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

Course Code	**MA322T1C**	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	03

CREDITS – 3

COURSE 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,	**8 Hours**

Combinations – The Binomial Theorem, Combinations with Repetition.	
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**

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
	MIII		MIII	MIII
	MIV	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	50 %	10

	Submissions		
	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.

REFERENCE WEB LINKS AND VIDEO LECTURES (E - RESOURCES):

1. https://www.youtube.com/watch?v=8Kg21jBCm-k
2. https://www.youtube.com/watch?v=Wa6kaCwyYRk
3. http://nptel.ac.in/courses.php?disciplineID=111
4. http://www.class-central.com/subject/math(MOOCs)
5. http://academicearth.org/
6. http://www.bookstreet.in.
7. VTU e-Shikshana Program

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	03
CREDITS – 4			

PREREQUISITES:

- Basic logic design principles and various function of digital computer.

COURSE OBJECTIVES:

- Illustrate combinational digital circuits.
- Demonstrate the use of flipflops 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 - I

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 - II	
Sequential Logic Design: Flip-Flops and its Applications**:** Master Slave Flip-Flops, Edge-Triggered Flip-Flops, Registers, Counters.	**8 Hours**
MODULE - III	
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 - IV	
ARM Instructions Set: Data Processing Instructions, Branch Instructions, Load-Store Instructions, Software Interrupt Instructions, Program Status Register Instruction.	**8 Hours**
MODULE - V	
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	Apply combinational logic components and design digital circuits	CL3
CO2	Apply sequential logic design principles through flip flops, counters and registers to develop digital circuits.	CL3
CO3	Describe the characteristics, quality attributes for designing an embedded system.	CL3
CO4	Use ISA (Instruction set architecture) of ARM controller to develop programs.	CL2
CO5	Interface the peripheral devices with ARM microcontroller.	CL2

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	CO1	CL4

	Code.		
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 7-segment display.	CO2	CL4
5.	Implement an ALP to find the square of a number (1 to 10) using 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 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
CO1	2	1											1	1
CO2	2	1	2				2						1	1
CO3	2	1	2				2						1	1
CO4	2	1	2				2						1	1
CO5	2	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%)			Practical Sessions (40%)	
	I	II	III		
	Syllabus Coverage				
	40%	30%	30%	100%	100%

CO1	MI			MI	MI
CO2	MII			MII	MII
CO3		MIII		MIII	MIII
CO4		MIV	MIV	MIV	MIV
CO4			MV	MV	MV

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 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. 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, 2008.

REFERENCE WEB LINKS AND VIDEO LECTURES (E - RESOURCES):

1. https://nptel.ac.in/courses/108/105/108105132/

2. https://nptel.ac.in/courses/106/103/106103068/
3. https://onlinecourses.nptel.ac.in/noc22_cs93/unit?unit=17&lesson=18
4. https://onlinecourses.nptel.ac.in/noc22_cs93/unit?unit=26&lesson=27
5. https://onlinecourses.nptel.ac.in/noc22_cs93/unit?unit=43&lesson=44
6. https://onlinecourses.nptel.ac.in/noc22_cs93/unit?unit=52&lesson=53
7. https://onlinecourses.nptel.ac.in/noc22_cs93/unit?unit=75&lesson=76

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			

PREREQUISITES:

- Fundamental knowledge of C programming.

COURSE OBJECTIVES:

- Learn fundamental Object-Oriented features of C++ and 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, readwrite problem, producer	**8 Hours**

consumer problems.	

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 CONTENTS

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 concept 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
CO1	3	2	2	2	2							3	2	2
CO2	3	2	2	2								3	2	2
CO3	3	3	2	2								3	2	2
CO4	3	3	2	2								3	2	2
CO5	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**
	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
	MIII		MIII	MIII
	MIV	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. E Balagurusamy, Programming with Java, McGraw Hill, 6th Edition, 2019.
4. Mahesh Bhave and Sunil Patekar, "Programming with Java", First Edition, Pearson Education,2008, ISBN:9788131720806

REFERENCE WEB LINKS AND VIDEO LECTURES (E - RESOURCES):

1. https://onlinecourses.nptel.ac.in/noc22_cs102/
2. https://www.geeksforgeeks.org

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

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 to Data Structures: Classifications, Data structure Operations, Demonstration	**8 Hours**

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.	
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
CO1	3	3	3		1			2	2			3	3	3
CO2	3	3	3		1			2	2			3	3	3
CO3	3	3	3		1			2	2			3	3	3
CO4	3	3	3		1			2	2			3	3	3
CO5	3	3	3		1			2	2			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
	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
	MIII		MIII	MIII
	MIV	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.

REFERENCE WEB LINKS AND VIDEO LECTURES (E - RESOURCES):

1. https://www.youtube.com/watch?v=3Xo6P_V-qns&t=201s

2. https://ds2-iiith.vlabs.ac.in/exp/selection-sort/index.html
3. https://nptel.ac.in/courses/106/102/106102064
4. https://ds1-iiith.vlabs.ac.in/exp/stacks-queues/index.html
5. https://ds1-iiith.vlabs.ac.in/exp/linked-list/basics/overview.html
6. https://ds1-iiith.vlabs.ac.in/List%20of%20experiments.html
7. https://ds1-iiith.vlabs.ac.in/exp/tree-traversal/index.html

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

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

<table>
<tr><td></td><td>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</td></tr>
<tr><td>5</td><td>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</td></tr>
<tr><td>6</td><td>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).</td></tr>
<tr><td>7</td><td>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 Inorder, Preorder and Postorder.</td></tr>
<tr><td>8</td><td>A company has seven top officers working for it. They are each fluent in atleast one language according to the following sample table,

<table>
<tr><th>Officer</th><th>Hindi</th><th>Malayalam</th><th>Kannada</th><th>Telugu</th></tr>
<tr><td>01</td><td>-</td><td>-</td><td>Y</td><td>-</td></tr>
<tr><td>02</td><td>-</td><td>-</td><td>Y</td><td>Y</td></tr>
<tr><td>03</td><td>-</td><td>-</td><td>-</td><td>Y</td></tr>
<tr><td>04</td><td>-</td><td>Y</td><td>-</td><td>Y</td></tr>
<tr><td>05</td><td>Y</td><td>Y</td><td>-</td><td>-</td></tr>
<tr><td>06</td><td>Y</td><td>-</td><td>Y</td><td>-</td></tr>
<tr><td>07</td><td>-</td><td>Y</td><td>-</td><td>-</td></tr>
</table>
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</td></tr>
</table>

	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.	CL3
CO2	Design and implement queue data structures for a given application.	CL3
CO3	Design and implement the concepts of DLL and SCLL.	CL3
CO4	Utilize the concepts of trees and graphs to solve the real world problems.	CL3
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
CO1	3	2	2		2			1	1			3	3	3
CO2	3	2	2		2			1	1			3	3	3
CO3	3	2	2		2			1	1			3	3	3
CO4	3	2	2		2			1	1			3	3	3
CO5	3	2	2		2			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**
	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:

- 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. Ellis Horowitz and SartajSahni, 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. Michael J. Folk, Bill Zoellick and Greg Riccardi, “File Structures - An Object Oriented Approach with C++”, Pearson Education, 2004.

