU32287X**	**CIA Marks**	**50**
Number of Contact Hours/Week (L: T: P: S)	**1:0:0:0**	**SEE Marks**	**50**
Total Hours of Pedagogy	**15**	**Exam Hours**	**03**

CREDITS – 1

COURSE PREREQUISITES:

- Have/Develop the critical analysis of the day today happenings.

COURSE OBJECTIVES:

This course will enable students to:

- Enable the student to do a deep drive into societal challenges being addressed by NGO(s), social enterprises & The government and build solutions to alleviate these complex social problems through immersion, design & technology.
- Provide a formal platform for students to communicate and connect to their surroundings.
- Enable to create a responsible connection with society

TEACHING - LEARNING STRATEGY:

These are some sample strategies, which course faculty members can incorporate in the Teaching Learning Process:

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies

COURSE CONTENTS

MODULE – I	
Connectivity with Nature: Importance of plants**,** Plantation process, **Plant Development:** Sequence of Plant Development, Factors affecting Plant Development, Practice Problems. Activity: Self-study on selected plant's origin, its usage in daily life and its appearance in folklore and literature.	**3 Hours**
MODULE – II	
Heritage walks and Regional Crafts: An overview of Heritage, Awareness on Indian Cultural Heritages, Crafts & Heritage, Protective measures for the survival of handicrafts. Activity: Self-study on selected Heritage and its Inheritance.	**3 Hours**
MODULE – III	
Organic farming and waste management: Introduction of organic farming, study on wet waste management, Effects of organic farming on crop productivity.	**3 Hours**
MODULE – IV	
Water Conservation: Necessity of water conservation, study on water reuse, an overview on rainwater harvesting. Activity: Documentary or photo blog presenting the current practices.	**3 Hours**
MODULE - V	
Food Practices: Fast foods - nutritional value, food lore and indigenous materials of the region used in cooking.	**3 Hours**

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	**Course Outcome Description**	**Bloom's Taxonomy Level**

CO1	To understand the social responsibility of individual-Adaptation and Plantation of Tree	CL3
CO2	To know the heritage and holistic places - Heritage walk and crafts corner	CL3
CO3	To understand the importance of Organic farming and waste management	CL3
CO4	To know the importance and necessity of Water Conservation	CL3
CO5	To understand diverse food practices of the region.	CL3

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1			1			1	2	1	2			1			
CO2			1			1	1	1	1			1			
CO3			1			1	2	1				1			
CO4			1			1	2	1				1			
CO5						1	1	1				1			

3: Substantial (High)	2: Moderate (Medium)	1: Poor (Low)

ASSESSMENT STRATEGY

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Continuous Internal Evaluation (CIE)	60 %	30
	Assignments	40 %	20
2	**Semester End Examination (SEE)**	**100 %**	**50**

CO - ASSESSMENT MAPPING

Course Outcomes	Continuous Internal Assessment (CIA) (50%)				Semester End Exam (SEE) (50%)
	Continuous Internal Evaluation (CIE) (60%)			Assignment/ Activities (40%)	
	I	II	III		
	Syllabus Coverage			Syllabus Coverage	Syllabus Coverage
	40%	30%	30%	100%	100%
CO1	MI			**MI**	**MI**
CO2	MII	MII		**MII**	**MII**
CO3		MIII		**MIII**	**MIII**
CO4			MIV	**MIV**	**MIV**
CO5			MV	**MV**	**MV**

Note: For Examinations (both CIE and SEE), the question papers shall contain the questions mapped to the appropriate Bloom's Level. Any COs mapped with higher cognitive Bloom's Level may also be assessed through the assignments.

ASSIGNMENT TYPES WITH WEIGHTAGES

Sl. No.	Assignment Description	Max. Weightage (%)	Max. Marks
1	Written Assignments	25 %	05
2	Case Studies	25 %	05
3	Seminar/Presentation	25 %	05
4	Peer - to - Peer Learning	25 %	05

Note: The assignments mentioned above may be provided appropriately to the students belonging to different bands

SEE Question Paper Pattern:

- The question paper will have **seventy MCQ** questions and **six** main questions.
- Each MCQ questions consisting of 1mark; and main questions of 5 marks.
- Main questions will be asked from all FIVE modules.

REFERENCE BOOKS:

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books,New Delhi, 2010
2. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
3. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
4. The Story of Stuff (Book).
5. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
6. Small is Beautiful - E. F Schumacher.

DATA ANALYTICS USING EXCEL

(Effective from the Academic Year 2023 - 2024)

III SEMESTER

Course Code	**CS32298CA**	**CIA Marks**	**50**
Number of Contact Hours/Week (L: T: P: S)	**0:0:2:0**	**SEE Marks**	**50**
Total Hours of Pedagogy	**20P**	**Exam Hours**	**03**

CREDITS – 1

COURSE PREREQUISITES:

- Basic Knowledge of Computers.

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 STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- Any other innovative initiatives with respect to the Course contents

LIST OF EXPERIMENTS

Sl. No.	Description
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 Reference Functions: use of UPPER and LOWER, TRIM function, Concatenate.
6	Cleaning Data Containing Date and Time Values: use of DATEVALUE function, DATEADD and DATEDIF, TIMEVALUE functions.
7	Conditional Formatting: formatting, parsing, and highlighting data in spreadsheets during data analysis.
8	Working with Multiple Sheets: work with multiple sheets within a workbook is crucial for organizing and managing data, perform complex calculations and create comprehensive reports.
9	Create worksheet with following fields: Empno, Ename, Basic Pay (BP), Travelling Allowance (TA), Dearness Allowance (DA), House Rent Allowance (HRA), Income Tax (IT), Provident Fund (PF), Net Pay (NP). Use appropriate formulas to calculate the above scenario. Analyse the data using appropriate chart and report the data.
10	Create worksheet on Inventory Management: Sheet should contain Product code, Product name, Product type, MRP, Cost after % of discount, Date of purchase. Use appropriate formulas to calculate the above scenario.

	Analyse the data using appropriate chart and report the data.
11	Create worksheet on Sales analysis of Merchandise Store: data consisting of Order ID, Customer ID, Gender, age, date of order, month, online platform, Category of product, size, quantity, amount, shipping city and other details.
	Use of formula to segregate different categories and perform a comparative study using pivot tables and different sort of charts.
12	Generation of report & presentation using Autofilter &macro.

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Use advanced functions and productivity tools to assist in developing worksheets	CL2
CO2	Manipulate data lists using Outline and PivotTables	CL3
CO3	Use Consolidation to summarize and report results from multiple worksheets	CL3
CO4	Apply Macros and Auto filter to solve the given real-world scenario	CL3

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2	2	2									2	2	
CO2	3	2	2	2									2	2	
CO3	3	2	2	2									2	2	
CO4	3	2	2	2									2	2	
CO5															

3: Substantial (High) | **2: Moderate (Medium)** | **1: Poor (Low)**

ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Laboratory Work (A)	50 %	25
	Laboratory Test (B)	30 %	15
	Problems solved in Competitive Programming websites (C)	20 %	10
2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT STRATEGY:

I. In Laboratory Courses where (B) and (C) are not the components of the assessment pattern, then (A) will have 100% weightage (50 Marks).

Assessment Mode: Weekly Assessment of Laboratory Work (50 Marks) - the marks will be awarded based on the Continuous Internal Assessment (Weekly Assessment, each of 25 marks) of the students in each laboratory session. The average of all the marks obtained across the sessions will be the Final CIA marks.

II. In Laboratory Courses where (C) is not a component of the assessment pattern, then (A) will have 50% weightage (25 Marks), and (B) will have 50% weightage (25 Marks).

Assessment Mode: The marks will be awarded based on the Continuous Internal Assessment (Weekly Assessment) (A) and One Laboratory Test (B).

- In Weekly Assessment, the student will be evaluated in each laboratory session for 25 marks. The average marks obtained across all the experiments will be the marks obtained for (A).
- A Laboratory Test, similar to the SEE exam is conducted towards the end of the Semester/Course, whichever is earlier. The obtained marks are scaled down to 25 Marks (B)

The Sum of marks obtained across (A) and (B) will be the Final CIA marks.

III. In Laboratory Courses where (C) is a component of the assessment pattern, then assessment will be done by considering the weightages given above, i.e. (A) – 25 Marks (Weekly Assessment), (B) – 15 Marks (Laboratory Examination), (C) – 10 marks (Open Ended Experiments/Mini Projects)

- The respective course instructor will design the assessment criteria for the said assessment components.
- The assessment components will be made known to the students by the respective Course Coordinators prior to the commencement of the Laboratory Work.

In all the cases, the assessments will be done based on the criteria designed by the Course Coordinator.

SEE QUESTION PAPER PATTERN:

1. All laboratory experiments should be included for practical examination, from which students are allowed to pick one experiment from the lot.
2. SEE shall be conducted for 100 Marks and the marks will be scaled down to 50.
3. General Marks Distribution: Procedure + Conduction + Viva = 20% + 50% + 30%.
4. Change of experiment is allowed only once and 20% of the marks allotted to the Procedure will be made ZERO (if a question carries two experiments, both should be changed). The evaluation will be done for 80% of the total maximum marks.

UI/UX Design

(Effective from the Academic Year 2022-2023)

III SEMESTER

Course Code	**CS32298CB**	**CIA Marks**	**50**
Number of Contact Hours/Week (L: T: P: S)	**0:0:2:0**	**SEE Marks**	**50**
Total Hours of Pedagogy	**20P**	**Exam Hours**	**03**

CREDITS – 1

COURSE PREREQUISITES:

- Basic Knowledge of creating Graphical User Interface

COURSE OBJECTIVES:

- To provide students with the knowledge of user- centered design, user -centered methods in design, graphic design on screens.
- Learn about the importance of user experience design in the digital world.
- To enable the students to design the user centered design in corporate perspective.
- To give exposure to wire framing and Prototyping software in the various UI/UX Design tools.

TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

LIST OF EXPERIMENTS

SI. No	Description	CO
1	Demonstrate the Interface connectivity between two different program modules.	CO1
2	Designing a small calculator app using Figma.	CO2/CO3
3	Create a photo gallery prototype using Figma.	CO2/CO3
4	Create a custom profile card using Figma.	CO2/CO3
5	Build the user interface for calendar application using Adobe XD	CO2/CO3
6	Build the Travel application design using Adobe XD and include animation between contents between different screens.	CO2/CO3

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Illustrate effective and compelling screen-based experiences in UI/UX development.	CL4
CO2	Experiment and analyze the various visual design aspects in UI/UX development.	CL4
CO3	Analyze all stages of the UI/UX development process in different tools.	CL4

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	3	2	3				2		3	3	3	3
CO2	3	2	3	2	3				2		3	3	3	3
CO3	3	2	3	2	3				2		3	3	3	3
CO4	3	2	3	2	3				2		3	3	3	3
CO5	3	2	3	2	3				2		3	3	3	3
3: Substantial (High)					2: Moderate (Medium)					1: Poor (Low)				

ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Laboratory Work (A)	50 %	25
	Laboratory Test (B)	30 %	15
	Open Ended Experiments /Mini Projects (C)	20 %	10
2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT STRATEGY:

I. In Laboratory Courses where (B) and (C) are not the components of the assessment pattern, then (A) will have 100% weightage (50 Marks).

Assessment Mode: Weekly Assessment of Laboratory Work (50 Marks) - the marks will be awarded based on the Continuous Internal Assessment (Weekly Assessment, each of 25 marks) of the students in each laboratory session. The average of all the marks obtained across the sessions will be the Final CIA marks.

II. In Laboratory Courses where (C) is not a component of the assessment pattern, then (A) will have 50% weightage (25 Marks), and (B) will have 50% weightage (25 Marks).

Assessment Mode: The marks will be awarded based on the Continuous Internal Assessment (Weekly Assessment) (A) and One Laboratory Test (B).

- In Weekly Assessment, the student will be evaluated in each laboratory session for 25 marks. The average marks obtained across all the experiments will be the marks obtained for (A).
- A Laboratory Test, similar to the SEE exam is conducted towards the end of the Semester/Course, whichever is earlier. The obtained marks are scaled down to 25 Marks (B)

The Sum of marks obtained across (A) and (B) will be the Final CIA marks.

III. In Laboratory Courses where (C) is a component of the assessment pattern, then assessment will be done by considering the weightages given above, i.e. (A) – 25 Marks (Weekly Assessment), (B) – 15 Marks (Laboratory Examination), (C) – 10 marks (Open Ended Experiments/Mini Projects)

- The respective course instructor will design the assessment criteria for the said assessment components.
- The assessment components will be made known to the students by the respective Course Coordinators prior to the commencement of the Laboratory Work.

In all the cases, the assessments will be done based on the criteria designed by the Course Coordinator.

SEE QUESTION PAPER PATTERN:

1. All laboratory experiments should be included for practical examination, from which students are allowed to pick one experiment from the lot.
2. SEE shall be conducted for 100 Marks and the marks will be scaled down to 50.

General Marks Distribution: Procedure + Conduction + Viva = 20% + 50% + 30%.

3. Change of experiment is allowed only once and 20% of the marks allotted to the Procedure will be made ZERO (ifa question carries two experiments, both should be changed). The evaluation will be done for 80% of the total

maximum marks.

MERN

(Effective from the Academic Year 2023 - 2024)

III SEMESTER

Course Code	**CS32298CC**		CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	0:0:2:0		SEE Marks	50
Total Hours of Pedagogy	20P		Exam Hours	03

CREDITS – 1

COURSE PREREQUISITES:

- Fundamental Knowledge of HTML, CSS.

COURSE OBJECTIVES:

- To design as web page using front end technologies.
- To develop application with server-side scripting tools.
- To develop web application with REST APIs and use of framework to communicate client-server applications.
- To build as responsive web application with managing SQL databases.

TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

LIST OF EXPERIMENTS

Sl. No.	Description
1	Demonstrate React Component Life cycle.
2	Develop React components for a basic frontend application.
3	Simulate the process of establishing communication between the React frontend and Express backend.
4	Demonstrate process of connecting Express application to a MongoDB database and perform database operations.
5	Implement MERN application for user authentication and authorization
6	Demonstrate the Redux integration method for state management in your React application.
7	Build a web application using the Express.js framework.
8	Develop a Node.js application demonstrating handling data I/O (Buffer, Stream, Zlib modules).

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Demonstrate React Component Life cycle and implement React components for a basic frontend application.	CL3
CO2	Illustrate the process of establishing communication between the React frontend and Express backend.	CL3
CO3	Demonstrate various database operations by connecting Express application to a MongoDB Database.	CL3
CO4	Illustrate MERN application for user authentication and implement Redux integration method for state	CL3

	management.	
CO5	Demonstrate Node.js application and handling I/O data.	CL3

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1		2				1			2	1	1	1
CO2	3	2	1		2				1			2	1	1	1
CO3	3	2	1		2				1			2	1	1	1
CO4	3	2	1		2				1			2	1	1	1
CO5	3	2	1		2				1			2	1	1	1

3: Substantial (High) | **2: Moderate (Medium)** | | **1: Poor (Low)**

ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)		Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**		**50**
	Laboratory Work (A)	50 %		25
	Laboratory Test (B)	30 %		15
	Open Ended Experiments /Mini Projects (C)	20 %		10
2	**Semester End Examination (SEE)**	**100 %**		**50**

ASSESSMENT STRATEGY:

I. In Laboratory Courses where (B) and (C) are not the components of the assessment pattern, then (A) will have 100% weightage (50 Marks).

Assessment Mode: Weekly Assessment of Laboratory Work (50 Marks) - the marks will be awarded based on the Continuous Internal Assessment (Weekly Assessment, each of 25 marks) of the students in each laboratory session. The average of all the marks obtained across the sessions will be the Final CIA marks.

II. In Laboratory Courses where (C) is not a component of the assessment pattern, then (A) will have 50% weightage (25 Marks), and (B) will have 50% weightage (25 Marks).

Assessment Mode: The marks will be awarded based on the Continuous Internal Assessment (Weekly Assessment) (A) and One Laboratory Test (B).

- In Weekly Assessment, the student will be evaluated in each laboratory session for 25 marks. The average marks obtained across all the experiments will be the marks obtained for (A).
- A Laboratory Test, similar to the SEE exam is conducted towards the end of the Semester/Course, whichever is earlier. The obtained marks are scaled down to 25 Marks (B)

The Sum of marks obtained across (A) and (B) will be the Final CIA marks.

III. In Laboratory Courses where (C) is a component of the assessment pattern, then assessment will be done by considering the weightages given above, i.e. (A) – 25 Marks (Weekly Assessment), (B) – 15 Marks (Laboratory Examination), (C) – 10 marks (Open Ended Experiments/Mini Projects)

- The respective course instructor will design the assessment criteria for the said assessment components.
- The assessment components will be made known to the students by the respective Course Coordinators prior to the commencement of the Laboratory Work.

In all the cases, the assessments will be done based on the criteria designed by the Course Coordinator.

SEE QUESTION PAPER PATTERN:

1. All laboratory experiments should be included for practical examination, from which students are allowed to pick one experiment from the lot.
2. SEE shall be conducted for 100 Marks and the marks will be scaled down to 50.
3. General Marks Distribution: Procedure + Conduction + Viva = 20% + 50% + 30%.
4. Change of experiment is allowed only once and 20% of the marks allotted to the Procedure will be made ZERO (if a

		question carries two experiments, both should be changed). The evaluation will be done for 80% of the total maximum marks.

COMPETITIVE PROGRAMMING USING C++
(Effective from the Academic Year 2023 - 2024)
III SEMESTER

Course Code	**CS32298CD**	**CIA Marks**	**50**
Number of Contact Hours/Week (L: T: P: S)	**0:0:2:0**	**SEE Marks**	**50**
Total Hours of Pedagogy	**20P**	**Exam Hours**	**03**

CREDITS – 1

COURSE PREREQUISITES:

- Basic Knowledge of C.

COURSE OBJECTIVES:

TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- Any other innovative initiatives with respect to the Course contents

LIST OF EXPERIMENTS

Sl. No.	Description
1	Introduction to programming in C++: input/output, variables, datatypes, operators (Arithmetic, Assignment, Logical, comparison, Bitwise, operator precedence)
2	Conditions, Loop, Functions, Introduction to competitive programming- sample programs
3	Simple programs in C++
4	Standard Template Library: Sequential – Pairs, Programs
5	Standard Template Library: Sequential – Vectors, Programs
6	Standard Template Library: Sequential- Stacks, Programs
7	Standard Template Library: Sequential- Queue, Programs
8	Standard Template Library: Ordered and Unordered Maps, Programs
9	Standard Template Library: Ordered and Unordered – Sets, Programs
10	Recursion, backtracking, Upper Bound, Lower Bound
11	Recursion, backtracking, Upper Bound, Lower Bound
12	Introduction to Classes and objects in C++, Programs

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Write simple programs in C++ and work with various competitive programming websites	CL2
CO2	Understand and apply Pair, and vectors as a part of the Standard Template Library (STL) in C++ to different problem statements	CL3
CO3	Understand and apply Stacks, and queue as a part of the STL in C++ to different problem statements	CL3
CO4	Understand and apply Maps, and Sets as STL in C++ to different problem statements	CL3
CO5	Understand and apply Object Oriented Concepts in C++, recursion and backtracking	CL2

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	1	3							2	2	1	3
CO2	3	3	3	1	3							2	2	1	3
CO3	3	3	3	1	3							2	2	1	3
CO4	3	3	3	1	3							2	2	1	3
CO5	3	3	3	1	3							2	2	1	3

3: Substantial (High) | **2: Moderate (Medium)** | **1: Poor (Low)**

ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Laboratory Work (A)	50 %	25
	Laboratory Test (B)	30 %	15
	Problems solved in Competitive Programming websites (C)	20 %	10
2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT STRATEGY:

I. In Laboratory Courses where (B) and (C) are not the components of the assessment pattern, then (A) will have 100% weightage (50 Marks).

Assessment Mode: Weekly Assessment of Laboratory Work (50 Marks) - the marks will be awarded based on the Continuous Internal Assessment (Weekly Assessment, each of 25 marks) of the students in each laboratory session. The average of all the marks obtained across the sessions will be the Final CIA marks.

II. In Laboratory Courses where (C) is not a component of the assessment pattern, then (A) will have 50% weightage (25 Marks), and (B) will have 50% weightage (25 Marks).

Assessment Mode: The marks will be awarded based on the Continuous Internal Assessment (Weekly Assessment) (A) and One Laboratory Test (B).

- In Weekly Assessment, the student will be evaluated in each laboratory session for 25 marks. The average marks obtained across all the experiments will be the marks obtained for (A).
- A Laboratory Test, similar to the SEE exam is conducted towards the end of the Semester/Course, whichever is earlier. The obtained marks are scaled down to 25 Marks (B)

The Sum of marks obtained across (A) and (B) will be the Final CIA marks.

III. In Laboratory Courses where (C) is a component of the assessment pattern, then assessment will be done by considering the weightages given above, i.e. (A) – 25 Marks (Weekly Assessment), (B) – 15 Marks (Laboratory

Examination), (C) – 10 marks (Open Ended Experiments/Mini Projects)

- The respective course instructor will design the assessment criteria for the said assessment components.
- The assessment components will be made known to the students by the respective Course Coordinators prior to the commencement of the Laboratory Work.

In all the cases, the assessments will be done based on the criteria designed by the Course Coordinator.

SEE QUESTION PAPER PATTERN:

1. All laboratory experiments should be included for practical examination, from which students are allowed to pick one experiment from the lot.
2. SEE shall be conducted for 100 Marks and the marks will be scaled down to 50.
3. General Marks Distribution: Procedure + Conduction + Viva = 20% + 50% + 30%.
4. Change of experiment is allowed only once and 20% of the marks allotted to the Procedure will be made ZERO (if a question carries two experiments, both should be changed). The evaluation will be done for 80% of the total maximum marks.

WEB TECHNOLOGY AND APPLICATIONS
(Effective from the Academic Year 2023 - 2024)
IV SEMESTER

Course Code	**CS422I1C**	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	3:0:2:0	SEE Marks	50
Total Hours of Pedagogy	40L + 20P	Exam Hours	03

CREDITS – 4

COURSE PREREQUISITES:

- Programming Fundamentals

COURSE OBJECTIVES:

Develop web pages using HTML syntax and semantics.

- Develop web pages using HTML syntax and semantics.
- Construct and visually format forms using HTML and CSS.
- Develop Client-Side Scripts using JavaScript to generate and display the contents dynamically.
- Develop fully functional dynamic web applications using the concepts of PHP, MySQL.
- Construct scalable web-based system using Laravel.

TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

COURSE CONTENTS

MODULE – I

Introduction to HTML: Introduction to HTML, What is HTML and Where did it come from?, HTML Syntax, Semantic Markup, Structure of HTML Documents, Quick Tour of HTML Elements, HTML5 Semantic Structure Elements, HTML Tables and Forms, Introducing Tables, Styling Tables, Introducing Forms, Form Control Elements, Table and Form Accessibility.	**8 Hours**

MODULE – II

Cascade Style Sheet: Introduction to CSS, What is CSS, CSS Syntax, Location of Styles, Selectors, The Cascade: How Styles Interact, The Box Model, CSS Reference Styling. **Advanced CSS:** Layout, Normal Flow, Positioning Elements, Floating Elements, Constructing Multicolumn Layouts, Approaches to CSS Layout, Responsive Design, CSS Frameworks.	**8 Hours**

MODULE – III

JavaScript: Client-Side Scripting, What is JavaScript and What can it do?, JavaScript Design Principles, Where does JavaScript Go?, Syntax, JavaScript Objects, The Document Object Model (DOM), JavaScript Events, Forms.	**8 Hours**

MODULE – IV

Introduction to Server-Side Development with PHP: Introduction to Server-Side Development with PHP, What is Server-Side Development, , Quick Tour of PHP, Program Control, Functions PHP Arrays and Superglobals, Arrays, $_GET and $_POST Superglobal Arrays, $_SERVER Array, $_Files Array, Reading/Writing Files. **Working with Databases:** Databases and Web Development, SQL, Database APIs, managing a MYSQL Database, Accessing MySQL in PHP, Building a application to connect front end to back end.	**8 Hours**

MODULE – V	
PHP MVC Framework Laravel: Why Laravel, Setting Up a Laravel Development Environment, Blade Templating, Collecting and handling user data.	**8 Hours**

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Develop web pages using HTML syntax and semantics.	CL3
CO2	Construct and visually format forms using HTML and CSS.	CL3
CO3	Develop Client-Side Scripts using JavaScript to generate and display the contents dynamically.	CL3
CO4	Develop fully functional dynamic web applications using the concepts of PHP, MySQL.	CL3
CO5	Construct scalable web based system using Laravel.	CL3

LABORATORY COMPONENTS

Exp. No.	Experiment Description	CO No.	Bloom's Taxonomy Level
1.	Create a simple webpage using HTML.	CO1	CL3
2.	Use frames to Include Images and Videos.	CO1	CL3
3.	Add a Cascading Style sheet for designing the web page.	CO2	CL3
4.	Design a dynamic web page with validation using JavaScript.	CO3	CL3
5.	Design an HTML having a Reference box and four buttons viz Factorial, Fibonacci, Prime, and Palindrome. When a button is pressed an appropriate javascript function should be called to display a. Factorial of that number b. Fibonacci series up to that number c. Prime numbers up to that number d. Is it palindrome or not	CO3	CL3
6.	Write JavaScript programs on Event Handling a. Validation of registration form b. Open a Window from the current window c. Change color of background at each click of button or refresh of a page d. Display calendar for the month and year selected from combo box e. On Mouse over event	CO3	CL3
7.	Demonstrate a simple web application using PHP, MySQL.	CO4	CL3
8.	Demonstrate a simple web application in PHP MVC Framework using Laravel	CO5	CL3

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	3		3				3	3	3	3	2	2	2
CO2	3	2	3		3				3	3	3	3	2	2	2
CO3	3	2	3		3				3	3	3	3	2	2	2
CO4	3	2	3		3				3	3	3	3	2	2	2
CO5	3	2	3		3				3	3	3	3	2	2	2

3: Substantial (High) | **2: Moderate (Medium)** | **1: Poor (Low)**

ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Continuous Internal Evaluation (CIE)	60 %	30
	Practical Session (Laboratory Component)	40 %	20
2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT DETAILS

Continuous Internal Assessment (CIA) (50%)				**Semester End Exam (SEE) (50%)**
Continuous Internal Evaluation (CIE) (60%)			**Practical Sessions (40%)**	
I	**II**	**III**		
Syllabus Coverage			**Syllabus Coverage**	**Syllabus Coverage**
40%	**30%**	**30%**	**100%**	**100%**
MI			MI	MI
MII	MII		MII	MII
	MIII		MIII	MIII
		MIV	MIV	MIV
		MV	MV	MV

NOTE:

- Assessment will be both CIA and SEE.
- The practical sessions of the IPCC shall be for CIE only.
- The Theory component of the IPCC shall be for both CIA and SEE respectively.
- The questions from the practical sessions shall be included in Theory SEE.

Note: For Examinations (both CIE and SEE), the question papers shall contain the questions mapped to the appropriate Bloom's Level. Any COs mapped with higher cognitive Bloom's Level may also be assessed through the assignments.

SEE QUESTION PAPER PATTERN:

1. The question paper will have **TEN** full questions from **FIVE** Modules
2. There will be 2 full questions from each module. Every question will carry a maximum of 20 marks.
3. Each full question may have a maximum of four sub-questions covering all the topics under a module.
4. The students will have to answer FIVE full questions, selecting one full question from each module.

OPERATING SYSTEMS

(Effective from the Academic Year 2023 - 2024)

IV SEMESTER

Course Code	**CS422I2C**	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	3:0:2:0	SEE Marks	50
Total Hours of Pedagogy	40L + 20P	Exam Hours	03

CREDITS – 4

COURSE PREREQUISITES(THEORY):

- C Programming, Data Structures, Object Oriented Programming, Computer Organization

COURSE OBJECTIVES:

The course will enable the student to

- Obtain awareness on various types of operating systems and their structures.
- Understand and implement the concept of Process and threads
- Demonstrate the common synchronization problems arising in the Operating systems and provide solutions to them
- Demonstrate the issue of deadlock and handle them effectively.
- Understand the concept of Memory and demonstrate its management using various strategies.
- Know the various storage mechanisms available and discuss the management of storage space.

TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- PowerPoint Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

COURSE CONTENTS

MODULE - I

Operating Systems and Structures: Introduction, user view, system view, Single processor systems, multiprocessors systems, clustered systems, multiprogramming and multitasking, dual mode and multimode operations, Distributed systems, Computing environments, Operating System services, System Calls, Linkers and Loader, Operating system design and implementation, Operating System Structures. **Process Management:** Process concept, process state, process control block, context switch; operations on processes, inter process communication.	**8 Hours**

MODULE - II

Multi-Threaded Programming: Overview of threads, multithreading models, thread libraries, threading issues. **CPU Scheduling:** Schedulers, Pre-emptive and non-pre-emptive scheduling, dispatcher; Scheduling Criteria. **Scheduling Algorithms:** FCFS, SJF, SRTF, RR, Priority, HRRN, multi-level feedback Queue scheduling, Multiprocessor scheduling.	**8 Hours**

MODULE - III	
Process Synchronization: Background, critical section problem, Peterson's solution; synchronization hardware- mutex, semaphores, monitors. **Deadlocks:** System model, necessary conditions for deadlocks, methods for handling deadlocks, deadlock prevention, deadlock avoidance -resource allocation graph algorithm, banker's algorithm, deadlock detection, recovery from deadlock	**8 Hours**
MODULE - IV	
Memory Management: Background, contiguous memory allocation, paging, swapping. **Virtual Memory Management:** Background; demand paging: copy-on-write; page replacement algorithms - FIFO, Optimal, LRU; thrashing **File System Interface and Operations:** Access methods, Directory structures, Protection, File system structure, Directory implementation, Allocation methods, Free space management.	**8 Hours**
MODULE - V	
Storage Management and Security: Mass storage structures; Disk scheduling algorithms, Swap space management. **Protection:** Goals, Principles and Domains of protection, Access matrix, Implementation of access matrix, Revocation of access rights, Access control.	**8 Hours**

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Identify the structure of an operating system and concept of Process along with inter-process communication.	CL3
CO2	Apply the concepts of multi-threading and CPU scheduling algorithms by considering different scheduling criteria.	CL3
CO3	Demonstrate the concepts of Process synchronization and Identify root causes of deadlock to provide the solution for deadlock elimination.	CL3
CO4	Explore the concept of memory management, working of various page replacement algorithms and file system operations.	CL3
CO5	Analyze Disk Storage Structures and the concepts of OS protection.	CL4

LABORATORY COMPONENTS

Mandatory Experiment (for practice only, not to be included for exam):

1. Demonstrate the system assembly and disassembly of computer hardware components
2. Demonstrate the OS installation with Multi Booting and Virtual Machine platform.

Exp. No.	Experiment Description	CO No.	Bloom's Taxonomy Level
1	Write C programs to implement basic UNIX system calls - read(), write() open(),close(), lseek(), create().	CO5	CL3
2	Write C programs to implement UNIX Directory API's - opendir, closedir readdir, mkdir.	CO5	CL3
3	Demonstrate the Process creation and Termination using System calls –fork () vfork (), getpid (), waitpid (), exec, exit (), return 0.	CO1	CL3
4	Write C programs to simulate Inter – Process Communication (IPC) techniques: Pipes, Messages Queues, and Shared Memory.	CO1	CL3
5	Simulate the following CPU scheduling algorithms 1. FCFS 2. SJF 3. Priority 4. Round Robin.Calculate Average Waiting Time, Average Turn-Around Time, Average Response time for each algorithm.	CO2	CL3

6	Demonstrate the following Classical problems of synchronization using semaphores. a. Producer-Consumer b. Dining Philosopher	CO3	CL3
7	Demonstrate following page replacement algorithms: a. FIFO, b. LRU, c. OPTIMAL.	CO4	CL3
8	Analyze the seek time for the following Disk scheduling algorithms – 1. FCFS; 2. SCAN; 3. LOOK	CO5	CL3

CO-PO- PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	1	1			1	2	1		2	2	2	2
CO2	3	3	3	2	1			1	2	1		2	2	2	2
CO3	3	3	3	2	1			1	2	1		2	2	2	2
CO4	3	3	3	2	1			1	2	1		2	2	2	2
CO5	3	3	3	3	2			1	2	1		2	2	2	2

3: Substantial (High) | **2: Moderate (Medium)** | **1: Poor (Low)**

ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100%**	**50**
	Continuous Internal Evaluation (CIE)	60 %	30
	Practical Session (Laboratory Component)	40 %	20
2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT DETAILS

Continuous Internal Assessment (CIA) (50%)				Semester End Exam (SEE) (50%)
Continuous Internal Evaluation (CIE) (60%)			Practical Sessions (40%)	
I	**II**	**III**		
Syllabus Coverage			**Syllabus Coverage**	**Syllabus Coverage**
40 %	**30 %**	**30 %**	**100%**	**100%**
MI			MI	MI
MI I	MI I		MII	MII
	MI II		MIII	MIII
		M IV	MIV	MIV
		M V	MV	MV

NOTE:

- Assessment will be both CIA and SEE.
- The practical sessions of the IPCC shall be for CIE only.
- The Theory component of the IPCC shall be for both CIA and SEE respectively.
- The questions from the practical sessions shall be included in Theory SEE.

Note: For Examinations (both CIE and SEE), the question papers shall contain the questions mapped to the appropriate Bloom's Level. Any COs mapped with higher cognitive Bloom's Level may also be assessed through the assignments.

SEE QUESTION PAPER PATTERN:

1. The question paper will have **TEN** full questions from **FIVE** Modules
2. There will be 2 full questions from each module. Every question will carry a maximum of 20 marks.
3. Each full question may have a maximum of four sub-questions covering all the topics under a module.
4. The students will have to answer FIVE full questions, selecting one full question from each module.

REFERENCE BOOKS:

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, "Operating System Principles", 10th edition, Wiley-India, 2021
2. M. Morris Mano, "Computer System Architecture", PHI, 3rd Edition
3. Ann McHoes, Ida M Fylnn, "Understanding Operating System", Cengage Learning, 6th Edition
4. D.M Dhamdhere, "Operating Systems: A Concept Based Approach", 3rd Edition, McGraw- Hill, 2013.
5. P.C.P. Bhatt, "An Introduction to Operating Systems: Concepts and Practice", 4th Edition, PHI(EEE), 2014.
6. William Stallings, "Operating Systems: Internals and Design Principles", 6th Edition, Pearson.

COMPUTER ORGANIZATION AND ARCHITECTURE
(Effective from the Academic Year 2023 - 2024)
IV SEMESTER

Course Code	**CS422T3C**	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	**40L**	Exam Hours	03

CREDITS – 3

COURSE PREREQUISITES:

- Fundamental knowledge of basic logic design principles and various function of digital computer.

COURSE OBJECTIVES:

- Understand the organization and architecture of computer systems, their structure and operation
- Illustrate the concept of machine instructions and programs
- Demonstrate different ways of communicating with I/O devices
- Describe different types memory devices and their functions
- Explain arithmetic and logical operations with different data types
- Demonstrate processing unit with parallel processing and pipeline architecture

TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

COURSE CONTENTS

MODULE - I	
Basic Structure of Computers: Basic Operational Concepts, Bus Structures, Performance – Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement. Machine Instructions and Programs: Memory Location and Addresses, Memory Operations, Instructions and Instruction Sequencing, Addressing Modes	**8 Hours**
MODULE - II	
Input/Output Organization: Accessing I/O Devices, Interrupts – Interrupt Hardware, Direct Memory Access, Buses, Interface Circuits	**8 Hours**
MODULE - III	
Memory System: Basic Concepts, Semiconductor RAM Memories, Read Only Memories, Speed, Size, and Cost, Cache Memories – Mapping Functions, Virtual memories	**8 Hours**
MODULE - IV	
Arithmetic: Numbers, Arithmetic Operations and Characters, Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Positive Numbers Basic Processing Unit: Fundamental Concepts, Execution of a Complete Instruction, Hardwired control, Microprogrammed control	**8 Hours**
MODULE - V	
Pipeline and Vector Processing: Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, Vector Processing, Array Processors	**8 Hours**

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Explain the organization and architecture of computer systems with machine instructions and programs	CL2
CO2	Analyse the input/output devices communicating with computer system	CL3
CO3	Demonstrate the functions of different types of memory devices	CL3
CO4	Apply different data types on simple arithmetic and logical unit	CL3
CO5	Analyze the functions of basic processing unit, Parallel processing and pipelining	CL3

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1	1							2		2	2	2	2
CO2	3	1	1							2		2	2	2	2
CO3	3	1	1							2		2	2	2	2
CO4	3	1	2							2		2	2	2	2
CO5	3	1	2							2		2	2	2	2

3: Substantial (High)	2: Moderate (Medium)	1: Poor (Low)

ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Continuous Internal Evaluation (CIE)	60 %	30
	Assignments	40 %	20
2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT DETAILS

Continuous Internal Assessment (CIA) (50%)				Semester End Exam (SEE) (50%)
Continuous Internal Evaluation (CIE) (60%)			Assignment/ Activities (40%)	
I	II	III		
Syllabus Coverage			Syllabus Coverage	Syllabus Coverage
40%	30%	30%	100%	100%
MI			MI	MI
MII	MII		MII	MII
	MIII		MIII	MIII
		MIV	MIV	MIV
		MV	MV	MV

Note: For Examinations (both CIE and SEE), the question papers shall contain the questions mapped to the appropriate Bloom's Level. Any COs mapped with higher cognitive Bloom's Level may also be assessed through the assignments.