REFERENCE WEB LINKS AND VIDEO LECTURES (E - RESOURCES):

1. https://www.youtube.com/watch?v=3Xo6P_V-qns&t=201s
2. https://ds2-iiith.vlabs.ac.in/exp/selection-sort/index.html
3. https://nptel.ac.in/courses/106/102/106102064
4. https://ds1-iiith.vlabs.ac.in/exp/stacks-queues/index.html
5. https://ds1-iiith.vlabs.ac.in/exp/linked-list/basics/overview.html
6. https://ds1-iiith.vlabs.ac.in/List%20of%20experiments.html
7. https://ds1-iiith.vlabs.ac.in/exp/tree-traversal/index.html

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 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
CO1	3	3	1		3				1		2	3	2	2
CO2	3	3	1		3				1		2	3	2	2
CO3	3	3	1		3				1		2	3	2	2
CO4	3	3	1		3				1		2	3	2	2
CO5	3	3	1		3				1		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**
	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
	MIII		MIII	MIII
	MIV	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).

REFERENCE WEB LINKS AND VIDEO LECTURES (E - RESOURCES):

1. https://www.learnbyexample.org/python-lambda-function/https://www.youtube.com/watch?v=5Y8Lfsreeck&list=PL7DC83C6B3312DF1E
2. https://www.youtube.com/watch?v=S47aSEqm_0I&list=PLgj_V-ZKxRKrxgFyOutPJpoLFBaQMOpK-

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:

- Basic Knowledge of Java Programming
- Installation procedure of the Android Studio software

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, Frame Layout, Linear Layout, Table Layout, Relative Layout, Scroll View. **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**: Text View – Button, Image Button, Edit Text, Checkbox, Toggle Button, Radio Button and Radio Group Views, Progress Bar View. **Using Picker Views:** Time Picker View, Date Picker View. **Using List Views to Display Long Lists**: List View, Using the Spinner View	**8 Hours**
MODULE – IV	
Displaying Pictures and Menus with Views: Using Image Views to Display Pictures: Image View, Image Switcher, Grid View. **Using Menus with Views**: Creating the Helper Methods,	**8 Hours**

Options Menu, Context Menu. **Using WebView**: WebView.	

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**
CO1	3	2	1		2							1	2	2
CO2	3	2	1		2							1	2	2
CO3	3	2	1		2							1	2	2
CO4	3	2	1		2							1	2	2
CO5	3	2	1		2							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%)				
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
	MIII		MIII	MIII
	MIV	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. J. F. DiMarzio, Beginning Android Programming with Android Studio, 4th Edition, 2017
2. John Horton, Android Programming for Beginners, 1st Edition, 2015
3. Dawn Griffiths & David Griffiths, Head First Android Development, O‟Reilly, 1st Edition, 2015

REFERENCE WEB LINKS AND VIDEO LECTURES (E - RESOURCES):

1. https://www.tutorialspoint.com/android
2. http://developer.android.com/guide/index.html.
3. http://developer.android.com/reference/packages.html.
4. http://developer.android.com/guide/components/fundamentals.html.
5. http://developer.android.com/guide/topics/ui/index.html.
6. http://developer.android.com/guide/topics/ui/declaring-layout.html.

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)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	**40L**	Exam Hours	03

CREDITS – 3

COURSE PREREQUISITES:

- Basic Knowledge of C Programming.

COURSE OBJECTIVES:

- To help the students to understand effective use of Unix concepts, commands and terminology.
- Identify, access, and evaluate UNIX file system.
- Understand UNIX command syntax and semantics.
- Ability to read and understand specifications, scripts and programs.
- Analyze Facility with UNIX Process.

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

Module - I	
Introduction of UNIX - Introduction, History, Architecture, Experience the Unix environment, Basic commands ls, cat, cal, date, calendar, who, printf, tty, sty, uname, passwd, echo, tput, and bc.	**8 Hours**
Module - II	
UNIX File System- The file, what's in a filename? The parent-child relationship, pwd, the Home directory, absolute pathnames, using absolute pathnames for a command, cd, mkdir, rmdir, Relative pathnames, The UNIX file system.	**8 Hours**
Module -III	
Basic File Attributes - Is – l, the –d option, File Permissions, chmod, Security and File Permission, users and groups, security level, changing permission, user masks, changing ownership and group, File Attributes, More file attributes: hard link, symbolic link, umask, find.	**8 Hours**
Module - IV	
Introduction to the Shell Scripting - Introduction to Shell Scripting, Shell Scripts, read, Command Line Arguments, Exit Status of a Command, The Logical Operators && and ||, exit, if, and case conditions, expr, sleep and wait, while, until, for, $, @, redirection. The here document, set, trap, Sample Validation and Data Entry Scripts.	**8 Hours**
Module - V	
Introduction to UNIX System Process: Mechanism of process creation. Parent and child process. The ps command with its options. Executing a command at a specified point of time: at command. Executing a command periodically: cron command and the crontab file.. Signals.	**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 the basics of Unix concepts and commands.	CL3
CO2	Evaluate the UNIX file system.	CL3

CO3	Apply Changes in file system.	CL3
CO4	Understand scripts and programs.	CL3
CO5	Analyze Facility with UNIX system process	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
CO1	3	2	3		3							1	1	1
CO2	3	2	3		3							1	1	1
CO3	3	2	3		3							1	1	1
CO4	3	2	3		3							1	2	2
CO5	3	2	3		3							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:

- 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. Unix Concepts & Applications 4th Edition, Sumitabha Das, Tata McGraw Hill
2. Unix Shell Programming, YashwantKanetkar
3. Introduction to UNIX by M G Venkatesh Murthy

REFERENCE WEB LINKS AND VIDEO LECTURES (E – RESOURCES):

1. https://www.youtube.com/watch?v=ffYUfAqEamY
2. https://www.youtube.com/watch?v=Q05NZiYFcD0
3. https://www.youtube.com/watch?v=8GdT53KDIyY
4. https://www.youtube.com/watch?app=desktop&v=3Pga3y7rCgo

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	**8 Hours**

Attacks, Addressing Physical Security.	
MODULE - II	
Foot Printing, Reconnaissance and scanning Networks: Footprinting Concepts, Footprinting through Search Engines, Web Services, Social Networking Sites, Website, Email, Competitive Intelligence, Footprinting through Social Engineering, Footprinting 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
CO1	2	1											1	2
CO2	2	1	3										1	2
CO3	2	1	3										1	1
CO4	2	1	3										1	1
CO5	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
	MIII		MIII	MIII
	MIV	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, DafyddStuttard and Marcus Pinto, 2011.
4. Black Hat Python: Python Programming for Hackers and Pentesters, Justin Seitz , 2014.

REFERENCE WEB LINKS AND VIDEO LECTURES (E - RESOURCES):

1. https://www.hackthebox.com/
2. https://www.hackthissite.org/

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	01
CREDITS – 1			

COURSE PREREQUISITES:

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

COURSE OBJECTIVES:

- 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 walk 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
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**
CO3		MIII		**MIII**	**MIII**
CO4		MIV	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. JeevanVidya: EkParichaya, ANagaraj, JeevanVidyaPrakashan, 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.

REFERENCE WEB LINKS AND VIDEO LECTURES (E - RESOURCES):

1. https://www.aicteindia.org/sites/default/files/Vol.%20II%20%20AICTE%20UG%20%20Curriculum.

SAHYADRI
COLLEGE OF ENGINEERING & MANAGEMENT
An Autonomous Institution
MANGALURU

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	**20**	Exam Hours	02

CREDITS – 1

COURSE PREREQUISITES:

- Basic Knowledge of Computer.

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
- 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.	Details
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 Auto filter &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 Pivot Tables	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**
CO1	3	2	3		3							1	2	1
CO2	3	2	3		3							1	2	1
CO3	3	2	3		3							1	2	1
CO4	3	2	3		3							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**
	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.

REFERENCE WEB LINKS AND VIDEO LECTURES (E - RESOURCES):

1. https://www.simplilearn.com/tutorials/excel-tutorial/data-analysis-excel
2. https://www.w3schools.com/EXCEL/index.php
3. https://edu.gcfglobal.org/en/excel/
4. https://support.microsoft.com/en-us/office/basic-tasks-in-excel-dc775dd1-fa52-430f-9c3c-d998d1735fca

UI/UX Design
(Effective from the Academic Year 2023 - 2024)
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	02
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 No.
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.
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 WEB LINKS AND VIDEO LECTURES (E – RESOURCES):

1. https://help.figma.com/hc/en-us/sections/4405269443991-Figma-for-Beginners-tutorial-4-parts-
2. https://www.youtube.com/watch?v=HZuk6Wkx_Eg
3. https://www.youtube.com/watch?v=dXQ7IHkTiMM

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	02
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 management.	CL3
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
CO1	3	2	1		2				1			2	1	2
CO2	3	2	1		2				1			2	1	3
CO3	3	2	1		2				1			2	1	3
CO4	3	2	1		2				1			2	1	2
CO5	3	2	1		2				1			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
	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.

REFERENCE WEB LINKS AND VIDEO LECTURES (E – RESOURCES):

1. https://nptel.ac.in/courses/106106156
2. https://www.coursera.org/learn/introduction-to-front-end-development

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	02

CREDITS – 1

COURSE PREREQUISITES:

- Basic Knowledge of C.

COURSE OBJECTIVES:

- To apply the fundamental concepts of C++ in real time problems.
- To illustrate the sorting, searching and recursive algorithms.
- To demonstrate graph and tree algorithms.
- To solve different string 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	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
CO1	3	2	3		2							1	1	1
CO2	3	2	3		2							1	1	1
CO3	3	2	3		2							1	1	1
CO4	3	2	3		2							1	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:

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 WEB LINKS AND VIDEO LECTURES (E – RESOURCES):

1. https://www.geeksforgeeks.org/competitive-programming-a-complete-guide/
2. https://www.youtube.com/playlist?list=PLauivoElc3ggagradg8MfOZreCMmXMmJ-

SAHYADRI
COLLEGE OF ENGINEERING & MANAGEMENT
An Autonomous Institution
MANGALURU

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.
- 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 a 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
- PowerPoint 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 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, 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 an 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 a 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 text 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**
CO1	3	3	3		2				2	2	2	2	2	2
CO2	3	3	3		2				2	2	2	2	2	2
CO3	3	3	3		2				2	2	2	2	2	2
CO4	3	3	3		2				2	2	2	2	2	2
CO5	3	3	3		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
	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
30%	30%	40%	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.
5. The questions from the practical sessions shall be included in Theory SEE.

REFERENCE BOOKS:

1. Randy Connolly, Ricardo Hoar, "Fundamentals of Web Development", 1st Edition, Pearson Education India. (ISBN:978- 9332575271)
2. Laravel: Up and Running, By Matt Stauffer. Publisher: O'Reilly Media
3. Robin Nixon, "Learning PHP, MySQL &JavaScript with jQuery, CSS and HTML5", 4th Edition, O"Reilly Publications, 2015. (ISBN:978-9352130153)
4. Luke Welling, Laura Thomson, "PHP and MySQL Web Development", 5th Edition, Pearson Education, 2016. (ISBN:978-9332582736)
5. Nicholas C Zakas, "Professional JavaScript for Web Developers", 3rd Edition, Wrox/Wiley India, 2012. (ISBN:978- 8126535088)

6. David Sawyer Mcfarland, "JavaScript & jQuery: The Missing Manual", 1st Edition, O"Reilly/Shroff Publishers & Distributors Pvt. Ltd., 2014

REFERENCE WEB LINKS AND VIDEO LECTURES (E - RESOURCES):

1. https://onlinecourses.nptel.ac.in/noc22_cs93/unit?unit=17&lesson=18
2. https://onlinecourses.nptel.ac.in/noc22_cs93/unit?unit=26&lesson=27
3. https://onlinecourses.nptel.ac.in/noc22_cs93/unit?unit=43&lesson=44
4. https://onlinecourses.nptel.ac.in/noc22_cs93/unit?unit=52&lesson=53
5. https://onlinecourses.nptel.ac.in/noc22_cs93/unit?unit=75&lesson=76