ASSIGNMENT TYPES WITH WEIGHTAGES

Sl. No.	Assignment Description	Max. Weightage (%)	Max. Marks
1	Written Assignments	25 %	05
2	Quiz	10 %	02
3	Case Studies	25 %	05
4	Seminar/Presentation	15 %	03
5	Peer - to - Peer Learning	10 %	02

6	Activity Based Learning	50 %	10
7	Project Based Learning	50 %	10
8	Field Work + Report	50 %	10
9	Industry Visit + Report	50 %	10
10	NPTEL/MOOC Courses – Registration and Assignment Submissions	50 %	10
	NPTEL Certification	75 %	15
11	Any other Innovative Assignments (CL4 and above)	50 %	10

Note: The assignments mentioned above may be provided appropriately to the students belonging to different bands

SEE QUESTION PAPER PATTERN:

- The question paper will have **TEN** full questions from **FIVE** Modules
- There will be 2 full questions from each module. Every question will carry a maximum of 20 marks.
- Each full question may have a maximum of four sub-questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting one full question from each module.

DESIGN AND ANALYSIS OF ALGORITHMS
(Effective from the Academic Year 2023 - 2024)
IV SEMESTER

Course Code	**CS422T4C**	CIA Marks	50
Number of Contact Hours/Week (L:T:P:S)	3:0:0:2	SEE Marks	50
Total Hours of Pedagogy	40 L + 20 S	Exam Hours	3 Hours

CREDITS – 3

COURSE PREREQUISITES:

- Fundamental knowledge of Mathematics, Data Structures.

COURSE OBJECTIVES:

This course will enable students to:

- Describe the techniques for analyzing algorithms and how to evaluate their performance. Indicate the effectiveness of the method using asymptotic notations.
- Utilize algorithm design techniques including the brute force approach, greedy approach, divide-and-conquer strategy, decrease-and-conquer strategy, transform-and-conquer strategy, dynamic programming, backtracking, and branch-and-bound to solve issues.
- Decide on the best data structure and algorithm design technique for the given application.
- Recognize the fundamental ideas behind NP-complete and NP-hard class issues.

TEACHING - LEARNING STRATEGY:

These are some sample strategies, which course faculty members can incorporate in the Teaching Learning Process:

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses

COURSE CONTENTS

MODULE - 1

Module Contents	Lecture Hours
Introduction to Algorithms- Properties, Specification, Fundamentals of Algorithmic Problem solving, Analysis Framework. **Performance Analysis:** Estimating Space complexity and Time complexity of algorithms. Asymptotic Notations with examples, Basic efficiency classes, Mathematical analysis of Non-Recursive and Recursive Algorithms with Examples. **Brute force design techniques:** Selection sort, sequential search and String-matching algorithm with complexity Analysis.	**8 Hours**

MODULE - 2

Divide and Conquer: General method, Recurrence equation for divides and conquers, solving it using Master's theorem. , Divide and Conquer algorithms and complexity Analysis of Finding the maximum & minimum, Binary search, Merge sort, Quick sort. **Decrease and Conquer Approach:** Introduction, Insertion sort, Topological Sorting and efficiency analysis.	**8 Hours**

MODULE - 3

Greedy Method: General method, Coin Change Problem, Knapsack Problem, Job sequencing with deadlines, Minimum cost spanning tree algorithms: Prim's Algorithm, Kruskal's Algorithm. **Single source shortest paths:** Dijkstra's Algorithm. **Optimal Tree problems:** Huffman Trees and Codes. **Transform and Conquer Approach:** Heaps and Heap Sort.	**8 Hours**

MODULE - 4

Dynamic Programming: General method with Examples, Multistage Graphs. **Transitive Closure:** Warshall's Algorithm. All Pairs Shortest Paths: Floyd's Algorithm, Knapsack problem, Optimal Binary Search Trees, Travelling Sales Person problem. **Space-Time Tradeoffs:** Sorting by Counting, Input Enhancement in String Matching Harspool's algorithm.	**8 Hours**

MODULE - 5

Backtracking: General method, N-Queens problem, Sum of subsets problem, Hamiltonian cycles Problems. **Branch and Bound:** Basic concepts, Assignment Problem, Travelling Sales Person problem, 0/1 Knapsack problem. **NP-Complete and NP-Hard problems:** Basic concepts, Non- deterministic algorithms, P, NP, NP-Complete, and NP-Hard classes.	**8 Hours**

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Solve the time complexity of recursive, non-recursive and brute force algorithm using asymptotic notations.	CL3
CO2	Solve the recurrence relation to obtain the performance of divide-and-conquer, decrease-and conquer approach.	CL3
CO3	Apply greedy technique, transform and conquer strategy to solve the problem for optimal solution.	CL3
CO4	Determine the time complexity for Dynamic-Programming paradigm and String-matching techniques.	CL3
CO5	Apply backtracking and branch-and-bound approach on combinatorial problems and categorize algorithms as P, NP, NP-complete and NP-hard classes.	CL3

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	1		1						3	2	2	2
CO2	3	3	2	1		1						3	2	2	2
CO3	3	3	3	1		1						3	2	2	2
CO4	3	3	3	1		1						3	2	2	2
CO5	3	3	3	1		1						3	2	2	2

3: Substantial (High)	2: Moderate (Medium)	1: Poor (Low)

CO - Assessment Mapping:

Course Outcomes	Continuous Internal Assessment (CIA) (50%)				Semester End Exam (SEE) (50%)
	Continuous Internal Evaluation (CIE) (60%)			Assignment/ Activities (40%)	
	I	II	III		
	Syllabus Coverage				
	40%	30%	30%	100%	100%
CO1	x			x	x

CO2	x			x	x
CO3		x		x	x
CO4		x	x	x	x
CO4			x	x	x

ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CI)**	**100 %**	**50**
	Continuous Internal Evaluation (CIE)	60 %	30
	Assignments*	40 %	20
2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT DETAILS

Sl. No.	Assignment Description	Max. Weightage	Max. Marks
1	Written Assignments	25 %	5
2	Quiz	25 %	5
3	Field Visits/Survey/Case Studies	50 %	10
4	Model / Prototype Development	100 %	20
5	Project Based Learning		
6	Seminar/Presentation	25 %	5
7	Peer - to -Peer Learning	25 %	5

SEE Question Paper Pattern:

- The question paper will have **TEN** full questions.
- Each full question consisting of 20 marks.
- There will be 2 full questions from all the FIVE modules.
- Each full question will have a maximum of four sub-questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

REFERENCE BOOKS:

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

DESIGN AND ANALYSIS OF ALGORITHMS LAB
(Effective from the Academic Year 2023 -2024)
SEMESTER - IV

Course Code	**CS422L5C**	CIA Marks	50
Number of Contact Hours/Week (L:T:P:S)	0:0:2:1	SEE Marks	50
Total Hours of Pedagogy	24 P+ 12 S	Exam Hours	3 Hours

CREDITS –1

COURSE PREREQUISITES:

- Knowledge of Mathematics, Data Structures and Programming

COURSE OBJECTIVES:

This course will enable students to:

- To design and implement various algorithms in C/C++/Java programming using suitable development tools to address different computational challenges. Make use of different algorithmic design techniques to solve problems.
- 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.

ALGORITHM IMPLEMENTATION USING PYTHON PROGRAMMING (MAX. MARKS: 50)

- Design, develop, and implement the specified algorithms using C/C++/Java Programming under LINUX/Windows environment.

	LIST OF EXPERIMENTS
Exp. No.	**Experiment Description**
1	Design and implement a 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.
2	Design and implement a 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.
3	Design and implement a Program to solve discrete Knapsack and continuous Knapsack problems using greedy approximation method.
4	Design an application for a thermal power station and electrical lines that are connected among various power stations. The costs of electrification involved appear as weights on the edges. Obtain the minimum possible connection among the thermal stations so that any two thermal stations can be linked with the minimum cost involved.
5	Develop an optimal route for a scenario where a person wants to buy a ticket to a baseball game. Along the way from house to reaching the destination, the person using it is a toll road, and has to pay a certain amount of money.
6	a. Design and implement a Program to solve All-Pairs Shortest Paths problem using Floyd's algorithm. b. Design and implement a Program to find the transitive closure using Warshal's algorithm.
7	The owner of a gourmet coffee shop wishes to mix a 10-pound bag of coffee using various types of coffee beans in such a way to produce the coffee blend at the maximum cost. The weights of the objects in the problem correspond to the quantity in pounds available of each type of coffee bean. The value of each quantity of coffee beans is the total cost of that quantity in rupees. Apply the Knapsack algorithm to maximize the profit.
8	Design an application for drilling an optimal printed circuit board. To drill two holes of different diameters consecutively, the head of the machine has to move to a toolbox and change the drilling equipment. This is quite time consuming. Thus, it is clear that one has to choose some diameter, drill all holes of the same diameter, change the drill, drill the holes of the next diameter, etc. Thus, this drilling problem has to minimize the travel time for the machine head. Find the optimal time to drill the circuit board.

9	Design and implement for a given chess board having N×N cells, place N queens on the board in such a way that no queen attacks any other queen. If it is possible to place all the N queens in such a way that no queen attacks another queen, then print N lines having N Queens. If there is more than one solution of placing the queens, print all of them. If it is not possible to place all N queens in the desired way, then print "Not possible".

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Demonstrate and present the development of program, its execution and running time(s) and record the results/inferences.	CL3
CO2	Compare algorithm design strategies by developing equivalent programs and observing running times for analysis (Empirical).	CL3
CO3	Develop programs to solve computational problems using suitable algorithm design strategy.	CL3
CO4	Make use of suitable integrated development tools to develop programs.	CL3
CO5	Choose appropriate algorithm design techniques to develop solution to the computational and complex problems.	CL3

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	1	3			2	2	1	2	2	2	2	2
CO2	3	3	3	1	3			2	2	1	2	2	2	2	2
CO3	3	3	3	1	3			2	2	1	2	2	2	2	2
CO4	3	3	3	1	3			2	2	1	2	2	2	2	2
CO5	3	3	3	1	3			2	2	1	2	2	2	2	2

3: Substantial (High)	2: Moderate (Medium)	1: Poor (Low)

ASSESSMENT STRATEGY:

- Assessment will be both CIA and SEE.
- All laboratory experiments should be included for practical examination.
- Students are allowed to pick one experiment from the lot.
- Lab test should be conducted for 25 Marks.
- Marks Distribution: Procedure + Conduction + Viva = 05 + 15 + 05 = 25 Marks.
- Change of experiment is allowed only once and marks allotted to the procedure part to be made zero.

Sl. No.	Assessment Description	Weightage (%)		Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**		**50**
	Weekly Assessment	50 %		25
	Lab Test	50 %		25
2	**Semester End Examination (SEE)**	**100 %**		**50**

REFERENCE BOOKS:

1. Introduction to the Design and Analysis of Algorithms, Anany Levitin: 3rd Edition, Pearson.
2. Computer Algorithms/C++, Ellis Horowitz, Satraj Sahni and Rajasekaran, 2nd Edition, Universities Press.

ADVANCED GRAPH THEORY
(Effective from the Academic Year 2023 -2024)
SEMESTER - IV

Course Code	**MA422T6CA**	CIA Marks	50
Number of Contact Hours/Week (L: T:P:S)	3:0:0:1	SEE Marks	50
Total Hours of Pedagogy	40 hrs	Exam Hours	3 Hours

CREDITS – 3

COURSE PREREQUISITES:

- Basic knowledge of Graph Theory.

COURSE OBJECTIVES:

- To learn fundamental concepts and to explore modern applications of Graph Theory for problem-solving and network analysis

TEACHING - LEARNING STRATEGY:

These are some sample strategies, which course faculty members can incorporate in the Teaching Learning Process:

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses

COURSE CONTENTS

Module Contents	Lecture Hours
MODULE - 1	
Graphs and Subgraphs: Definitions and Examples, Subgraphs, Operations on graphs, Connected and Disconnected Graphs, Complements, Graph Isomorphism, Vertex Degree, Euler Trails and Circuits, Hamiltonian paths and circuits.	**8 Hours**
MODULE - II	
Matrices, Coloring and Directed Graph Matrix Representation, Adjacency matrix, Incidence matrix, Circuit matrix, Path Matrix, Properties - Related Theorems. Graph Coloring, Chromatic Polynomial, Chromatic Partitioning, Matching, Covering - Related Theorems.	**8 Hours**
MODULE - III	
Trees: Trees, Properties of trees, Distance and centres in tree, Rooted and binary trees. Spanning trees of a graph and Spanning trees in a weighted graph. Traversal of Binary Tree, Pre-order and Post-order Traversal. Prefix codes, optimal tree. Fundamental Circuits and Cut sets, Network Flows. Max- flow Min- cut Theorem (Statement only and problems).	**8 Hours**
MODULE - IV	
Planar, Dual Graphs: Planar Graphs. Kuratowski's graphs. Different representation of planar graph. Detection of planar graphs. Euler's polyhedral formula (No proof). Geometrical Dual (no theorems) problems. **Dominating sets:** Dominating set. Minimal Dominating set. Domination number. Independent dominating set. Finding minimal dominating sets. Some applications of domination theory.	**8 Hours**
MODULE - V	
Graph Theoretic Algorithms and Graph theory in Electrical networks: Computer representation of a graph. Algorithm on spanning trees: Kruskal's and Prim's Algorithm. Shortest path algorithms: Dijkstra's algorithm, Warshall's algorithm. Graphs in switching and coding Theory. Contact networks, analysis of contact networks, Sequential switching networks. Electrical	**8 Hours**

network analysis, Kirchhoff's current and voltage networks, Loop currents and node voltages, LRC networks.	

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Description	Bloom's Taxonomy Level
CO1	Illustrate the Properties of Graphs and Subgraphs.	CL3
CO2	Classify the relationship between the properties of a matrix representation and the structure of the underlying graph.	CL3
CO3	Solve complex problems using properties of trees in Computer science.	CL3
CO4	Apply critical analysis to construct and interpret planar graphs and their duals in mathematical and engineering contexts.	CL3
CO5	Develop advanced graph algorithms to optimize electrical networks.	CL3

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	1					1				1	2	2	2
CO2	3	3						1				1	2	2	2
CO3	3	3	1					1				1	2	2	2
CO4	3	3			1			1				1	2	2	2
CO5	3	3	1		1			1	1	1		1	2	2	2
3: Substantial (High)					2: Moderate (Medium)					1: Poor (Low)					

CO - Assessment Mapping:

Course Outcomes	Continuous Internal Assessment (CIA) (50%)				Semester End Exam (SEE) (50%)
	Continuous Internal Evaluation (CIE) (60%)			Assignment/Activities (40%)	
	I	II	III		
	Syllabus Coverage				
	40%	30%	30%	100%	100%
CO1	x			x	x
CO2	x	x		x	x
CO3		x		x	x
CO4			x	x	x
CO5			x	x	x

Assessment Strategy:

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Continuous Internal Evaluation (CIE)	60 %	30
	Assignments*	40 %	20
2	**Semester End Examination (SEE)**	**100 %**	**50**

Assignment Types:

Sl. No.	Assignment Description	Max. Weightage (%)	Max. Marks

1	Written Assignments	25 %	5
2	Quiz	25 %	5
3	Case Studies	25 %	5
4	Seminar/Presentation	15 %	3
5	Peer - to -Peer Learning	10 %	2

SEE Question Paper Pattern:

- The question paper will have **TEN** full questions.
- Each full question consisting of 20 marks.
- There will be 2 full questions from all the FIVE modules.
- Each full question will have a maximum of three sub-questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

REFERENCE BOOKS:

1. Narsingh Deo, "Graph Theory with Application to Engineering and Computer Science", Printice Hall of India Private Limited, 2009.
2. Grimaldi R.P. “Discrete and Combinatorial Mathematics: An Applied Introduction”, Pearson Addison Wesley, 5th edition, 2006.
3. Bondy, J. A. and Murty, U.S.R., "Graph Theory with Applications", North Holland Publication,2008.
4. West, D. B., ―Introduction to Graph Theory‖, Pearson Education, 2011.
5. John Clark, Derek Allan Holton, ―A First Look at Graph Theory‖, World Scientific Publishing Company, 1991.
6. Rosen K.H., “Discrete Mathematics and Its Applications”, Mc Graw Hill, 2007.

REGRESSION STATISTICAL COMPUTING
(Effective from the Academic Year 2023 - 2024)
IV SEMESTER

Course Code	**MA422T6CB**	CIA Marks	50
Number of Contact Hours/Week (L: T:P:S)	3:0:0:1	SEE Marks	50
Total Hours of Pedagogy	40 L	Exam Hours	3 Hours

CREDITS – 3

COURSE PREREQUISITES:
Basic knowledge of statistics and programming**.**

COURSE OBJECTIVES:

- Understand the fundamentals of regression analysis and its application in statistical computing.
- Develop proficiency in implementing regression models, assessing model fit, and interpreting results.
- Apply regression techniques to real-world datasets, solving complex problems in data analysis and prediction.

TEACHING - LEARNING STRATEGY:

These are some sample strategies, which course faculty members can incorporate in the Teaching Learning Process:

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses

COURSE CONTENTS

MODULE - I	
Introduction to Regression Analysis: Basics of regression analysis. Simple linear regression model. Assumptions, Estimation of model parameters, least squares method, Difference between descriptive and inferential statistics. Regression, Dependent and independent variables.	**8 Hours**
MODULE - II	
Simple Linear Regression: least squares method, Interpretation of Regression coefficient properties Correlation-Karl Pearson's coefficient of correlation regression analysis-lines of regression. Fitting of first and second-degree curve, exponential curve by the method of least squares after logarithmic transformation.	**8 Hours**
MODULE - III	
Multivariate data analysis 1: Multiple linear regression (3 variables only), Assumption, Estimation of Regression by least squares method. Estimation of regression coefficients. Partial, multiple correlation coefficients. Coefficient of Determination (R^2)	**8 Hours**
MODULE - IV	
Multivariate Data Analysis 2 - (Description of various multivariate methods to be given) Logistic regression, Factor Analysis, Structural Equation Modelling, Cluster Analysis, Discriminant Analysis, conjoint analysis, Correspondence Analysis	**8 Hours**
MODULE – V	
Statistical Computing: Packages, GGplot2 package, Likert package, correlation and regression analysis (bivariate and multivariate data), polynomial regression	**8 Hours**

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Apply regression analysis to solve complex computer science problems.	CL3
CO2	Use statistical software tools proficiently for data analysis and modeling.	CL2
CO3	Interpret and communicate results effectively.	CL3
CO4	Apply regression techniques to enhance decision-making and prediction in computer science.	CL3
CO5	Demonstrate critical thinking and problem-solving skills in practical applications	CL3

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	3	1		1		1						2	2	2
CO2	3	3	2		1						1	1	2	2	2
CO3	3	2			1					1		1	2	2	2
CO4	3	2			2		1					1	2	2	2
CO5	3	3	2		1		1				1		2	2	2

3: Substantial (High) | **2: Moderate (Medium)** | **1: Poor (Low)**

ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Continuous Internal Evaluation (CIE)	60 %	30
	Assignments	40 %	20
2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT DETAILS

Continuous Internal Assessment (CIA) (50%)				Semester End Exam (SEE) (50%)
Continuous Internal Evaluation (CIE) (60%)			Assignment/ Activities (40%)	
I	II	III		
Syllabus Coverage			Syllabus Coverage	Syllabus Coverage
40%	30%	30%	100%	100%
MI			MI	MI
MII	MII		MII	MII
	MIII		MIII	MIII
		MIV	MIV	MIV
		MV	MV	MV

Note: For Examinations (both CIE and SEE), the question papers shall contain the questions mapped to the appropriate Bloom's Level. Any COs mapped with higher cognitive Bloom's Level may also be assessed through the assignments.

ASSIGNMENT TYPES WITH WEIGHTAGES

Sl. No.	Assignment Description	Max. Weightage (%)	Max. Marks
1	Written Assignments	25 %	05
2	Quiz	10 %	02
3	Case Studies	25 %	05
4	Seminar/Presentation	15 %	03

5	Peer - to - Peer Learning	10 %	02
6	Activity Based Learning	50 %	10
7	Project Based Learning	50 %	10
8	Field Work + Report	50 %	10
9	Industry Visit + Report	50 %	10
10	NPTEL/MOOC Courses – Registration and Assignment Submissions	50 %	10
	NPTEL Certification	75 %	15
11	Any other Innovative Assignments (CL4 and above)	50 %	10

Note: The assignments mentioned above may be provided appropriately to the students belonging to different bands

SEE QUESTION PAPER PATTERN:

- The question paper will have **TEN** full questions from **FIVE** Modules
- There will be 2 full questions from each module. Every question will carry a maximum of 20 marks.
- Each full question may have a maximum of four sub-questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting one full question from each module.

REFERENCE BOOKS:

1. Gupta, S. C., & Kapoor, V. K. (2002). Fundamental of Mathematical Statistics. Sultan Chand & sons.
2. Joseph Hair, F., Willium Black, C., Barry Babin, J., & Rolph Anderson, E. (2010). Multivariate Data Analysis, Seventh edition. Pearson Prentice Hall.
3. Kothari, C. R. (2004). Research methodology. New Age International Publishers.
4. Levin, R. (2013). Statistics for Management. Prentice Hall India.
5. Medhi, J. (2006). Statistical Methods: An Introductory Reference. New Age International(P) Limited, New delhi.
6. Montgomery, D. C. (2007). Introduction to Linear Regression analysis. John Willey & sons.
7. Mukhopadhyay, P. (2000). Mathematical Statistics. Books & Allied Pvt. Ltd.
8. Robert Kabacoff, I. (2015). R in Action - Data Analysis and Graphics with R, second edition. dreamtech Press.
9. Sudha Purohit, G., Sharad Gore, D., & Shailaja Deshmukh, R. (2008). Statistics Using R. Narosa Publishing House.

OPTIMIZATION TECHNIQUES
(Effective from the Academic Year 2023 - 2024)
IV SEMESTER

Subject code	**MA422T6CC**	CIA Marks	50
Number of Contact Hours/Week (L: T:P:S)	3:0:0:1	SEE Marks	50
Total Hours of Pedagogy	40 L	Exam Hours	3 Hours

CREDITS – 3

COURSE PREREQUISITES:
Basics of Statistics, Probability distributions. Multiple integration

COURSE OBJECTIVES:

- Study the techniques of complex variables and functions together with their derivatives, Contour integration and transformations
- Enable the students to apply basic concepts of graph theory on developing algorithms
- Understand the concept of probability and enable the students to predict the outcome of simple experiments
- Enable the students to use various tests of significance in engineering problems
- Understand the concept of optimization techniques

TEACHING - LEARNING STRATEGY:

These are some sample strategies, which course faculty members can incorporate in the Teaching Learning Process:

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses

COURSE CONTENTS

MODULE - I	
Joint Probability Distribution Functions: Discrete and Continuous Random variables, Probability mass function, Probability density functions. Cumulative distribution functions. Lab Components: Finding joint Probability using R-software	**8 Hours**
MODULE - II	
Stochastic Process and Estimation: Regular stochastic matrices. Transition Probability matrices. Markov Process. Estimation of Parameters, Interval Estimation, Central Limit Theorem. Maximum Likelihood functions.	**8 Hours**
MODULE - III	
Linear Programming Problem: Components of LPP, Characteristics of LPP Advantages of LPP Simplex method, Big M method, Duality in LPP. Lab Components: Solving LPP using R-software	**8 Hours**
MODULE - IV	
Transportation and Assignment Problem: Balanced TP. Components of TP, Northwest corner method. Least. cost cell method. Objectives of AP. Hungarian method of solving AP.	**8 Hours**
MODULE – V	
Game Theory: Introduction of game theory, Two-person zero sum game with two or more number of players. Payoff matrix. Optimal strategy. Minimax-Maxmin Principle. Games with and without Saddle point.	**8 Hours**

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Illustrate random variables and Joint probability distribution functions to analyse the probability models in engineering field.	CL3
CO2	Construct Markov models to predict probability for a problem statement.	CL3
CO3	Solve Linear Programming Problem to get optimal solutions of a Mathematical model.	CL3
CO4	Ability to solve balanced Transportation and Assignment problems	CL3
CO5	Develop the technique of best strategic planning using Game theory.	CL3

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	3		1	2					1		1	1	1	1
CO2	2	3			1				1	1		1	1	1	1
CO3	3	3	1	1				1					1	1	1
CO4	3	3	1	1	1				1			1	1	1	1
CO5	3	3		1				1	1				1	1	1

3: Substantial (High)	2: Moderate (Medium)	1: Poor (Low)

ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Continuous Internal Evaluation (CIE)	60 %	30
	Assignments	40 %	20
2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT DETAILS

Continuous Internal Assessment (CIA) (50%)				Semester End Exam (SEE) (50%)
Continuous Internal Evaluation (CIE) (60%)			Assignment/ Activities (40%)	
I	II	III		
Syllabus Coverage			Syllabus Coverage	Syllabus Coverage
40%	30%	30%	100%	100%
MI			MI	MI
MII	MII		MII	MII
	MIII		MIII	MIII
		MIV	MIV	MIV
		MV	MV	MV

Note: For Examinations (both CIE and SEE), the question papers shall contain the questions mapped to the appropriate Bloom's Level. Any COs mapped with higher cognitive Bloom's Level may also be assessed through the assignments.

ASSIGNMENT TYPES WITH WEIGHTAGES

Sl. No.	Assignment Description	Max. Weightage (%)	Max. Marks
1	Written Assignments	25 %	05
2	Quiz	10 %	02
3	Case Studies	25 %	05
4	Seminar/Presentation	15 %	03

5	Peer - to - Peer Learning	10 %	02
6	Activity Based Learning	50 %	10
7	Project Based Learning	50 %	10
8	Field Work + Report	50 %	10
9	Industry Visit + Report	50 %	10
10	NPTEL/MOOC Courses – Registration and Assignment Submissions	50 %	10
	NPTEL Certification	75 %	15
11	Any other Innovative Assignments (CL4 and above)	50 %	10

Note: The assignments mentioned above may be provided appropriately to the students belonging to different bands

SEE QUESTION PAPER PATTERN:

- The question paper will have **TEN** full questions from **FIVE** Modules
- There will be 2 full questions from each module. Every question will carry a maximum of 20 marks.
- Each full question may have a maximum of four sub-questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting one full question from each module.

REFERENCE BOOKS:

1. V.K Kapoor and S.C Gupta “Mathematical Statistics” 11th edition, S. Chand Publications
2. 2.B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, 43rd Ed., 2015.
3. C Ray Wylie, Louis C Barrett: “Advanced Engineering Mathematics", 6th Edition,
4. B.V Ramana: "Higher Engineering Mathematics" 11th Edition, Tata McGraw-Hill,
5. Dr. K. Chandrashekar: " Complex analysis, Probability and Statistical Methods" Sudha Publications,2021

METRIC SPACES
(Effective from the Academic Year 2023 - 2024)
IV SEMESTER

Course Code	**MA422T6CD**	CIA Marks	50
Number of Contact Hours/Week (L: T:P:S)	3:0:0:1	SEE Marks	50
Total Hours of Pedagogy	50 L	Exam Hours	3 Hours

CREDITS – 3

COURSE PREREQUISITES:

- Basic knowledge of Set theory and Group theory

COURSE OBJECTIVES:

- Introduce computer engineering students to metric theory, emphasizing its application in analyzing and optimizing data structures, algorithms, and network performance.

TEACHING - LEARNING STRATEGY:

These are some sample strategies, which course faculty members can incorporate in the Teaching Learning Process:

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses

COURSE CONTENTS

MODULE - I	
Introduction to Metric Spaces: Definition of metric space. Examples of metric spaces. Metrics and Distance Functions: Properties of metrics. Common distance functions. Open and Closed Sets, Definitions and properties.	**8 Hours**
MODULE - II	
Topology of a Metric Space: Topological concepts, Convergence and Limit Points, Convergence of sequences and series. Limit points, limit set. **Continuity in Metric Spaces**: Continuous functions in metric spaces. Properties of continuous functions.	**8Hours**
MODULE - III	
Compactness and Completeness: Connectedness, separated sets, Connected and disconnected sets, Components of metric spaces, Connectedness of product of connected metric spaces. Bounded sets and Compactness, Other Characterizations of Compactness, Continuous Functions on Compact Spaces, Locally Compact Spaces.	**8 Hours**
MODULE - IV	
Cauchy Sequences and Completeness: Cauchy sequences and completeness. Applications in analysis. **Compactness and Bolzano-Weierstrass Theorem**: Bolzano-Weierstrass theorem. Compactness and its applications.	**8 Hours**
MODULE - 5	
Applications in Computer Networks: Routing algorithms using metrics. Latency and distance metrics in network design. Metric Spaces in Geometry and Graphics: Geometric interpretations of metric spaces. Graphics algorithms and spatial metrics.	**8 Hours**

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Describe Metric space concepts in computer science engineering, enhancing problem-solving skills and algorithm optimization.	CL2
CO2	Apply topological concepts and continuous functions in metric spaces to enhance problem-solving skills in computer science.	CL3
CO3	Demonstrate compactness and apply concepts of Metric space to optimize network design and data compression.	CL3
CO4	Apply Cauchy sequences, completeness, and compactness to solve problems in mathematical analysis and optimization."	CL3
CO5	Interpret routing algorithms' effectiveness through metrics in computer network design, enhancing network performance and reliability."	CL3

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2		1							1		1	1	1	1
CO2	2	2	1					1		2		1	1	1	1
CO3	2	2										1	1	1	1
CO4	2	2						1				1	1	1	1
CO5	3	2	2	1	2			1				1	1	1	1

3: Substantial (High) | **2: Moderate (Medium)** | **1: Poor (Low)**

ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Continuous Internal Evaluation (CIE)	60 %	30
	Assignments	40 %	20
2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT DETAILS

Continuous Internal Assessment (CIA) (50%)				Semester End Exam (SEE) (50%)
Continuous Internal Evaluation (CIE) (60%)			Assignment/ Activities (40%)	
I	II	III		
Syllabus Coverage			Syllabus Coverage	Syllabus Coverage
40%	30%	30%	100%	100%
MI			MI	MI
MII	MII		MII	MII
	MIII		MIII	MIII
		MIV	MIV	MIV
		MV	MV	MV

Note: For Examinations (both CIE and SEE), the question papers shall contain the questions mapped to the appropriate Bloom's Level. Any COs mapped with higher cognitive Bloom's Level may also be assessed through the assignments.

ASSIGNMENT TYPES WITH WEIGHTAGES

Sl. No.	Assignment Description	Max. Weightage (%)	Max. Marks

1	Written Assignments	25 %	05
2	Quiz	10 %	02
3	Case Studies	25 %	05
4	Seminar/Presentation	15 %	03
5	Peer - to - Peer Learning	10 %	02
6	Activity Based Learning	50 %	10
7	Project Based Learning	50 %	10
8	Field Work + Report	50 %	10
9	Industry Visit + Report	50 %	10
10	NPTEL/MOOC Courses – Registration and Assignment Submissions	50 %	10
	NPTEL Certification	75 %	15
11	Any other Innovative Assignments (CL4 and above)	50 %	10

Note: The assignments mentioned above may be provided appropriately to the students belonging to different bands

SEE QUESTION PAPER PATTERN:

- The question paper will have **TEN** full questions from **FIVE** Modules
- There will be 2 full questions from each module. Every question will carry a maximum of 20 marks.
- Each full question may have a maximum of four sub-questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting one full question from each module.

REFERENCE BOOKS:

1. Elements of Real Analysis,Shanti Narayan,Dr.M.D. Raisinghania,(2016)
2. Topology of Metric Spaces by S. Kumareshan, Alpha Science International Limited (2005)
3. Metric Spaces by Satish Shirali and Harikrishan L Vasudeva Springer, (2006)
4. Metric Spaces by P.K. Jain and Khalil Ahmad, Alpha Science International, (2004)
5. Elements of Metric spaces by M.N. Mukherjee, Academic Publishers (2005)

GITHUB: AI-POWERED DEVELOPER PLATFORM
(Effective from the Academic Year 2023 - 2024)
IV SEMESTER

Course Code	**CS42297CA**	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	0:0:2:0	SEE Marks	50
Total Hours of Pedagogy	24	Exam Hours	03

CREDITS – 1

COURSE PREREQUISITES:

- Basic Knowledge of Programming.

COURSE OBJECTIVES:

- To familiar with basic command of Git
- To create and manage branches
- To understand how to collaborate and work with Remote Repositories
- To familiar with virion controlling commands

TEACHING - LEARNING STRATEGY:
Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Practical Based Learning
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

List of Experiments

Sl. No.	
1	**Setting Up and Basic Commands** Initialize a new Git repository in a directory. Create a new file and add it to the staging area and commit the changes with an appropriate commit message.
2	**Creating and Managing Branches** Create a new branch named "feature-branch." Switch to the "master" branch. Merge the "feature-branch" into "master."
3	**Creating and Managing Branches** Write the commands to stash your changes, switch branches, and then apply the stashed changes.
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.
6	**Collaboration and Remote Repositories** Write the command to merge "feature-branch" into "master" while providing a custom commit message for the merge.
7	**Git Tags and Releases** Write the command to create a lightweight Git tag named "v1.0" for a commit in your local repository.

8	**Advanced Git Operations** Write the command to cherry-pick a range of commits from "source-branch" to the current branch.
9	**Analysing and Changing Git History** Given a commit ID, how would you use Git to view the details of that specific commit, including the author, date, and commit message?
10	**Analysing and Changing Git History** Write the command to list all commits made by the author "JohnDoe" between "2023-01-01" and "2023-12-31."
11	**Analysing and Changing Git History** Write the command to display the last five commits in the repository's history.
12	**Analysing and Changing Git History** Write the command to undo the changes introduced by the commit with the ID "abc123".

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Use the basics commands related to git repository	CL3
CO2	Create and manage the branches	CL3
CO3	Apply commands related to Collaboration and Remote Repositories	CL3
CO4	Use the commands related to Git Tags, Releases and advanced git operations	CL3
CO5	Analyze and change the git history	CL3

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	3		3							1	2	2	2
CO2	3	2	3		3							1	2	2	2
CO3	3	2	3		3							1	2	2	2
CO4	3	2	3		3							1	2	2	2
CO5	3	2	3		3							1	2	2	2

3: Substantial (High)	2: Moderate (Medium)	1: Poor (Low)

ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Laboratory Work (A)	50 %	25
	Laboratory Test (B)	30 %	15
	Open Ended Experiments /Mini Projects (C)	20 %	10
2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT STRATEGY:

I. In Laboratory Courses where (B) and (C) are not the components of the assessment pattern, then (A) will have 100% weightage (50 Marks).

Assessment Mode: Weekly Assessment of Laboratory Work (50 Marks) - the marks will be awarded based on the Continuous Internal Assessment (Weekly Assessment, each of 25 marks) of the students in each laboratory session. The average of all the marks obtained across the sessions will be the Final CIA marks.

II. In Laboratory Courses where (C) is not a component of the assessment pattern, then (A) will have 50% weightage (25 Marks), and (B) will have 50% weightage (25 Marks).

Assessment Mode: The marks will be awarded based on the Continuous Internal Assessment (Weekly Assessment) (A) and One Laboratory Test (B).

- In Weekly Assessment, the student will be evaluated in each laboratory session for 25 marks. The average marks obtained across all the experiments will be the marks obtained for (A).
- A Laboratory Test, similar to the SEE exam is conducted towards the end of the Semester/Course, whichever is earlier. The obtained marks are scaled down to 25 Marks (B)

The Sum of marks obtained across (A) and (B) will be the Final CIA marks.

III. In Laboratory Courses where (C) is a component of the assessment pattern, then assessment will be done by considering the weightages given above, i.e. (A) – 25 Marks (Weekly Assessment), (B) – 15 Marks (Laboratory Examination), (C) – 10 marks (Open Ended Experiments/Mini Projects)

- The respective course instructor will design the assessment criteria for the said assessment components.
- The assessment components will be made known to the students by the respective Course Coordinators prior to the commencement of the Laboratory Work.

In all the cases, the assessments will be done based on the criteria designed by the Course Coordinator.

SEE QUESTION PAPER PATTERN:

1. All laboratory experiments should be included for practical examination, from which students are allowed to pick one experiment from the lot.
2. SEE shall be conducted for 100 Marks and the marks will be scaled down to 50.
3. General Marks Distribution: Procedure + Conduction + Viva = 20% + 50% + 30%.
4. Change of experiment is allowed only once and 20% of the marks allotted to the Procedure will be made ZERO (if a question carries two experiments, both should be changed). The evaluation will be done for 80% of the total maximum marks.

SUGGESTED LEARNING RESOURCES:

- Version Control with Git, 3rd Edition, by Prem Kumar Ponuthorai, Jon Loeliger Released October 2022, Publisher(s): O'Reilly Media, Inc.
- Pro Git book, written by Scott Chacon and Ben Straub and published by Apress, https://gitscm.com/book/en/v2
- https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013094443347369984278 2_shared/overview
- https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013301347121774592119 26_shared/overview

DevOps
(Effective from the Academic Year 2023- 2024)
IV SEMESTER

Course Code	**CS42297CB**	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	3:0:2:0	SEE Marks	50
Total Hours of Pedagogy	40L + 20P	Exam Hours	03

CREDITS – 4

COURSE PREREQUISITES:

- Fundamental knowledge of Embedded systems and basic concepts of ARM architecture and programming.

COURSE OBJECTIVES:

- Understand the fundamentals of ARM based systems, basic hardware components, selection methods and attributes of an embedded system.
- Program ARM controller using the various instructions.
- Identify the applicability of the embedded system.
- Comprehend the real time operating system used for the embedded system.

TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

COURSE CONTENTS

MODULE – I	
DevOps and Infrastructure as Code: DevOps Culture and Practices: Getting started with DevOps, Implementing CI/CD and continuous deployment, Understanding IaC practices. Using Ansible for Configuring IaaS Infrastructure: Installing Ansible, Creating an inventory for targeting Ansible hosts, writing the first playbook, Executing Ansible, Protecting data with Ansible Vault, Using a dynamic inventory for Azure infrastructure. Optimizing Infrastructure Deployment with Packer: An overview of Packer, Creating Packer templates for Azure VMs with scripts, Using Ansible in a Packer template, Executing Packer, Using a Packer image with Terraform.	**8 Hours**
MODULE – II	
DevOps CI/CD Pipeline: Managing Your Source Code with Git: Overviewing Git and its command lines, Understanding the Git process and GitFlow pattern. Continuous Integration and Continuous Delivery: The CI/CD principles, using a package manager, Using Jenkins, Using Azure Pipelines, Using GitLab CI.	**8 Hours**
MODULE – III	
Containerized Applications with Docker and Kubernetes : Containerizing Your Application with Docker: Installing Docker, Creating a Dockerfile, Building and running a container on a local machine, Pushing an image to Docker Hub, Deploying a container to ACI with a CI/CD pipeline. Managing Containers Effectively with Kubernetes: Installing Kubernetes, First example of Kubernetes application deployment, Using HELM as a package manager, Using AKS, Creating a CI/CD pipeline for Kubernetes with Azure Pipelines.	**8 Hours**
MODULE – IV	
Testing Your Application: Testing APIs with Postman**:** Creating a Postman collection with requests, Using environments and variables to dynamize requests, Writing Postman tests, Executing Postman request tests locally, Understanding the Newman concept, Preparing Postman collections for Newman, Running the Newman command line, Integration of Newman in the CI/CD pipeline process. Static Code Analysis with	**8 Hours**

SonarQube: Exploring SonarQube, Installing SonarQube, Real-time analysis with SonarLint, Executing SonarQube in continuous integration. Security and Performance Tests: Applying web security and penetration testing with ZAP, Running performance tests with Postman.	

MODULE – V

Taking DevOps Further: Security in the DevOps Process with DevSecOps: Testing Azure infrastructure compliance with Chef InSpec, Using the Secure DevOps Kit for Azure, Preserving data with HashiCorp's Vault. Reducing Deployment Downtime: Reducing deployment downtime with Terraform, Understanding blue-green deployment concepts and patterns, Applying blue-green deployments on Azure. DevOps for Open-Source Projects: Storing the source code in GitHub, Contributing using pull requests, Managing the changelog and release notes, Sharing binaries in GitHub releases, Using Travis CI for continuous integration, Getting started with GitHub Actions, Analyzing code with SonarCloud, Detecting security vulnerabilities with WhiteSource Bolt. DevOps Best Practices.	**8 Hours**

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Demonstrate the DevOps culture by illustrating applications cloud infrastructure and configuration management with Ansible.	CL3
CO2	Apply the DevOps pipeline process starting with continuous integration and continuous deployment principles.	CL3
CO3	Demonstrate how to create and run a container from a Docker file and deploy a complex application on Kubernetes.	CL3
CO4	Illustrate the different ways to test APIs with Postman, static code analysis with SonarQube and perform security and performance tests.	CL3
CO5	Apply security in the DevOps process with DevSecOps and related best practices.	CL3

LABORATORY COMPONENTS

Exp. No.	Experiment Description	CO No.	Bloom's Taxonomy Level
1.	Applying CI/CD Principles to Web Development Using Jenkins, Git, and Local HTTP Server	CO1	CL3
2.	Exploring Git Commands through Collaborative Coding.	CO2	CL3
3.	Implement GitHub Operations	CO2	CL3
4.	Implement GitLab Operations	CO2	CL3
5.	Exploring Containerization and Application Deployment with Docker	CO3	CL3
6.	Applying CI/CD Principles to Web Development Using Jenkins, Git, using Docker Containers	CO3	CL3
7.	Create the GitHub Account to demonstrate CI/CD pipeline using Cloud Platform.	CO4	CL3
8.	Demonstrating Infrastructure as Code (IaC) with Terraform	CO5	CL3

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2		2				1			1	2	2	2
CO2	3	3	2		2				1			1	2	2	2
CO3	3	3	2		2				1			1	2	2	2
CO4	3	3	2		2				1			1	2	2	2

CO5	3	3	2		2				1			1	2	2	2
3: Substantial (High)					**2: Moderate (Medium)**					**1: Poor (Low)**					

ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Continuous Internal Evaluation (CIE)	60 %	30
	Practical Session (Laboratory Component)	40 %	20
2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT DETAILS

Continuous Internal Assessment (CIA) (50%)				**Semester End Exam (SEE) (50%)**
Continuous Internal Evaluation (CIE) (60%)			**Practical Sessions (40%)**	
I	**II**	**III**		
Syllabus Coverage			**Syllabus Coverage**	**Syllabus Coverage**
40%	**30%**	**30%**	**100%**	**100%**
MI			MI	MI
MII	MII		MII	MII
	MIII		MIII	MIII
		MIV	MIV	MIV
		MV	MV	MV

NOTE:

- Assessment will be both CIA and SEE.
- The practical sessions of the IPCC shall be for CIE only.
- The Theory component of the IPCC shall be for both CIA and SEE respectively.
- The questions from the practical sessions shall be included in Theory SEE.

Note: For Examinations (both CIE and SEE), the question papers shall contain the questions mapped to the appropriate Bloom's Level. Any COs mapped with higher cognitive Bloom's Level may also be assessed through the assignments.

SEE QUESTION PAPER PATTERN:

1. The question paper will have **TEN** full questions from **FIVE** Modules
2. There will be 2 full questions from each module. Every question will carry a maximum of 20 marks.
3. Each full question may have a maximum of four sub-questions covering all the topics under a module.
4. The students will have to answer FIVE full questions, selecting one full question from each module.

REFERENCE BOOKS:

1. Learning DevOps: Mikael Krief, October 2019, Packt Publishing Ltd, ISBN: 978-1-83864-273-0.
2. Continuous Delivery: Reliable Software Releases through Build, Test, and Deployment Automation, Jez Humble and David Farley, 2010, Addison-Wesley Professional, ISBN: 9780321670250.
3. The DevOPS Handbook: How to Create World, Gene Kim & Jez Humble, 2016, It Revolution Press, ISBN: 9781942788003.
4. The Phoenix Project: A Novel about It, Devops, and Helping Your Business Win, George Spafford & Gene Kim, 2018, It Revolution Press, ISBN: 9781942788294.
5. Effective DevOps: Building a Culture of Collaboration, Affinity, and Tooling at Scale, Jennifer Davi & Ryn Daniels, 2016, O'Reilly Media, ISBN.

SAHYADRI
COLLEGE OF ENGINEERING & MANAGEMENT
An Autonomous Institution
MANGALURU

DATA VISUALIZATION USING R
(Effective from the Academic Year 2023 - 2024)
IV SEMESTER

Course Code	**CS42297CC**	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	0:0:2:0	SEE Marks	50
Total Hours of Pedagogy	20P	Exam Hours	03

CREDITS – 1

COURSE PREREQUISITES:

- Basic Knowledge R programming and data manipulation concepts.

COURSE OBJECTIVES:

- Understand the basic plots and major packages available for plotting graphs in R.
- To develop small applications using R Programming

TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

LIST OF EXPERIMENTS

Exp. No.	Description	CO No.	Bloom's Taxonomy Level
	PART-A		
1	For a given set of training data examples stored in a .CSV file, compute the Mean, Median, Variance, Standard Deviation, Range and Quartiles of one of the attributes using R programming.	**CO1**	**CL3**
2	Write an R program to perform the following operations: Create a file, Writing into a file, Renaming a file, Reading a file, Listing all files, Copy a file.	**CO1**	**CL3**
3	Write an R program to perform the following operations on strings: Concatenate two strings, compare two strings, Reverse the string and Check if a given string is a palindrome or not.	**CO2**	**CL3**
4	Write an R program to demonstrate the use of the following String manipulation functions in R: nchar, toupper, tolower, substr, grep, paste, strsplit, sprintf, cat and sub functions.	**CO2**	**CL3**
	PART-B		
1	Write an R program to create the following basic plots: Scatter plot, Line graph, Bar plot and Histogram.	**CO3**	**CL3**
2	Write an R program to create a 2D and 3D Pie chart with slice percentage & legend.	**CO3**	**CL3**
3	Using the in-build Iris dataset and ggplot2 package, write an R program to create Scatter plot, Line graph and Bar plot with chart titles and axis titles.	**CO4**	**CL3**
4	Write an R program to create Histogram and Box plots using ggplot2 package in R.	**CO4**	**CL3**
5	Using the in-build mtcars dataset and lattice package, write an R program to create Bar plot, Scatter plot, Histogram and Density plot.	**CO5**	**CL3**
6	Write an R program to create 3D Wireframe Plot and Level Plot using lattice	**CO5**	**CL3**

	package in R.		

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Apply the concepts of R programming to read and write data files.	CL3
CO2	Implement the string manipulation and data handling concepts.	CL3
CO3	Illustrate the use of inbuilt functions in the creation and customization of graphs.	CL3
CO4	Apply ggplot2 Package for data visualization.	CL3
CO5	Demonstrate the lattice graphics and control styles using the lattice package.	CL3

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	1	2				1	1		2	2	2	2
CO2	3	3	2	1	2				1	1		2	2	2	2
CO3	3	3	2	1	2				1	1		2	2	2	2
CO4	3	3	2	1	2				1			2	2	2	2
CO5	3	3	2	1	2				1			2	2	2	2

3: Substantial (High)	2: Moderate (Medium)	1: Poor (Low)

ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Laboratory Work (A)	50 %	25
	Laboratory Test (B)	30 %	15
	Open Ended Experiments /Mini Projects (C)	20 %	10
2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT STRATEGY:

I. In Laboratory Courses where (B) and (C) are not the components of the assessment pattern, then (A) will have 100% weightage (50 Marks).

Assessment Mode: Weekly Assessment of Laboratory Work (50 Marks) - the marks will be awarded based on the Continuous Internal Assessment (Weekly Assessment, each of 25 marks) of the students in each laboratory session. The average of all the marks obtained across the sessions will be the Final CIA marks.

II. In Laboratory Courses where (C) is not a component of the assessment pattern, then (A) will have 50% weightage (25 Marks), and (B) will have 50% weightage (25 Marks).

Assessment Mode: The marks will be awarded based on the Continuous Internal Assessment (Weekly Assessment) (A) and One Laboratory Test (B).

- In Weekly Assessment, the student will be evaluated in each laboratory session for 25 marks. The average marks obtained across all the experiments will be the marks obtained for (A).
- A Laboratory Test, similar to the SEE exam is conducted towards the end of the Semester/Course, whichever is earlier. The obtained marks are scaled down to 25 Marks (B)

The Sum of marks obtained across (A) and (B) will be the Final CIA marks.

III. In Laboratory Courses where (C) is a component of the assessment pattern, then assessment will be done by considering the weightages given above, i.e. (A) – 25 Marks (Weekly Assessment), (B) – 15 Marks (Laboratory Examination), (C) – 10 marks (Open Ended Experiments/Mini Projects)

- The respective course instructor will design the assessment criteria for the said assessment components.
- The assessment components will be made known to the students by the respective Course Coordinators prior

to the commencement of the Laboratory Work.

In all the cases, the assessments will be done based on the criteria designed by the Course Coordinator.

SEE QUESTION PAPER PATTERN:

1. All laboratory experiments should be included for practical examination, from which students are allowed to pick one experiment from the lot.
2. SEE shall be conducted for 100 Marks and the marks will be scaled down to 50.
3. General Marks Distribution: Procedure + Conduction + Viva = 20% + 50% + 30%.
4. Change of experiment is allowed only once and 20% of the marks allotted to the Procedure will be made ZERO (if a question carries two experiments, both should be changed). The evaluation will be done for 80% of the total maximum marks.

SAHYADRI
COLLEGE OF ENGINEERING & MANAGEMENT
An Autonomous Institution
MANGALURU

COMPETITIVE PROGRAMMING USING GO
(Effective from the Academic Year 2023 - 2024)
IV SEMESTER

Course Code	**CS42297CD**	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	0:0:2:0	SEE Marks	50
Total Hours of Pedagogy	20P	Exam Hours	03

CREDITS – 1

COURSE PREREQUISITES:

- Basic Knowledge of C.

COURSE OBJECTIVES:

- This course will enable students to:
- Improve problem - solving abilities.
- Enhance thinking abilities in turn prepare for better opportunities.

TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

LIST OF EXPERIMENTS

Sl. No.	Description
1	Write a go program to find Even Fibonacci numbers
2	Write a go program to find Largest prime factor
3	Write a go program to find Largest palindrome product
4	Write a go program to find Special Pythagorean triplet
5	Write a go program to illustrate Maps
6	Write a go program to Illustrate Interfaces
7	Write a go program to build a Simple Webserver
8	Write a go program to illustrate Dining Philosophers Problem
9	Write a go program to illustrate Checkpoint Synchronization
10	Write a go program to illustrate HTTP requests

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Demonstrate the usage of flow control and looping.	CL3
CO2	Apply the ability to write optimized code using basic data types and functions.	CL3
CO3	Apply the usage of methods and interfaces.	CL3
CO4	Apply Go routines and channels for directory traversals	CL3
CO5	Usage of all the packages and Go tools required to write optimized code.	CL3

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3			3			2	2	1	3	3	2	2	2
CO2	3	3			3			2	2	1	3	3	2	2	2
CO3	3	3			3			2	2	1	3	3	2	2	2
CO4	3	3			3			2	2	1	3	3	2	2	2
CO5	3	3			3			2	2	1	3	3	2	2	2
3: Substantial (High)					2: Moderate (Medium)					1: Poor (Low)					

ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Laboratory Work (A)	50 %	25
	Laboratory Test (B)	30 %	15
	Open Ended Experiments /Mini Projects (C)	20 %	10
2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT STRATEGY:

I. In Laboratory Courses where (B) and (C) are not the components of the assessment pattern, then (A) will have 100% weightage (50 Marks).

Assessment Mode: Weekly Assessment of Laboratory Work (50 Marks) - the marks will be awarded based on the Continuous Internal Assessment (Weekly Assessment, each of 25 marks) of the students in each laboratory session. The average of all the marks obtained across the sessions will be the Final CIA marks.

II.In Laboratory Courses where (C) is not a component of the assessment pattern, then (A) will have 50% weightage (25 Marks), and (B) will have 50% weightage (25 Marks).

Assessment Mode: The marks will be awarded based on the Continuous Internal Assessment (Weekly Assessment) (A) and One Laboratory Test (B).

- In Weekly Assessment, the student will be evaluated in each laboratory session for 25 marks. The average marks obtained across all the experiments will be the marks obtained for (A).
- A Laboratory Test, similar to the SEE exam is conducted towards the end of the Semester/Course, whichever is earlier. The obtained marks are scaled down to 25 Marks (B)

The Sum of marks obtained across (A) and (B) will be the Final CIA marks.

III. In Laboratory Courses where (C) is a component of the assessment pattern, then assessment will be done by considering the weightages given above, i.e. (A) – 25 Marks (Weekly Assessment), (B) – 15 Marks (Laboratory Examination), (C) – 10 marks (Open Ended Experiments/Mini Projects)

- The respective course instructor will design the assessment criteria for the said assessment components.
- The assessment components will be made known to the students by the respective Course Coordinators prior to the commencement of the Laboratory Work.

In all the cases, the assessments will be done based on the criteria designed by the Course Coordinator.

SEE QUESTION PAPER PATTERN:

1. All laboratory experiments should be included for practical examination, from which students are allowed to pick one experiment from the lot.
2. SEE shall be conducted for 100 Marks and the marks will be scaled down to 50.
3. General Marks Distribution: Procedure + Conduction + Viva = 20% + 50% + 30%.
4. Change of experiment is allowed only once and 20% of the marks allotted to the Procedure will be made ZERO (if a question carries two experiments, both should be changed). The evaluation will be done for 80% of the total maximum marks.

BIOLOGY FOR ENGINEERS
(Effective from the Academic Year 2023 - 2024)
IV SEMESTER

Course Code	**HI422T8X**	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	2:0:0:0	SEE Marks	50
Total Hours of Pedagogy	30L	Exam Hours	03

CREDITS – 2

COURSE PREREQUISITES:

- Basic Concepts of Biology

COURSE OBJECTIVES:

- Implementation of new technology in medical Science.
- Use modern technical skills to bring out innovations in medical field.

TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

COURSE CONTENTS

MODULE - I	
Basic Cell Biology- Introduction to Biology, Cell-The unit of life, Cell Theory, Cell structure and Function-Plant cell and Animal cell. **Human Organ System**-Brain as a CPU system - architecture, CNS and Peripheral Nervous System, signal transmission, EEG, Heart as the pump system- Double circulation of human heart, ECG.	**6 Hours**
MODULE - II	
Common Diseases and Vaccination - Allergies, Colds and Flu - causes and precautions. First vaccine in the world, Vaccine for Rabies and RNA vaccines for COVID. Heart disease and its types. Modern technologies to detect heart diseases. Engineering solutions for Parkinson's disease. DNA fingerprinting.	**6 Hours**
MODULE - III	
Biosensors: Various components of biosensors, Transducers in Biosensors: Various types of transducers; principles and applications, applications of biosensors. **Telemedicine**: Block diagram of telemedicine system, origin and development of Telemedicine, Benefits and limitations of Telemedicine.	**6 Hours**
MODULE - IV	
Biomechanics of Joints: Skeletal Joints, Skeletal Muscles, Joint Function, forces and stresses in human joints, Mechanics of the Elbow, Shoulder, Spinal Column, Hip, Knee and Ankle, Applications of prosthetics. **Bio-fluid Mechanics:** Circulatory System in the Human Body, Modeling of Flow in Blood Vessels, Blood Flow Theory. **Biomaterials:** Definition and classification of biomaterials, biocompatibility and biodegradability, Biomedical Implants.	**6 Hours**
MODULE - V	
Artificial intelligence for Medical Application: Introduction to Artificial intelligence and machine learning in medical Science. Application of AI in Imaging and Computer-aided Diagnosis, Neuroscience and drug discovery, Genetic algorithms.	**6 Hours**

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Interpret the basics of cell biology and brain functions.	CL2
CO2	Understand effect of common diseases, types of vaccination and general forensics.	CL2
CO3	Summarize the application of biosensors and telemedicine in medical science.	CL2
CO4	Visualize biomechanical joints, biofluid mechanics and bio materials in medical science.	CL2
CO5	Contrast innovative methods of information technology in computer aided medical diagnosis.	CL2

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	1	1			1			1	1		1			
CO2	1	1	1			2			1	1		1			
CO3	1	2	2			1			1	1		1			
CO4	1	2	2			2			1	1		1			
CO5	1	2	2			1			1	1		1			

3: Substantial (High) | **2: Moderate (Medium)** | **1: Poor (Low)**

ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Continuous Internal Evaluation (CIE)	60 %	30
	Assignments	40 %	20
2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT DETAILS

Continuous Internal Assessment (CIA) (50%)				Semester End Exam (SEE) (50%)
Continuous Internal Evaluation (CIE) (60%)			Assignment/ Activities (40%)	
I	II	III		
Syllabus Coverage			Syllabus Coverage	Syllabus Coverage
40%	30%	30%	100%	100%
MI			MI	MI
MII	MII		MII	MII
	MIII		MIII	MIII
		MIV	MIV	MIV
		MV	MV	MV

Note: For Examinations (both CIE and SEE), the question papers shall contain the questions mapped to the appropriate Bloom's Level. Any COs mapped with higher cognitive Bloom's Level may also be assessed through the assignments.

ASSIGNMENT TYPES WITH WEIGHTAGES

Sl. No.	Assignment Description	Max. Weightage (%)	Max. Marks
1	Written Assignments	25 %	05
2	Case Studies	25 %	05
3	Seminar/Presentation	25 %	05
4	Peer - to - Peer Learning	25 %	05

Note: The assignments mentioned above may be provided appropriately to the students belonging to different bands

SEE QUESTION PAPER PATTERN:

1. The question paper will have TEN full questions.
2. Each full question consists of 20 marks.
3. There will be 2 full questions from all the FIVE modules.
4. Each full question will have a maximum of three sub-questions covering all the topics under a module.
5. The students will have to answer 5 full questions, selecting one full question from each module.

REFERENCE BOOKS:

1. Biology for Engineers, Thyagarajan S., Selvamurugan N., Rajesh M.P., Nazeer R.A., Thilagaraj W., Barathi S., and Jaganthan M.K., Tata McGraw-Hill, New Delhi, 2012
2. Human Physiology, Stuart Fox, Krista Rompolski, McGraw-Hill eBook. 16th Edition, 2022.
3. Brian R Eggins - Biosensors an Introduction, First edition, John Wiley & Sons Publishers, 1996.
4. R S Khandpur, “Telemedicine technology and applications”, PHI Learning Pvt. Ltd, New Delhi, 2017.
5. N. Ozkaya and M. Nordin: Fundamentals of Biomechanics-Equilibrium, Motion and Deformation, Springer-Verlag,2nd Edition,1999.
6. Biomaterials Science and Tissue Engineering: Principles and Methods, by Bikramjit Basu, Cambridge IISc Series.

UHV -2: UNDERSTANDING HARMONY and ETHICAL HUMAN CONDUCT
(Effective from the Academic Year 2023 - 2024)
SEMESTER - IV

Course Code	**HU42289X**	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	1:0:0:0	SEE Marks	50
Total Hours of Pedagogy	15	Exam Hours	03

CREDITS – 1

COURSE PREREQUISITES:

- Have/Develop the critical analysis of the day today happenings.

COURSE OBJECTIVES:

This course will enable students to:

1. To make the students to understand, the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
2. 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.
3. To highlight possible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature.

TEACHING - LEARNING STRATEGY:

These are some sample strategies, which course faculty members can incorporate in the Teaching Learning Process:

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies

COURSE CONTENTS

The course is mainly activity-based that will offer a set of activities for the student that enables them to connect with fellow human beings, nature, society, and the world at large. The course will engage students' interactive sessions, open mic, reading groups, storytelling sessions, and semester-long activities conducted by faculty mentors. In the following a set of activities planned for the course have been listed:

MODULE - I

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 fulfill the Basic Human Aspirations.	**3 Hours**

MODULE - II	
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.	**3 Hours**
MODULE - III	
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.	**3 Hours**
MODULE - IV	
Harmony in the Nature/Existence: Understanding Harmony in the Nature, Inter-connectedness, 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	**3 Hours**
MODULE - V	
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.	**3 Hours**

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Understand value education to develop basic human aspirations through a holistic approach	CL2
CO2	Relate to the needs of self and body to establish co-existence leading to harmony in the human being.	CL2
CO3	Recognize the importance of trust and respect to promote harmony in the family and society.	CL2
CO4	Realize the existence as coexistence to establish harmony through mutual fulfillment among four orders of nature.	CL2
CO5	Recognize the needs for a holistic understanding of human values to develop ethical and professional conduct.	CL2

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1								1				2			
CO2						1		1	1			2			
CO3						2		1	1			2			
CO4							2	1	1			2			
CO5							1	1				2			

3: Substantial (High)	2: Moderate (Medium)	1: Poor (Low)

ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Continuous Internal Evaluation (CIE)	60 %	30
	Assignments	40 %	20
2	**Semester End Examination (SEE)**	**100 %**	**50**

CO - ASSESSMENT MAPPING

Course Outcomes	Continuous Internal Assessment (CIA) (50%)				Semester End Exam (SEE) (50%)
	Continuous Internal Evaluation (CIE) (60%)			Assignment/ Activities (40%)	
	I	II	III		
	Syllabus Coverage			Syllabus Coverage	Syllabus Coverage
	40%	30%	30%	100%	100%
CO1	MI			**MI**	**MI**
CO2	MII	MII		**MII**	**MII**
CO3		MIII		**MIII**	**MIII**
CO4			MIV	**MIV**	**MIV**
CO5			MV	**MV**	**MV**

Note: For Examinations (both CIE and SEE), the question papers shall contain the questions mapped to the appropriate Bloom's Level. Any COs mapped with higher cognitive Bloom's Level may also be assessed through the assignments.

ASSIGNMENT TYPES WITH WEIGHTAGES

Sl. No.	Assignment Description	Max. Weightage (%)	Max. Marks
1	Written Assignments	25 %	05
2	Case Studies	25 %	05
3	Seminar/Presentation	25 %	05
4	Peer - to - Peer Learning	25 %	05

Note: The assignments mentioned above may be provided appropriately to the students belonging to different bands

SEE QUESTION PAPER PATTERN:

Theory SEE will be conducted, with common question papers for the subject (**duration 01 hours)**

1. The question paper will have 50 questions. Each question is set for 01 marks.
2. The students have to answer all the questions, selecting one full question from each module

REFERENCE 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, 2019. ISBN 978-93-87034- 47-1
2. The Teacher‟s Manual Teachers‟ Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G
3. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
4. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
5. The Story of Stuff (Book).
6. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
7. Small is Beautiful - E. F Schumacher.
8. Gandhi - Romain Rolland (English)

MACHINE LEARNING AND APPLICATIONS
(Effective from the Academic Year 2024 - 2025)
V SEMESTER

Course Code	**CS522I1C**	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	3:0:2:0	SEE Marks	50
Total Hours of Pedagogy	40L + 20P	Exam Hours	03

CREDITS – 4

COURSE PREREQUISITES:

- Fundamental knowledge of Mathematical concepts and statistics.
- Fundamentals of python programming.

COURSE OBJECTIVES: This course will enable students to:

- Illustrate ML algorithms and evaluate their performance by using the appropriate applications.
- Apply the classification, clustering and regression-based machine learning algorithms techniques to solve real time problems.
- Apply the algorithms to a real-world problem, optimize the models for maximum accuracy

TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

COURSE CONTENTS

MODULE - I

Introduction: Machine Learning Overview, Types of Machine Learning, Main challenges of Machine Learning, Testing and Validating, Concept Learning: Concept learning task, Concept learning as search, Find-S algorithm, Version space, Candidate Elimination algorithm.	**8 Hours**

MODULE - II	
Decision Tree Learning: Representation, Problems for decision tree learning, Basic decision tree learning algorithm, hypothesis space search in decision tree learning, inductive Bias in decision tree learning, issues in decision tree learning.	**8 Hours**
MODULE - III	
Artificial Neural Network: Introduction, NN representation, Appropriate problems, Perceptron, Backpropagation algorithm. **Genetic Algorithms:** Representing hypothesis, genetic operator, fitness function and selection, Hypothesis space search, genetic programming.	**8 Hours**
MODULE – IV	
Bayesian Learning: Introduction, Bayes theorem, Bayes theorem and Concept learning, Maximum likelihood and least squared error hypothesis, Minimum description length principle, Bayes Optimal classifier, Gibbs algorithm, Naive Bayes classifier, Text classification, Bayesian Belief Networks.	**8 Hours**
MODULE – V	
Instance-Based and Reinforcement Learning: Introduction, k-Nearest Neighbor learning, Locally Weighted Regression, Radial Basis Function, Case-Based Reasoning, Reinforcement Learning, Learning task, Q-Learning.	**8 Hours**

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Understand theory of probability and statistics related to machine learning	CL2
CO2	Apply Decision tree learning algorithm for the data.	CL3
CO3	Apply the concept of neural networks for learning linear and non-linear activation functions and Bayesian classifier to label data.	CL3
CO4	Illustrate concept learning, ML and LS error hypothesis, Bayes classifier.	CL3
CO5	Illustrate clustering, instant based and reinforcement learning algorithms and identify its applicability in real life problems.	CL3

LABORATORY COMPONENTS

Exp. No.	Experiment Description	CO No.	Bloom's Taxonomy Level
1.	Implement and demonstrate the Find-S algorithm for finding the most specific hypothesis.	CO1	CL3
2.	Implement and demonstrate the Candidate Elimination algorithm using a data set stored as a .CSV file.	CO1	CL3
3.	Demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.	CO2	CL3

4.	Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets	CO3	CL3
5.	Demonstrate the text classifier using Naive Bayes classifier algorithm.	CO4	CL3
6.	Implement the Naive Bayesian classifier for a sample training data set stored as a .CSV file.	CO4	CL3
7.	Construct a Bayesian network to analyze the diagnosis of heart patients using heart diseases dataset.	CO4	CL4
8.	Implement KNN classification algorithm with an appropriate dataset and analyze the results.	CO5	CL4

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3							1		1	3	3	3
CO2	3	3	3							1		1	3	3	3
CO3	3	3	3	1	2				1	1		1	3	3	3
CO4	3	3	3	1	2				1	1		1	3	3	3
CO5	3	3	3							1		1	3	3	3

3: Substantial (High)	**2: Moderate (Medium)**	**1: Poor (Low)**

ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Continuous Internal Evaluation (CIE)	60 %	30
	Practical Session (Laboratory Component)	40 %	20
2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT DETAILS

Continuous Internal Assessment (CIA) (50%)				**Semester End Exam (SEE) (50%)**
Continuous Internal Evaluation (CIE) (60%)			**Practical Sessions (40%)**	
I	**II**	**III**		
Syllabus Coverage			**Syllabus Coverage**	**Syllabus Coverage**

40%	30%	30%	100%	100%
MI			MI	MI
MII	MII		MII	MII
	MIII		MIII	MIII
		MIV	MIV	MIV
		MV	MV	MV

NOTE:

- Assessment will be both CIA and SEE.
- The practical sessions of the IPCC shall be for CIE only.
- The Theory component of the IPCC shall be for both CIA and SEE respectively.
- The questions from the practical sessions shall be included in Theory SEE.

Note: For Examinations (both CIE and SEE), the question papers shall contain the questions mapped to the appropriate Bloom's Level. Any COs mapped with higher cognitive Bloom's Level may also be assessed through the assignments.

SEE QUESTION PAPER PATTERN:

- The question paper will have **TEN** full questions from **FIVE** Modules
- There will be 2 full questions from each module. Every question will carry a maximum of 20 marks.
- Each full question may have a maximum of four sub-questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting one full question from each module.

REFERENCE BOOKS:

1. Aurelien Geron, Hands-on Machine Learning with Scikit-Learn & TensorFlow, O'Reilly Media Publications, 3rd Edition, 2022, ISBN: 978-93-5542-198-2.
2. Tom M Mitchell, Machine Learning, McGraw Hill Education Pvt. Ltd, 1st Edition, 2017, ISBN: 978-1-25-909695-2.
3. Saroj Kaushik, Artificial Intelligence, Cengage learning
4. Stuart Rusell, Peter Norving, Artificial Intelligence: A Modern Approach, Pearson Education 2nd Edition
5. AurÈlienGÈron,"Hands-On Machine Learning with Scikit-Learn and Tensor Flow: Concepts, Tools, and Techniques to Build Intelligent Systems", 1st Edition, Shroff/O'Reilly Media, 2017.
6. Trevor Hastie, Robert Tibshirani, Jerome Friedman , The Elements of Statistical Learning, 2nd edition, springer series in statistics.
7. Ethem Alpaydin, Introduction to machine learning, second edition, MIT press
8. Srinivasa K G and Shreedhar, "Artificial Intelligence and Machine Learning", Cengage

COMPUTER NETWORKS
(Effective from the Academic Year 2024- 2025)
V SEMESTER

Course Code	**CS522I2C**	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	3:0:2:0	SEE Marks	50
Total Hours of Pedagogy	40L + 20P	Exam Hours	03

CREDITS – 4

COURSE PREREQUISITES:

- Fundamental of data communication and Network Management

COURSE OBJECTIVES: This course will enable students to:

- Demonstration of application layer protocols
- Discuss transport layer services and UDP and TCP protocols.
- Explore routers, IP and Routing Algorithms in network layer.
- Illustrate concepts of Multimedia Networking, Security and Network Management.

TEACHING - LEARNING STRATEGY:
Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- PowerPoint Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

COURSE CONTENTS

MODULE – I

Introduction to networks: Network hardware, Network software, Reference models. **Application Layer:** **Principles of Network Applications:** Network Application Architectures, Processes Communicating, Transport Services Available to Applications, Transport Services Provided by the Internet, Application-Layer Protocols. **The Web and HTTP:** Overview of HTTP, Non-persistent and Persistent Connections, HTTP Message Format, User-Server Interaction: Cookies, Web Caching, The Conditional GET, **File Transfer:** FTP Commands & Replies, **DNS**; The Internet's Directory Service: Services Provided by DNS, Overview of How DNS Works, DNS Records and Messages	**8 Hours**

MODULE – II	
Transport Layer: **Introduction and Transport-Layer Services:** Relationship Between Transport and Network Layers, **Principles of Reliable Data Transfer:** Building a Reliable Data Transfer Protocol, Pipelined Reliable Data Transfer Protocols, Go-Back-N, Selective repeat, **Connection-Oriented Transport TCP:** The TCP Connection, TCP Segment Structure, Round Trip Time Estimation and Timeout, Reliable Data Transfer, Flow Control, TCP Connection Management.	**8 Hours**
MODULE – III	
The Network layer: **What's Inside a Router?** Switching, Output Processing, Where Does Queuing Occur? IPv6, A Brief foray into IP Security, **Routing Algorithms:** The Link-State (LS) Routing Algorithm, The Distance-Vector (DV) Routing Algorithm, Hierarchical Routing,	**8 Hours**
MODULE – IV	
The Data link layer: Design issues of DLL, Error detection and correction, Elementary data link protocols, Sliding window protocols**. The medium access control sublayer:** The channel allocation problem, Multiple access protocols.	**8 Hours**
MODULE – V	
Multimedia Networking: **Streaming stored video:** UDP Streaming, HTTP Streaming, Adaptive streaming and DASH, content distribution Networks **Voice-over-IP:** Limitations of the Best-Effort IP Service, Removing Jitter at the Receiver for Audio, Recovering from Packet Loss Protocols for Real-Time Conversational Applications, RTP, SIP.	**8 Hours**

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Discuss the principles of application layer protocol and importance of web and HTTP	CL2
CO2	Apply transport layer services and infer UDP and TCP protocol	CL3
CO3	Explore Routers, IP Routing algorithms in network layer	CL3
CO4	Describe the wireless transmission that happens in the physical and data link layer.	CL2
CO5	Illustrate the Multimedia Networking and summarization of Voice -over-IP, RTP, SIP	CL2

LABORATORY COMPONENTS			
Exp. No.	**Experiment Description**	**CO No.**	**Bloom's Taxonomy Level**
1.	Implement Three nodes point – to – point network with duplex links between them for different topologies. Set the queue size, vary the bandwidth, and find the number of packets dropped for various iterations using GNS3.	CO1	CL2
2.	Write a Socket Programming in 'JAVA' using UDP and Network Monitoring and Analysis with Wireshark.	CO2	CL2
3.	Write a Socket Programming in JAVA using TCP -Iterative Client-Server Programs.	CO2	CL2
4.	Analyze the Network Data Analysis using TCP dump using GNS3.	C03	CL4
5.	Analyze the Computer Network Design using SWITCH and ROUTERS in GNS3	C03	CL4
6.	Analyze the Dynamic Host Configuration Protocol (DHCP) using GNS3.	C03	CL4
7.	Implement transmission of ping messages/traceroute over a network topology consisting of 6 nodes and find the number of packets dropped due to congestion in the network.	CO3	CL2
8.	Write a program for error detecting code using CRC-CCITT (16- bits) using JAVA.	CO4	CL2
9.	Write a program for congestion control using a leaky bucket algorithm using JAVA program.	CO4	CL2
10.	Analyze the design of VLANs Using GNS3.	CO5	CL4

CO-PO-PSO MAPPING

CO No.	**Programme Outcomes (PO)**												**Programme Specific Outcome (PSO)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3									3	1	1	
CO2	3	3	3									3	1		
CO3	3	3	3	1								3	2	1	
CO4	3	2	3	1								2			
CO5	3	2	3						2	2		2	1		

3: Substantial (High)	**2: Moderate (Medium)**	**1: Poor (Low)**

ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Continuous Internal Evaluation (CIE)	60 %	30
	Practical Session (Laboratory Component)	40 %	20
2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT DETAILS

Continuous Internal Assessment (CIA) (50%)				**Semester End Exam (SEE) (50%)**
Continuous Internal Evaluation (CIE) (60%)			**Practical Sessions (40%)**	
I	**II**	**III**		
Syllabus Coverage			**Syllabus Coverage**	**Syllabus Coverage**
40%	**30%**	**30%**	**100%**	**100%**
MI			MI	MI
MII	MII		MII	MII
	MIII		MIII	MIII
		MIV	MIV	MIV
		MV	MV	MV

NOTE:

- Assessment will be both CIA and SEE.
- The practical sessions of the IPCC shall be for CIE only.
- The Theory component of the IPCC shall be for both CIA and SEE respectively.
- The questions from the practical sessions shall be included in Theory SEE.

Note: For Examinations (both CIE and SEE), the question papers shall contain the questions mapped to the appropriate Bloom's Level. Any COs mapped with higher cognitive Bloom's Level may also be assessed through the assignments.

SEE QUESTION PAPER PATTERN:

- The question paper will have **TEN** full questions from **FIVE** Modules
- There will be 2 full questions from each module. Every question will carry a maximum of 20 marks.
- Each full question may have a maximum of four sub-questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting one full question from each module.