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:

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

COURSE OBJECTIVES:

The course will enable the student to

- Obtain awareness on concepts of operating systems and 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	**8 Hours**

Process Management: Process concept, process state, process control block, context switch; operations on processes, inter process communication.	
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	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	3	3	1								2	2	2
CO2	3	3	3	1								2	2	2
CO3	3	3	3	1								2	2	2
CO4	3	3	3	1								2	2	2
CO5	3	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**
	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%)				
Continuous Internal Evaluation (CIE) (60%)			Practical Sessions (40%)	Semester End Exam (SEE) (50%)
I	II	III		
Syllabus Coverage			Syllabus Coverage	Syllabus Coverage
30%	30%	40%	100%	100%
MI			MI	MI
MII	MII		MII	MII
	MIII		MIII	MIII
		MIV	MIV	MIV
		MV	MV	MV

NOTE:

1. Assessment will be both CIA and SEE.
2. The practical sessions of the IPCC shall be for CIE only.
3. The Theory component of the IPCC shall be for both CIA and SEE respectively.
4. 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.
5. The paper shall mandatorily contain the questions from the laboratory component of the course

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.

REFERENCE WEB LINKS AND VIDEO LECTURES (E - RESOURCES):

1. https://www.geeksforgeeks.org/operating-systems/
2. https://www.youtube.com/watch?v=RozoeWzT7IM&list=PLdo5W4Nhv31a5ucW_S1K3-x6ztBRD-PNa
3. https://en.wikipedia.org/wiki/Operating_system
4. https://www.youtube.com/watch?v=By6lWjiPpVI&list=PLG9aCp4uE-s17rFjWM8KchGlffXgOzzVP
5. https://www.youtube.com/watch?v=bkSWJJZNgf8&list=PLxCzCOWd7aiGz9donHRrE9I3Mwn6XdP8

SAHYADRI
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MANGALURU

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 operation and function of computer system.

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
CO1	3	2	1							1			1	1
CO2	3	2	1										1	1
CO3	3	2	1							1			1	1
CO4	3	2	1										1	1
CO5	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%)				
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.

TEXT BOOKS:

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Computer Organization, 5th Edition, Tata McGraw Hill
2. M. Morris Mano, Computer System Architecture, PHI, 3rd Edition

REFERENCE BOOKS:

1 William Stallings: Computer Organization & Architecture, 9th Edition, Pearson

REFERENCE WEB LINKS AND VIDEO LECTURES (E - RESOURCES):

1. http://www.nptelvideos.in/2012/11/computer-organization.html
2. https://nptel.ac.in/courses/106/103/106103068/
3. https://nptel.ac.in/content/storage2/courses/106103068/pdf/coa.pdf
4. https://nptel.ac.in/courses/106/105/106105163/
5. https://nptel.ac.in/courses/106/106/106106092/
6. https://nptel.ac.in/courses/106/106/106106166/
7. http://www.nptelvideos.in/2012/11/computer-organization.html

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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)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	**40 L + 20 S**	Exam Hours	03

CREDITS – 3

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	**8 Hours**

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.	
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**
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 algorithms 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	CL3

	String-matching techniques.	
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**
CO1	3	3	2	1		1						3	2	1
CO2	3	3	2	1		1						3	2	1
CO3	3	3	3	1		1						3	2	1
CO4	3	3	3	1		1						3	2	1
CO5	3	3	3	1		1						3	2	1

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

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	MI			MI	MI
CO2	MII	MII		MII	MII
CO3		MIII		MIII	MIII
CO4			MIV	MIV	MIV
CO4			MV	MV	MV

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 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, AnanyLevitin: 3rd Edition, Pearson.
2. Computer Algorithms/C++, Ellis Horowitz, SatrajSahni 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).

Reference Web Links and Video Lectures (e - Resources):

1. https://www.youtube.com/watch?v=gY0MwGLq9W8&list=PLyqSpQzTE6M9DKhN7z2fOpKTJWu-639_P
2. https://www.youtube.com/watch?v=5Y8Lfsreeck&list=PL7DC83C6B3312DF1E
3. https://www.youtube.com/watch?v=S47aSEqm_0I&list=PLgj_VZKxRKrxgFyOutPJpoLFBaQMOpK-

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

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	03

CREDITS –1

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 C/C++/Java (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 obtain the Topological ordering of vertices in a given digraph.
4	Design and implement a Program to solve discrete Knapsack and continuous Knapsack problems using greedy approximation method.
5	Design and implement a Program to find Minimum Cost Spanning Tree of a given connected undirected graph using Kruskal's algorithm.
6	Design and implement a Program to find shortest paths from a given vertex in a weighted connected graph to other vertices using Dijkstra's algorithm.

7	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.
8	Design and implement a Program to solve 0/1 Knapsack problem using Dynamic Programming method.
9	Design and implement a Program for N Queen's problem using Backtracking.
10	Design and implement a Program to find a subset of a given set S = {sl , s2,.....,sn} of n positive integers whose sum is equal to a given positive integer d.

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**

Learning Resources:

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.

Reference Web Links and Video Lectures (e - Resources):

1. https://nptel.ac.in/courses/106106182.

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

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	03

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 network analysis, Kirchhoff's current and voltage networks, Loop currents and node voltages, LRC networks.	**8 Hours**

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			
CO2	3	3						1				1			
CO3	3	3	1					1				1			
CO4	3	3			1			1				1			

CO5	3	3	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	MI			MI	MI
CO2	MII	MII		MII	MII
CO3		MIII		MIII	MIII
CO4			MIV	MIV	MIV
CO5			MV	MV	MV

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.

Text 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.

Reference Books:

1. Bondy, J. A. and Murty, U.S.R., "Graph Theory with Applications", North Holland Publication,2008.
2. West, D. B., ―Introduction to Graph Theory‖, Pearson Education, 2011.
3. John Clark, Derek Allan Holton, ―A First Look at Graph Theory‖, World Scientific Publishing Company, 1991.
4. Rosen K.H., “Discrete Mathematics and Its Applications”, Mc Graw Hill, 2007.