REFERENCE BOOKS:

1. James F Kurose and Keith W Ross, Computer Networking, A Top-Down Approach, Sixth edition, Pearson,2017.
2. Behrouz A Forouzan, Data and Communications and Networking, Fifth Edition, McGraw Hill, Indian Edition
3. Larry L Peterson and Brusce S Davie, Computer Networks, Fifth Edition, ELSEVIER
4. Andrew S Tanenbaum, Computer Networks, Fifth Edition, Pearson
5. Mayank Dave, Computer Networks, Second edition, Cengage Learning

AUTOMATA THEORY AND COMPUTABILITY
(Effective from the Academic Year 2024 - 2025)
V SEMESTER

Course Code	**CS522T3C**	**CIA Marks**	50
Number of Contact Hours/Week (L: T:P:S)	3:0:0:0	**SEE Marks**	50
Total Contact Hours	40	**Exam Hours**	03

CREDITS - 3

Prerequisites:

Knowledge of Discrete Mathematics and Data Structures

Course Objectives: This course will enable students to:

- Outline the need to study formal languages and automata theory and design the finite automata for a given language.
- Write the regular expressions for a given language and the finite automata and examine the properties of regular languages.
- Construct and simplify the context-free grammars and design the pushdown automata for a given language.
- Explore the properties of context-free languages and design the Turing Machine for a given language.
- Describe the Turing machine extensions and examine the decidability of the computational problems.

Teaching-Learning Strategy:

Following are some sample strategies that can be incorporated for the Course Delivery:

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem-Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

COURSE CONTENTS

MODULE - I

Introduction to Automata Theory: Overview and Applications of Automata Theory, The Central Concepts of Automata Theory. **Finite Automata:** Deterministic Finite Automata; Nondeterministic Finite Automata, Equivalence of Deterministic and Nondeterministic Finite Automata, An Application of Finite Automata: Text Search, Finite Automata with Epsilon-transitions.	**8 Hours**

MODULE - II	
Regular Expressions and Languages: Regular Expressions; Finite Automata and Regular Expressions; Applications of Regular Expressions. **Properties of Regular Languages:** Proving Languages Not to Be Regular; Closure Properties of Regular Languages; Equivalence and Minimization of Automata.	**8 Hours**
MODULE - III	
Context-Free Grammars and Languages: Context-Free Grammars; Parse Trees; Applications of Context-Free Grammars, Ambiguity in Grammars and Languages. **Pushdown Automata:** Definition of the Pushdown Automaton (PDA); The Languages of a PDA; Design of PDA; Equivalence of PDA's and CFG's – Conversion from CFG to PDA and vice versa; Deterministic Pushdown Automata.	**8 Hours**
MODULE - IV	
Properties of Context-Free Languages: Normal Forms for Context-Free Grammars; The Pumping Lemma for Context-Free Languages; Closure Properties of Context-Free Languages. **Turing Machine:** Turing Machine Model; Representation of Turing Machine, Language Acceptability by Turing Machine, Design of Turing Machines, Techniques for Turing Machine Construction.	**8 Hours**
MODULE - V	
Variants of Turing Machines (TM): Nondeterministic Turing Machine, Multi Tape Turing Machine, The Model of Linear Bounded Automaton. **Decidability and Recursively Enumerable Languages:** Decidability, Decidable Languages, Undecidable Languages, Halting Problem of Turing Machine, The Post Correspondence Problem. **Complexity:** Growth Rate of Functions, The Classes of P and NP, Quantum Computation - Quantum Computers, Church-Turing Thesis**.**	**8 Hours**

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Make use of central concepts of automata theory to solve the finite automata for different formal languages and identify the equivalence between different models of finite automata.	CL3
CO2	Build the regular expression for a given formal language and identify the equivalence between finite automata and regular expressions. Also, explore the properties of regular languages.	CL3
CO3	Construct the context-free grammar and pushdown automata for the different formal languages and identify the equivalence between pushdown automata and context-free grammar.	CL3
CO4	Show the properties of context-free languages by simplifying the context-free grammar and build the Turing machine for the given formal language.	CL3
CO5	Outline the concepts of Turing machine variants and identify the decidability and intractability of computational problems.	CL3

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3		2						2	2	1		
CO2	3	3	3	3	2						2	2	2	1	
CO3	3	3	3		2						2	2	2	1	
CO4	3	3	3	3	2							2	1		
CO5	2	2	2	2								1	1		

3: Substantial (High)	2: Moderate (Medium)	1: Poor (Low)

ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Student's learning will be assessed using Direct and Indirect methods.

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Continuous Internal Evaluation (CIE)	60 %	30
	Assignments	40 %	20
2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT DETAILS

Continuous Internal Assessment (CIA) (50%)				
Continuous Internal Evaluation (CIE) (60%)			Assignment/ Activities (40%)	Semester End Exam (SEE) (50%)
I	II	III		
Syllabus Coverage			Syllabus Coverage	Syllabus Coverage
30%	30%	40%	100%	100%
M I			M I	M I
M II	M II		M II	M II
	M III		M III	M III
		M IV	M IV	M IV
		M V	M V	M V

Note: For Examinations (both CIE and SEE), the question papers shall contain the questions mapped to the appropriate Bloom's Level. Any COs mapped with higher cognitive Bloom's Level may also be assessed through the assignments.

ASSIGNMENT TYPES WITH WEIGHTAGES			
Sl. No.	**Assignment Description**	**Max. Weightage (%)**	**Max. Marks**
1	Written Assignments	25 %	05
2	Quiz	10 %	02
3	Case Studies	25 %	05
4	Seminar/Presentation	15 %	03
5	Peer-to-Peer Learning	10 %	02
6	Activity Based Learning	50 %	10
7	Project Based Learning	50 %	10
8	Field Work + Report	50 %	10
9	Industry Visit + Report	50 %	10
10	NPTEL/MOOC Courses – Registration and Assignment Submissions	50 %	10
	NPTEL Certification	75 %	15
11	Any other Innovative Assignments (CL4 and above)	50 %	10

Note: The assignments mentioned above may be provided appropriately to the students belonging to different bands.

SEE Question Paper Pattern:

- The question paper will have **TEN** full questions from **FIVE** Modules.
- There will be 2 full questions from each module. Every question will carry a maximum of 20 marks.
- Each full question may have a maximum of four sub-questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting one full question from each module.

Reference Books:

1. John E. Hopcroft, Rajeev Motwani, Jeffrey D.Ullman: Introduction to Automata Theory, Languages and Computation, 3rd Edition, Pearson Education. Elaine Rich, Automata, Computability and Complexity, 1st Edition, Pearson Education, 2012/2013
2. K L P Mishra, N Chandrasekaran, 3rd Edition, Theory of Computer Science, PHI.
3. Michael Sipser: Introduction to the Theory of Computation, 3rd Edition, Cengage Learning, 2013
4. John C Martin, Introduction to Languages and The Theory of Computation, 3rd Edition, Tata McGraw–Hill Publishing Company Limited, 2013
5. Peter Linz, “An Introduction to Formal Languages and Automata”, 3rd Edition, Narosa Publishers, 1998
6. Basavaraj S. Anami, Karibasappa K G, Formal Languages and Automata Theory, Wiley India, 2012
7. C K Nagpal, Formal Languages and Automata Theory, Oxford University Press, 2012.

DATABASE MANAGEMENT SYSTEM
(Effective from the Academic Year 2024 - 2025)
V SEMESTER

Course Code	**CS522T4C**	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	**40L**	Exam Hours	03

CREDITS – 3

COURSE PREREQUISITES:

- Knowledge of Data Structures

COURSE OBJECTIVES: This course will enable students to:

- Provide a strong foundation in database concepts, technology, and practice.
- Practice SQL programming through a variety of database problems.
- Demonstrate the use of concurrency and transactions in the database.
- Design and build database applications for real world problems.

TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Virtual Lab
- Expert Talk/Webinar/Seminar
- Peer-to-Peer Activities
- Problem Based Learning
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

COURSE CONTENTS

MODULE - I

Introduction to Databases*:* Overview, Characteristics and, Advantages of using the DBMS approach. **Database System Concepts and Architecture:** Data Models, Schemas, and Instances. Three schema architecture and data independence, database languages, and interfaces, Database System environment. **Basic SQL:** SQL data definition and data types, specifying constraints in SQL, retrieval queries in SQL, INSERT, DELETE, and UPDATE statements in SQL.	**8 Hours**

MODULE - II	
Data Modeling Using the Entity-Relationship (ER) Model: Entity types, Entity sets, attributes, roles, and structural constraints, Weak entity types, ER diagrams, Relationship Types of Degree Higher than Two, Examples. **Relational Database Design by ER-to-Relational Mapping**: Relational Database Design using ER-to-Relational mapping. **The Relational Data Model and Relational Database Constraints:** Relational Model Concepts, Relational Model Constraints and relational database schemas, Update operations, transactions, and dealing with constraint violations.	**8 Hours**
MODULE - III	
The Relational Algebra and Relational Calculus: Unary Relational Operation**s:** SELECT and PROJECT, Relational Algebra Operations from Set Theory, Binary Relational Operations: JOIN and DIVISION, Additional relational operations (aggregate, grouping, etc.), Examples of Queries in relational algebra. **SQL: Advances Queries**: More complex SQL retrieval queries, Specifying constraints as assertions and action triggers, Views in SQL, Schema change statements in SQL.	**8 Hours**
MODULE - IV	
Basics of Functional Dependencies and Normalization for Relational Databases: Informal Design Guidelines for Relation Schemas, Functional Dependencies, Normal Forms based on Primary Keys, General Definitions of Second and Third Normal Forms, Boyce-Codd Normal Form. **Relational Database Design Algorithms and Further Dependencies:** Inference Rules, Equivalence, and Minimal Cover, Properties of Relational Decompositions, Algorithms for Relational Database Schema Design.	**8 Hours**
MODULE - V	
Introduction to Transaction Processing Concepts and Theory: Introduction to Transaction Processing, Transaction and System concepts, Desirable properties of Transactions, characterizing schedules based on recoverability, characterizing schedules based on Serializability, Transaction support in SQL**.** **Concurrency Control Techniques:** Two-phase locking techniques for Concurrency control, Concurrency control based on Timestamp ordering.	**8 Hours**

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Discuss the fundamental concepts of database technology and illustrate the fundamental concepts of Structured Query Language (SQL) for database manipulation.	CL3
CO2	Make use of Entity Relationship (ER) model to illustrate conceptual database design and describe the basic principles of relational model	CL3
CO3	Examine the concepts of relational algebra and advanced Structured Query Language in database application development	CL3
CO4	Apply the functional dependency to measure the appropriateness of attribute groupings into relation schemas and discuss the process of normalization with its algorithms.	CL3
CO5	Identify the basic concepts and theory needed for transaction processing, concurrency control in database applications	CL3

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1									2	1	1	1
CO2	3	2	1		3							2	1	1	1
CO3	3	2	1									2	1	1	1
CO4	3	2	1	1								2	1	1	1
CO5	3	3	2	2		2				3		2	1	1	1

3: Substantial (High)	2: Moderate (Medium)	1: Poor (Low)

ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Continuous Internal Evaluation (CIE)	60 %	30
	Assignments	40 %	20
2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT DETAILS

Continuous Internal Assessment (CIA) (50%)				Semester End Exam (SEE) (50%)
Continuous Internal Evaluation (CIE) (60%)			Assignment/ Activities (40%)	
I	II	III		
Syllabus Coverage			Syllabus Coverage	Syllabus Coverage
40%	30%	30%	100%	100%
MI			MI	MI
MII	MII		MII	MII
	MIII		MIII	MIII
		MIV	MIV	MIV
		MV	MV	MV

Note: For Examinations (both CIE and SEE), the question papers shall contain the questions mapped to the appropriate Bloom's Level. Any COs mapped with higher cognitive Bloom's Level may also be assessed through the assignments.

ASSIGNMENT TYPES WITH WEIGHTAGES			
Sl. No.	**Assignment Description**	**Max. Weightage (%)**	**Max. Marks**
1	Written Assignments	25 %	05
2	Quiz	10 %	02
3	Case Studies	25 %	05
4	Seminar/Presentation	15 %	03
5	Peer - to - Peer Learning	10 %	02
6	Activity Based Learning	50 %	10
7	Project Based Learning	50 %	10
8	Field Work + Report	50 %	10
9	Industry Visit + Report	50 %	10
10	NPTEL/MOOC Courses – Registration and Assignment Submissions	50 %	10
	NPTEL Certification	75 %	15
11	Any other Innovative Assignments (CL4 and above)	50 %	10

Note: The assignments mentioned above may be provided appropriately to the students belonging to different bands

SEE QUESTION PAPER PATTERN:

- The question paper will have **TEN** full questions from **FIVE** Modules
- There will be 2 full questions from each module. Every question will carry a maximum of 20 marks.
- Each full question may have a maximum of four sub-questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting one full question from each module.

REFERENCE BOOKS:

1. Ramez Elmasri and Shamkant B. Navathe, Fundamentals of Database Systems, 7th Edition, Pearson, 2017.
2. Ramakrishnan, and Gehrke, Database management systems, 3rd Edition, McGraw Hill, 2014
3. Silberschatz Korth and Sudharshan, Database System Concepts, 6th Edition, Mc-GrawHill, 2013.
4. Coronel, Morris, and Rob, Database Principles Fundamentals of Design, Implementation and Management, Cengage Learning 2012.

DATABASE MANAGEMENT SYSTEM LABORATORY
(Effective from the Academic Year 2024 - 2025)
V SEMESTER

Course Code	**CS522L5C**	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	0:0:2:0	SEE Marks	50
Total Hours of Pedagogy	20P	Exam Hours	03

CREDITS – 1

COURSE PREREQUISITES:

- Basics of SQL

COURSE OBJECTIVES: This course will enable students to:

- Foundation knowledge in database concepts, technology, and practice to groom students into well-informed database application developers.
- Strong practice in SQL programming through a variety of database problems.
- Develop database applications using front-end tools and back-end DBMS.

TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

LIST OF EXPERIMENTS

Sl. No.	**Description**
Pre-requisite: Introduction to SQL. Demonstrate the Basic Database operations.	
Part-A	
1	Consider the following schema for Bank Database: BRANCH (bid: varchar, bname:string, branch-name:string, assets:integer) ACCOUNT (accno:int, bid: varchar, acctype: varchar, accbalance:integer, Cid:varchar) CUSTOMER (Cid:varchar, customer-name:string, customer-age:integer, customer-address:string, customer-phone:string) LOAN (loan-number:int, bid: varchar, amount:integer, Cid:varchar)

	Write SQL queries to 1. Find all the customers who have at least one account at the "Mangaluru" branch. 2. Find names of the depositors who have deposited highest amount among all the customers. 3. Retrieve the Customer name and loan amount of a customer who borrowed a loan more than 5,00,000. 4. Retrieve the details of bank branch with maximum and minimum assets among the various branches. 5. Demonstrate how you delete all account tuples at every branch located in a specific city.
2	Consider the following schema for a Library Database: BOOK (Book_id:varchar, Title:string, Publisher_Name:string, Pub_Year:integer) BOOK_AUTHORS (Book_id:varchar, Author_Name:string) PUBLISHER (Name:string, Address:string, Phone:integer) BOOK_COPIES (Book_id:varchar, Programme_id:varchar, No-of_Copies:integer) BOOK_LENDING (Book_id:varchar, Programme_id:varchar, Card_No:varchar, Date_Out:date, Due_Date:date) LIBRARY_PROGRAMME (Programme_id:varchar**,** Programme_Name:string, Address:string) Write SQL queries to 1. Retrieve details of all books in the library – id, title, name of publisher, authors, number of copies in each Programme, etc. 2. Get the particulars of borrowers who have borrowed more than 3 books, but from Jan 2023 to Jun 2023. 3. Delete a book in BOOK table. Update the contents of other tables to reflect this data manipulation operation. 4. Partition the BOOK table based on year of publication. Demonstrate its working with a simple query. 5. Create a view of all books and its number of copies that are currently available in the Library

3	Consider the schema for College Database: STUDENT (USN, SName, Address, Phone, Gender) SEMSEC (SSID, Sem, Sec) CLASS (USN, SSID) COURSE (Subcode, Title, Sem, Credits) IAMARKS (USN, Subcode, SSID, Test1, Test2, Test3, FinalIA) Write SQL queries to 1. List all the student details studying in fourth semester „C" section. 2. Compute the total number of male and female students in each semester and in each section. 3. Create a view of Test1 marks of student USN "4SF20CD001" in all Courses. 4. Calculate the FinalIA (average of three test marks) and update the corresponding table for all students. 5. Categorize students based on the following criterion: If FinalIA = 45 to 50 then CAT = "Outstanding" If FinalIA= 40 to 45 then CAT= "Good" If FinalIA = 30 to 40 then CAT = "Average" If FinalIA< 30 then CAT = "Weak" Give these details only for 8th semester A, B, and C section students.
4	Consider the schema for Company Database: EMPLOYEE (Eid:varchar, Name:string, Address: string, Gender:string, Salary: integer, SuperEid: varchar, Dno: varchar) DEPARTMENT (Dnum: varchar, Dname: string, DMgr_id:varchar, Mgr_start_date: date) DLOCATION (Dno: varchar, Dlocation:string) PROJECT (Pnum:varchar, Pname: string, Plocation:string, Dno:varchar) WORKS_ON (Eid: varchar, Pno: varchar, Hours: integer) DEPENDENT (Empid: varchar, Dep_name:string, Gender:string, Bdate:date, Relationship:String) Write SQL queries to 1. Make a list of all project numbers for projects that involve an employee whose name is "Rahul", either as a worker or as a manager of the department that controls the project. 2. Show the resulting salaries if every employee working on the "IoT" project is given a 10 percent raise. 3. Find the sum of the salaries of all employees of the "Accounts" department, as well as the maximum salary, the minimum salary, and the average salary in this department. 4. Retrieve the name of each employee who works on all the projects controlled by department number 5 (use NOT EXISTS operator). 5. Create a view Dept_info that gives details of department name, Number of employees and total salary of each department.
5	Consider the schema for Airline Database: Flights (fno: varchar, from: string, to: string, distance: integer, departs: time, arrives: time, price: integer) Aircraft (aid: varchar, aname: string, cruisingrange: integer) Certified (eid: varchar, aid: varchar) Employees (eid: varchar, ename: string, salary: integer)

Note: The Employees relation describes pilots and other kinds of employees as well; Every pilot is certified for some aircraft, and only pilots are certified to fly.

Write SQL queries to

1. Find the names of aircraft such that all pilots certified to operate them have salaries more than Rs.80, 000.
2. For each pilot who is certified for more than three aircrafts, find the eid and the maximum cruisingrange of the aircraft for which she or he is certified.
3. Find the names of pilots whose salary is less than the price of the cheapest route from Bengaluru to Mumbai.
4. Find the aids of all aircraft that can be used on routes from Bengaluru to New Delhi.
5. Find the employee name and salary earning second highest salary.

Part-B: Mini Project

- For any societal problem statement selected.
- Make sure that the application should have five or more tables, one trigger and one Stored Procedure.
- Mobile Applications are strictly prohibited.
- The mini project team may consist of maximum two members.
- The areas for problem statement may include, but not limited to the following:
  - Educational sector
  - Environmental issues
  - Healthcare
  - Women empowerment
  - Childcare
  - Banking sector

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Use SQL programming and different concepts of DBMS to create, update and query on the Bank and Library databases.	CL3
CO2	Demonstrate SQL programming and different concepts of DBMS to create, update and query on the College database.	CL3
CO3	Illustrate the concepts of SQL programming and DBMS to create, update and query on the Company database.	CL3
CO4	Create, update and query on the Airline database by using different concepts of DBMS and SQL programming.	CL3
CO5	Design, implement and demonstrate a mini project using front end tools and database and compile the working with well document using modern tool.	CL3

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	2	2			1				2	1	1	1
CO2	3	3	3	2	2			1				2	1	1	1
CO3	3	3	3	2	2			1				2	1	1	1
CO4	3	3	3	2	2			1				2	1	1	1
CO5	3	3	3	3	3	2		3	3	3	3	2	1	1	1

3: Substantial (High)	2: Moderate (Medium)	1: Poor (Low)

ASSESSMENT STRATEGY

I. In Laboratory Courses where (B) and (C) are not the components of the assessment pattern, then (A) will have 100% weightage (50 Marks).

Assessment Mode: Weekly Assessment of Laboratory Work (50 Marks) - the marks will be awarded based on the Continuous Internal Assessment (Weekly Assessment, each of 25 marks) of the students in each laboratory session. The average of all the marks obtained across the sessions will be the Final CIA marks.

II. In Laboratory Courses where (C) is not a component of the assessment pattern, then (A) will have 50% weightage (25 Marks), and (B) will have 50% weightage (25 Marks).

Assessment Mode: The marks will be awarded based on the Continuous Internal Assessment (Weekly Assessment) (A) and One Laboratory Test (B).

- In Weekly Assessment, the student will be evaluated in each laboratory session for 25 marks. The average marks obtained across all the experiments will be the marks obtained for (A).
- A Laboratory Test, similar to the SEE exam is conducted towards the end of the Semester/Course, whichever is earlier. The obtained marks are scaled down to 25 Marks (B)

The Sum of marks obtained across (A) and (B) will be the Final CIA marks.

III. In Laboratory Courses where (C) is a component of the assessment pattern, then assessment will be done by considering the weightages given above, i.e. (A) – 25 Marks (Weekly Assessment), (B) – 15 Marks (Laboratory Examination), (C) – 10 marks (Open Ended Experiments/Mini Projects)

1) The respective course instructor will design the assessment criteria for the said assessment components.
2) The assessment components will be made known to the students by the respective Course Coordinators prior to the commencement of the Laboratory Work.

In all the cases, the assessments will be done based on the criteria designed by the Course Coordinator.

SEE QUESTION PAPER PATTERN:

- All laboratory experiments should be included for practical examination, from which students are allowed to pick one experiment from the lot.
- SEE shall be conducted for 100 Marks and the marks will be scaled down to 50.
- General Marks Distribution: Procedure + Conduction + Viva = 20% + 50% + 30%.
- Change of experiment is allowed only once and 20% of the marks allotted to the Procedure will be made ZERO (if a question carries two experiments, both should be changed). The evaluation will be done for 80% of the total maximum marks.

REFERENCE BOOKS:

1. Fundamentals of Database Systems, Ramez Elmasri and Shamkant B. Navathe, 7th Edition, 2017, Pearson.
2. Database management systems, Ramakrishnan, and Gehrke, 3rd Edition, 2014, McGraw Hill
3. Silberschatz Korth and Sudharshan, Database System Concepts, 6th Edition, Mc-GrawHill, 2013.
4. Coronel, Morris, and Rob, Database Principles Fundamentals of Design, Implementation and Management, Cengage Learning 2012.

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SECURE CODING

(Effective from the Academic Year 2024 - 2025)

V SEMESTER

Course Code	**CS52216CA**	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	**40L**	Exam Hours	03

CREDITS – 3

COURSE PREREQUISITES:

- Programming Experience: A strong foundation in programming using languages like Java, Python, or C/C++ is essential.
- Basics System Security Concepts.

COURSE OBJECTIVES: This course will enable students to:

- Understand Security Threats: Develop an awareness of common security threats and vulnerabilities in software development, enabling students to identify potential risks and their impact on applications.

TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course content

COURSE CONTENTS

MODULE - I

Running with Scissors: Gauging the threat, Security concepts. **Strings:** Common String Manipulation errors - Improperly Bounded String Copies - Off-by-One Errors - Null Termination Errors - String Truncation - String Errors without Functions, String vulnerabilities - Buffer Overflow - Process memory organization – Stack management – Stack smashing, Mitigation techniques – String handling functions.	**8 Hours**

MODULE - II	
Dynamic Memory Management – C Memory management functions, Common C Memory Management Errors – Initialization Errors - Failing to Check Return Values – Dereferencing Null or Invalid Pointers - Referencing Freed Memory - Freeing Memory Multiple Times - Memory Leaks - Zero-Length Allocations, Memory Managers, Doug Lea's Memory Allocator.	**8 Hours**
MODULE - III	
Integer Security: Introduction to integer types, Integer Data Types, Integer Conversions, Integer operations, Integer Vulnerabilities, Mitigation strategies- Integer type selection- Abstract Data types - Range checking - secure Integer libraries.	**8 Hours**
MODULE – IV	
Formatted Output: Variadic Functions, Formatted Output Functions, Stack Randomization, Mitigation Strategies.	**8 Hours**
MODULE - V	
Concurrency: Multithreading, Parallelism, Performance Goals, Common Errors, Mitigation Strategies, Mitigation pitfalls. **File I/O**: TOCTOU, Mitigation strategies.	**8 Hours**

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO NO.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Understand the common security threats in software applications and identify/mitigate vulnerabilities stemming from string manipulation errors.	CL2
CO2	Identify and mitigate the vulnerabilities based on dynamic memory management errors	CL2
CO3	Apply strategies to identify and address vulnerabilities associated with integer operations.	CL3
CO4	Identify and mitigate the vulnerabilities due to errors in formatted output functions	CL3
CO5	Demonstrate the ability to identify and effectively mitigate vulnerabilities resulting from errors in both concurrency and file I/O operations.	CL3

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2		2				2			2	3	2	

CO2	3	3	2		2				2			2	3	2	1
CO3	3	3	2		2				2			2	3	2	1
CO4	3	3	2		2				2			2	3	2	1
CO5	3	3	2		2				2			2	3	2	

3: Substantial (High)	**2: Moderate (Medium)**	**1: Poor (Low)**

ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	**Assessment Description**	**Weightage (%)**	**Max. Marks**
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Continuous Internal Evaluation (CIE)	60 %	30
	Assignments	40 %	20
2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT DETAILS

Continuous Internal Assessment (CIA) (50%)				
Continuous Internal Evaluation (CIE) (60%)			**Assignment/ Activities (40%)**	**Semester End Exam (SEE) (50%)**
I	**II**	**III**		
Syllabus Coverage			**Syllabus Coverage**	**Syllabus Coverage**
40%	**30%**	**30%**	**100%**	**100%**
MI			MI	MI
MII	MII		MII	MII
	MIII		MIII	MIII

		MIV	MIV	MIV
		MV	MV	MV

Note: For Examinations (both CIE and SEE), the question papers shall contain the questions mapped to the appropriate Bloom's Level. Any COs mapped with higher cognitive Bloom's Level may also be assessed through the assignments.

ASSIGNMENT TYPES WITH WEIGHTAGES

Sl. No.	Assignment Description	Max. Weightage (%)	Max. Marks
1	Written Assignments	25 %	05
2	Quiz	10 %	02
3	Case Studies	25 %	05
4	Seminar/Presentation	15 %	03
5	Peer - to - Peer Learning	10 %	02
6	Activity Based Learning	50 %	10
7	Project Based Learning	50 %	10
8	Field Work + Report	50 %	10
9	Industry Visit + Report	50 %	10
10	NPTEL/MOOC Courses – Registration and Assignment Submissions	50 %	10
	NPTEL Certification	75 %	15
11	Any other Innovative Assignments (CL4 and above)	50 %	10

Note: The assignments mentioned above may be provided appropriately to the students belonging to different bands

SEE QUESTION PAPER PATTERN:

- The question paper will have **TEN** full questions from **FIVE** Modules
- There will be 2 full questions from each module. Every question will carry a maximum of 20 marks.
- Each full question may have a maximum of four sub-questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting one full question from each module.

REFERENCE BOOKS:

1. "Secure Coding in C and C++" by Robert C. Seacord.
2. OWASP Testing Guide" by The OWASP Foundation.
3. Secure Programming with Static Analysis, by Brian Chess and Jacob West.
4. The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws" by Dafydd Stuttard and Marcus Pinto.

DRONE TECHNOLOGY AND ITS APPLICATION
(Effective from the Academic Year 2023 - 2024)
V SEMESTER

Course Code	**CS52216CB**	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	**40L**	Exam Hours	03

CREDITS – 3

COURSE PREREQUISITES:

- Fundamental knowledge of Drone technology.

COURSE OBJECTIVES: This course will enable students:

- To understand the basics of drone concepts.
- To learn and understand the fundamentals of design, fabrication and programming of drone.
- To impart the knowledge of flying and operation of drone.
- To know about the various applications of drone.
- To understand the safety risks and guidelines of fly safely.

TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

COURSE CONTENTS

MODULE - I

Introduction to Drone Technology: Drone Concept, Vocabulary Terminology, History of drone, Types of current generation of drones based on their method of propulsion, Drone technology impact on the businesses, Drone business through entrepreneurship, Opportunities/applications for entrepreneurship and employability.	**8 Hours**

MODULE - II

Drone Design, Fabrication and Processing: Classifications of the UAV, Overview of the main drone parts, technical characteristics of the parts, Function of the component parts, assembling a drone, The energy sources, Level of autonomy, Drones configurations, The methods of programming drone, Download program, Install program on computer, Running Programs, Multi rotor stabilization, Flight modes, Wi-Fi connection.	**8 Hours**

MODULE - III	
Drone Flying and Operation: Concept of operation for drone, Flight modes, operate a small drone in a controlled environment, Drone controls Flight operations, management tool, Sensors, Onboard storage capacity, Removable storage devices, Linked mobile devices and applications.	**8 Hours**
MODULE - IV	
Drone Commercial Application: Choosing a drone based on the application, Drones in the insurance sector, Drones in delivering mail, parcels and other cargo, Drones in agriculture, Drones in inspection of transmission lines and power distribution, Drones in filming and panoramic picturing.	**8 Hours**
MODULE - V	
Future Drones and Safety: The safety risks, Guidelines to fly safely, Specific aviation regulation and standardization, Drone license, Miniaturization of drones, Increasing autonomy of drones, The use of drones in swarms.	**8 Hours**

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Know about a various type of drone technology, drone fabrication and programming.	CL2
CO2	Execute the suitable operating procedures for functioning a drone.	CL3
CO3	Select appropriate sensors and actuators for Drones	CL3
CO4	Develop a drone mechanism for specific applications.	CL3
CO5	Create the programs for various drones	CL4

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	1											1	1	
CO2	2	1				2							1	1	1
CO3	2	1				2							1	1	
CO4	2	1				1							1	1	1
CO5	2	1											1	1	1

3: Substantial (High)	2: Moderate (Medium)	1: Poor (Low)

ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Continuous Internal Evaluation (CIE)	60 %	30

	Assignments	40 %	20
2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT DETAILS

Continuous Internal Assessment (CIA) (50%)				**Semester End Exam (SEE) (50%)**
Continuous Internal Evaluation (CIE) (60%)			**Assignment/ Activities (40%)**	
I	**II**	**III**		
Syllabus Coverage			**Syllabus Coverage**	**Syllabus Coverage**
40%	**30%**	**30%**	**100%**	**100%**
MI			MI	MI
MII	MII		MII	MII
	MIII		MIII	MIII
		MIV	MIV	MIV
		MV	MV	MV

Note: For Examinations (both CIE and SEE), the question papers shall contain the questions mapped to the appropriate Bloom's Level. Any COs mapped with higher cognitive Bloom's Level may also be assessed through the assignments.

ASSIGNMENT TYPES WITH WEIGHTAGES

Sl. No.	**Assignment Description**	**Max. Weightage (%)**	**Max. Marks**
1	Written Assignments	25 %	05
2	Quiz	10 %	02
3	Case Studies	25 %	05
4	Seminar/Presentation	15 %	03
5	Peer - to - Peer Learning	10 %	02
6	Activity Based Learning	50 %	10
7	Project Based Learning	50 %	10
8	Field Work + Report	50 %	10
9	Industry Visit + Report	50 %	10
10	NPTEL/MOOC Courses – Registration and Assignment Submissions	50 %	10
	NPTEL Certification	75 %	15
11	Any other Innovative Assignments (CL4 and above)	50 %	10

Note: The assignments mentioned above may be provided appropriately to the students belonging to different bands

SEE QUESTION PAPER PATTERN:

- The question paper will have **TEN** full questions from **FIVE** Modules
- There will be 2 full questions from each module. Every question will carry a maximum of 20 marks.
- Each full question may have a maximum of four sub-questions covering all the topics under a module.

- The students will have to answer FIVE full questions, selecting one full question from each module.

REFERENCE BOOKS:

1. Daniel Tal and John Altschuld, “Drone Technology in Architecture, Engineering and Construction: A Strategic Guide to Unmanned Aerial Vehicle Operation and Implementation”, 2021 John Wiley & Sons, Inc.
2. Terry Kilby and Belinda Kilby, “Make:Getting Started with Drones “,Maker Media, Inc, 2016
3. John Baichtal, “Building Your Own Drones: A Beginners' Guide to Drones, UAVs, and ROVs”, Que Publishing, 2016
4. Zavrsnik, “Drones and Unmanned Aerial Systems: Legal and Social Implications for Security and Surveillance”, Springer, 2018.

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INFORMATION STORAGE AND MANAGEMENT
(Effective from the Academic Year 2024 -2025)
SEMESTER - V

Course Code	**CS52216CC**	**CIA Marks**	**50**
Number of Contact Hours/Week (L:T:P:S)	**3:0:0:0**	**SEE Marks**	**50**
Total Hours of Pedagogy	**40L**	**Exam Hours**	**03**

CREDITS –3

Prerequisites:

- Fundamental knowledge of computer systems and basic networking concepts.

Course Objectives: This course will enable students:

- To provide a comprehensive understanding of storage technology, including architectures, protocols, and technologies.
- To understand storage systems, storage networking technologies, and management techniques.
- To describe different storage architectures and their applications.
- To understand data protection and security mechanisms in storage systems.
- To manage and optimize storage resources in a data center environment

Teaching - Learning Strategy:

These are some sample strategies, which course faculty members can incorporate in the Teaching Learning Process:

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Project Based Learning
- Activity Based Learning
- Case Studies
- MOOC/NPTEL Courses

COURSE CONTENTS

MODULE – 1

Module Contents	**Lecture Hours**
Introduction to Information Storage: Information Storage, Evolution of Storage Architecture, Data Center Infrastructure, Virtualization and Cloud Computing. **Data Center Environment:** Application, Database Management System, Host, Connectivity, Storage, Disk Drive Component, Disk Drive Performance.	**8 Hours**

MODULE – 2	
Data Protection -RAID: RAID Implementation Methods, Raid Array Components, Raid Techniques, RAID levels, RAID Impact on Disk Performance, RAID Comparison. **Intelligent Storage Systems:** Component of an Intelligent Storage System, Storage Provisioning, Type of Intelligent Storage System.	**8 Hours**
MODULE – 3	
Fibre Channel Storage Area Networks: Fibre Channel Overview, The SAN and its Evolution, Components of FC SCAN, FC Connectivity, Zoning **IP SAN and FCoE:** iSCSI, FCIP.	**8 Hours**
MODULE – 4	
Network-Attached Storage: General-Purpose Servers versus NAS Devices, Benefits of NAS, File System and Network File Sharing, Components of NAS, NAS I/O Operation, NAS Implementation, NAS File Sharing Protocol, Factor Affecting NAS Performance **Replication:** Local Replication, Uses of Local Replicas, Local Replication Technology, Remote Replication, Modes of Remote Replication, Remote Replication Technology.	**8 Hours**
MODULE – 5	
Securing the Storage Infrastructure: Information Security Framework, Risk Triad, Storge Security Domain **Backup and Archive:** Backup Purpose, Backup Consideration, Backup Granularity, Backup Methods, Backup Architecture, Backup and Restore Operations, Backup Topologies.	**8 Hours**

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Understand the evolution of storage architecture and the role of virtualization and cloud computing in modern data centers.	CL2
CO2	Identify RAID implementation methods and compare RAID levels for data protection and performance.	CL2
CO3	Describe Fibre Channel SAN architecture, components, and IP-based SAN solutions like iSCSI and FCoE.	CL2
CO4	Discuss the benefits and components of Network –Attached Storage (NAS) and explain replication technologies.	CL2
CO5	Summarize storage security frameworks and backup strategies to ensure data protection and recovery.	CL2

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1		1	1			1	1	1		2			1
CO2	3	1		1	1			1	1	1		2			
CO3	3	1		2	1			1	1	1		2		1	
CO4	3	1		2	1			1	1	1		2			
CO5	3	1		2	1			1	1	1				1	1

3: Substantial (High)	2: Moderate (Medium)	1: Poor (Low)

CO - Assessment Mapping:

Course Outcomes	Continuous Internal Assessment (CIA) (50%)				Semester End Exam (SEE) (50%)
	Continuous Internal Evaluation (CIE)(60%)			Assignment/Activities (40%)	
	I	II	III		
	Syllabus Coverage				
	40%	30%	30%	100%	100%
CO1	x			x	x
CO2	x			x	x
CO3		x		x	x
CO4		x	x	x	x
CO5			x	x	x

Assessment Strategy:

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Continuous Internal Evaluation (CIE)	60 %	30
	Assignments*	40 %	20
2	**Semester End Examination (SEE)**	**100 %**	**50**

Assignment Types:

Sl. No.	Assignment Description	Max. Weightage (%)	Max. Marks
1	Written Assignments	25 %	5
2	Quiz	25 %	5
3	Field Visits/Survey/Case Studies	50 %	10
4	Model / Prototype Development	100 %	20
5	Project Based Learning		
6	Seminar/Presentation	25 %	5
7	Peer - to -Peer Learning	25 %	5

SEE Question Paper Pattern:

- The question paper will have TEN full questions.
- Each full question consisting of 20 marks.
- There will be 2 full questions from all the FIVE modules.
- Each full question will have a maximum of four sub-questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Reference Books:

1. Somasundaram Gnanasundaram, Alok Shrivastava, Information Storage and Management, 2nd Ed, Wiley,2017.
2. G. Somasundaram & Alok Shrivastava (EMC Education Services) editors; Information Storage and Management: Storing, Managing, and Protecting Digital Information,2nd Ed, Wiley India,2009.
3. EMC Education Services, Information Storage and Management: Storing, Managing and Protecting Digital Information in Classic, Virtualized, and Cloud Environments,2nd Ed, Wiley,2012.

SOCIAL NETWORK ANALYSIS
(Effective from the Academic Year 2024 - 2025)
V SEMESTER

Course Code	**CS52216CD**	**CIA Marks**	**50**
Number of Contact Hours/Week (L: T:P:S)	**3:0:0:0**	**SEE Marks**	**50**
Total Hours of Pedagogy	**40L**	**Exam Hours**	**3 Hours**

CREDITS –3

Prerequisites:

- Knowledge of computer networks and Mathematics.

Course Objectives: This course will enable students:

- To determine how network analysis can contribute to increasing knowledge about diverse aspects of society.
- To analyze the implementation of semantic web applications and the architectures of social networking.
- To Formalize different types of entities and relationships as nodes and edges and represent this information as relational data.

Teaching - Learning Strategy:
These are some sample strategies; which course faculty members can incorporate in the Teaching Learning Process:

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Peer-to-Peer Activities
- Project Based Learning
- Activity Based Learning
- Case Studies
- MOOC/NPTEL Courses

COURSE CONTENTS

MODULE – 1

Module Contents	**Lecture Hours**
The History of Social Network Analysis: The sociogram and sociometry, Balance and group dynamics, Informal organization and community relations, Matrices and cliques, Formal models of community and kinship. Data collection for social network analysis.	**8 Hours**

MODULE – 2

Organizing and Analyzing Network Data: Matrices and relational data, Matrix conventions, An analysis of directorship data, direction and value in relational data, computer programs for social network analysis. **Terminology for Network Analysis**: The language of network analysis, The flow of information and resources, density of connections, density in egonets, problems in density measures, A digression on absolute density, Community structure and density.	**8 Hours**

MODULE – 3

Groups, Factions and Social Divisions: Identifying subgraphs, the components of a network, the strength and stability of components, Cycles and circuits, The contours of components, Cliques within components, Intersecting social circles, Components and citation circles.	**8 Hours**

MODULE – 4

Information Networks and the World Wide Web: The Structure of the Web, The World Wide Web, Information Networks, Hypertext, and Associative Memory, The Web as a Directed Graph, The Bow-Tie Structure of the Web, The Emergence of Web 2.0	**8 Hours**

MODULE – 5

Link Analysis and Web Search: Searching the Web: The Problem of Ranking, Link Analysis Using Hubs and Authorities, PageRank, Applying Link Analysis in Modern Web Search, Applications beyond the Web, Advanced Material, Spectral Analysis, Random Walks, and Web Search.	**8 Hours**

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Illustrate the notation and terminology used in network science.	CL2
CO2	Demonstrate model and visualization of social network.	CL2
CO3	Identify about network measures, community detection, and analyzing information flow within networks.	CL3
CO4	Interpret the structure of world wide web and information network.	CL2
CO5	Construct and interpret social networks for various real-world applications.	CL3

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2					2				2	2		
CO2	3	3	2					2				2	2		
CO3	3	3	2					2				2	2		
CO4	3	3	2					2				2	2		
CO5	3	3	2					2				2	2		

3: Substantial (High)	2: Moderate (Medium)	1: Poor (Low)

CO - Assessment Mapping:

Course Outcomes	Continuous Internal Assessment (CIA) (50%)				Semester End Exam (SEE) (50%)
	Continuous Internal Evaluation (CIE)(60%)			Assignment/ Activities (40%)	
	I	II	III		
	Syllabus Coverage				
	40%	30%	30%	100%	100%
CO1	x			x	x
CO2	x			x	x
CO3		x		x	x

CO4		x	x	x	x
CO5			x	x	x

Assessment Strategy:
Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Continuous Internal Evaluation (CIE)	60 %	30
	Assignments*	40 %	20
2	**Semester End Examination (SEE)**	**100 %**	**50**

Assignment Types:

Sl. No.	Assignment Description	Max. Weightage (%)	Max. Marks
1	Written Assignments	25 %	5
2	Quiz	25 %	5
3	Field Visits/Survey/Case Studies	50 %	10
4	Model / Prototype Development	100 %	20
5	Project Based Learning		
6	Seminar/Presentation	25 %	5
7	Peer - to -Peer Learning	25 %	5

SEE Question Paper Pattern:

- The question paper will have TEN full questions.
- Each full question consisting of 20 marks.
- There will be 2 full questions from all the FIVE modules.
- Each full question will have a maximum of four sub-questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

RESEARCH METHODOLOGY & INTELLECTUAL PROPERTY RIGHTS
(Effective from the Academic Year 2024- 2025)
SEMESTER – V

Course Code	**CS52298C**	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	1:2:0:0	SEE Marks	50
Total Hours of Pedagogy	30L	Exam Hours	03

CREDITS – 1

COURSE PREREQUISITES:

- A foundational understanding of research and knowledge of research problem formulation, familiarity with academic ethics, a basic understanding of statistics and data analysis, ability to search and evaluate academic sources, basic writing and communication skills, critical thinking skills, time management skills and awareness of ethical considerations in research.

COURSE OBJECTIVES:

- Understand the basic concepts, principles, and types of research methodologies
- Collect, analyze, and interpret data using relevant techniques.
- Ethically conduct research and adhere to academic integrity.
- Communicate research findings effectively through written and oral presentations.
- Understand the intellectual property rights and the types of IPR.

TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporated into the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- PowerPoint Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem-Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

COURSE CONTENTS

MODULE – I

Introduction to Research Methodology and Literature Review **Introduction to Research Methodology:** Meaning of research, Objectives of research, Types of research, Importance of scientific research in decision making, Defining the research problem, techniques involved in defining a problem**.** Research Design: Meaning of research design, need for research design, Features of good design. **Literature Review:** Significance of literature review, Sources for literature: Books, Journals, Proceedings, Thesis and Dissertations. Online databases: Web of Science, Google and Google Scholar. Quality research papers**.** Research metrics: Citation, Citation Index, Impact Factor, H-index, i10-index, Google index and their significance.	**6 Hours**

MODULE – II

Data Collection, Analysis and Report Writing **Data Collection:** Introduction, collection of primary data: observation method, questionnaires and case study method, collection of secondary data, Selection of an appropriate method for data collection. **Data Analysis**: Introduction, Data analysis process, Types of data analysis, Methods of data analysis: Qualitative analysis, Quantitative analysis. Tools for data analysis. **Report Writing:** Effective technical writing, Steps for writing a report, structure of the research report, method of writing a research article (manuscript)/ research report, crafting effective project proposals, Paper writing for National and international journals, submitting papers to journals (Scopus Indexed Journals, Science Citation Indexed journals), preparation of effective slides, pictures, and graphs for presentation.	**6 Hours**

MODULE – III	
Ethics in Research Ethics with respect to research, ethical principles, the importance of adhering to ethical norms in research, research misconducts, plagiarism, penalties for plagiarism, publication ethics, conflict of interest, publication misconduct, violation of publication ethics and authorships, identification of publication misconduct, complaints and appeals (examples) and Open Access Publishing.	**6 Hours**
MODULE – IV	
Intellectual Property Rights, Patents and Industrial Designs: **Intellectual Property Rights**: Introduction to intellectual property and intellectual property rights, objectives of IPR, History of IPR in India, Role of WIPO and WTO in IPR establishments, Types of Intellectual property rights. **Patents:** Introduction to patent, need and importance of a patent, requirements of patent, types of patents, few famous examples of patent, patentable and non-patentable items, Duration, limitations of a patent, the Indian Patent Act-1970, Rights associated with patents, Enforcement of patent rights, Patent infringements. Case Studies on Patents**:** Case study of Curcuma (Turmeric) Patent, Case study of Neem Patent, Case study of Basmati patent **Industrial Designs:** Design introduction, Features of Design, Design law 2000, Registration of Design, Need for registration of Design, Procedure for registration of Design, Infringement of Design. Famous Case Law: Apple Inc. vs. Samsung Electronics Co.	**6 Hours**
MODULE – V	
Copyrights, Trademarks and Geographical Indications: **Copyrights:** Introduction to copyright, characteristics of copyright, copyright-National Vs international, Indian copyright Act-1957, Indian perspective on copyright, Term/duration of copyright, registration of copyright, copyright symbol, procedure of copyright certification, benefits of copyright registration, copyright infringement, limitations of copyright. **Trademarks:** Introduction to Trademark, signs which may serve as Trademarks, functions of Trademark, Essential features of Trademark, Types of Trademark, the validity of the trademark, Unfair competition, Trademark Act 1999, Infringement of Trademark, Famous case law: Coca-Cola Company vs. Bisleri International Pvt. Ltd. **Geographical Indications:** Introduction to G.I, History of G.I, G.I Act 1999, Registration of G.I, Registration process of G.I, Duration of G.I Tag, Infringement of G.I, some important G.I Tags.	**6 Hours**

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Comprehend the process of research methodology to define a research problem.	CL2
CO2	Understand the analytical tools for the analysis and interpretation of data.	CL2
CO3	Understand the research ethics and adhere to ethical norms in the research process.	CL2
CO4	Illustrate the significance of Intellectual property rights and of research projects for economic growth and social benefits.	CL2
CO5	Demonstrate the copyright laws, subject matters of copyrights and Trademarks.	CL2

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1	1			1		1	1		2		1		1
CO2	3	2	1	1	1	1		1	1		2			1	
CO3	3	1	1			2		3	1	1	1	2	1	1	1
CO4	3	2	2	2	1	2		3	1	1	1	2		1	
CO5	3	2	2	2	1	2		3	1	1	1	2			

3: Substantial (High) | 2: Moderate (Medium) | 1: Poor (Low)

ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Continuous Internal Evaluation (CIE)	60 %	30
	Assignment	40 %	20
2	**Semester End Examination (SEE)**	**100 %**	**50**

CO - ASSESSMENT MAPPING

Continuous Internal Assessment (CIA) (50%)				Semester End Exam (SEE) (50%)
Continuous Internal Evaluation (CIE) (60%)			Assignment (40%)	
I	II	III		
Syllabus Coverage			Syllabus Coverage	Syllabus Coverage
40%	30%	30%	100%	100%
MI			MI	MI
MII	MII		MII	MII
	MIII		MIII	MIII
		MIV	MIV	MIV
		MV	MV	MV

NOTE

- Assessment will be both CIA and SEE.
- The assignment of the IPCC shall be for CIE only.
- The Theory component of the IPCC shall be for both CIA and SEE respectively.

Note: For Examinations (both CIE and SEE), the question papers shall contain the questions mapped to the appropriate Bloom's Level. Any COs mapped with higher cognitive Bloom's Level may also be assessed through the assignments.

SEE QUESTION PAPER PATTERN:

MCQ

1. The question paper will have TEN full questions from FIVE Modules
2. There will be 2 full questions from each module. Every question will carry a maximum of 20 marks.
3. Each full question may have a maximum of four sub-questions covering all the topics under a module.
4. The students will have to answer FIVE full questions, selecting one full question from each module.

REFERENCE BOOKS:

1. Kothari C R and Gaurav Garg, Research Methodology Methods and Techniques, Fourth Edition by, New Age International, 2019.
2. Ranjit Kumar, Research Methodology- A step by step guide for beginners, Pearson Education, Australia, 2005.
3. Pratim Ray, Partha "A Guide to Research and Publication Ethics" First edition, New Delhi Publishers c2022.
4. Deborah E Bouchoux, Intellectual Property Rights by CENGAGE Learning.
5. Rupinder Tewari and Mamta Bhardwa, Intellectual Property A Primer for Academia.
6. David V. Thiel “Research Methods for Engineers” Cambridge University Press, 978-1-107-03488-4.
7. Catherine J. Holland, “Intellectual property: Patents, Trademarks, Copyrights, Trade Secrets”, Entrepreneur Press, 2007.
8. Acharya N K, Intellectual Property Rights, Asia Law House 6th Edition. ISBN: 978-93-81849-30-9

SOFTWARE ENGINEERING & PROJECT MANAGEMENT
(Effective from the Academic Year 2024- 2025)
VI SEMESTER

Course Code	**CS622T1C**	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	**40L**	Exam Hours	03

CREDITS – 3

COURSE PREREQUISITES:

- Fundamentals of software Development activities, Management functions.

COURSE OBJECTIVES: This course will enable students to:

- Outline software engineering principles and activities involved in building large software programs.
- Identify ethical and professional issues and explain why they are of concern to Software Engineers.
- Describe the process of requirement gathering, requirement classification, requirement specification and requirements validation.
- Infer the fundamentals of object-oriented concepts, differentiate system models, use UML diagrams and apply design patterns.

TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- PowerPoint Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course content

COURSE CONTENTS

MODULE – I

Introduction: The evolving role of software, The changing nature of software, Software engineering, A Process Framework, Process Patterns, Process Assessment, Personal and Team Process Models, Process Technology, Product and Process. **Process Models**: Prescriptive models, Waterfall model, Incremental process models, Evolutionary process models, Specialized process models.	**8 Hours**

MODULE – II	
Modelling Concepts and Class Modeling: Object orientation, OO development? OO Themes; Evidence for usefulness of OO development; OO modeling history. Modeling as Design technique: Modeling, abstraction, The Three models. Class Modeling: Object and Class Concept, Link and associations concepts, Generalization and Inheritance, A sample class model, Navigation of class models, and UML diagrams	**8 Hours**
MODULE – III	
Software Testing: A Strategic Approach to Software Testing, Strategic Issues, Test Strategies for Conventional Software, Test Strategies for Object -Oriented Software, Validation Testing, System Testing, The Art of Debugging. **Agile Methodology:** Before Agile – Waterfall, Agile Development	**8 Hours**
MODULE - IV	
Project Management: Importance of Project Management, Contract Management, Activities Covered by Software Project Management, Plans, Methods and Methodologies, some ways of categorizing Software Projects, Stakeholders, Setting Objectives, Business Case, Project Success and Failure, Management and Management Control, Project Management life cycle, Traditional versus Modern Project Management Practices.	**8 Hours**
MODULE – V	
Activity Planning: Objectives of Activity Planning, When to Plan, Project Schedules, Sequencing and Scheduling Activities, Network Planning Models, Forward Pass– Backward Pass, identifying critical path, Activity Float, Shortening Project Duration, Activity on Arrow Networks. **Software Quality:** Introduction, the place of software quality in project planning, Importance of software quality, software quality models, ISO 9126, quality management systems, process capability models, techniques to enhance software quality, quality plans.	**8 Hours**

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Understand the activities involved in software engineering and analyze the role of various process models	CL2
CO2	Discuss the basics of object-oriented concepts and build a suitable class model using modeling techniques	CL2
CO3	Describe various software testing methods and to understand the importance of agile methodology.	CL2
CO4	Illustrate the role of project planning and quality management in software development	CL2

CO5	Understand the importance of activity planning and also understand the importance of software quality	CL2

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	3	2	1		1		2		1	1		
CO2	3	3	2	3	2	1		1		2		1		1	
CO3	3	3	2	3	2	1		1	2	2	2	2	1		1
CO4	3	3	2	3	2	1		1	2	2	2	2		1	
CO5	3	3	2	3	2	1		1	2	2	2	2			1

3: Substantial (High)	2: Moderate (Medium)	1: Poor (Low)

ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Continuous Internal Evaluation (CIE)	60 %	30
	Assignments	40 %	20
2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT DETAILS

Continuous Internal Assessment (CIA) (50%)			Semester End Exam (SEE) (50%)
Continuous Internal Evaluation (CIE) (60%)			Assignment/ Activities (40%)
I	II	III	

Syllabus Coverage			Syllabus Coverage	Syllabus Coverage
40%	**30%**	**30%**	**100%**	**100%**
MI			MI	MI
MII	MII		MII	MII
	MIII		MIII	MIII
		MIV	MIV	MIV
		MV	MV	MV

Note: For Examinations (both CIE and SEE), the question papers shall contain the questions mapped to the appropriate Bloom's Level. Any COs mapped with higher cognitive Bloom's Level may also be assessed through the assignments.

ASSIGNMENT TYPES WITH WEIGHTAGES

Sl. No.	Assignment Description	Max. Weightage (%)	Max. Marks
1	Written Assignments	25 %	05
2	Quiz	10 %	02
3	Case Studies	25 %	05
4	Seminar/Presentation	15 %	03
5	Peer - to - Peer Learning	10 %	02
6	Activity Based Learning	50 %	10
7	Project Based Learning	50 %	10
8	Field Work + Report	50 %	10
9	Industry Visit + Report	50 %	10
10	NPTEL/MOOC Courses – Registration and Assignment Submissions	50 %	10
	NPTEL Certification	75 %	15
11	Any other Innovative Assignments (CL4 and above)	50 %	10

SYSTEM SOFTWARE AND COMPILER DESIGN
(Effective from the Academic Year 2024- 2025)
VI SEMESTER

Course Code	**CS622I2C**	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	3:0:2:0	SEE Marks	50
Total Hours of Pedagogy	**40L +20P**	Exam Hours	03

CREDITS – 4

COURSE PREREQUISITES:

- Knowledge of computer organization, automata theory and computability, operating systems, programming languages (C/Java).

COURSE OBJECTIVES: This course will enable students:

- To acquire the knowledge on various system software's, such as loaders, assemblers, and compilers, as well as their applications and design aspects.
- To acquaint with the development of source file, object file and executable file structures and libraries.
- To understand the basic theory underlying the different components and phases of a compiler along with LEX and YACC tools.

TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

COURSE CONTENTS

MODULE - I

Introduction: System Software, Machine Architecture of SIC and SIC/XE, Basic assembler functions, Machine dependent assembler features, Machine independent assembler features, Assembler design options, Basic loader functions.	**8 Hours**

MODULE - II

Compiler: Language processors, the structure of a compiler, the evaluation of programming languages, the science of building a compiler, Applications of compiler technology. **Lexical Analysis:** The role of lexical analyzer, Input buffering, Specifications of token, recognition of tokens.	**8 Hours**

MODULE - III	
Syntax Analysis: Introduction, Context Free Grammars, Writing a grammar, Top-Down Parsers, Bottom-Up Parser.	**8 Hours**
MODULE - IV	
Syntax Directed Translation: Syntax directed definitions, Evaluation orders for SDD's, Applications of syntax directed translations. **Intermediate code generation:** Variants of syntax trees, Three address code. **Code generation:** Issues in the design of a code generator, The target language.	**8 Hours**
MODULE - V	
Lex and Yacc: The Lex program, Grammars, Parser-Lexer communication, A YACC parser, the rules section, Running LEX and YACC, LEX and Hand- Written Lexers, Regular expression, Examples of regular expressions, A word counting program, Grammars, Recursive rules, Shift/Reduce parsing, What YACC cannot parse, The Lexer, Compiling and running a simple parser, Arithmetic expressions and ambiguity.	**8 Hours**

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Analyze and apply the concept of system software and its machine architectures to generate the object program.	CL3
CO2	Analyze the functionality of each phase involved in the compilation process and the applications of compiler technology.	CL3
CO3	Develop and apply the various parsing techniques suitable for the implementation of top down and bottom up parsers.	CL3
CO4	Design Syntax Directed Definitions, Syntax Directed Translations, intermediate code and machine codes for the given input statements.	CL3
CO5	Implement the LEX and YACC tools to demonstrate lexers and parsers.	CL3

LABORATORY COMPONENTS

Exp. No.	Experiment Description	CO No.	Bloom's Taxonomy Level
1.	Design a LEX program to recognize valid arithmetic expressions. Identifiers in the expression could be only integers and operators could be + and *. Count the identifiers & operators present and print them separately.	CO5	CL3
2.	Design a YACC program to evaluate arithmetic expression involving operators: +, -, *, and /	CO5	CL3

3.	Design a YACC tool to recognize all strings ending with b preceded by n a's using the grammar an b (note: input n value).	CO5	CL3
4.	Design, develop and implement YACC/C program to construct Predictive / LL(1) Parsing Table for the grammar rules: A ->aBa , B ->bB | ε. Use this table to parse the sentence: abba$.	CO3	CL3
5.	Design, develop and implement YACC/C program to demonstrate Shift Reduce Parsing technique for the grammar rules: E ->E+T | T, T ->T*F | F, F ->(E) | id and parse the sentence: id + id * id.	CO3	CL3
6.	Design, develop and implement a C/Java program to generate the machine code using Triples for the statement A = -B * (C +D) whose intermediate code in three-address form: T1 = -B T2 = C + D T3 = T1 * T2 A = T3	CO2, CO4	CL3
7.	Design a LEX program to eliminate comment lines in a C program and copy the resulting program into a separate file.	CO5	CL3
8.	Design a YACC program to recognize valid identifiers, operators and keywords in the given text (C program) file.	CO5	CL3

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2									2	3		
CO2	3	3	2									2	3		
CO3	3	3	2									2	3		
CO4	3	3	2									2	3		
CO5	3	3	2		2							2	3		

3: Substantial (High)	2: Moderate (Medium)	1: Poor (Low)

ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Continuous Internal Evaluation (CIE)	60 %	30

	Practical Session (Laboratory Component)	40 %	20
2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT DETAILS

Continuous Internal Assessment (CIA) (50%)				**Semester End Exam (SEE) (50%)**
Continuous Internal Evaluation (CIE) (60%)			**Practical Sessions (40%)**	
I	**II**	**III**		
Syllabus Coverage			**Syllabus Coverage**	**Syllabus Coverage**
40%	**30%**	**30%**	**100%**	**100%**
MI			MI	MI
MII	MII		MII	MII
	MIII		MIII	MIII
		MIV	MIV	MIV
		MV	MV	MV

NOTE:

- Assessment will be both CIA and SEE.
- The practical sessions of the IPCC shall be for CIE only.
- The Theory component of the IPCC shall be for both CIA and SEE respectively.
- The questions from the practical sessions shall be included in Theory SEE.

Note: For Examinations (both CIE and SEE), the question papers shall contain the questions mapped to the appropriate Bloom's Level. Any COs mapped with higher cognitive Bloom's Level may also be assessed through the assignments.

SEE QUESTION PAPER PATTERN:

- The question paper will have **TEN** full questions from **FIVE** Modules
- There will be 2 full questions from each module. Every question will carry a maximum of 20 marks.
- Each full question may have a maximum of four sub-questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting one full question from each module.

REFERENCE BOOKS:

1. System Software by Leland. L. Beck, D Manjula, 3rd edition, 2012.
2. Alfred V Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, Compilers-Principles, Techniques and Tools, Pearson, 2nd edition, 2007.
3. Doug Brown, John Levine, Tony Mason, lex & yacc, O'Reilly Media, October 2012.
4. Systems programming, Srimanta Pal, Oxford university press, 2016.
5. Compiler Design, K Muneeswaran, Oxford University Press 2013.

COMPUTER GRAPHICS AND FUNDAMENTALS OF IMAGE PROCESSING
(Effective from the Academic Year 2024 - 2025)
VI SEMESTER

Course Code	**CS622T3C**	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	**40L**	Exam Hours	03

CREDITS – 3

COURSE PREREQUISITES:

- Basic knowledge of mathematics

COURSE OBJECTIVES: This course will enable students to:

- Overview of Computer Graphics along with its applications.
- Exploring 2D and 3D graphics mathematics along with OpenGL API's.
- Use of Computer graphics principles for animation and design of GUI's.
- Basic understanding of Image processing operations.
- Perform operations such as Image segmentation and Morphological operations

TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

COURSE CONTENTS

MODULE - I

Computer Graphics: Basics of computer graphics, Application of Computer Graphics, Graphics software. **OpenGL:** Introduction to OpenGL, coordinate reference frames, specifying two-dimensional world coordinate reference frames in OpenGL, OpenGL point functions, OpenGL line functions, point attributes, line attributes, curve attributes, OpenGL point attribute functions, OpenGL line attribute functions, Line drawing algorithms (DDA, Bresenham‟s), circle generation algorithms (Bresenham‟s)	**8 Hours**

MODULE - II

2D and 3D graphics with OpenGL: 2D Geometric Transformations: Basic 2D Geometric Transformations, matrix representations and homogeneous coordinates, 2D Composite transformations, other 2D transformations, raster methods for geometric transformations, OpenGL raster transformations, OpenGL geometric transformations functions **3D Geometric Transformations:** Translation, rotation, scaling, composite 3D transformations, other 3D transformations, OpenGL geometric transformations functions **Color models:** color model, RGB color model, CMY color model	**8 Hours**

MODULE - III	
Interactive Input Methods and Graphical User Interfaces: Graphical Input Data, Logical Classification of Input Devices, Input Functions for Graphical Data, Interactive Picture-Construction Techniques, Virtual-Reality Environments, OpenGL Interactive Input-Device Functions, OpenGL Menu Functions, Designing a Graphical User Interface. **Computer Animation:** Raster Method for computer animation, Design of Animation Sequences, Traditional Animation Techniques, General Computer-Animation Functions, Computer-Animation Languages, Character Animation, Periodic Motions, OpenGL Animation Procedures	**8 Hours**
MODULE - IV	
Introduction of image processing: Overview of image processing, Nature of image processing, Digital image representation, types of images, digital image processing operations, Fundamentals steps in image processing. **Digital Image Processing Operations:** Basic relationships and distance metrics, Classification of Image processing Operations, Image interpolation Techniques	**8 Hours**
MODULE - V	
Image Segmentation: Introduction, classification, detection of discontinuities, Edge detection (up to canny edge detection(included)). **Image Morphology:** Need of Morphological Processing, Morphological operators, Hit or miss transform.	**8 Hours**

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Use OpenGL to write simple programs that involve coordinate systems, reference frames, point and line functions, attributes, and drawing algorithms.	CL2
CO2	Illustrate 2D and 3D geometric transformations using OpenGL	CL3
CO3	Design interactive programs and simple animations using OpenGL programs	CL3
CO4	Apply basic Image processing operations for different types of images	CL3
CO5	Apply segmentation and morphology techniques on different images.	CL3

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	3	1	2	3						2	3			
CO2	2	3	2	2	3				2		3	3	3		2
CO3	2	3	2	2	3				2		3	3	3		2
CO4	2	3	2	2	3				2		3	3	3		2
CO5	2	3	2	2	3				2		3	3	3		2

3: Substantial (High)	2: Moderate (Medium)	1: Poor (Low)

ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Continuous Internal Evaluation (CIE)	60 %	30
	Assignments	40 %	20
2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT DETAILS

Continuous Internal Assessment (CIA) (50%)				Semester End Exam (SEE) (50%)
Continuous Internal Evaluation (CIE) (60%)			Assignment/ Activities (40%)	
I	II	III		
Syllabus Coverage			Syllabus Coverage	Syllabus Coverage
40%	30%	30%	100%	100%
MI			MI	MI
MII	MII		MII	MII
	MIII		MIII	MIII
		MIV	MIV	MIV
		MV	MV	MV

Note: For Examinations (both CIE and SEE), the question papers shall contain the questions mapped to the appropriate Bloom's Level. Any COs mapped with higher cognitive Bloom's Level may also be assessed through the assignments.

ASSIGNMENT TYPES WITH WEIGHTAGES

Sl. No.	Assignment Description	Max. Weightage (%)	Max. Marks
1	Written Assignments	25 %	05
2	Quiz	10 %	02
3	Case Studies	25 %	05
4	Seminar/Presentation	15 %	03
5	Peer - to - Peer Learning	10 %	02
6	Activity Based Learning	50 %	10
7	Project Based Learning	50 %	10
8	Field Work + Report	50 %	10
9	Industry Visit + Report	50 %	10
10	NPTEL/MOOC Courses – Registration and Assignment Submissions	50 %	10
	NPTEL Certification	75 %	15
11	Any other Innovative Assignments (CL4 and above)	50 %	10

Note: The assignments mentioned above may be provided appropriately to the students belonging to different bands

SEE QUESTION PAPER PATTERN:

- The question paper will have **TEN** full questions from **FIVE** Modules
- There will be 2 full questions from each module. Every question will carry a maximum of 20 marks.
- Each full question may have a maximum of four sub-questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting one full question from each module.

REFERENCE BOOKS:

1. Donald D Hearn, M Pauline Baker and Warren Carithers: Computer Graphics with OpenGL 4th Edition, Pearson, 2014
2. S. Sridhar, Digital Image Processing, second edition, Oxford University press 2016
3. Edward Angel: Interactive Computer Graphics- A Top Down approach with OpenGL, 5th edition. Pearson Education, 2008
4. James D Foley, Andries Van Dam, Steven K Feiner, John F Huges Computer graphics with OpenGL: Pearson education

BLOCKCHAIN AND APPLICATIONS
(Effective from the Academic Year 2024 - 2025)
VI SEMESTER

Course Code	**CS62214CA**	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	**40L**	Exam Hours	03

CREDITS – 3

COURSE PREREQUISITES:

- Fundamental knowledge of Mathematics, Data Structures, Cryptography, Finite State Machines

COURSE OBJECTIVES: This course will enable students to:

- Describe the fundamentals of Block chain technology
- Examine cryptographic techniques for Block chain
- Illustrate the models of Bitcoin
- Analyze and demonstrate the Ethereum

TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

COURSE CONTENTS

MODULE - I

Introduction: Blockchain Technology, Distributed systems, The history of blockchain, CAP theorem and blockchain, Benefits and limitations of blockchain, Decentralization using blockchain, Methods of decentralization, Routes to decentralization.	**8 Hours**

MODULE - II

Cryptography in Blockchain: Introduction, cryptographic primitives, Asymmetric cryptography, public and private keys, RSA, ECC, Hash functions, financial markets and trading	**8 Hours**

MODULE - III	
Bit Coin Introduction, Transactions: Structure, Transactions types, the structure of a block, The genesis block, The bitcoin network, Wallets and its types, Bitcoin payments, Bitcoin investment and buying and selling bitcoins, Bitcoin installation, Bitcoin programming and the command-line interface, Bitcoin improvement proposals (BIPs).	**8 Hours**
MODULE - IV	
Ethereum, Ethereum block chain, Ethereum network, Components of the Ethereum ecosystem, Keys and Addresses, Accounts and its types , Transactions and Messages, Contract Creation transaction, Message call transaction, messages ,Calls, Transaction Validation and execution, Transaction substrate, State storage in the Ethereum blockchain, Ether cryptocurrency / tokens (ETC and ETH), The Ethereum Virtual Machine (EVM), Execution environment, Native contracts	**8 Hours**
MODULE - V	
Smart Contract and Hyper ledger – Ricardian contracts, Application developed on Ethereum: The DAO, Hyper ledger**:** Hyper ledger projects, Hyperledger as a protocol, The reference architecture, Requirements and design goals of Hyperledger Fabric, Applications on blockchain on fabric, Consensus in Hyperledger Fabric, The transaction life cycle in Hyperledger Fabric, Sawtooth lake, Corda Architecture.	**8 Hours**

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Understand basic concepts of Blockchain and evaluate the benefits and limitation of Blockchain	CL3
CO2	Examine the decentralization concepts and apply the cryptography techniques in Blockchain	CL3
CO3	Demonstrate the usage of Bitcoin and Alternative coin	CL3
CO4	Develop Blockchain applications using Ethereum.	CL3
CO5	Interpret the usage of Smart contract and Hyperledger	CL3

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2		1							1			
CO2	3	3	2		1							1	2	2	
CO3	3	3	2		3							1			
CO4	3	3	2		3							1	2	2	
CO5	3	3	2		3							1	2	2	

3: Substantial (High)	2: Moderate (Medium)	1: Poor (Low)

ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Continuous Internal Evaluation (CIE)	60 %	30
	Assignments	40 %	20
2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT DETAILS

Continuous Internal Assessment (CIA) (50%)				**Semester End Exam (SEE) (50%)**
Continuous Internal Evaluation (CIE) (60%)			**Assignment/ Activities (40%)**	
I	**II**	**III**		
Syllabus Coverage			**Syllabus Coverage**	**Syllabus Coverage**
40%	**30%**	**30%**	**100%**	**100%**
MI			MI	MI
MII	MII		MII	MII
	MIII		MIII	MIII
		MIV	MIV	MIV
		MV	MV	MV

Note: For Examinations (both CIE and SEE), the question papers shall contain the questions mapped to the appropriate Bloom's Level. Any COs mapped with higher cognitive Bloom's Level may also be assessed through the assignments.

ASSIGNMENT TYPES WITH WEIGHTAGES

Sl. No.	Assignment Description	Max. Weightage (%)	Max. Marks
1	Written Assignments	25 %	05
2	Quiz	10 %	02
3	Case Studies	25 %	05
4	Seminar/Presentation	15 %	03
5	Peer - to - Peer Learning	10 %	02
6	Activity Based Learning	50 %	10
7	Project Based Learning	50 %	10
8	Field Work + Report	50 %	10
9	Industry Visit + Report	50 %	10

10	NPTEL/MOOC Courses – Registration and Assignment Submissions	50 %	10
	NPTEL Certification	75 %	15
11	Any other Innovative Assignments (CL4 and above)	50 %	10

Note: The assignments mentioned above may be provided appropriately to the students belonging to different bands

SEE QUESTION PAPER PATTERN:

- The question paper will have **TEN** full questions from **FIVE** Modules
- There will be 2 full questions from each module. Every question will carry a maximum of 20 marks.
- Each full question may have a maximum of four sub-questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting one full question from each module.

REFERENCE BOOKS:

1. Bashir, Mastering Blockchain: Distributed ledger technology, decentralization, and smart contracts explained, 2nd Edition, 2nd Revised edition. Birmingham: Packt Publishing, 2018.
2. A. M. Antonopoulos, Mastering bitcoin, First edition. Sebastopol CA: O'Reilly,2015.
3. Z. Zheng, S. Xie, H. Dai, X. Chen, and H. Wang, ―An Overview of Blockchain Technology: Architecture, Consensus, and Future Trends in 2017 IEEE International Congress on Big Data (Bigdata Congress), 2017, pp.557–564

INTERNET OF THINGS
(Effective from the Academic Year 2024 - 2025)
VI SEMESTER

Course Code	**CS62214CB**	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	3:0:2:0	SEE Marks	50
Total Hours of Pedagogy	40L + 20P	Exam Hours	03

CREDITS – 3

COURSE PREREQUISITES:

- Fundamentals of embedded system and computer communication

COURSE OBJECTIVES: This course will enable students to:

- Understand the impact of IoT applications, architectures
- Analyse the diverse methods of deploying smart objects and connect them to networks.
- Interpret the IOT protocols and Security.

TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

COURSE CONTENTS

MODULE - I

Introduction to IoT: Defining IoT, Characteristics of IoT. Sensors, types of sensors, actuator and smart object Physical design of IoT: Things in IoT, IoT protocol. Logical design of IoT: Functional blocks of IoT, Communication models & APIs. IoT & M2M: Machine to Machine, Difference between IoT and M2M	**8 Hours**

MODULE - II

IoT levels & Deployment templates Developing IoTs: IoT design methodology, Case study on IoT system for weather monitoring, Motivation for using Python.	**8 Hours**

MODULE - III	
IoT Physical device & Endpoint: Basic building blocks of an IoT device, Introduction to Raspberry Pi, About board, Programming raspberry Pi with python, Introduction to Arduino board, Programming Arduino device.	**8 Hours**
MODULE - IV	
Application of IoT: Home automation – Case study of home automation Cities – Case study of smart parking Environment – Case study of industry automation, Agriculture – Case study of smart irrigation	**8 Hours**
MODULE - V	
Data and Analytics for IoT: An introduction to data analytics for IoT, structures versus unstructured data, IoT data analytics overview, IoT data analytics challenges, Edge streaming analytics, Securing IoT: OT security, common challenges in OT security	**8 Hours**

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Understand the fundamental concepts and characteristics of IoT	CL2
CO2	Interpret the IoT levels and deployment templates, IoT design methodology, and will be able to develop IoT systems,	CL3
CO3	Interpret the basic building blocks of IoT devices, and gain practical skills in programming Raspberry Pi with Python and Arduino boards.	CL3
CO4	Apply IoT concepts to various domains through case studies,	CL3
CO5	Understand the fundamentals of data analytics for IoT, including the differences between structured and unstructured data	CL2

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	1				1	1	1		1	1		
CO2	3	3	3	1				1	1	1		1	1		
CO3	3	3	3	1	1			1	1	1		1	1		
CO4	3	3	3	1		1	1	1	1	1		1	1		
CO5	3	3	3	1				1	1	1		1	1		

3: Substantial (High) | **2: Moderate (Medium)** | **1: Poor (Low)**

ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Continuous Internal Evaluation (CIE)	60 %	30
	Practical Session (Laboratory Component)	40 %	20
2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT DETAILS

Continuous Internal Assessment (CIA) (50%)				**Semester End Exam (SEE) (50%)**
Continuous Internal Evaluation (CIE) (60%)			**Practical Sessions (40%)**	
I	**II**	**III**		
Syllabus Coverage			**Syllabus Coverage**	**Syllabus Coverage**
40%	**30%**	**30%**	**100%**	**100%**
MI			MI	MI
MII	MII		MII	MII
	MIII		MIII	MIII
		MIV	MIV	MIV
		MV	MV	MV

NOTE:

- Assessment will be both CIA and SEE.
- The practical sessions of the IPCC shall be for CIE only.
- The Theory component of the IPCC shall be for both CIA and SEE respectively.
- The questions from the practical sessions shall be included in Theory SEE.

Note: For Examinations (both CIE and SEE), the question papers shall contain the questions mapped to the appropriate Bloom's Level. Any COs mapped with higher cognitive Bloom's Level may also be assessed through the assignments.

SEE QUESTION PAPER PATTERN:

- The question paper will have **TEN** full questions from **FIVE** Modules
- There will be 2 full questions from each module. Every question will carry a maximum of 20 marks.
- Each full question may have a maximum of four sub-questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting one full question from each module.