Reference Web Links and Video Lectures (e - Resources):

1. http://users.utu.fi/harju/graphtheory/graphtheory.pdf.
2. https://www.maths.ed.ac.uk/~v1ranick/papers/wilsongraph.pdf
3. https://www.academia.edu/35284015/Graph_Theory_With_Applications_To_Engineering_And_Computer_Science_by_Narsingh_Deo
4. https://onlinecourses.nptel.ac.in/noc22_ma10/preview#:~:text=Graph%20theory%20is%20the%20core,primary%20methods%20in%20Graph%20Theory.

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COLLEGE OF ENGINEERING & MANAGEMENT
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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	03

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

TEXT BOOKS:

1) Gupta, S. C., & Kapoor, V. K. (2002). Fundamental of Mathematical Statistics. Sultan Chand & sons.

REFERENCE BOOKS:

1) Joseph Hair, F., Willium Black, C., Barry Babin, J., & Rolph Anderson, E. (2010). Multivariate Data Analysis, Seventh edition. Pearson Prentice Hall.

2) Kothari, C. R. (2004). Research methodology. New Age International Publishers.

3) Levin, R. (2013). Statistics for Management. Prentice Hall India.

4) Medhi, J. (2006). Statistical Methods: An Introductory Text. New Age International(P) Limited, New delhi.

5) Montgomery, D. C. (2007). Introduction to Linear Regression analysis. John Willey & sons.

6) Mukhopadhyay, P. (2000). Mathematical Statistics. Books & Allied Pvt. Ltd.

7) Robert Kabacoff, I. (2015). R in Action - Data Analysis and Graphics with R, second edition. dreamtech Press.

8) Sudha Purohit, G., Sharad Gore, D., & Shailaja Deshmukh, R. (2008). Statistics Using R. Narosa Publishing House.

REFERENCE WEB LINKS AND VIDEO LECTURES (E - RESOURCES):

1. https://www.youtube.com/watch?v=8Kg21jBCm-k
2. https://www.youtube.com/watch?v=Wa6kaCwyYRk
3. http://nptel.ac.in/courses.php?disciplineID=111
4. http://www.class-central.com/subject/math(MOOCs)
5. http://academicearth.org/
6. http://www.bookstreet.in.
7. VTU e-Shikshana Program

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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	03

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			
CO2	2	3			1				1	1		1			
CO3	3	3	1	1				1							
CO4	3	3	1	1	1				1			1			
CO5	3	3		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.	Assessment Description	Weightage (%)	Max. Marks

No.			
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. V.K Kapoor and S.C Gupta “Mathematical Statistics” 11th edition, S. Chand Publications
2. B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, 43rd Ed., 2015.

REFERENCE BOOKS:

1. C Ray Wylie, Louis C Barrett: “Advanced Engineering Mathematics", 6th Edition,
2. B.V Ramana: "Higher Engineering Mathematics" 11th Edition, Tata McGraw-Hill,
3. Dr. K. Chandrashekar: " Complex analysis, Probability and Statistical Methods" Sudha Publications, 2021

REFERENCE WEB LINKS AND VIDEO LECTURES (E - RESOURCES):

1. https://www.youtube.com/watch?v=8Kg21jBCm-k
2. https://www.youtube.com/watch?v=Wa6kaCwyYRk
3. http://nptel.ac.in/courses.php?disciplineID=111
4. http://www.class-central.com/subject/math(MOOCs)
5. http://academicearth.org/
6. http://www.bookstreet.in.
7. VTU e-Shikshana Program

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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	03

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,	**8 Hours**

Continuous Functions on Compact Spaces, Locally Compact Spaces.	
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			
CO2	2	2	1					1		2		1			
CO3	2	2										1			
CO4	2	2						1				1			
CO5	3	2	2	1	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 %	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.

TEXT 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)

REFERENCE BOOKS:

1. Metric Spaces by Satish Shirali and Harikrishan L Vasudeva Springer, (2006)

2. Metric Spaces by P.K. Jain and Khalil Ahmad ,Alpha Science International, (2004)

3. 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 L**	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** a) Create a new branch named "feature-branch." Switch to the "master" branch. Merge the "feature-branch" into "master." b) Write the commands to stash your changes, switch branches, and then apply the

	stashed changes.
3	**Collaboration and Remote Repositories** a) Clone a remote Git repository to your local machine. b) Fetch the latest changes from a remote repository and rebase your local branch onto the updated remote branch. c) Write the command to merge "feature-branch" into "master" while providing a custom commit message for the merge.
4	**Git Tags and Releases** Write the command to create a lightweight Git tag named "v1.0" for a commit in your local repository.
5	**Advanced Git Operations** Write the command to cherry-pick a range of commits from "source-branch" to the current branch.
6	**Analysing and Changing Git History** a) Given a commit ID, how would you use Git to view the details of that specific commit, including the author, date, and commit message? b) Write the command to list all commits made by the author "JohnDoe" between "2023-01-01" and "2023-12-31." c) Write the command to display the last five commits in the repository's history. d) 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	Analyse 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
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:

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_0133013471217745921192 6_shared/overview

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NODE AND REACT JS

(Effective from the Academic Year 2023 - 2024)

IV SEMESTER

Course Code	**IS42297IB**	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

COURSE PREREQUISITES:

- Basic Knowledge of programming.

COURSE OBJECTIVES:

- To use the NPM in Node and React applications.
- To design the different web applications.
- To illustrate the event driven programming, components and props.

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	Illustrate the practical use of the Node Package Manager (NPM) in Node.js by creating and showcasing a basic web application. Provide a step-by-step guide, including the installation of NPM packages, and demonstrate their integration within the Node.js environment to build a simple web application.
2	Demonstrate a simple web server in Node.js and elucidate the principles of event-driven programming in Node.js, highlighting how events are utilized in the context of building a web server with NodeJS.

3	Develop a customized application using Node.js, tailoring it to meet specific requirements. Provide details on the features and functionality you plan to incorporate, and illustrate the process of developing and implementing this personalized Node.js application.
4	Design and implement a Node.js application to showcase the use of tuples and tables, incorporate tuples and tables within the application, and demonstrate their functionality in a Node.js environment.
5	Illustrate the implementation of create, update, delete, and insert operations on tables using Node.js. Provide a comprehensive demonstration of each operation's functionality and how they are executed within a Node.js environment
6	Create a React.js application and demonstrate the process of publishing a component to the Node Package Manager (NPM). Show developing the React component, preparing it for publication, and successfully publishing it to NPM.
7	Demonstrate the ReactJS application to create a countdown timer, provide the implementation of the countdown timer component, and also implement its functionality within the React.js framework.
8	Develop a React.js program that utilizes components to create a Toggle Switch and demonstrate how components are employed in the React.js application, specifically focusing on the implementation and functionality of the Toggle Switch component
9	Implement a React.js program that utilizes the mapping of props to dynamically create new elements. Provide the demonstration of React components using props and mapping to dynamically generate and render elements within the application.