REFERENCE BOOKS:

1. Vijay Madisetti, Arshdeep Bahga, “Internet of Things: A Hands -On Approach”.
2. David Hanes, Gonzalo Salgueiro, Rob Barton " IoT Fundamentals: Networking Technologies, Protocols and Use Cases for the Internet of Things”, 2019.
3. Francis daCosta, “Rethinking the Internet of Things: A Scalable Approach to Connecting Everything”, 1st Edition, Apress Publications, 2013
4. Waltenegus Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice"

CRYPTOGRAPHY AND NETWORK SECURITY
(Effective from the Academic Year 2024 - 2025)
VI SEMESTER

Course Code	**CS62214CC**	CIA Marks	40
Number of Contact Hours/Week (L: T: P: S)	3:0:0:0	SEE Marks	60
Total Hours of Pedagogy	**40L**	Exam Hours	03

CREDITS – 3

COURSE PREREQUISITES:

- Knowledge of mathematical principles, such as linear algebra, number theory, and combinatorics.

COURSE OBJECTIVES: This course will enable students to:

- Illustrate cryptographic techniques essential for ensuring secure communication.
- Demonstrate the principles and applications of Public and Private key cryptography.
- Classify strategies for key management, distribution, and certification in cryptographic systems.
- Outline proficiency in effectively implementing IPsec for secure communication protocols.

TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

COURSE CONTENTS

MODULE – I

Classical Encryption Techniques Symmetric Cipher Model, Cryptography, Cryptanalysis and Brute-Force Attack, Substitution Techniques, Caesar Cipher, Monoalphabetic Cipher, Playfair Cipher, Hill Cipher, Polyalphabetic Cipher, One Time Pad. **Block Ciphers and the data encryption standard**: Traditional block Cipher structure, stream Ciphers and block Ciphers, Motivation for the feistel Cipher structure, the feistel Cipher, The data encryption standard, DES encryption, DES decryption, A DES example, results, the avalanche effect.	**8 Hours**

MODULE – II	
Advanced Encryption Standard: AES Structure **Public-Key Cryptography and RSA:** Principles of public-key cryptosystems. Public-key cryptosystems. Applications for public-key cryptosystems, requirements for public-key cryptosystems. public-key cryptanalysis. The RSA algorithm, description of the algorithm, computational aspects, the security of RSA. **Other Public-Key Cryptosystems**: Diffie-Hellman, Key exchange, The algorithm, key exchange protocols, man in the middle attack, Elgamal Cryptographic systems.	**8 Hours**
MODULE – III	
Elliptic curve cryptography, Analog of Diffie-hellman key exchange, Elliptic curve encryption/ decryption, security of Elliptic curve cryptography, Pseudorandom number generation based on an asymmetric cipher, PRNG based on RSA. **Key Management and Distribution**: Symmetric key distribution using Symmetric encryption, A key distribution scenario, Hierarchical key control, session key lifetime, a transparent key control scheme, Decentralized key control, controlling key usage, Symmetric key distribution using asymmetric encryption, simple secret key distribution, secret key distribution with confidentiality and authentication, A hybrid scheme, distribution of public keys, public announcement of public keys, publicly available directory, public key authority, public keys certificates.	**8 Hours**
MODULE – IV	
X-509 certificates. Certificates, X-509 version 3, public key infrastructure. User Authentication: Remote user Authentication principles, Mutual Authentication, one-way Authentication, remote user Authentication using Symmetric encryption, Mutual Authentication, one way Authentication, Kerberos, Motivation, Kerberos version 4, Kerberos version 5, Remote user Authentication using Asymmetric encryption, Mutual Authentication, one way Authentication **Electronic Mail Security:** Pretty good privacy, notation, operational; description, S/MIME, RFC5322, Multipurpose internet mail extensions, S/MIME functionality, S/MIME messages, S/MIME certificate processing, enhanced security services, Domain keys identified mail, internet mail architecture, E-Mail threats, DKIM strategy, DKIM functional flow.	**8 Hours**
MODULE – V	
IP Security: IP Security overview, applications of IPsec, benefits of IPsec, Routing applications, IPsec documents, IPsec services, transport and tunnel modes, IP Security policy, Security associations, Security associations database, Security policy database, IP traffic processing, Encapsulating Security payload, ESP format, encryption and authentication algorithms, Padding, Anti replay service, Transport and tunnel modes, combining security associations, authentication plus confidentiality, basic combinations of security associations, internet key exchange, key determinations protocol, header and payload formats, cryptographic suits.	**8 Hours**

COURSE OUTCOMES		
Upon completion of this course, the students will be able to:		
CO No.	**Course Outcome Description**	**Bloom's Taxonomy Level**
CO1	Illustrate classical encryption techniques, block ciphers, and the Data Encryption Standard (DES).	CL2
CO2	Summarize the applications of public key cryptography, including RSA encryption and other public key cryptosystems.	CL2
CO3	Outline elliptic curve arithmetic and the necessity of key management and distribution in	CL2

	modern cryptography.	
CO4	Demonstrate understanding of the technology behind user authentication and electronic mail security.	CL2
CO5	Interpret IP security concepts, distinguishing between transport and tunnel modes in securing communications.	CL2

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1															
CO2															
CO3															
CO4															
CO5															

3: Substantial (High)	2: Moderate (Medium)	1: Poor (Low)

ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Continuous Internal Evaluation (CIE)	60 %	30
	Assignments	40 %	20
2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT DETAILS

Continuous Internal Assessment (CIA) (50%)				Semester End Exam (SEE) (50%)
Continuous Internal Evaluation (CIE) (60%)			Assignment/ Activities (40%)	
I	II	III		
Syllabus Coverage			Syllabus Coverage	Syllabus Coverage
40%	30%	30%	100%	100%
MI			MI	MI
MII	MII		MII	MII
	MIII		MIII	MIII
		MIV	MIV	MIV
		MV	MV	MV

Note: For Examinations (both CIE and SEE), the question papers shall contain the questions mapped to the appropriate Bloom's Level. Any COs mapped with higher cognitive Bloom's Level may also be assessed through the assignments.

ASSIGNMENT TYPES WITH WEIGHTAGES			
Sl. No.	**Assignment Description**	**Max. Weightage (%)**	**Max. Marks**
1	Written Assignments	25 %	05
2	Quiz	10 %	02
3	Case Studies	25 %	05
4	Seminar/Presentation	15 %	03
5	Peer - to - Peer Learning	10 %	02
6	Activity Based Learning	50 %	10
7	Project Based Learning	50 %	10
8	Field Work + Report	50 %	10
9	Industry Visit + Report	50 %	10
10	NPTEL/MOOC Courses – Registration and Assignment Submissions	50 %	10
	NPTEL Certification	75 %	15
11	Any other Innovative Assignments (CL4 and above)	50 %	10

Note: The assignments mentioned above may be provided appropriately to the students belonging to different bands

SEE QUESTION PAPER PATTERN:

- The question paper will have **TEN** full questions from **FIVE** Modules
- There will be 2 full questions from each module. Every question will carry a maximum of 20 marks.
- Each full question may have a maximum of four sub-questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting one full question from each module.

REFERENCE BOOK:

1. William Stallings: Cryptography and Network Security, Pearson 7th edition.

2. V K Pachghare: Cryptography and Information Security, PHI 2nd Edition

3. Wade Trappe, Lawrence C Washington, “Introduction to Cryptography with coding theory”, Pearson.

4. W. Mao, “Modern Cryptography – Theory and Practice”, Pearson Education.

5. Charles P. Pfleeger, Shari Lawrence Pfleeger – Security in computing – Prentice Hall of India.

SAHYADRI
COLLEGE OF ENGINEERING & MANAGEMENT
An Autonomous Institution
MANGALURU

PARALLEL COMPUTING ARCHITECTURE AND PROGRAMMING
(Effective from the Academic Year 2024 - 2025)
VI SEMESTER

Course Code	**CS62214CD**	CIA Marks	40
Number of Contact Hours/Week (L: T: P: S)	3:0:0:0	SEE Marks	60
Total Hours of Pedagogy	**40L**	Exam Hours	03

CREDITS – 3

COURSE PREREQUISITES:

- Introduction to Computer Architecture
- Programming Fundamentals
- Operating Systems

COURSE OBJECTIVES: This course will enable students to:

- To understand the architecture, motivation, and challenges of multicore processors, including the principles of parallel processing and instruction-level parallelism.
- To develop the skills to design and analyze parallel algorithms using various models, such as Data Parallel, Task Graph, Work Pool, Master-Slave, and Pipeline models, with an emphasis on minimizing communication overhead.
- To gain proficiency in implementing parallel programs using OpenMP directives and runtime routines, ensuring efficient utilization of multicore processors for parallel computing tasks.
- To acquire the ability to develop parallel programs for distributed memory systems using MPI, and parallel processing capabilities of modern GPUs through CUDA programming.

TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

COURSE CONTENTS

MODULE – I

Multicore Processors: Introduction, Motivation towards Multicore processors, Multicore Processors, Challenges involved in Multicore Processors, Architecture, Microarchitecture, and Processors, Concept of Parallel Processing, Parallelism through Multiple Processors, Conventional Parallel Processors and Chip Multiprocessors, Performance of Parallel Processors, Instruction level Parallelism, Challenges in ILP, Superscalar Processors and Simultaneous Multithreading.	**8 Hours**

MODULE – II	
Fundamentals of Parallelization: Introduction, Designing Parallel Algorithms, Mapping Techniques, Techniques to reduce Communication Overhead. **Parallel Algorithms Models:** Data Parallel Model, Task Graph Model, Work Pool Model, Master-Slave Model, Pipeline or Producer Consumer Model, Hybrid Model.	**8 Hours**
MODULE – III	
Directive-Based Paraallel Programming with OpenMP: Introduction, Compilation of OpenMP Programs, OpenMP Pragma and Construct, Runtime Library Routines, Environment Variables, OpenMP Version 3.0 and Above.	**8 Hours**
MODULE – IV	
Programming the Distributed Memory Parallel Computers: Introduction, MPI Program Structure, Environment Management Routines, Point-to-Point Communication, Collective Communication, Groups and Communicators, Deadlocks with MPI Communications, Parallel Programming Support in Python.	**8 Hours**
MODULE – V	
Introduction to GPUs and CUDA Programming: Introduction to GPU Computing, Evolution of Graphics Processing Unit, CUDA Device Architecture – Architecture of Modern GPUs, Introduction to CUDA C Programming.	**8 Hours**

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Understand the architecture and challenges of multicore processors, including parallel processing and instruction-level parallelism.	CL2
CO2	Design and analyze parallel algorithms, using various models and techniques to minimize communication overhead.	CL3
CO3	Implement parallel programs using OpenMP directives and runtime routines for efficient computing.	CL3
CO4	Develop parallel programs with MPI, focusing on communication management and deadlock handling.	CL4
CO5	Utilize GPU computing and CUDA programming to harness the parallel processing capabilities of modern GPUs.	CL4

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1	-	2				1			1	3	2	1
CO2	2	3	3	2	2				1			1	3	3	2
CO3	2	2	3	1	3				2	1		1	3	2	3
CO4	2	2	3	3	3				3	2	1	2	3	3	3
CO5	2	1	2	2	3				2	1		1	3	2	3

3: Substantial (High)	2: Moderate (Medium)	1: Poor (Low)

ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Continuous Internal Evaluation (CIE)	60 %	30
	Assignments	40 %	20
2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT DETAILS

Continuous Internal Assessment (CIA) (50%)				**Semester End Exam (SEE) (50%)**
Continuous Internal Evaluation (CIE) (60%)			**Assignment/ Activities (40%)**	
I	**II**	**III**		
Syllabus Coverage			**Syllabus Coverage**	**Syllabus Coverage**
40%	**30%**	**30%**	**100%**	**100%**
MI			MI	MI
MII	MII		MII	MII
	MIII		MIII	MIII
		MIV	MIV	MIV
		MV	MV	MV

Note: For Examinations (both CIE and SEE), the question papers shall contain the questions mapped to the appropriate Bloom's Level. Any COs mapped with higher cognitive Bloom's Level may also be assessed through the assignments.

ASSIGNMENT TYPES WITH WEIGHTAGES

Sl. No.	Assignment Description	Max. Weightage (%)	Max. Marks
1	Written Assignments	25 %	05
2	Quiz	10 %	02
3	Case Studies	25 %	05
4	Seminar/Presentation	15 %	03
5	Peer - to - Peer Learning	10 %	02
6	Activity Based Learning	50 %	10
7	Project Based Learning	50 %	10
8	Field Work + Report	50 %	10
9	Industry Visit + Report	50 %	10
10	NPTEL/MOOC Courses – Registration and Assignment Submissions	50 %	10
	NPTEL Certification	75 %	15
11	Any other Innovative Assignments (CL4 and above)	50 %	10

Note: The assignments mentioned above may be provided appropriately to the students belonging to different bands

SEE QUESTION PAPER PATTERN:

- The question paper will have **TEN** full questions from **FIVE** Modules
- There will be 2 full questions from each module. Every question will carry a maximum of 20 marks.
- Each full question may have a maximum of four sub-questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting one full question from each module.

REFERENCE BOOK:

1. Niranjan N. Chiplunkar, Raju K - Introduction to Parallel Computing, Wiley.
2. Peter S. Pacheco – An Introduction to Parallel Programming.
3. Quinn Michael – Parallel Programming in C with MPI and OpenMP, McGraw-Hill Education- Europe.
4. Shane Cook – CUDA Programming: A Developers guide to Parallel Computing with GPUs, Morgan Kaufman Publishers In.

INTRODUCTION TO DATA SCIENCE
(Effective from the Academic Year 2024 - 2025)
VI SEMESTER

Course Code	**CS62225CA**	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	**40L**	Exam Hours	03

CREDITS – 3

COURSE PREREQUISITES:

- Fundamental knowledge of Mathematics, Data Structures.

COURSE OBJECTIVES: This course will enable students:

- To provide a foundation in data Science terminologies
- To familiarize data science process and steps
- To Demonstrate the data visualization tools
- To analyze the data science applicability in real time applications.

TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

COURSE CONTENTS

MODULE - I	
Introduction: Big Data and Data Science hype – and getting past the hype, Datafication, Current landscape of perspectives, Populations and samples, Statistical modeling, probability distributions, fitting a model	**8 Hours**
MODULE - II	
Statistics: Describing a Single Set of Data, Correlation **Probability:** Dependence and Independence, Conditional Probability, Bayes's Theorem, Random Variables	**8 Hours**
MODULE - III	
Machine Learning: Three Basic Machine Learning Algorithms: Linear Regression, k-Nearest Neighbours (kNN), k-means	**8 Hours**
MODULE – IV	
Visualization–NumPy, Pandas, Matplotlib, Bar, chart, Line chart, Scatter Plot.	**8 Hours**

MODULE – V	
Simplifying Visualizations using Seaborn: Introduction, Advantages of Seaborn Controlling Figure Aesthetics: Seaborn Figure Styles, Removing Axes Spines, Contexts; Color Palettes: Categorical Color Palettes, Sequential Color Palettes	**8 Hours**

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Understand and apply data science principles in a big data context.	CL3
CO2	Apply the data science process, including defining goals, retrieving and preparing data, and building models.	CL3
CO3	Apply basic machine learning algorithms to analyze data	CL3
CO4	Apply different data visualization techniques to understand the data.	CL3
CO5	Analyze the data using suitable method, visualize using the open source tool.	CL3

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2			2				2	2	2	2	1	2	1
CO2	2	2			2				2	2	2	2			
CO3	2	2			2				2	2	2	2	1		1
CO4	2	2			2				2	2	2	2	1	2	
CO5	2	2			2				2	2	2	2			
3: Substantial (High)					2: Moderate (Medium)					1: Poor (Low)					

ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Continuous Internal Evaluation (CIE)	60 %	30
	Assignments	40 %	20
2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT DETAILS

Continuous Internal Assessment (CIA) (50%)				Semester End Exam (SEE) (50%)
Continuous Internal Evaluation (CIE) (60%)			Assignment/ Activities (40%)	
I	II	III		
Syllabus Coverage			Syllabus Coverage	Syllabus Coverage
40%	30%	30%	100%	100%
MI			MI	MI
MII	MII		MII	MII
	MIII		MIII	MIII
		MIV	MIV	MIV

		MV	MV	MV

Note: For Examinations (both CIE and SEE), the question papers shall contain the questions mapped to the appropriate Bloom's Level. Any COs mapped with higher cognitive Bloom's Level may also be assessed through the assignments.

ASSIGNMENT TYPES WITH WEIGHTAGES

Sl. No.	Assignment Description	Max. Weightage (%)	Max. Marks
1	Written Assignments	25 %	05
2	Quiz	10 %	02
3	Case Studies	25 %	05
4	Seminar/Presentation	15 %	03
5	Peer - to - Peer Learning	10 %	02
6	Activity Based Learning	50 %	10
7	Project Based Learning	50 %	10
8	Field Work + Report	50 %	10
9	Industry Visit + Report	50 %	10
10	NPTEL/MOOC Courses – Registration and Assignment Submissions	50 %	10
	NPTEL Certification	75 %	15
11	Any other Innovative Assignments (CL4 and above)	50 %	10

Note: The assignments mentioned above may be provided appropriately to the students belonging to different bands

SEE QUESTION PAPER PATTERN:

- The question paper will have **TEN** full questions from **FIVE** Modules
- There will be 2 full questions from each module. Every question will carry a maximum of 20 marks.
- Each full question may have a maximum of four sub-questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting one full question from each module.

REFERENCE BOOKS:

1. Doing Data Science Cathy O'Neil and Rachel Schutt, Straight Talk from The Frontline O'Reilly 2014
2. Data Science from Scratch: Joel Grus, O'Reilly Media Inc., ISBN: 9781491901427
3. Data Visualization Workshop, Tim Grobmann and Mario Dobler, Packt Publishing
4. Practitioner's Guide to Data Science: Hui Lin and Ming Li
5. Doing Data Science, Straight Talk from the Frontline, Cathy O'Neil, Rachel Schutt, O' Reilly, 1st edition, 2013.
6. Mining of Massive Datasets, Jure Leskovec, Anand Rajaraman, Jeffrey David Ullman, Cambridge University Press, 2nd edition, 2014.
7. An Introduction to Statistical Learning: with Applications in R, Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, Springer, 1st edition, 2013.

INTRODUCTION TO DATA STRUCTURE
(Effective from the Academic Year 2024 - 2025)
VI SEMESTER

Course Code	**CS62214CB**	**CIA Marks**	**50**
Number of Contact Hours/Week (L: T: P: S)	**3:0:0:0**	**SEE Marks**	**50**
Total Hours of Pedagogy	**40L**	**Exam Hours**	**03**

CREDITS – 3

COURSE PREREQUISITES:
Knowledge of Mathematics and C-Programming

COURSE OBJECTIVES: This course will enable students to:

- Explain the fundamental knowledge of various types of data structures and their applications essential for implementing solutions to problems.
- Illustrate representations and implementations of various linear and nonlinear data structures such as Stack, Queues, linked list, Trees, Graphs and Hashing.

TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

COURSE CONTENTS

MODULE – I	
Introduction: Classifications, Data structure Operations, Demonstration of Sparse Matrices with arrays, Strings: Operations and Pattern Matching Algorithms. Stack: Concepts and Operations, Array Representation of Stacks. **Applications of Stack:** Infix to Postfix Conversion, Evaluation of Postfix expression, Recursion: Ackermann function.	**8 Hours**
MODULE – II	
Introduction: Queues, Array and Linked Representation of Queues, Operations on queues, Circular queues Operations, Dequeues, Priority Queues.	**8 Hours**
MODULE – III	
Introduction: Linked Lists, Representation of linked lists in Memory, Dynamic Memory allocation functions, Singly Linked list Operations: Traversing, Searching, Insertion and Deletion, Doubly Linked lists Operations.	**8 Hours**
MODULE – IV	
Trees: Terminologies, Binary Trees, Properties of Binary trees, Array and linked representation of Binary Trees, Binary Tree Traversals, threaded binary trees, Binary Search Trees: Definition, Insertion, Deletion, **Application of Trees:** Evaluation of Arithmetic Expression.	**8 Hours**

MODULE – V	
Graphs: Terminologies, Graph representations, Traversal methods: Breadth First Search and Depth First Search. **Hashing:** Introduction, Hash Table organizations, Hashing Functions, Static and Dynamic Hashing	**8 Hours**

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Demonstrate the fundamental knowledge of various types of data structures and apply stack data structure for problem solving.	CL3
CO2	Apply the concept of queues, circular queue for solving various problems.	CL3
CO3	Illustrate the operations such as insertion, deletion and searching on singly linked lists, circular linked lists and doubly linked list.	CL3
CO4	Make use of tree data structure with different traversal methods to evaluate arithmetic expression.	CL3
CO5	Illustrate the concept of graphs with applications and the usage of hashing techniques.	CL3

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3		1			2	2			3	3	3	2
CO2	3	3	3		1			2	2			3	3	3	2
CO3	3	3	3		1			2	2			3	3	3	2
CO4	3	3	3		1			2	2			3	3	3	2
CO5	3	3	3		1			2	2			3	3	3	2

3: Substantial (High)	2: Moderate (Medium)	1: Poor (Low)

ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Continuous Internal Evaluation (CIE)	60 %	30
	Assignments	40 %	20
2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT DETAILS

Continuous Internal Assessment (CIA) (50%)				**Semester End Exam (SEE) (50%)**
Continuous Internal Evaluation (CIE) (60%)			**Assignment/ Activities (40%)**	
I	**II**	**III**		
Syllabus Coverage			**Syllabus Coverage**	**Syllabus Coverage**
40%	**30%**	**30%**	**100%**	**100%**
MI			MI	MI
MII	MII		MII	MII
	MIII		MIII	MIII
		MIV	MIV	MIV
		MV	MV	MV

Note: For Examinations (both CIE and SEE), the question papers shall contain the questions mapped to the appropriate Bloom's Level. Any COs mapped with higher cognitive Bloom's Level may also be assessed through the assignments.

ASSIGNMENT TYPES WITH WEIGHTAGES

Sl. No.	Assignment Description	Max. Weightage (%)	Max. Marks
1	Written Assignments	25 %	05
2	Quiz	10 %	02
3	Case Studies	25 %	05
4	Seminar/Presentation	15 %	03
5	Peer - to - Peer Learning	10 %	02
6	Activity Based Learning	50 %	10
7	Project Based Learning	50 %	10
8	Field Work + Report	50 %	10
9	Industry Visit + Report	50 %	10
10	NPTEL/MOOC Courses – Registration and Assignment Submissions	50 %	10
	NPTEL Certification	75 %	15

11	Any other Innovative Assignments (CL4 and above)	50 %	10

Note: The assignments mentioned above may be provided appropriately to the students belonging to different bands

SEE QUESTION PAPER PATTERN:

- The question paper will have **TEN** full questions from **FIVE** Modules
- There will be 2 full questions from each module. Every question will carry a maximum of 20 marks.
- Each full question may have a maximum of four sub-questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting one full question from each module.

TEXT BOOKS:

1. Ellis Horowitz and Sartaj Sahni, Fundamentals of Data Structures in C, 2nd Ed, Universities Press, 2014.
2. Seymour Lipschutz, Data Structures Schaum's Outlines, Revised 1st Ed, McGraw Hill, 2014.
3. Gilberg and Forouzan, Data Structures: A Pseudo-code approach with C, 2nd Ed, Cengage Learning, 2014.
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,2nd Ed, PHI,1996.

PROGRAMMING IN JAVA
(Effective from the Academic Year 2024 - 2025)
VI SEMESTER

Course Code	**CS62225CC**	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	**40L**	Exam Hours	03

CREDITS – 3

COURSE PREREQUISITES:

- Fundamentals of C and C++ programming.

COURSE OBJECTIVES: This course will enable students to:

- Learn fundamental features of object-oriented language and JAVA.
- Set up a Java JDK environment to create, debug and run simple Java programs.
- Learn object-oriented concepts using programming examples.
- Study the concepts of importing packages and exception handling mechanisms.
- Discuss the String Handling examples with Object Oriented concepts.

TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- PowerPoint Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

COURSE CONTENTS

MODULE – I

Introduction: Object-Oriented Programming with Simple Program, Control Statements, Using Blocks of Code, Lexical Issues, The Java Class Libraries, The Primitive Types, Literals, Type Conversion and Casting, Automatic Type Promotion in Expressions, Operators, Operator Precedence and using parentheses.	**8 Hours**

MODULE – II

Control Statements: Java's Selection Statements, Iteration Statements, Jump Statements **Classes and Methods:** Fundamentals of classes, Declaring Objects, Assigning Object Reference Variables, Constructors, This Keyword, Garbage Collection.	**8 Hours**

MODULE – III

Constructors: Overloading Methods, Using Objects as Parameters, Argument Passing, Returning Objects, Recursion, Access Control, understanding static, final, Arrays Revisited. **Inheritance:** Fundamentals, using super, creating a Multilevel Hierarchy, Calling Constructors, Method Overriding, Dynamic Method Dispatch, Abstract Classes, final with Inheritance, The Object Class.	**8 Hours**

MODULE – IV	
Packages and Interfaces: Fundamentals of Packages, Access Protection, Importing Packages, Interfaces and its concepts. **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 own exception subclasses, Chained Exceptions, Using Exceptions.	**8 Hours**
MODULE - V	
Enumerations, Type Wrappers, String Handling: The String Constructors, String Length, Special String Operations, Character Extraction, String Comparison, Searching Strings, Modifying a String, Data Conversion Using valueOf( ), Changing the Case of Characters Within a String , Additional String Methods, StringBuffer, StringBuilder.	**8 Hours**

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Describe the readability and maintainability of Java programs through the proper use of blocks of code and control statements.	CL2
CO2	Demonstrate the functionality of Java classes and methods, including control statements, constructors and object management techniques.	CL3
CO3	Implement method overloading, recursion, and access control in Java programs.	CL3
CO4	Use packages, interfaces and write exception free application programs.	CL3
CO5	Use enumeration and String concept to develop computer programs to solve real world problems in Java	CL3

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3		2							2			
CO2	3	3	3		2							2			
CO3	3	3	3		2		1	1				2			
CO4	3	3	3		2	2	1	1				2			
CO5	3	3	3		2	2	1	2	2		2	2			

3: Substantial (High)	2: Moderate (Medium)	1: Poor (Low)

ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Continuous Internal Evaluation (CIE)	60 %	30
	Assignments	40 %	20

2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT DETAILS

Continuous Internal Assessment (CIA) (50%)				**Semester End Exam (SEE) (50%)**
Continuous Internal Evaluation (CIE) (60%)			**Assignment/ Activities (40%)**	
I	**II**	**III**		
Syllabus Coverage			**Syllabus Coverage**	**Syllabus Coverage**
40%	**30%**	**30%**	**100%**	**100%**
MI			MI	MI
MII	MII		MII	MII
	MIII		MIII	MIII
		MIV	MIV	MIV
		MV	MV	MV

Note: For Examinations (both CIE and SEE), the question papers shall contain the questions mapped to the appropriate Bloom's Level. Any COs mapped with higher cognitive Bloom's Level may also be assessed through the assignments.

ASSIGNMENT TYPES WITH WEIGHTAGES

Sl. No.	**Assignment Description**	**Max. Weightage (%)**	**Max. Marks**
1	Written Assignments	25 %	05
2	Quiz	10 %	02
3	Case Studies	25 %	05
4	Seminar/Presentation	15 %	03
5	Peer - to - Peer Learning	10 %	02
6	Activity Based Learning	50 %	10
7	Project Based Learning	50 %	10
8	Field Work + Report	50 %	10
9	Industry Visit + Report	50 %	10
10	NPTEL/MOOC Courses – Registration and Assignment Submissions	50 %	10
	NPTEL Certification	75 %	15
11	Any other Innovative Assignments (CL4 and above)	50 %	10

Note: The assignments mentioned above may be provided appropriately to the students belonging to different bands

SEE QUESTION PAPER PATTERN:

- The question paper will have **TEN** full questions from **FIVE** Modules
- There will be 2 full questions from each module. Every question will carry a maximum of 20 marks.
- Each full question may have a maximum of four sub-questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting one full question from each module.

REFERENCE BOOKS:

- Herbert Schildt, Java the Complete Reference, 7th Edition, Tata McGraw Hill, 2007.
- Cay S Horstmann, "Core Java - Vol. 1 Fundamentals", Pearson Education, 10th Edition, 2016.
- Raoul-Gabriel Urma, Mario Fusco, Alan Mycroft, "Java 8 in Action", Dreamtech Press/Manning Press, 1st Edition, 2014

SAHYADRI
COLLEGE OF ENGINEERING & MANAGEMENT
An Autonomous Institution
MANGALURU

INTRODUCTION TO WEB TECHNOLOGY
(Effective from the Academic Year 2024 - 2025)
VI SEMESTER

Course Code	**CS62225CD**	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40L	Exam Hours	03

CREDITS – 3

COURSE PREREQUISITES:

- Programming Fundamentals

COURSE OBJECTIVES: This course will enable students:

- To develop web pages using HTML syntax and semantics.
- To construct and visually format forms using HTML and CSS.
- To build Client-Side Scripts using JavaScript to generate and display the contents dynamically.
- To implement dynamic web applications using the concepts of PHP, MySQL.

TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

COURSE CONTENTS

MODULE - I

Introduction to HTML: HTML Syntax, Semantic Markup, Structure of HTML Documents, Quick Tour of HTML Elements, HTML5 Semantic Structure Elements, HTML Tables and Forms, Introducing Tables, Styling Tables, Introducing Forms, Form Control Elements, Table and Form Accessibility.	**8 Hours**

MODULE - II

Cascade Style Sheet: CSS Syntax, Location of Styles, Selectors, The Cascade: How Styles Interact, The Box Model, CSS Text Styling. **Advanced CSS:** Layout, Normal Flow, Positioning Elements, Floating Elements, Constructing Multicolumn Layouts, Approaches to CSS Layout, Responsive Design, CSS Frameworks.	**8 Hours**

MODULE - III	
JavaScript: Client-Side Scripting, JavaScript Design Principles, where does JavaScript Go? Syntax, JavaScript Objects, The Document Object Model (DOM), JavaScript Events, Forms.	**8 Hours**
MODULE - IV	
Introduction to Server-Side Development with PHP: Server-Side Development, , Quick Tour of PHP, Program Control, Functions PHP Arrays and Superglobals, Arrays, $_GET and $_POST Superglobal Arrays, $_SERVER Array, $_Files Array, Reading/Writing Files.	**8 Hours**
MODULE - V	
Working with Databases: Databases and Web Development, SQL, Database APIs, managing a MYSQL Database, Accessing MySQL in PHP, Building a application to connect front end to back end.	**8 Hours**

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Develop web pages using HTML syntax and semantics.	CL3
CO2	Apply HTML and CSS to format forms.	CL3
CO3	Build Client-Side Scripts using JavaScript to generate and display the contents dynamically.	CL3
CO4	Construct fully functional dynamic web applications using the concepts of PHP, MySQL.	CL3
CO5	Make use of PHP, MySQL in web application to connect front end to back end.	CL3

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3		3							3	3	3	3
CO2	3	3	3		3							3	3	3	3
CO3	3	3	3		3							3	3	3	3
CO4	3	3	3		3							3	3	3	3
CO5	3	3	3		3				3	3		3	3	3	3

3: Substantial (High)	2: Moderate (Medium)	1: Poor (Low)

ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Continuous Internal Evaluation (CIE)	60 %	30
	Assignment	40 %	20
2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT DETAILS				
Continuous Internal Assessment (CIA) (50%)				Semester End Exam (SEE) (50%)
Continuous Internal Evaluation (CIE) (60%)			Practical Sessions (40%)	
I	II	III		
Syllabus Coverage			Syllabus Coverage	Syllabus Coverage
40%	30%	30%	100%	100%
MI			MI	MI
MII	MII		MII	MII
	MIII		MIII	MIII
		MIV	MIV	MIV
		MV	MV	MV

Note: For Examinations (both CIE and SEE), the question papers shall contain the questions mapped to the appropriate Bloom's Level. Any COs mapped with higher cognitive Bloom's Level may also be assessed through the assignments.

SEE QUESTION PAPER PATTERN:

- The question paper will have **TEN** full questions from **FIVE** Modules
- There will be 2 full questions from each module. Every question will carry a maximum of 20 marks.
- Each full question may have a maximum of four sub-questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting one full question from each module.

REFERENCE BOOKS:

1. Randy Connolly, Ricardo Hoar, "Fundamentals of Web Development", 1st Edition, Pearson Education India. (ISBN:978-9332575271)
2. Robin Nixon, "Learning PHP, MySQL &JavaScript with jQuery, CSS and HTML5", 4th Edition, O'Reilly Publications, 2015. (ISBN:978-9352130153)
3. Luke Welling, Laura Thomson, "PHP and MySQL Web Development", 5th Edition, Pearson Education, 2016. (ISBN:978-9332582736)
4. Nicholas C Zakas, "Professional JavaScript for Web Developers", 3rd Edition, Wrox/Wiley India, 2012. (ISBN:978-8126535088)
5. David Sawyer Mcfarland, "JavaScript & jQuery: The Missing Manual", 1st Edition, O'Reilly/Shroff Publishers & Distributors Pvt Ltd, 2014

COMPUTER GRAPHICS AND IMAGE PROCESSING LABORATORY
(Effective from the Academic Year 2024- 2025)
VI SEMESTER

Course Code	**CS622L7C**	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	0:0:2:0	SEE Marks	50
Total Hours of Pedagogy	20P	Exam Hours	03

CREDITS – 1

COURSE PREREQUISITES:

- Basic Knowledge of C and Python programming

COURSE OBJECTIVES: This course will enable students to:

- Understand the concept of OpenGL
- Exploring 2D and 3D graphics with OpenGL API's.
- Use of Computer graphics principles for animation and design of GUI's.
- Basic understanding of Image processing operations.
- Perform operations such as Image segmentation and Morphological operations

TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

LIST OF EXPERIMENTS

Sl.No	Description
1	Implement Bresenham's line drawing algorithm for all types of slopes.
2	Write a program in OpenGL that demonstrates basic 2D geometric transformations such as translation, rotation, and scaling. Allow the user to interactively apply these transformations to a 2D object.
3	Develop a program to demonstrate 3D transformation on 3D objects
4	Write a program that takes an RGB color as input and converts it to its corresponding CMY and CMYK values.
5	Create a program that captures user input to dynamically adjust the properties of a shape (e.g., size, color).
6	Write a Program to read a digital image. Split and display image into 4 quadrants, up, down, right and left
7	Read an image and extract and display low-level features such as edges, textures using filtering techniques

8	Write a program to blur and smoothing an image.
9	Write a program for image segmentation by using edge-based segmentation

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Use OpenGL to write simple programs that involve coordinate systems, reference frames, point and line functions, attributes, and drawing algorithms.	CL3
CO2	Illustrate 2D and 3D geometric transformations using OpenGL	CL3
CO3	Design interactive programs and simple animations using OpenGL	CL3
CO4	Apply basic Image processing operations for different types of images	CL3
CO5	Make use of segmentation and morphology techniques on different images.	CL3

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	3	2	3				3	2	2	3	1	1	
CO2	3	2	3	2	3				3	2	2	3	2	2	
CO3	3	2	3	2	3				3	2	2	3	2	2	
CO4	3	2	3	2	3				3	2	2	3	2	2	
CO5	3	2	3	2	3				3	2	2	3	2	2	

3: Substantial (High)	2: Moderate (Medium)	1: Poor (Low)

ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Laboratory Work (A)	50 %	25
	Laboratory Test (B)	30 %	15
	Open Ended Experiments /Mini Projects (C)	20 %	10
2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT STRATEGY:

- In Laboratory Courses where (B) and (C) are not the components of the assessment pattern, then (A) will have 100% weightage (50 Marks).

a. **Assessment Mode:** Weekly Assessment of Laboratory Work (50 Marks) - the marks will be awarded based on the Continuous Internal Assessment (Weekly Assessment, each of 25 marks) of the students in each laboratory session. The average of all the marks obtained across the sessions will be the Final CIA marks.

- In Laboratory Courses where (C) is not a component of the assessment pattern, then (A) will have 50% weightage (25 Marks), and (B) will have 50% weightage (25 Marks).
    a. **Assessment Mode:** The marks will be awarded based on the Continuous Internal Assessment (Weekly Assessment) (A) and One Laboratory Test (B).

- In Weekly Assessment, the student will be evaluated in each laboratory session for 25 marks. The average marks obtained across all the experiments will be the marks obtained for (A).
- A Laboratory Test, similar to the SEE exam is conducted towards the end of the Semester/Course, whichever is earlier. The obtained marks are scaled down to 25 Marks (B)
    a. The Sum of marks obtained across (A) and (B) will be the Final CIA marks.

- In Laboratory Courses where (C) is a component of the assessment pattern, then assessment will be done by considering the weightages given above, i.e. (A) – 25 Marks (Weekly Assessment), (B) – 15 Marks (Laboratory Examination), (C) – 10 marks (Open Ended Experiments/Mini Projects)
- The respective course instructor will design the assessment criteria for the said assessment components.
- The assessment components will be made known to the students by the respective Course Coordinators prior to the commencement of the Laboratory Work.
- In all the cases, the assessments will be done based on the criteria designed by the Course Coordinator.

SEE QUESTION PAPER PATTERN:

- All laboratory experiments should be included for practical examination, from which students are allowed to pick one experiment from the lot.
- SEE shall be conducted for 100 Marks and the marks will be scaled down to 50.
- General Marks Distribution: Procedure + Conduction + Viva = 20% + 50% + 30%.
- Change of experiment is allowed only once and 20% of the marks allotted to the Procedure will be made ZERO (if a question carries two experiments, both should be changed). The evaluation will be done for 80% of the total maximum marks.

REFERENCE BOOKS:

1. Donald Hearn & Pauline Baker: Computer Graphics with OpenGL Version,3rd/4th Edition, Pearson Education,2011
2. James D Foley, Andries Van Dam, Steven K Feiner, John F Huges Computer graphics with OpenGL: Pearson education S. Sridhar, Digital Image Processing, Second Edition

3D ANIMATION USING BLENDER
(Effective from the Academic Year 2024 - 2025)
VI SEMESTER

Course Code	**CS62298CA**	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	0:0:2:0	SEE Marks	50
Total Hours of Pedagogy	20P	Exam Hours	03

CREDITS – 1

COURSE PREREQUISITES:

- Computer with GPU
- Understanding of Graphics coordinate systems.

COURSE OBJECTIVES: This course will enable students:

- To install blender software and become proficient in 3D modeling.
- To Develop the ability to conceptualize models for animation.
- To acquire skills in developing the 3D environment for 3D animation.

TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

LIST OF EXPERIMENTS

Sl. No	**Description**
	PART A
1	Introduction to Blender software and getting familiar with the blender interface.
2	Model a Coffee Mug to explore on adding a new mesh object, edit mesh mode, Grid fill tool, outer edge, create loops cuts, Solidify Modifier, Spin tool, Bridge edge loops, Subdivision Surface Modifier
3	Create a Basketball and Basketball Hoop in blender explore texture adding.
4	Design of 3D low poly vehicles use a suitable interface.
5	Design a 3D a low poly house in Blender use suitable interface to make appealing 3D view.
6	Design 3D realistic tree using blender.
7	Create detailed and realistic clothing for 3D characters or models using Blender's sculpting tools.

PART-B	
1	Students has to develop 3D animation shows a small story-based animation.

Note

Part A

- Each student is required to complete Part-A individually.

Part B

- PART B is a group project where students will work in groups of four.
- project report must be submitted to the course instructor for evaluation.

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Build competence in using Blender and its interfaces.	CL3
CO2	Construct a 3D Models and add textures to it.	CL3
CO3	Develop a 3D characters or models using Blender's sculpting tools	CL3
CO4	Develop shaders for realistic 3D scenes and animations	CL3
CO5	Develop 3D story-based animation	CL3

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2			2								2		1
CO2	2	2			2								2		1
CO3	2	2			2								2		1
CO4	2	2			2								2		1
CO5	2	2			2								2		1

3: Substantial (High)	2: Moderate (Medium)	1: Poor (Low)

ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	100 %	50
	Laboratory Work (A)	50 %	25
	Laboratory Test (B)	30%	15
	Open Ended Experiments /Mini Projects (C)	20 %	10
2	**Semester End Examination (SEE)**	**100 %**	50

ASSESSMENT STRATEGY:

- In Laboratory Courses where (B) and (C) are not the components of the assessment pattern, then (A) will have 100% weightage (50 Marks).
    - **Assessment Mode:** Weekly Assessment of Laboratory Work (50 Marks) - the marks will be awarded based on the Continuous Internal Assessment (Weekly Assessment, each of 25 marks) of the students in each laboratory session. The average of all the marks obtained across the sessions will be the Final CIA marks.

- In Laboratory Courses where (C) is not a component of the assessment pattern, then (A) will have 50% weightage (25 Marks), and (B) will have 50% weightage (25 Marks).
    - **Assessment Mode:** The marks will be awarded based on the Continuous Internal Assessment (Weekly Assessment) (A) and One Laboratory Test (B).
- In Weekly Assessment, the student will be evaluated in each laboratory session for 25 marks. The average marks obtained across all the experiments will be the marks obtained for (A).
- A Laboratory Test, similar to the SEE exam is conducted towards the end of the Semester/Course, whichever is earlier. The obtained marks are scaled down to 25 Marks (B)
    - The Sum of marks obtained across (A) and (B) will be the Final CIA marks.

- In Laboratory Courses where (C) is a component of the assessment pattern, then assessment will be done by considering the weightages given above, i.e. (A) – 25 Marks (Weekly Assessment), (B) – 15 Marks (Laboratory Examination), (C) – 10 marks (Open Ended Experiments/Mini Projects)
- The respective course instructor will design the assessment criteria for the said assessment components.
- The assessment components will be made known to the students by the respective Course Coordinators prior to the commencement of the Laboratory Work.
    - In all the cases, the assessments will be done based on the criteria designed by the Course Coordinator.

SEE QUESTION PAPER PATTERN:

- All laboratory experiments should be included for practical examination, from which students are allowed to pick one experiment from the lot.
- SEE shall be conducted for 100 Marks and the marks will be scaled down to 50.
- General Marks Distribution: Procedure + Conduction + Viva = 20% + 50% + 30%.

Change of experiment is allowed only once and 20% of the marks allotted to the Procedure will be made ZERO (if a question carries two experiments, both should be changed). The evaluation will be done for 80% of the total maximum marks.

CISCO PACKET TRACER
(Effective from the Academic Year 2023-2024)
VI SEMESTER

Course Code	**CS62298CB**	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	0:0:2:0	SEE Marks	50
Total Hours of Pedagogy	**20P**	Exam Hours	03

CREDITS – 1

COURSE PREREQUISITES:

- Basic Knowledge of Programming.

COURSE OBJECTIVES:

- Explore the basic operations of Packet Tracer: - File commands, visualization and configuration of networking devices.
- Learn how the switches and routers are configured
- Design Star, Bus, Ring Topology using packet tracer
- configure and use vpn on routers

TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Practical Based Learning
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

List of Experiments

Sl. No.	
1	Provide an in-depth overview and explanation of the Cisco Packet Tracer Simulator, highlighting its key features and uses for network simulation.
2	Explain the steps involved in the initial configuration of a switch and a router, including basic settings, necessary commands, and best practices for setting up a functional network environment.
3	Provide a detailed guide on the initial setup and configuration of both a switch and a router.

4	Demonstrate how to design and implement Star, Bus, and Ring network topologies using Cisco Packet Tracer.
5	Design a network that incorporates Network Address Translation (NAT) and tunneling concepts. Please include detailed steps, configurations, and examples to illustrate how these technologies can be effectively implemented.
6	Design a wireless LAN (WLAN) and Please include the necessary steps, equipment selection, configuration guidelines, and best practices for creating an efficient and secure wireless network
7	Implement on a data set of characters the three CRC polynomials – CRC 12, CRC 16 and CRC CCIP. Program: CRC-12,16, CCITT
8	Implement Dijkstra's algorithm to compute the shortest path through a graph and please include an explanation of the algorithm, a detailed walkthrough of the implementation process, and example scenarios to illustrate how it works.

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Learn the basic operations of Packet Tracer: - File commands, visualization and configuration of networking devices.	CL3
CO2	Understand the initial Configuration of switches and routers	CL3
CO3	Create Topologies and Configure ip address to routers	CL3
CO4	Learn how to configure and use vpn on routers.We will learn to create a vpn tunnel between routers for safe communication	CL3
CO5	Implement Dijkstra 's algorithm to compute the Shortest path through a graph.	CL3

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	3		3							1			
CO2	3	2	3		3							1			
CO3	3	2	3		3							1			
CO4	3	2	3		3							1			
CO5	3	2	3		3							1			

3: Substantial (High)	2: Moderate (Medium)	1: Poor (Low)

ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Laboratory Work (A)	50 %	25
	Laboratory Test (B)	30 %	15
	Open Ended Experiments /Mini Projects (C)	20 %	10
2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT STRATEGY:

- In Laboratory Courses where (B) and (C) are not the components of the assessment pattern, then (A) will have 100% weightage (50 Marks).
    - **Assessment Mode:** Weekly Assessment of Laboratory Work (50 Marks) - the marks will be awarded based on the Continuous Internal Assessment (Weekly Assessment, each of 25 marks) of the students in each laboratory session. The average of all the marks obtained across the sessions will be the Final CIA marks.

- In Laboratory Courses where (C) is not a component of the assessment pattern, then (A) will have 50% weightage (25 Marks), and (B) will have 50% weightage (25 Marks).
    - **Assessment Mode:** The marks will be awarded based on the Continuous Internal Assessment (Weekly Assessment) (A) and One Laboratory Test (B).
- In Weekly Assessment, the student will be evaluated in each laboratory session for 25 marks. The average marks obtained across all the experiments will be the marks obtained for (A).
- A Laboratory Test, similar to the SEE exam is conducted towards the end of the Semester/Course, whichever is earlier. The obtained marks are scaled down to 25 Marks (B)
    - The Sum of marks obtained across (A) and (B) will be the Final CIA marks.
- In Laboratory Courses where (C) is a component of the assessment pattern, then assessment will be done by considering the weightages given above, i.e. (A) – 25 Marks (Weekly Assessment), (B) – 15 Marks (Laboratory Examination), (C) – 10 marks (Open Ended Experiments/Mini Projects)
- The respective course instructor will design the assessment criteria for the said assessment components.
- The assessment components will be made known to the students by the respective Course Coordinators prior to the commencement of the Laboratory Work.
- In all the cases, the assessments will be done based on the criteria designed by the Course Coordinator.

SEE QUESTION PAPER PATTERN:

- All laboratory experiments should be included for practical examination, from which students are allowed to pick one experiment from the lot.
- SEE shall be conducted for 100 Marks and the marks will be scaled down to 50.
- General Marks Distribution: Procedure + Conduction + Viva = 20% + 50% + 30%.
- Change of experiment is allowed only once and 20% of the marks allotted to the Procedure will be made ZERO (if a question carries two experiments, both should be changed). The evaluation will be done for 80% of the total maximum marks.

GAME DEVELOPMENT
(Effective from the Academic Year 2023 - 2024)
VI SEMESTER

Course Code	**CS62298CC**	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	0:0:2:0	SEE Marks	50
Total Hours of Pedagogy	20P	Exam Hours	03

CREDITS – 1

COURSE PREREQUISITES:

- Basics of C-Sharp language
- Basics of unity game engine

COURSE OBJECTIVES: This course will enable students:

- To install Unity and Unreal engine and become proficient in their GUI for game development.
- Develop the ability to conceptualize and define engaging themes for 2D games.
- To acquire skills in character design, sprite creation, character control and movement to create functional 2D gameplay.
- To design interactive game environments with tiles, interactive objects, and collectibles to enhance player engagement.
- To explore the design of player world interactions, with the option of using physics engines, for immersive and dynamic gameplay experiences.

TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

LIST OF EXPERIMENTS

Sl. No.	Description
1	Installation of a game engine, e.g., Unity familiarization of the GUI.
2	Creation of 2D assets, Character Movement Program core mechanic, Sprite animation.
3	Level design: design of the world in the form of tiles along with interactive and collectible objects.
4	Design of interaction between the player and the world, optionally using the physics engine.
5	Developing a 2D interactive using Pygame.
6	Developing a multiplayer experience.
7	Design 3D environment, animation and AI behavior
8	Developing a camera, Physics and core game mechanics for 3D game.
9	Developing a physics-based mechanic for 3D game, optimization of 3D, Testing, Publishing and delivery.

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Apply game engine expertise to install and navigate game engines like unity and unreal engine.	CL3
CO2	Create conceptually sound 2D game themes.	CL3
CO3	Implement 2D game elements by executing their character design, character control, and movement to construct functional game play experiences.	CL3
CO4	Design interactive game environments through the creation of game worlds using tiles, interactive objects, and collectibles.	CL3
CO5	Implement 3D environment, animation and behaviour along with physics based and shooter-based 3D game mechanics	CL3

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	3		2							1	1	1	1
CO2	3	2	3		2							1	1	1	1
CO3	3	2	3		2							1	1		1
CO4	3	2	3		2							1		1	
CO5	3	2	3		2							1	1		1

3: Substantial (High)	2: Moderate (Medium)	1: Poor (Low)

ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Laboratory Work (A)	50 %	25
	Laboratory Test (B)	30 %	15
	Open Ended Experiments /Mini Projects (C)	20 %	10
2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT STRATEGY:

- In Laboratory Courses where (B) and (C) are not the components of the assessment pattern, then (A) will have 100% weightage (50 Marks).
    a. **Assessment Mode:** Weekly Assessment of Laboratory Work (50 Marks) - the marks will be awarded based on the Continuous Internal Assessment (Weekly Assessment, each of 25 marks) of the students in each laboratory session. The average of all the marks obtained across the sessions will be the Final CIA marks.

- In Laboratory Courses where (C) is not a component of the assessment pattern, then (A) will have 50% weightage (25 Marks), and (B) will have 50% weightage (25 Marks).
    a. **Assessment Mode:** The marks will be awarded based on the Continuous Internal Assessment (Weekly Assessment) (A) and One Laboratory Test (B).
- In Weekly Assessment, the student will be evaluated in each laboratory session for 25 marks. The average marks obtained across all the experiments will be the marks obtained for (A).
- A Laboratory Test, similar to the SEE exam is conducted towards the end of the Semester/Course, whichever is earlier. The obtained marks are scaled down to 25 Marks (B)
    a. The Sum of marks obtained across (A) and (B) will be the Final CIA marks.

- In Laboratory Courses where (C) is a component of the assessment pattern, then assessment will be done by considering the weightages given above, i.e. (A) – 25 Marks (Weekly Assessment), (B) – 15 Marks (Laboratory Examination), (C) – 10 marks (Open Ended Experiments/Mini Projects)
- The respective course instructor will design the assessment criteria for the said assessment components.
- The assessment components will be made known to the students by the respective Course Coordinators prior to the commencement of the Laboratory Work.
- In all the cases, the assessments will be done based on the criteria designed by the Course Coordinator.

SEE QUESTION PAPER PATTERN:

- All laboratory experiments should be included for practical examination, from which students are allowed to pick one experiment from the lot.
- SEE shall be conducted for 100 Marks and the marks will be scaled down to 50.
- General Marks Distribution: Procedure + Conduction + Viva = 20% + 50% + 30%.
- Change of experiment is allowed only once and 20% of the marks allotted to the Procedure will be made ZERO (if a question carries two experiments, both should be changed). The evaluation will be done for 80% of the total maximum marks.

MongoDB
(Effective from the Academic Year 2023 - 2024)
VI SEMESTER

Course Code	**CS62298CD**	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	0:0:2:0	SEE Marks	50
Total Hours of Pedagogy	**20P**	Exam Hours	02

CREDITS – 1

PREREQUISITES:

- Fundamental knowledge of any programming language
- Basic understanding of any database, SQL, and query language for databases
- Working knowledge of Linux or Unix-based systems (recommended, but not mandatory)

COURSE OBJECTIVES:

- Able to demonstrate a solid understanding of MongoDB fundamentals, including its NoSQL architecture, key features, and the advantages it offers over traditional relational databases.
- Acquire the skills to perform advanced data manipulation using MongoDB, including CRUD operations, indexing strategies, and complex querying techniques.
- Develop practical skills in MongoDB application development, integrating MongoDB with popular programming languages.

TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

LIST OF EXPERIMENTS

Sl. No.	Description
1	MongoDB installation and configuration in windows.
2	Demonstrate how to create and drop database in MongoDB.
3	Creating the Collection in MongoDB.
4	Creating collection with options before inserting the documents and drop the collection created.
5	MogoDB Insert Document a. Insert single document. b. Insert multiple documents in collection.

6	Querying all the documents in json format and Querying based on the criteria.
7	MongoDB update document a. Using update() method. b. Using save() method.
8	MongoDB delete document from a collection. a. Using remove() method. b. Remove only one document matching your criteria c. Remove all documents.
9	MongoDB Projection
10	limit() ,skip(), sort() methods in MongoDB
11	MongoDB indexing a. Create index in MongoDB b. Finding the indexes in a collection c. Drop indexes in a collection d. Drop all the indexes

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Demonstrate MongoDB fundamentals, including creating and dropping databases and collections.	CL3
CO2	Demonstrate the significance of document manipulation operations in MongoDB, such as inserting, querying, updating, and deleting documents.	CL3
CO3	Illustrate collections with specific options, project and filter data based on criteria, and perform advanced collection manipulations.	CL3
CO4	Apply limit, skip, and sort methods to demonstrate their ability to control and enhance data retrieval.	CL3
CO5	Demonstrate indexing in MongoDB.	CL3

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	3		2						1	1	1	1	
CO2	3	2	3		2						1	1	1	1	1
CO3	3	2	3		2						1	1	1	1	
CO4	3	2	3		2						1	1	1	1	1
CO5	3	2	3		2						1	1	1	1	1

3: Substantial (High) | **2: Moderate (Medium)** | **1: Poor (Low)**

ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Laboratory Work (A)	50 %	25
	Laboratory Test (B)	30 %	15
	Open Ended Experiments /Mini Projects (C)	20 %	10
2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT STRATEGY:

I. In Laboratory Courses where (B) and (C) are not the components of the assessment pattern, then (A) will have 100% weightage (50 Marks).

Assessment Mode: Weekly Assessment of Laboratory Work (50 Marks) - the marks will be awarded based on the Continuous Internal Assessment (Weekly Assessment, each of 25 marks) of the students in each laboratory session. The average of all the marks obtained across the sessions will be the Final CIA marks.

II. In Laboratory Courses where (C) is not a component of the assessment pattern, then (A) will have 50% weightage (25 Marks), and (B) will have 50% weightage (25 Marks).

Assessment Mode: The marks will be awarded based on the Continuous Internal Assessment (Weekly Assessment) (A) and One Laboratory Test (B).

- In Weekly Assessment, the student will be evaluated in each laboratory session for 25 marks. The average marks obtained across all the experiments will be the marks obtained for (A).
- A Laboratory Test, similar to the SEE exam is conducted towards the end of the Semester/Course, whichever is earlier. The obtained marks are scaled down to 25 Marks (B)

The Sum of marks obtained across (A) and (B) will be the Final CIA marks.

III. In Laboratory Courses where (C) is a component of the assessment pattern, then assessment will be done by considering the weightages given above, i.e. (A) – 25 Marks (Weekly Assessment), (B) – 15 Marks (Laboratory Examination), (C) – 10 marks (Open Ended Experiments/Mini Projects)

- The respective course instructor will design the assessment criteria for the said assessment components.
- The assessment components will be made known to the students by the respective Course Coordinators prior to the commencement of the Laboratory Work.

In all the cases, the assessments will be done based on the criteria designed by the Course Coordinator.

SEE QUESTION PAPER PATTERN:

1. All laboratory experiments should be included for practical examination, from which students are allowed to pick one experiment from the lot.
2. SEE shall be conducted for 100 Marks and the marks will be scaled down to 50.
3. General Marks Distribution: Procedure + Conduction + Viva = 20% + 50% + 30%.
4. Change of experiment is allowed only once and 20% of the marks allotted to the Procedure will be made ZERO (if a question carries two experiments, both should be changed). The evaluation will be done for 80% of the total maximum marks.

CLOUD COMPUTING AND SECURITY
(Effective from the Academic Year 2023 - 2024)
VII SEMESTER

Course Code	**CS722I1C**	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	**40L**	Exam Hours	03

CREDITS – 4

COURSE PREREQUISITES:

- Fundamental knowledge of computer architecture and organization and computer networks.

COURSE OBJECTIVES: This course will enable students:

- To provide students with the fundamentals and essentials of Cloud Computing.
- To provide students a sound foundation of Cloud Computing so that they are able to start using and adopting Cloud Computing services and tools in their real-life scenarios.
- To enable students exploring some important cloud computing driven commercial systems and applications.
- To expose the students to frontier areas of Cloud Computing and information systems, while providing sufficient foundations to enable further study and research.

TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

COURSE CONTENTS

MODULE – I

Introduction: Cloud Computing at a Glance, The Vision of Cloud Computing, Defining a Cloud, A Closer Look, Cloud Computing Reference Model, Characteristics and Benefits, Challenges Ahead, Historical Developments **Virtualization**: Characteristics of Virtualized Environments, Taxonomy of Virtualization Techniques, Execution Virtualization, Other Types of Virtualization, Virtualization and Cloud Computing, Pros and Cons of Virtualization, Technology Examples Xen: Paravirtualization, VMware: Full Virtualization, Microsoft Hyper-V	**8 Hours**

MODULE – II	
Cloud Computing Architecture: Cloud Reference Model, Architecture, Infrastructure / Hardware as a Service, Platform as a Service, Software as a Service, Types of Clouds, Public Clouds, Private Clouds, Hybrid Clouds, Community Cloud.	**8 Hours**
MODULE – III	
Concurrent Computing-Thread Programming: Introducing Parallelism for Single Machine Computation, Programming Applications with Threads, Thread APIs, Techniques for Parallel Computation with Threads **High-Throughput Computing-Task Programming:** Task computing, characterizing a Task, Computing categories, Framework for Task computing, Task based Application Models	**8 Hours**
MODULE – IV	
Data-Intensive Computing: Characterizing Data-Intensive Computations, Challenges Ahead, Historical Perspective, Technologies for Data-Intensive Computing, Storage Systems, Programming Platforms **Cloud Platforms in Industry:** Amazon Web Services, Compute Services, Storage Services, Communication Services, Additional Services, Google App Engine, Architecture and Core Concepts, Application Life-Cycle, Cost Model, Observations, Microsoft Azure, Azure Core Concepts, SQL Azure, Windows Azure Platform Appliance.	**8 Hours**
MODULE – V	
Cloud Security - Basic Components, Security Attacks, Classes of Threats, Policies and Mechanisms, Goals of Security, Trust and Assumptions Assurance, Operational Issues, Human Issues, Passive and Active Attacks, Security Services, Role of Security, Types of Attack, Network Security, Security Stack	**8 Hours**

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Understand the concept of cloud computing and virtualization	CL2
CO2	Choose cloud architecture and types of cloud services	CL3
CO3	Analyze the different types of programming approaches used in computation of cloud data	CL3
CO4	Develop applications using different cloud platforms	CL3
CO5	Outline different Cloud Security attacks and Security services	CL2

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	1				2				2	1		1
CO2	3	3	2					2				2	1		
CO3	3	3	3					2				2		1	
CO4	3	3	3					2				2	1		1
CO5	3	3	3					2				2			

3: Substantial (High)	2: Moderate (Medium)	1: Poor (Low)

ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Continuous Internal Evaluation (CIE)	60 %	30
	Assignments	40 %	20
2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT DETAILS

Continuous Internal Assessment (CIA) (50%)				Semester End Exam (SEE) (50%)
Continuous Internal Evaluation (CIE) (60%)			Assignment/ Activities (40%)	
I	II	III		
Syllabus Coverage			Syllabus Coverage	Syllabus Coverage
40%	30%	30%	100%	100%
MI			MI	MI
MII	MII		MII	MII
	MIII		MIII	MIII
		MIV	MIV	MIV
		MV	MV	MV

Note: For Examinations (both CIE and SEE), the question papers shall contain the questions mapped to the appropriate Bloom's Level. Any COs mapped with higher cognitive Bloom's Level may also be assessed through the assignments.

ASSIGNMENT TYPES WITH WEIGHTAGES			
Sl. No.	**Assignment Description**	**Max. Weightage (%)**	**Max. Marks**
1	Written Assignments	25 %	05
2	Quiz	10 %	02
3	Case Studies	25 %	05
4	Seminar/Presentation	15 %	03
5	Peer - to - Peer Learning	10 %	02
6	Activity Based Learning	50 %	10
7	Project Based Learning	50 %	10
8	Field Work + Report	50 %	10
9	Industry Visit + Report	50 %	10
10	NPTEL/MOOC Courses – Registration and Assignment Submissions	50 %	10
	NPTEL Certification	75 %	15
11	Any other Innovative Assignments (CL4 and above)	50 %	10

Note: The assignments mentioned above may be provided appropriately to the students belonging to different bands

SEE QUESTION PAPER PATTERN:

- The question paper will have **TEN** full questions from **FIVE** Modules
- There will be 2 full questions from each module. Every question will carry a maximum of 20 marks.
- Each full question may have a maximum of four sub-questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting one full question from each module.

REFERENCE BOOKS:

1. Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi Mastering Cloud. Computing McGraw Hill Education
2. Dan C. Marinescu, Cloud Computing Theory and Practice, Morgan Kaufmann, Elsevier 2013.

DEEP LEARNING
(Effective from the Academic Year 2023 - 2024)
VII SEMESTER

Course Code	**CS722T2C**	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	**40L**	Exam Hours	03

CREDITS – 3

COURSE PREREQUISITES:

- It is recommended that students have a strong mathematical background (linear algebra, calculus especially taking partial derivatives, probabilities and statistics) and at least an introductory course in Machine Learning. Strong programming skills (specifically Python) are necessary to complete the assignments.

COURSE OBJECTIVES: This course will enable students to:

- Develop and Train Deep Neural Networks.
- Develop a CNN, R-CNN, Fast R-CNN, Faster-R-CNN, Mask-RCNN for detection and recognition
- Build and train RNNs, work with NLP and Word Embeddings
- Design an internal structure of LSTM and GRU and the differences between them
- Examine Auto Encoders for Image Processing

TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- PowerPoint Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

COURSE CONTENTS

MODULE – I

Foundations of Neural Networks and Deep Learning: Training Neural Networks, Activation Functions, Loss Functions, Hyperparameters, Defining Deep Learning, Common Architectural Principles of Deep Networks: Parameters, Layers, Activation Functions, Loss Functions, Optimization Algorithms, Hyperparameters, Building Blocks of Deep Networks: RBMs, Autoencoders, Variational Autoencoders	**8 Hours**

MODULE – II

Architectures of Deep Networks: Unsupervised Pretrained Networks, Convolutional Neural Networks (CNNs), Recurrent Neural Networks, Recursive Neural Network	**8 Hours**

MODULE – III

Building Deep Networks: Matching Deep Networks to the Right Problem, The DL4J Suite of Tools, Basic Concepts of the DL4J API, Modeling CSV Data with Multilayer Perceptron Networks, Modeling Handwritten Images Using CNNs, Modeling Sequence Data by Using Recurrent Neural Networks, Using Autoencoders for Anomaly Detection, Using Variational Autoencoders to Reconstruct MNIST Digits.	**8 Hours**

MODULE – IV	
Tuning Deep Networks: Basic Concepts, Matching Input Data and Network Architectures, Relating Model Goal and Output Layers, Working with Layer Count, Parameter Count, and Memory, Weight Initialization Strategies, Using Activation Functions, Applying Loss Functions, Understanding Learning Rates, How Sparsity Affects Learning, Applying Methods of Optimization, Using Parallelization and GPUs for Faster Training.	**8 Hours**
MODULE – V	
Tuning Deep Network Architectures: Convolutional Neural Networks (CNNs), Recurrent Neural Networks, Restricted Boltzmann Machines, DBNs.	**8 Hours**

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Understand the fundamentals of Neural Networks and Deep Learning	CL2
CO2	Implement the Unsupervised algorithms like Convolutional Neural Networks (CNNs), Recurrent Neural Networks, Recursive Neural Networks (RNN).	CL3
CO3	Apply Deep Networks to the Right Problem using the DL4J Suite of Tools for various dataset.	CL3
CO4	Interpret Tuning of Deep Networks using Activation Functions by applying optimization methods.	CL3
CO5	Implement various architectures for tuning deep networks.	CL3

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	3
CO1	2	2	3	3	3	3						2	2	1	
CO2	1	2	1	3	3	3						2	2	1	
CO3	1	2	1	3	2	3						2	2	1	1
CO4	3	1	2	2	3	2						2	2	1	
CO5	2	1	3		1	1						2	2	1	

3: Substantial (High)	2: Moderate (Medium)	1: Poor (Low)

ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Continuous Internal Evaluation (CIE)	60 %	30
	Assignments	40 %	20
2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT DETAILS

Continuous Internal Assessment (CIA) (50%)				Semester End Exam (SEE) (50%)
Continuous Internal Evaluation (CIE) (60%)			Assignment/ Activities (40%)	
I	II	III		
Syllabus Coverage			Syllabus Coverage	Syllabus Coverage
40%	30%	30%	100%	100%
MI			MI	MI
MII	MII		MII	MII
	MIII		MIII	MIII
		MIV	MIV	MIV
		MV	MV	MV

Note: For Examinations (both CIE and SEE), the question papers shall contain the questions mapped to the appropriate Bloom's Level. Any COs mapped with higher cognitive Bloom's Level may also be assessed through the assignments.

ASSIGNMENT TYPES WITH WEIGHTAGES

Sl. No.	Assignment Description	Max. Weightage (%)	Max. Marks
1	Written Assignments	25 %	05
2	Quiz	10 %	02
3	Case Studies	25 %	05
4	Seminar/Presentation	15 %	03
5	Peer - to - Peer Learning	10 %	02
6	Activity Based Learning	50 %	10
7	Project Based Learning	50 %	10
8	Field Work + Report	50 %	10
9	Industry Visit + Report	50 %	10
10	NPTEL/MOOC Courses – Registration and Assignment Submissions	50 %	10
	NPTEL Certification	75 %	15
11	Any other Innovative Assignments (CL4 and above)	50 %	10

Note: The assignments mentioned above may be provided appropriately to the students belonging to different bands

SEE QUESTION PAPER PATTERN:

- The question paper will have **TEN** full questions from **FIVE** Modules
- There will be 2 full questions from each module. Every question will carry a maximum of 20 marks.
- Each full question may have a maximum of four sub-questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting one full question from each module.

TEXT BOOKS:

1. Deep Learning: A Practitioner's Approach (Greyscale Indian Edition), Josh Patterson and Adam
2. Gibson O'Reilly Media, Inc.2017 January 2017.
3. Learn Keras for Deep Neural Networks, Jojo Moolayil, Apress, 2018.
4. Deep Learning Projects Using TensorFlow 2, Vinita Silaparasetty, Apress, 2020.
5. Deep Learning with Python, FRANÇOIS CHOLLET, MANNING SHELTER ISLAND, 2017.
6. Pro Deep Learning with TensorFlow, Santanu Pattanayak, Apress, 2017.

BIG DATA ANALYTICS
(Effective from the Academic Year 2024 - 2025)
VII SEMESTER

Course Code	**CS72213CA**	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	**40L**	Exam Hours	03

CREDITS – 3

COURSE PREREQUISITES:

- Basic understanding on Database Management Systems

COURSE OBJECTIVES: This course will enable students:

- To learn and understand the fundamental concepts of Big Data analytics and Big data framework.
- To provide understanding on NoSQL Database concepts.
- To demonstrate distributed data processing using MapReduce programming model.
- To understand various machine learning algorithms for Big Data Analytics.

TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

COURSE CONTENTS

MODULE – I

Introduction to Big Data Analytics: Big Data, Scalability and Parallel Processing, Designing Data Architecture, Data Sources, Quality, Pre-Processing and Storing, Data Storage and Analysis, Big Data Analytics Applications and Case Studies.	**8 Hours**

MODULE – II

Introduction to Hadoop: Hadoop and its Ecosystem, Hadoop Distributed File System, MapReduce Framework and Programming Model, Hadoop Yarn, Hadoop Ecosystem Tools. **Hadoop Distributed File System Basics:** HDFS Design Features, Components, HDFS User Commands. **Essential Hadoop Tools:** Using Apache Pig, Hive, Sqoop, Flume, Oozie, HBase.	**8 Hours**

MODULE – III

NoSQL Big Data Management: NoSQL Data Store, NoSQL Data Architecture Patterns, NoSQL to Manage Big Data, Shared-Nothing Architecture for Big Data Tasks, **MongoDB and Cassandra:** MongoDB, Databases, Cassandra Databases.	**8 Hours**

MODULE – IV	
MapReduce, Hive and Pig: MapReduce Map Tasks, Reduce Tasks and MapReduce Execution, Composing MapReduce for Calculations and Algorithms, Hive, HiveQL, Pig.	**8 Hours**
MODULE – V	
Machine Learning Algorithms for Big Data Analytics: Regression analysis, Finding Similar Items, Frequent Item sets and Association Rule Mining. **Text, Web Content, Link, and Social Network Analytics:** Text mining, Web Mining, Web Content and Web Usage Analytics, Page Rank, Structure of Web and analyzing a Web Graph, Social Network as Graphs and Social Network Analytics.	**8 Hours**

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Understand the fundamental concepts of Big Data Analytics.	CL 2
CO2	Explain the Big Data framework like Hadoop and Hadoop Distributed File system.	CL 2
CO3	Illustrate the concepts of NoSQL using MongoDB and Cassandra for Big Data.	CL 3
CO4	Demonstrate the MapReduce programming model to process the big data with Hadoop tools.	CL 3
CO5	Use various Machine Learning algorithms for real world big data.	CL 3

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	2	1	1						2	2	2	
CO2	3	3	2	2	2	1			1			2	2	2	
CO3	3	3	2	2	3	1			2			2	2	2	1
CO4	3	3	2	2	2	1			1			2	2	2	1
CO5	3	3	3	3	2	1				2		2	2	2	

3: Substantial (High)	2: Moderate (Medium)	1: Poor (Low)

ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Continuous Internal Evaluation (CIE)	60 %	30
	Assignments	40 %	20
2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT DETAILS				
Continuous Internal Assessment (CIA) (50%)				Semester End Exam (SEE) (50%)
Continuous Internal Evaluation (CIE) (60%)			Assignment/ Activities (40%)	
I	II	III		
Syllabus Coverage			Syllabus Coverage	Syllabus Coverage
40%	30%	30%	100%	100%
MI			MI	MI
MII	MII		MII	MII
	MIII		MIII	MIII
		MIV	MIV	MIV
		MV	MV	MV

Note: For Examinations (both CIE and SEE), the question papers shall contain the questions mapped to the appropriate Bloom's Level. Any COs mapped with higher cognitive Bloom's Level may also be assessed through the assignments.

ASSIGNMENT TYPES WITH WEIGHTAGES

Sl. No.	Assignment Description	Max. Weightage (%)	Max. Marks
1	Written Assignments	25 %	05
2	Quiz	10 %	02
3	Case Studies	25 %	05
4	Seminar/Presentation	15 %	03
5	Peer - to - Peer Learning	10 %	02
6	Activity Based Learning	50 %	10
7	Project Based Learning	50 %	10
8	Field Work + Report	50 %	10
9	Industry Visit + Report	50 %	10
10	NPTEL/MOOC Courses – Registration and Assignment Submissions	50 %	10
	NPTEL Certification	75 %	15
11	Any other Innovative Assignments (CL4 and above)	50 %	10

Note: The assignments mentioned above may be provided appropriately to the students belonging to different bands

SEE QUESTION PAPER PATTERN:

- The question paper will have **TEN** full questions from **FIVE** Modules
- There will be 2 full questions from each module. Every question will carry a maximum of 20 marks.
- Each full question may have a maximum of four sub-questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting one full question from each module.

REFERENCE BOOKS:

1. Raj Kamal and Preeti Saxena, "Big Data Analytics Introduction to Hadoop, Spark, and Machine-Learning", McGraw Hill Education, 2018 ISBN: 9789353164966, 9353164966
2. Douglas Eadline, "Hadoop 2 Quick-Start Guide: Learn the Essentials of Big Data Computing in the Apache Hadoop 2 Ecosystem", 1stEdition, Pearson Education, 2016. ISBN-13: 978-9332570351
3. Tom White, "Hadoop: The Definitive Guide", 4th Edition, O"Reilly Media, 2015.ISBN-13: 978-9352130672
4. Eric Sammer, "Hadoop Operations: A Guide for Developers and Administrators",1stEdition, O'Reilly Media, 2012.ISBN-13: 978-9350239261
5. Arshdeep Bahga, Vijay Madisetti, "Big Data Analytics: A Hands-On Approach", 1st Edition, VPT Publications, 2018. ISBN-13: 978-0996025577

NATURAL LANGUAGE PROCESSING
(Effective from the Academic Year 2024 - 2025)
VII SEMESTER

Course Code	**CS72213CB**	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	**40L**	Exam Hours	03

CREDITS – 3

COURSE PREREQUISITES:

Fundamentals of Automata Theory and Basic knowledge of English Grammar.

COURSE OBJECTIVES: This course will enable students to:

- Define the natural language and analyze the importance of natural language.
- Analyze spelling error detection and correction methods and parsing techniques in NLP.
- Understand the Applications of natural language processing.
- Illustrate the information retrieval models in natural language processing.

TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporated for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

COURSE CONTENTS

MODULE – I	
Overview and language modeling: Origins and challenges of NLP-Language and Grammar-Processing Indian Languages- NLP Applications. **Language Modeling:** Statistical Language Model- N-gram model- (unigram, bigram), Paninion Framework, Karaka theory, Smoothing Technique.	**8 Hours**
MODULE – II	
Word Level Analysis: Regular Expressions, Finite State Automata, Morphological Parsing, Spelling Error Detection and Correction, Words and Word Classes-Part-of Speech Tagging.	**8 Hours**
MODULE – III	
Syntactic Analysis: Context-free Grammar, Constituency, top-down and bottom-up Parsing, CYK parsing.	**8 Hours**
MODULE – IV	
Naive Bayes and Sentiment Classification: Naive Bayes Classifiers, Training the Naive Bayes Classifier, worked example, Optimizing for Sentiment Analysis, Naive Bayes for other text classification tasks, Naive Bayes as a Language Model.	**8 Hours**

MODULE – V	
Information Retrieval and Lexical Resources: Information Retrieval: Design features of Information Retrieval Systems-Classical, Non-classical, Alternative Models of Information Retrieval- Custer model, Fuzzy model, LSTM model**,** Major Issues in Information Retrieval. **Lexical Resources**: World Net, Frame Net, Stemmers, POS Tagger- Research Corpora.	**8 Hours**

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Outline natural language processing and demonstrate the statistical-based language models and smoothing techniques	CL2
CO2	Apply regular expressions, finite state automata, morphological parsing, spelling error detection and correction, and part-of-speech tagging to tackle various natural language processing tasks	CL3
CO3	Demonstrate the use of context-free grammar, and different parsing approaches	CL3
CO4	Apply the Naïve Bayes classifier and sentiment analysis for Natural language problems and text classifications	CL3
CO5	Illustrate the use of Information Retrieval in the context of NLP	CL3

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1		2							2			
CO2	3	3	3	1	2							2			
CO3	3	3	3	3	2							2			
CO4	3	3	3	3	2							2			
CO5	3	3	3	3	2							2			

3: Substantial (High)	2: Moderate (Medium)	1: Poor (Low)

ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Continuous Internal Evaluation (CIE)	60 %	30
	Assignments	40 %	20
2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT DETAILS				
Continuous Internal Assessment (CIA) (50%)				**Semester End Exam (SEE) (50%)**
Continuous Internal Evaluation (CIE) (60%)			**Assignment/ Activities (40%)**	
I	**II**	**III**		
Syllabus Coverage			**Syllabus Coverage**	**Syllabus Coverage**
40%	**30%**	**30%**	**100%**	**100%**
MI			MI	MI
MII	MII		MII	MII
	MIII		MIII	MIII
		MIV	MIV	MIV
		MV	MV	MV

Note: For Examinations (both CIE and SEE), the question papers shall contain the questions mapped to the appropriate Bloom's Level. Any COs mapped with higher cognitive Bloom's Level may also be assessed through the assignments.