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 practical use of Node Packet Manager in NodeJS and ReactJS.	CL3
CO2	Determine the use of web applications and event-driven programming.	CL3
CO3	Demonstrate the use of table and tuple operations.	CL3
CO4	Illustrate the use of components in ReactJS.	CL3
CO5	Demonstrate the use of props in ReactJS.	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**
CO1	3	3	3	1	2			2	1	2		1	1	1
CO2	3	3	3	1	2			2	1	2		1	1	1
CO3	3	3	3	1	2			2	1	2		1	1	1

CO4	3	3	3	1	2			2	1	2		1	1	1
CO5	3	3	3	1	2			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.

REFERENCE WEB LINKS AND VIDEO LECTURES (E – RESOURCES):

1. https://gist.github.com/sharmaeklavya2/8aa2830f3a46a3f46ff249b4e1f07767
2. https://www.geeksforgeeks.org/c-plus-plus/

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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 package in R.	**CO5**	**CL3**

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**
CO1	3	3	2	1	2				1	1		2		
CO2	3	3	2	1	2				1	1		2		
CO3	3	3	2	1	2				1	1		2		
CO4	3	3	2	1	2				1			2		
CO5	3	3	2	1	2				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**
	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%.

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 WEB LINKS AND VIDEO LECTURES (E – RESOURCES):

1. Essentials of R with Data Analytics, Saroj Dahiya Ratnoo, Himmat Singh Ratnoo, Wiley (India), Low price edition.
2. https://elearn.nptel.ac.in/shop/iit-workshops/completed/data-visualization-with-r/

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COMPETITIVE PROGRAMMING USING GO
(Effective from the Academic Year 2022 - 2023)
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:

- Understand the usage of running multiple processes at the same time.
- Unleash the ability to Write Better and Optimized Codes.

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
CO1	3	3			3			2	2	1	3	3	2	3
CO2	3	3			3			2	2	1	3	3	2	3
CO3	3	3			3			2	2	1	3	3	2	3
CO4	3	3			3			2	2	1	3	3	2	3
CO5	3	3			3			2	2	1	3	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**
	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:

IV. 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.

V. 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.

VI. 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 WEB LINKS AND VIDEO LECTURES (E – RESOURCES):

1. https://www.AUTOSAR.org/standards/
2. https://www.comasso.org/
3. AUTOSAR Architecture (Learn from Scratch with Demo)
   https://www.udemy.com/course/AUTOSAR-architecture/

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

Course Code	**BS422T8X**	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 inthe 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, Benefitsand 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 machinelearning 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
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%)				
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	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.

TEXT BOOKS:

1. Biology for Engineers, Thyagarajan S., Selvamurugan N., Rajesh M.P., Nazeer R.A., Thilagaraj W., Barathi S., andJaganthan 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. 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.

REFERENCE BOOKS:

1. Biomaterials Science and Tissue Engineering: Principles and Methods, by Bikramjit Basu, Cambridge IISc Series.

REFERENCE WEB LINKS AND VIDEO LECTURES (E - RESOURCES):

1. https://www.youtube.com/watch?v=96-u9s6D16k
2. https://www.youtube.com/watch?v=4_emccqgYMs
3. https://onlinecourses.nptel.ac.in/noc22_cs56/preview
4. https://onlinecourses.nptel.ac.in/noc22_cs29/preview

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DATA SCIENCE AND APPLICATIONS
(Effective from the Academic Year 2023 - 2024)
V SEMESTER

Course Code	**IS522I1I**	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, analytical skills and programming.

COURSE OBJECTIVES:

- Develop relevant programming abilities.
- Demonstrate proficiency with statistical analysis of data.
- Develop the ability to build and assess data-based models.
- Learn to execute statistical analyses.

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: The Ascendance of Data, What Is Data Science? , Visualizing Data, matplotlib, Bar Charts, Line Charts, Scatterplots, Statistics, Describing a Single Set of Data, Correlation,	**8 Hours**

Simpson's Paradox, Some Other Correlational Caveats, Correlation and Causation, Dependence and Independence, Conditional Probability, Bayes's Theorem, Random Variables, Continuous Distributions, The Normal Distribution, The Central Limit Theorem.	
MODULE - II	
Working with data: Getting Data, stdin and stdout, Reading Files, Scraping the Web, Using APIs, Example: Using the Twitter APIs, Exploring the Data, Using NamedTuples, Dataclasses, Cleaning and Munging, Manipulating Data, Rescaling, An Aside: tqdm, Dimensionality Reduction. The Curse of Dimensionality, Main Approaches for Dimensionality Reduction, Projection, Manifold Learning, PCA, Preserving the Variance, Principal Components, Projecting Down to d Dimensions.	**8 Hours**
MODULE - III	
Training: Models, Linear Regression, The Normal Equation, Computational Complexity, Gradient Descent, Batch Gradient Descent, Stochastic Gradient Descent, Mini-batch Gradient Descent, Polynomial Regression, Learning Curves, Regularized Linear Models, Ridge Regression, Lasso Regression, ElasticNet Early Stopping, Estimating Probabilities, Training and Cost Function Decision Boundaries, Softmax Regression	**8 Hours**
MODULE - IV	
Machine Learning and Deep Learning: Machine Learning, Modeling, What Is Machine Learning, Overfitting and Underfitting, Correctness, The Bias-Variance Tradeoff, Feature Extraction and Selection, Neural Networks, Perceptrons, Feed-Forward Neural Networks, Backpropagation, Example: Fizz Buzz, Deep Learning, The Tensor, The Layer Abstraction, The Linear Layer, Neural Networks as a Sequence of Layers, Loss and Optimization, Other Activation Functions, Softmaxes and Cross-Entropy, Dropout, Saving and Loading Models, Clustering, The Idea, The Model, Choosing k, Bottom-Up Hierarchical Clustering.	**8 Hours**
MODULE – V	
Network Analysis, Recommender System and MapReduce: Betweenness Centrality, Eigenvector Centrality, Directed Graphs and PageRank, Recommender Systems, Manual Curation, Recommending What's Popular, User-Based Collaborative Filtering, Item-Based Collaborative Filtering, Matrix Factorization, Create Table and Insert, Update, Delete, Select, Group By, Order By, Join, Subqueries, Indexes, Query Optimization, N0Sql, MapReduce, Example: Word count, Why MapReduce, MapReduce more generally, Example: Analyzing status updates, Example: Matrix multiplication, An Aside: Combiners.	**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 and demonstrate data using visualization tools and apply statistical analysis methods, to analyze and interpret data effectively in various real-world contexts.	CL3
CO2	Apply techniques for data acquisition, exploring and preparing data, dimensionality reduction, to reduce dataset complexity while preserving key information.	CL3
CO3	Apply gradient descent optimization techniques, to train linear regression, polynomial regression and logistic regression effectively.	CL3
CO4	Demonstrate the use of machine learning and deep learning models to implement efficient data-driven solutions for real-world problems.	CL3
CO5	Demonstrate knowledge about the recommender system, MapReduce and understand the importance of data ethics.	CL3