ASSIGNMENT TYPES WITH WEIGHTAGES

Sl. No.	Assignment Description	Max. Weightage (%)	Max. Marks
1	Written Assignments	25 %	05
2	Quiz	10 %	02
3	Case Studies	25 %	05
4	Seminar/Presentation	15 %	03
5	Peer - to - Peer Learning	10 %	02
6	Activity Based Learning	50 %	10
7	Project Based Learning	50 %	10
8	Field Work + Report	50 %	10
9	Industry Visit + Report	50 %	10
10	NPTEL/MOOC Courses – Registration and Assignment Submissions	50 %	10
	NPTEL Certification	75 %	15
11	Any other Innovative Assignments (CL4 and above)	50 %	10

Note: The assignments mentioned above may be provided appropriately to the students belonging to different bands

SEE QUESTION PAPER PATTERN:

- The question paper will have **TEN** full questions from **FIVE** Modules
- There will be 2 full questions from each module. Every question will carry a maximum of 20 marks.
- Each full question may have a maximum of four sub-questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting one full question from each module.

TEXTBOOKS:

1. Tanveer Siddiqui, U.S. Tiwary, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008.
2. D. Jurafsky, J. H. Martin, "Speech and Language Processing, An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition (3e)", Pearson Education, 2023.
3. Akshay Kulkarni, Adarsha Shivananda, "Natural Language Processing Recipes - Unlocking Text Data with Machine Learning and Deep Learning using Python", Apress, 2019
4. James Allen, "Natural Language Understanding", 2nd edition, Benjamin/Cummings publishing company, 1995.
5. Gerald J. Kowalski and Mark.T. Maybury, "Information Storage and Retrieval systems", Kluwer Academic Publishers, 2000

SAHYADRI
COLLEGE OF ENGINEERING & MANAGEMENT
An Autonomous Institution
MANGALURU

ROBOTIC PROCESS AUTOMATION
(Effective from the Academic Year 2024 - 2025)
VII SEMESTER

Course Code	**CS72213CC**	**CIA Marks**	**50**
Number of Contact Hours/Week (L: T:P:S)	**3:0:0:0**	**SEE Marks**	**50**
Total Hours of Pedagogy	**40 L**	**Exam Hours**	**3 Hours**

CREDITS – 3

Prerequisites:

- Fundamental knowledge of automation and programming language

Course Objectives: This course will enable students to:

- Understand Basic Concepts and Applications of RPA
- Describe different types of variables and control flow concepts.
- Automate Image, Text, and Data Tables and Handle Exceptions

Teaching-Learning Strategy:

These are some sample strategies; which course faculty members can incorporate into the Teaching-Learning Process:

- Chalk and Talk Method/Blended Mode Method
- PowerPoint Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem-Based Learning
- Case Studies
- MOOC/NPTEL Courses

COURSE CONTENTS

MODULE – 1

RPA Foundations- The Benefits of RPA- The downsides of RPA- RPA Compared to BPO, BPM and BPA – Consumer Willingness for Automation- The Workforce of the Future- RPA Skills-On-Premise Vs. the Cloud- Web Technology- Programming Languages and Low Code- OCR-Databases-APIs- AI-Cognitive Automation-Agile, Scrum, Kanban and Waterfall0 DevOps- Flow Charts.	**8 Hours**

MODULE – 2

Components of RPA- RPA Platforms-About Ui Path- About UiPath - The future of automation - Record and Play - Downloading and installing UiPath Studio -Learning Ui Path Studio- Task recorder - Step-by step examples using the recorder.	**8 Hours**

MODULE – 3	
Sequence, Flowchart, and Control Flow-Sequencing the workflow Activities-Control flow, various types of loops, and decision making Step-by-step example using Sequence and Flowchart-Step-by-step example using Sequence and Control flow-Data Manipulation-Variables and Scope Collections-Arguments – Purpose and use-Data table usage with examples Clipboard management-File operation with step-by-step example-CSV/Excel to data table and vice versa (with a step-by-step example)**.**	**8 Hours**
MODULE – 4	
Taking Control of the Controls- Finding and attaching windows- Finding the control- Techniques for waiting for a control- Act on controls – mouse and keyboard activities- Working with UiExplorer-Handling events- Revisit recorder- Screen Scraping- When to use OCR- Types of OCR available-How to use OCR- Avoiding typical failure points	**8 Hours**
MODULE – 5	
Exception Handling, Debugging, and Logging- Exception handling- Common exceptions and ways to handle them- Logging and taking screenshots Debugging techniques- Collecting crash dumps-Error reporting- Future of RPA	**8 Hours**

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Summarize the basic concepts of RPA.	CL2
CO2	Illustrate various components and platforms of RPA	CL2
CO3	To interpret the different types of variables, control flow and data manipulation techniques.	CL2
CO4	Identify various control techniques and OCR in RPA	CL3
CO5	Demonstrate various types and strategies to handle exceptions.	CL2

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	2		1			1	1			2	1	1	1
CO2	3	2	2		1			1	1			2	1	1	1
CO3	3	2	2		1			1	1			2	1	1	1
CO4	3	2	2	1	1			1	1			2	1	1	1
CO5	3	2	2	1	1			1	1			2	1	1	1

3: Substantial (High)	2: Moderate (Medium)	1: Poor (Low)

CO - Assessment Mapping:

Course Outcomes	Continuous Internal Assessment (CIA) (50%)	

	Continuous Internal Evaluation (CIE) (60%)			Assignment/ Activities (40%)	Semester End Exam (SEE) (50%)
	I	II	III		
	Syllabus Coverage				
	40%	30%	30%	100%	100%
CO1	x			X	X
CO2	x			X	X
CO3		X		X	X
CO4		X	X	X	X
CO4			X	X	X

Assessment Strategy:

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CI)**	**100 %**	**50**
	Continuous Internal Evaluation (CIE)	60 %	30
	Assignments*	40 %	20
2	**Semester End Examination (SEE)**	**100 %**	**50**

Assignment Types:

Sl. No.	Assignment Description	Max. Weightage (%)	Max. Marks
1	Written Assignments	25 %	5
2	Quiz	25 %	5
3	Field Visits/Survey/Case Studies	50 %	10
4	Model / Prototype Development	100 %	20
5	Project Based Learning		
6	Seminar/Presentation	25 %	5
7	Peer - to -Peer Learning	25 %	5

SEE Question Paper Pattern:

- The question paper will have **TEN** full questions.
- Each full question consists of 20 marks.
- There will be 2 full questions from all the FIVE modules.
- Each full question will have a maximum of four sub-questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

REFERENCE BOOKS:

1. Tom Taulli, The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems,2020, ISBN-13 (electronic): 978-1-4842-5729-6, Publisher: A press.
2. Alok Mani Tripathi, Learning Robotic Process Automation, Publisher: Packt Publishing Release Date: March 2018 ISBN: 9781788470940.
3. Frank Casale, Rebecca Dilla, Heidi Jaynes, Lauren Livingston, "Introduction to Robotic Process Automation: a Primer", Institute of Robotic Process Automation.
4. Richard Murdoch, Robotic Process Automation: Guide to Building Software Robots, Automate Repetitive Tasks & Become an RPA Consultant.
5. Srikanth Merianda, Robotic Process Automation Tools, Process Automation and their benefits: Understanding RPA and Intelligent Automation

CYBER SECURITY MANAGEMENT, COMPLIANCE AND GOVERNANCE
(Effective from the Academic Year 2024 - 2025)
VII SEMESTER

Course Code	**CS72213CD**	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	**40L**	Exam Hours	03

CREDITS – 3

COURSE PREREQUISITES:

- It is recommended that students must have Basics of Internet and Social Application.

COURSE OBJECTIVES: This course will enable students to:

- Identify common strategies used by cybercriminals, including social engineering and botnet utilization.
- Formulate measures and policies for managing mobile device security within organizations.
- Recognize different strategies to prevent cyber-attacks and Managing a Cybersecurity Crisis
- Mapping an organization's cybersecurity measures against established frameworks.

TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

COURSE CONTENTS

MODULE – I

Cyber Crime: Cybercrime and information security, Classification of cybercrimes, cybercrime legal perspective and Indian Perspective. Cybercrime and Indian ITA 2000, a global perspective on cybercrime, cybercrime ERA,Cyber Offenses: How Criminals plan the Attacks, Social Engineering, Cyber stalking, Cyber Cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector.	**8 Hours**

MODULE – II

Mobile and Wireless Devices: Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptop	**8 Hours**

MODULE – III	
Types of Attacks and Cybercrime: Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horse and Backdoors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Overflow.	**8 Hours**
MODULE – IV	
The Art of Cyber defense: Building an Effective Defense, Responding to Incidents, Managing a Cybersecurity Crisis	**8 Hours**
MODULE – V	
Enterprise Cyber defense Assessment: Assessing Enterprise Cybersecurity, Measuring a Cybersecurity Program, Mapping Against Cybersecurity Frameworks.	**8 Hours**

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Describe the classification of cybercrimes and distinguish between different types of cyber offenses.	CL2
CO2	Identify and assess the various forms of attacks on mobile and cell phones.	CL3
CO3	Model the basic security measures to protect against keyloggers, spyware, and Trojans.	CL3
CO4	Describe the steps involved in Implementing strategies and techniques for managing cybersecurity crises.	CL2
CO5	Make use of standard frameworks for assessments of enterprise cybersecurity.	CL3

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1	1	1								2	1	1	1
CO2	2	2	2	2								2	1	1	2
CO3	2	2	2	2	1							2	1	1	2
CO4	2	2		1								2	1	1	2
CO5	2	2	2	1	1							2	1	1	2

3: Substantial (High) | **2: Moderate (Medium)** | **1: Poor (Low)**

ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Continuous Internal Evaluation (CIE)	60 %	30
	Assignments	40 %	20
2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT DETAILS

Continuous Internal Assessment (CIA) (50%)				Semester End Exam (SEE) (50%)
Continuous Internal Evaluation (CIE) (60%)			Assignment/ Activities (40%)	
I	II	III		
Syllabus Coverage			Syllabus Coverage	Syllabus Coverage

40%	30%	30%	100%	100%
MI			MI	MI
MII	MII		MII	MII
	MIII		MIII	MIII
		MIV	MIV	MIV
		MV	MV	MV

Note: For Examinations (both CIE and SEE), the question papers shall contain the questions mapped to the appropriate Bloom's Level. Any COs mapped with higher cognitive Bloom's Level may also be assessed through the assignments.

ASSIGNMENT TYPES WITH WEIGHTAGES

Sl. No.	Assignment Description	Max. Weightage (%)	Max. Marks
1	Written Assignments	25 %	05
2	Quiz	10 %	02
3	Case Studies	25 %	05
4	Seminar/Presentation	15 %	03
5	Peer - to - Peer Learning	10 %	02
6	Activity Based Learning	50 %	10
7	Project Based Learning	50 %	10
8	Field Work + Report	50 %	10
9	Industry Visit + Report	50 %	10
10	NPTEL/MOOC Courses – Registration and Assignment Submissions	50 %	10
	NPTEL Certification	75 %	15
11	Any other Innovative Assignments (CL4 and above)	50 %	10

Note: The assignments mentioned above may be provided appropriately to the students belonging to different bands

SEE QUESTION PAPER PATTERN:

- The question paper will have **TEN** full questions from **FIVE** Modules
- There will be 2 full questions from each module. Every question will carry a maximum of 20 marks.
- Each full question may have a maximum of four sub-questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting one full question from each module.

TEXT BOOKS:

1. "Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Sumit Belapure and Nina Godbole, Wiley India Pvt. Ltd
2. Enterprise Cybersecurity: How to Build a Successful Cyberdefense Program Against Advanced Threats, Scott Donaldson, Stanley Siegel , Chris K. Williams , Abdul Aslam

INTRODUCTION TO ALGORITHMS
(Effective from the Academic Year 2024- 2025)
VII SEMESTER

Course Code	**CS72224CA**	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	**40L**	Exam Hours	03

CREDITS – 3

COURSE PREREQUISITES:

- Fundamental knowledge of Mathematics

COURSE OBJECTIVES: This course will enable students:

- To describe the various algorithmic techniques for solving problems and how to evaluate their performance.
- To indicate the effectiveness of the method using asymptotic notations.
- To be able to decide appropriate methods to solve a given problem.

TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

COURSE CONTENTS

MODULE – I

Introduction to Algorithms- Properties, Specification, Fundamentals of Algorithmic Problem solving, Analysis Framework. **Performance Analysis:** Estimating Space complexity and Time complexity of algorithms. Asymptotic Notations with examples, Basic efficiency classes, Mathematical analysis of Non-Recursive and Recursive Algorithms with Examples.	**8 Hours**

MODULE – II

Brute force design techniques: Selection sort, Sequential Search. **Divide and Conquer:** General method, Binary search, Merge sort, Quick sort. **Decrease and Conquer Approach:** Insertion sort.	**8 Hours**

MODULE – III	
Greedy Method: General method, Coin Change Problem, Job sequencing with deadlines, Minimum cost spanning tree algorithms: Prim's Algorithm, Kruskal's Algorithm. **Single source shortest paths:** Dijkstra's Algorithm. **Optimal Tree problems:** Huffman Trees and Codes.	**8 Hours**
MODULE – IV	
Dynamic Programming: General method with Examples. **Transitive Closure:** Warshall's Algorithm. All Pairs Shortest Paths: Floyd's Algorithm, Knapsack problem, Travelling Sales Person problem.	**8 Hours**
MODULE – V	
Backtracking: General method, N-Queens problem. **Branch and Bound:** Basic concepts, Assignment Problem, 0/1 Knapsack problem.	**8 Hours**

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Analyze algorithms by estimating their space and time complexities, using asymptotic notations.	CL3
CO2	Explore various fundamental algorithmic design techniques.	CL3
CO3	Demonstrate greedy technique to solve the problem for optimal solution.	CL3
CO4	Utilize dynamic programming techniques to address complex computational problems.	CL3
CO5	Apply backtracking and branch-and-bound approach on combinatorial problems.	CL3

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	1		1		2				2	1	1	1
CO2	3	3	2	1		1		2				2	1	1	1
CO3	3	3	3	1		1		2				2	1	1	1
CO4	3	3	3	1		1		2				2	1	1	1
CO5	3	3	3	1		1		2				2	1	1	1

3: Substantial (High)	2: Moderate (Medium)	1: Poor (Low)

ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Continuous Internal Evaluation (CIE)	60 %	30
	Assignments	40 %	20
2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT DETAILS

Continuous Internal Assessment (CIA) (50%)				**Semester End Exam (SEE) (50%)**
Continuous Internal Evaluation (CIE) (60%)			**Assignment/ Activities (40%)**	
I	**II**	**III**		
Syllabus Coverage			**Syllabus Coverage**	**Syllabus Coverage**
40%	**30%**	**30%**	**100%**	**100%**
MI			MI	MI
MII	MII		MII	MII
	MIII		MIII	MIII
		MIV	MIV	MIV
		MV	MV	MV

Note: For Examinations (both CIE and SEE), the question papers shall contain the questions mapped to the appropriate Bloom's Level. Any COs mapped with higher cognitive Bloom's Level may also be assessed through the assignments.

ASSIGNMENT TYPES WITH WEIGHTAGES

Sl. No.	Assignment Description	Max. Weightage (%)	Max. Marks
1	Written Assignments	25 %	05
2	Quiz	10 %	02
3	Case Studies	25 %	05
4	Seminar/Presentation	15 %	03
5	Peer - to - Peer Learning	10 %	02
6	Activity Based Learning	50 %	10
7	Project Based Learning	50 %	10
8	Field Work + Report	50 %	10
9	Industry Visit + Report	50 %	10
10	NPTEL/MOOC Courses – Registration and Assignment Submissions	50 %	10
	NPTEL Certification	75 %	15
11	Any other Innovative Assignments (CL4 and above)	50 %	10

Note: The assignments mentioned above may be provided appropriately to the students belonging to different bands

SEE QUESTION PAPER PATTERN:

- The question paper will have **TEN** full questions from **FIVE** Modules
- There will be 2 full questions from each module. Every question will carry a maximum of 20 marks.
- Each full question may have a maximum of four sub-questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting one full question from each module.

REFERENCE BOOKS:

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

SAHYADRI
COLLEGE OF ENGINEERING & MANAGEMENT
An Autonomous Institution
MANGALURU

INTRODUCTION TO DBMS
(Effective from the Academic Year 2024 - 2025)
VII SEMESTER

Course Code	**CS72224CB**	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	**40L**	Exam Hours	03

CREDITS – 3

COURSE PREREQUISITES:

- Fundamental of programming

COURSE OBJECTIVES: The students should be able to:

- Understand fundamental database concepts
- Work with databases using SQL
- Design efficient and well-structured database schemas and apply normalization techniques to eliminate data anomalies.
- Understand transaction processing, and data security, ensuring they can manage and maintain databases effectively.

TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

COURSE CONTENTS

MODULE – I

Introduction to DBMS: Characteristics of database approach, Advantages of using the DBMS approach. Overview of Database Languages and Architectures: Data Models, Schemas, and Instances. Three schema architecture and data independence, database languages, and interfaces. **Data Modeling Using the Entity-Relationship (ER) Model:** Entity types, Entity sets, attributes, roles, and structural constraints, Weak entity types, ER diagrams, Relationship Types of Degree Higher than Two, Examples.	**8 Hours**

MODULE – II	
Relational Database Design by ER-to-Relational Mapping: Relational Database Design using ER-to-Relational mapping. **The Relational Data Model and Relational Database Constraints:** Relational Model Concepts, Relational Model Constraints and relational database schemas, Update operations, transactions, and dealing with constraint violations.	**8 Hours**
MODULE – III	
The Relational Algebra: Unary Relational Operation**s:** SELECT and PROJECT, Relational Algebra Operations from Set Theory, Binary Relational Operations: JOIN and DIVISION, Additional relational operations (aggregate, grouping, etc.), Examples of Queries in relational algebra.	**8 Hours**
MODULE – IV	
Basic SQL: SQL data definition and data types, specifying constraints in SQL, retrieval queries in SQL, INSERT, DELETE, and UPDATE statements in SQL. More complex SQL retrieval queries.	**8 Hours**
MODULE – V	
Basics of Functional Dependencies and Normalization for Relational Databases: Informal Design Guidelines for Relation Schemas, Functional Dependencies, Normal Forms based on Primary Keys, General Definitions of Second and Third Normal Forms, Boyce-Codd Normal Form.	**8 Hours**

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Outline the fundamental concepts of database system	CL2
CO2	Develop appropriate databases by applying various concepts Relational model	CL3
CO3	Design and manipulate queries using Relational Algebra.	CL3
CO4	Apply Structured Query Language (SQL) to create queries for data retrieval	CL3
CO5	Design standard databases using Normal Forms	CL3

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1	1								2	2	1	
CO2	3	2	3	2	1	1						2	2	1	
CO3	3	2	1									2	2	2	
CO4	3	2	1	1		2						2	2	1	
CO5	3	3	2	2		2						2	2	1	

3: Substantial (High)	2: Moderate (Medium)	1: Poor (Low)

ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Continuous Internal Evaluation (CIE)	60 %	30
	Assignments	40 %	20
2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT DETAILS

Continuous Internal Assessment (CIA) (50%)				Semester End Exam (SEE) (50%)
Continuous Internal Evaluation (CIE) (60%)			Assignment/ Activities (40%)	
I	II	III		
Syllabus Coverage			Syllabus Coverage	Syllabus Coverage
40%	30%	30%	100%	100%
MI			MI	MI
MII	MII		MII	MII
	MIII		MIII	MIII
		MIV	MIV	MIV
		MV	MV	MV

Note: For Examinations (both CIE and SEE), the question papers shall contain the questions mapped to the appropriate Bloom's Level. Any COs mapped with higher cognitive Bloom's Level may also be assessed through the assignments.

ASSIGNMENT TYPES WITH WEIGHTAGES

Sl. No.	Assignment Description	Max. Weightage (%)	Max. Marks
1	Written Assignments	25 %	05
2	Quiz	10 %	02
3	Case Studies	25 %	05
4	Seminar/Presentation	15 %	03
5	Peer - to - Peer Learning	10 %	02
6	Activity Based Learning	50 %	10
7	Project Based Learning	50 %	10
8	Field Work + Report	50 %	10
9	Industry Visit + Report	50 %	10
10	NPTEL/MOOC Courses – Registration and Assignment Submissions	50 %	10
	NPTEL Certification	75 %	15
11	Any other Innovative Assignments (CL4 and above)	50 %	10

Note: The assignments mentioned above may be provided appropriately to the students belonging to different bands

SEE QUESTION PAPER PATTERN:

- The question paper will have **TEN** full questions from **FIVE** Modules
- There will be 2 full questions from each module. Every question will carry a maximum of 20 marks.
- Each full question may have a maximum of four sub-questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting one full question from each module.

REFERENCE BOOKS:

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

FUNDAMENTALS OF OPERATING SYSTEMS
(Effective from the Academic Year 2023 - 2024)
VII SEMESTER

Course Code	**CS72224CC**	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	**40L**	Exam Hours	03

CREDITS – 3

COURSE PREREQUISITES:

- Data Structures and Algorithms.
- Computer Fundamentals.

COURSE OBJECTIVES: This course will enable students to:

- Explain the mechanisms by which OS handles processes, threads, and their communication.
- Describe the mechanisms involved in memory management in contemporary operating systems.
- Analyze distributed operating system concepts, including architecture, mutual exclusion algorithms, deadlock detection algorithms, and agreement protocols.
- Identify the components and management aspects of concurrency management.

TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

COURSE CONTENTS

MODULE - I

Introductory Concepts: Operating system functions and characteristics, historical evolution of operating systems, Real time systems, Distributed systems, Methodologies for implementation of O/S service system calls, system programs, Interrupt mechanisms.	**8 Hours**

MODULE - II

File Systems: Functions of the system, File access and allocation methods, Director Systems: Structured Organization, directory and file protection mechanisms, implementation issues; hierarchy of file and device management. **CPU Scheduling:** Levels of Scheduling, Comparative study of scheduling algorithms, multiple processor scheduling.	**8 Hours**

MODULE - III	
Storage Management: Storage allocation methods: Single contiguous allocation, Multiple contiguous allocation, Paging, Segmentation combination of Paging and Segmentation, Virtual memory concepts, Demand Paging, Page, replacement Algorithms, Thrashing.	**8 Hours**

MODULE - IV	
Device Management: Hardware Organization, Device scheduling policies. **Deadlocks:** Deadlock characterization, Deadlock prevention and avoidance, Deadlock detection and recovery, practical considerations.	**8 Hours**

MODULE - V	
Concurrent Processes: Critical section problem, Semaphores, Classical process coordination problems and their solutions, Interprocess Communications. **Protection:** Mechanisms and Policies, Implementation.	**8 Hours**

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Apply fundamental principles of operating systems to understand their functions and components.	CL3
CO2	Examine file system management techniques and evaluate their effectiveness in different scenarios.	CL3
CO3	Implement efficient scheduling algorithms to solve real-world problems and analyze their performance.	CL3
CO4	Compare various storage and device management techniques and determine their suitability for different applications.	CL3
CO5	Design deadlock-free and synchronized concurrent algorithms to ensure system reliability and assess their correctness.	CL3

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1						2			2	2		
CO2	3	2	1						2			2	2		
CO3	3	2	1						2			2	2		
CO4	3	2	1						2			2	2		
CO5	3	2	1						2			2	2		

3: Substantial (High)	2: Moderate (Medium)	1: Poor (Low)

ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Continuous Internal Evaluation (CIE)	60 %	30
	Assignments	40 %	20
2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT DETAILS

Continuous Internal Assessment (CIA) (50%)				Semester End Exam (SEE) (50%)
Continuous Internal Evaluation (CIE) (60%)			Assignment/ Activities (40%)	
I	II	III		
Syllabus Coverage			Syllabus Coverage	Syllabus Coverage
40%	30%	30%	100%	100%
MI			MI	MI
MII	MII		MII	MII
	MIII		MIII	MIII

		MIV	MIV	MIV
		MV	MV	MV

Note: For Examinations (both CIE and SEE), the question papers shall contain the questions mapped to the appropriate Bloom's Level. Any COs mapped with higher cognitive Bloom's Level may also be assessed through the assignments.

ASSIGNMENT TYPES WITH WEIGHTAGES

Sl. No.	Assignment Description	Max. Weightage (%)	Max. Marks
1	Written Assignments	25 %	05
2	Quiz	10 %	02
3	Case Studies	25 %	05
4	Seminar/Presentation	15 %	03
5	Peer - to - Peer Learning	10 %	02
6	Activity Based Learning	50 %	10
7	Project Based Learning	50 %	10
8	Field Work + Report	50 %	10
9	Industry Visit + Report	50 %	10
10	NPTEL/MOOC Courses – Registration and Assignment Submissions	50 %	10
	NPTEL Certification	75 %	15
11	Any other Innovative Assignments (CL4 and above)	50 %	10

Note: The assignments mentioned above may be provided appropriately to the students belonging to different bands

SEE QUESTION PAPER PATTERN:

- The question paper will have **TEN** full questions from **FIVE** Modules
- There will be 2 full questions from each module. Every question will carry a maximum of 20 marks.
- Each full question may have a maximum of four sub-questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting one full question from each module.

REFERENCE BOOKS:

1. Peterson, J.L. & Silberschatz, A.: Operating System Concepts, Addison, Wesley, Reading.
2. Brinch, Hansen: Operating System Principles, Prentice Hall of India.
3. Haberman, A.N.: Introduction to Operating System Design Galgotia Publication, New Delhi.
4. Tanenbaum, A.S.: Operating System.

SOFTWARE ENGINEERING
(Effective from the Academic Year 2023- 2024)
VII SEMESTER

Course Code	**CS72224CD**	CIA Marks	40
Number of Contact Hours/Week (L: T: P: S)	4:0:0:0	SEE Marks	60
Total Hours of Pedagogy	**40L**	Exam Hours	03

CREDITS – 3

COURSE OBJECTIVES: This course will enable students to:

- To gain knowledge of various software development methodologies and processes such as agile, waterfall, iterative development, to effectively manage and execute software projects.
- To develop proficiency in designing scalable and maintainable software systems using design principles, architecture patterns, and system integration techniques.
- To acquire essential project management skills including planning, scheduling, budgeting, resource allocation, risk management, and team coordination to successfully deliver software projects on time and within budget.

TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

COURSE CONTENTS

MODULE – I

Introduction: Need for Software Engineering. Professional Software Development, Software Engineering Ethics. Case Studies. **Software Processes**: Models: Waterfall Model, Incremental Model and Spiral Model Process activities. **Requirements Engineering**: Requirements Engineering Processes. Requirements Elicitation and Analysis. Functional and non-functional requirements. The software Requirements Document Requirements Specification Requirements Validation, Requirements Management.	**12 Hours**

MODULE – II

System Models: Context models, Interaction models Structural models Behavioral models Model-driven engineering **Design and Implementation**: Introduction to RUP, Design Principles. Object-oriented design using the UML Design patterns Implementation issues Open-source development	**11 Hours**

MODULE – III

Software Testing: Development testing, Test-driven development, Release testing, User testing Test Automation. **Software Evolution**: Evolution processes, Program evolution dynamics, Software maintenance Legacy system management.	**9 Hours**

MODULE – IV

Project Planning: Software pricing. Plan-driven development. Project scheduling Estimation techniques. **Quality management**: Software quality Reviews and inspections. Software measurement and metrics Software standards.	**10 Hours**

MODULE – V

Agile Software Development: Coping with Change, The Agile Manifesto: Values and Principles. Agile methods: SCRUM and Extreme Programming Plan-driven and agile development. Agile project management, Scaling agile methods.	**8 Hours**

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Analyze and apply various software process models to effectively manage software development projects, ensuring alignment with project requirements and constraints.	CL3
CO2	Design and implement object-oriented software systems using UML diagrams, incorporating design patterns and considering implementation issues, such as those encountered in open-source development projects.	CL3
CO3	Develop and implement software testing strategies, including test-driven development and test automation, and apply techniques for managing software evolution and maintenance, including legacy system management.	CL3
CO4	Implement project plans, incorporating software pricing, scheduling, and resource estimation using plan-driven development techniques, while demonstrating effective quality management practices.	CL3
CO5	Evaluate and apply agile principles, including coping with change as per the Agile Manifesto, to effectively implement SCRUM and Extreme Programming methodologies, compare plan-driven and agile development approaches.	CL3

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	3	2	1		1		2		1	1	1	1
CO2	3	3	2	3	2	1		1		2		1	1	1	1
CO3	3	3	2	3	2	1		1	2	2	2	2	1	2	1
CO4	3	3	2	3	2	1		1	2	2	2	2	1	1	1
CO5	3	3	2	3	2	1		1	2	2	2	2	1	1	1

3: Substantial (High)	2: Moderate (Medium)	1: Poor (Low)

ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Continuous Internal Evaluation (CIE)	60 %	30

	Assignments	40 %	20
2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT DETAILS

Continuous Internal Assessment (CIA) (50%)				**Semester End Exam (SEE) (50%)**
Continuous Internal Evaluation (CIE) (60%)			**Assignment/ Activities (40%)**	
I	**II**	**III**		
Syllabus Coverage			**Syllabus Coverage**	**Syllabus Coverage**
40%	**30%**	**30%**	**100%**	**100%**
MI			MI	MI
MII	MII		MII	MII
	MIII		MIII	MIII
		MIV	MIV	MIV
		MV	MV	MV

Note: For Examinations (both CIE and SEE), the question papers shall contain the questions mapped to the appropriate Bloom's Level. Any COs mapped with higher cognitive Bloom's Level may also be assessed through the assignments.

ASSIGNMENT TYPES WITH WEIGHTAGES

Sl. No.	**Assignment Description**	**Max. Weightage (%)**	**Max. Marks**
1	Written Assignments	25 %	05
2	Quiz	10 %	02
3	Case Studies	25 %	05
4	Seminar/Presentation	15 %	03
5	Peer - to - Peer Learning	10 %	02
6	Activity Based Learning	50 %	10
7	Project Based Learning	50 %	10
8	Field Work + Report	50 %	10
9	Industry Visit + Report	50 %	10
10	NPTEL/MOOC Courses – Registration and Assignment Submissions	50 %	10
	NPTEL Certification	75 %	15
11	Any other Innovative Assignments (CL4 and above)	50 %	10

Note: The assignments mentioned above may be provided appropriately to the students belonging to different bands

SEE QUESTION PAPER PATTERN:

- The question paper will have **TEN** full questions from **FIVE** Modules
- There will be 2 full questions from each module. Every question will carry a maximum of 20 marks.
- Each full question may have a maximum of four sub-questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting one full question from each module.

REFERENCE BOOKS:

1. Ian Sommerville: Software Engineering, 9th Edition, Pearson Education, 2012. (Listed topics only from Chapters 1,2,3,4, 5, 7, 8, 9, 23, and 24)
2. The SCRUM Primer A lightweight Guide to the theory and practice of scrum by Pete Deemer, Gabrielle Benefield, Craig Larman, Bas Vodde, Ver 2.0
3. Roger S. Pressman: Software Engineering-A Practitioners approach, 7th Edition, Tata McGraw Hill.
4. Pankaj Jalote: An Integrated Approach to Software Engineering, Wiley India

SAHYADRI
COLLEGE OF ENGINEERING & MANAGEMENT
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MANGALURU

DEEP LEARNING LAB
(Effective from the Academic Year 2024 - 2025)
VII SEMESTER

Course Code	**CS722L5C**	CIA Marks	40
Number of Contact Hours/Week (L: T: P: S)	0:0:2:0	SEE Marks	60
Total Hours of Pedagogy	**20L**	Exam Hours	03

CREDITS – 1

COURSE PREREQUISITES:

- Basic Knowledge of Python

COURSE OBJECTIVES: This course will enable students to:

 To Equip students with hands-on experience in implementing and experimenting with various deep learning algorithms and architectures, including CNN and RNN.

 Enable students to apply deep learning methods to real-world problems, encouraging them to design, develop, and optimize deep learning models for diverse applications such as image recognition, natural language processing, and predictive analytics.

TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

LIST OF EXPERIMENTS

Sl. No.	Description
1	Solving XOR problem using Multilayer perceptron
2	Implement character and Digit Recognition using ANN.
3	Implement the analysis of X-ray image using autoencoders
4	Implement Speech Recognition using NLP.
5	Develop a code to design object detection and classification for traffic analysis using CNN
6	Implement online fraud detection of share market data using any one of the data analytics tools
7	Implement image augmentation using deep RBM.
8	Implement Sentiment Analysis using LSTM.

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	To comprehend and apply various neural network architectures such as multilayer perceptron's, ANNs, CNNs, and LSTMs to solve complex problems.	CL3
CO2	To analyze and interpret complex data using advanced techniques such as autoencoders for X-ray image analysis and NLP for speech recognition.	CL4
CO3	To design and develop sophisticated machine learning models using data analytics tools, including object detection, classification systems for traffic analysis etc.	CL3
CO4	To implement data augmentation techniques to enhance their ability to improve the quality and diversity of training datasets.	CL3
CO5	To analyze and optimize deep learning solutions for various real-world applications, ensuring high performance and accuracy in tasks such as image recognition, speech recognition, and predictive modeling.	CL4

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	1	1					1		2	2	1	1
CO2	3	3	2	1						1		2	2	1	1
CO3	3	3	2	2	2	1			1	1		2	2	1	1
CO4	3	2	2	2								2	2	1	1
CO5	3	2	2	2	1				1			2	2	1	1

3: Substantial (High)	2: Moderate (Medium)	1: Poor (Low)

ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**40**
	Laboratory Work (A)	50 %	20
	Laboratory Test (B)	30 %	10
	Open Ended Experiments /Mini Projects (C)	20 %	10
2	**Semester End Examination (SEE)**	**100 %**	**60**

ASSESSMENT STRATEGY:

I. In Laboratory Courses where (B) and (C) are not the components of the assessment pattern, then (A) will have 100% weightage (50 Marks).

Assessment Mode: Weekly Assessment of Laboratory Work (50 Marks) - the marks will be awarded based on the Continuous Internal Assessment (Weekly Assessment, each of 25 marks) of the students in each laboratory session. The average of all the marks obtained across the sessions will be the Final CIA marks.

II. In Laboratory Courses where (C) is not a component of the assessment pattern, then (A) will have 50% weightage (25 Marks), and (B) will have 50% weightage (25 Marks).

Assessment Mode: The marks will be awarded based on the Continuous Internal Assessment (Weekly Assessment) (A) and One Laboratory Test (B).

- In Weekly Assessment, the student will be evaluated in each laboratory session for 25 marks. The average marks obtained across all the experiments will be the marks obtained for (A).
- A Laboratory Test, similar to the SEE exam, is conducted towards the end of the Semester/Course, whichever is earlier. The obtained marks are scaled down to 25 Marks (B)

The Sum of marks obtained across (A) and (B) will be the Final CIA marks.

III. In Laboratory Courses where (C) is a component of the assessment pattern, then assessment will be done by considering the weightages given above, i.e. (A) – 25 Marks (Weekly Assessment), (B) – 15 Marks (Laboratory Examination), (C) – 10 marks (Open Ended Experiments/Mini Projects)

- The respective course instructor will design the assessment criteria for the said assessment components.
- The assessment components will be made known to the students by the respective Course Coordinators prior to the commencement of the Laboratory Work.

In all the cases, the assessments will be done based on the criteria designed by the Course Coordinator.

SEE QUESTION PAPER PATTERN:

1. All laboratory experiments should be included for practical examination, from which students are allowed to pick one experiment from the lot.
2. SEE shall be conducted for 100 Marks and the marks will be scaled down to 50.
3. General Marks Distribution: Procedure + Conduction + Viva = 20% + 50% + 30%.
4. Change of experiment is allowed only once and 20% of the marks allotted to the Procedure will be made ZERO (if a question carries two experiments, both should be changed). The evaluation will be done for 80% of the total maximum marks.

REFERENCE BOOKS:

1. Wani, M.A., Raj, B., Luo, F., Dou, D. (Eds.), "Deep Learning Applications", Volume 3, Springer Publications 2022.
2. Stone, James. (2019), " Artificial Intelligence Engines: A Tutorial Introduction to the Mathematics of Deep Learning", Sebtel Press, United States, 2019

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