LABORATORY COMPONENTS

Exp. No.	Experiment Description	CO No.	Bloom's Taxonomy Level
1	Demonstrate all the basic plots using Matplotlib package and python programming.	CO1	CL3
2	Implement a python program to perform File Operations on Excel Dataset.	CO2	CL3
3	Write a python program to perform Array operations using the Numpy package.	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 Linear Regression operation using python programming.	CO4	CL3
6	Train a regularized logistic regression classifier on the in-build iris dataset using scikit-learn. Train the model and report the best classification accuracy.	CO4	CL3
7	Write a python program to perform Data Manipulation operations using	CO4	CL3

	Pandas package.		
8	Develop a MapReduce program to find the grades of students in python.	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**
CO1	3	3	3	2	3						2	2	3	2
CO2	3	3	3	2	3						2	2	3	2
CO3	3	3	3	2	3						2	2	3	2
CO4	3	3	3	2	3						2	2	3	2
CO5	3	3	3	2	3						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
	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. Joel Grus, Data Science from Scratch-First Principles with Python, O' Reilly Publications, 2nd Edition, 2019, ISBN: 978-9352138326.
2. Aurelien Geron, Hands-on Machine Learning with Scikit-Learn & TensorFlow, O'Reilly Media Publications, 3rd Edition, 2022, ISBN: 978-93-5542-198-2.
3. Emily Robinson, Jacqueline Nolis, Build a Career in Data Science, Manning Publications, 1st Edition, 2020, ISBN: 9781638350156.
4. Aurelien Geron, Hands-on Machine Learning with Scikit-Learn & TensorFlow, O'Reilly Media Publications, 3rd Edition, 2022, ISBN: 978-93-5542-198-2.

REFERENCE WEB LINKS AND VIDEO LECTURES (E - RESOURCES):

1. https://onlinecourses.nptel.ac.in/noc21_cs69
2. https://onlinecourses.nptel.ac.in/noc22_cs32

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DATA COMMUNICATIONS AND NETWORKING
(Effective from the Academic Year 2023 - 2024)
V SEMESTER

Course Code	**IS522I2C**	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			

PREREQUISITES:

- Fundamental of data communication and Network Management

COURSE OBJECTIVES:

- Illustrate concepts of data communication, Fundamentals of Physical layer and Data link layer
- Explain routers, IP and Routing Algorithms in network layer
- Discuss transport layer services and understand UDP and TCP protocols
- Demonstration of application layer 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

Introduction To Data Communications: Networks, Network Types, Internet History, Standards and administration. OSI and TCP/IP model. **Physical layer:** Data and Signals, Periodic Analog signals, Digital Signals, Transmission Impairment, Data Rate limits, Performance**,** Pulse Code Modulation, Line coding Techniques	**8 Hours**

(NRZ, Manchester, Differential Manchester, AMI, Psedoternary)	
MODULE - II	
Data-Link Layer: Introduction to Data-Link Layer, Link-Layer addressing, Error Detection and correction, Block Coding, Cyclic Codes, Checksum**.** **Media Access Control:** Random Access, Controlled Access, Channelization.	**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, Routing in the Internet, **Intra-AS Routing in the Internet:** RIP and OSPF. Inter/AS Routing: BGP, Broadcast Routing Algorithms and Multicast.	**8 Hours**
MODULE - IV	
Transport Layer - Introduction and Transport-Layer Services: Relationship Between Transport and Network Layers, Overview of the Transport Layer in the Internet, Multiplexing and Demultiplexing: Connectionless Transport: UDP, UDP Segment Structure, UDP Checksum **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 - V	
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, Electronic Mail in the Internet: SMTP, Comparison with HTTP, Mail Message Format, Mail Access Protocols, DNS. **The Internet's Directory Service:** Services Provided by DNS, Overview of How DNS Works, DNS Records and Messages.	**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 basic fundamentals of data communication and networking	CL2
CO2	Analyze Error detection and correction techniques, Flow control & error control	CL4
CO3	Examine Routers, IP Routing algorithms in network layer	CL3
CO4	Analyze transport layer services and infer UDP and TCP protocol	CL4
CO5	Discuss the principles of application layer protocol and importance of web and HTTP	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 tcpdump 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/trace route 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	CO4	CL2

	JAVA.		
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
CO1	3	2	2									2	3	2
CO2	3	2	2									2	3	2
CO3	3	2	2		2							2	3	2
CO4	3	2	2		2							2	3	2
CO5	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
	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

	MIII		MIII	MIII
	MIV	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. Behrouz A Forouzan, Data and Communications and Networking, Fifth Edition, McGraw Hill, Indian Edition
2. 2.James F Kurose and Keith W Ross, Computer Networking, A Top-Down Approach, Sixth edition, Pearson, 2017.
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

REFERENCE WEB LINKS AND VIDEO LECTURES (E - RESOURCES):

1. https://onlinecourses.nptel.ac.in/noc22_cs93/unit?unit=17&lesson=18
2. https://onlinecourses.nptel.ac.in/noc22_cs93/unit?unit=26&lesson=27

3. https://onlinecourses.nptel.ac.in/noc22_cs93/unit?unit=43&lesson=44
4. https://onlinecourses.nptel.ac.in/noc22_cs93/unit?unit=52&lesson=53
5. https://onlinecourses.nptel.ac.in/noc22_cs93/unit?unit=75&lesson=76

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AUTOMATA THEORY AND COMPUTABILITY
(Effective from the Academic Year 2023 - 2024)
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	**40L**	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 also, 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
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.	Assessment Description	Weightage (%)	Max. Marks

1	**Continuous Internal Assessment**	**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**
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.
2. K L P Mishra, N Chandrasekaran, 3rd Edition, Theory of Computer Science, PhI.
3. Elaine Rich, Automata, Computability and Complexity, 1st Edition, Pearson Education, 2012/2013
4. Michael Sipser: Introduction to the Theory of Computation, 3rd Edition, Cengage Learning, 2013
5. John C Martin, Introduction to Languages and The Theory of Computation, 3rd Edition, Tata McGraw–Hill Publishing Company Limited, 2013
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.

REFERENCE WEB LINKS AND VIDEO LECTURES (E-RESOURCES):

1. https://nptel.ac.in/courses/106106049
2. https://www.jflap.org/

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DATABASE MANAGEMENT SYSTEMS
(Effective from the Academic Year 2023 - 2024)
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

PREREQUISITES:

- Knowledge of Data Structures

COURSE OBJECTIVES:

- 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 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 of database approach, Actors on the Scene, Workers behind the Scene, Advantages of using the DBMS approach, History of Database Applications. **Database System Concepts and Architecture:** Data Models, Schemas, and Instances, Three schema architecture and data independence, database languages, and interfaces, The Database	**8 Hours**

System environment. **Basic SQL:** SQL data definition and data types, specifying constraints in SQL, basic retrieval queries in SQL, INSERT, DELETE, and UPDATE statements in SQL.	
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: 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. **Advanced SQL:** 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,	**8 Hours**

Concurrency control based on Timestamp ordering. **Introduction to NOSQL Databases:** Emergence of NOSQL Systems, Characteristics of NOSQL Systems, Categories of NOSQL Systems**.**	

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 SQL 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	Explain the concepts and theory needed for transaction processing, concurrency control in database applications. Describe the NOSQL database with its categories.	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
CO1	3	2	1									2	1	1
CO2	3	2	1		3							2	1	1
CO3	3	2	1									2	2	1
CO4	3	2	1	1								2	2	1
CO5	3	3	2	2		2				3		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.	Assessment Description	Weightage (%)	Max. Marks

No.			
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
	MIII		MIII	MIII
	MIV	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.
3. Silberschatz Korth and Sudharshan, Database System Concepts, 6th Edition, Mc-Graw Hill, 2013.
4. Coronel, Morris, and Rob, Database Principles Fundamentals of Design, Implementation and Management, Cengage Learning 2012.

REFERENCE WEB LINKS AND VIDEO LECTURES (E - RESOURCES):

1. https://www.youtube.com/watch?v=6Iu45VZGQDk&list=PLBlnK6fEyqRi_CUQ-FXxgzKQ1dwr_ZJWZ
2. https://www.youtube.com/watch?v=IoL9Ve2SRwQ&list=PLIwC9bZ0rmjSkm1VRJROX4vP2YMIf4Ebh
3. https://www.youtube.com/watch?v=OMwgGL3lHlI&list=PLBlnK6fEyqRiyryTrbKHX1Sh9luYI0dhX
4. https://onlinecourses.nptel.ac.in/noc23_cs41/preview
5. http://vlabs.iitkgp.ernet.in/se/4/

SAHYADRI
COLLEGE OF ENGINEERING & MANAGEMENT
An Autonomous Institution
MANGALURU

DATABASE MANAGEMENT SYSTEMS LABORATORY
(Effective from the Academic Year 2023 - 2024)
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			

PREREQUISITES:

- Basics of SQL

COURSE OBJECTIVES:

- 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
- 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

LIST OF EXPERIMENTS

Sl. No.	Description
	Part-A
1	Consider the following schema for Bank Database: **BRANCH(Branch_id, Bank_name, Branch_name, Assets)**

	ACCOUNT(Acc_no, Branch_id, Account_Type, Account_Balance, Customer_id) **CUSTOMER(Customer_id, Customer_name, Customer_age, Customer_address, Customer_phone)** **LOAN(Loan_number, Branch_id, Amount, Customer_id)** Note: Account_Type may be of following: Savings, Recurrent, Fixed Deposit 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, Title, Publisher_Name, Pub_Year)** **BOOK_AUTHORS(Book_id, Author_Name)** **PUBLISHER(Name, Address, Phone)** **BOOK_COPIES(Book_id, Programme_id, No-of_Copies)** **BOOK_LENDING(Book_id, Programme_id, Card_No, Date_Out, Due_Date)** **LIBRARY_PROGRAMME(Programme_id, Programme_Name, Address)** 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 the 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 the 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, Name, Address, Gender, Salary, SuperEid, Dno)** **DEPARTMENT (Dnum, Dname, DMgr_id, Mgr_start_date)** **DLOCATION (Dno, Dlocation)** **PROJECT (Pnum, Pname, Plocation, Dno)** **WORKS_ON (Eid, Pno, Hours)** **DEPENDENT (Empid, Dep_name, Gender, Bdate, Relationship)** 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 (Flight_num, Source, Destination, Distance, Departs, Arrives, Price)** **Aircraft (Aid, Aname, Cruising_range)** **Certified (Emp_id, Aid)** **Employees (Emp_id, Ename, Salary)** **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 Emp_id and the maximum cruising range 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 the 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 a maximum of two members.
- The areas for problem statement may include, but not limited to the following :
  - ❖ Educational sector
  - ❖ Environmental issues
  - ❖ Healthcare
  - ❖ Women empowerment
  - ❖ Child care
  - ❖ 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 database application using front end tools and Compile the working with well document using modern tool.	CL6

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

CO5	3	3	3	2	2			1				2	3	2
CO6	3	3	3	3	3	2		3	3	3	3	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**
	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.

REFERENCE WEB LINKS AND VIDEO LECTURES (E – RESOURCES):

1. https://www.youtube.com/watch?v=6Iu45VZGQDk&list=PLBlnK6fEyqRi_CUQ-
2. https://onlinecourses.nptel.ac.in/noc23_cs41/preview
3. http://vlabs.iitkgp.ernet.in/se/4/

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INFORMATION STORAGE AND MANAGEMENT
(Effective from the Academic Year 2023 - 2024)
V SEMESTER

Course Code	**IS52216IA**	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 Data Communication, Database Management System and Data Warehousing

Course Objectives:

This course will enable students to:

- Describe the importance of data, information, and storage infrastructure.
- Review the evolution of storage technology.
- Understand the key management requirements of a storage system.
- Introduce RAID and intelligent storage systems.
- Explain the storage networking technologies and virtualization.
- Discuss CAS, business continuity, backup and recovery.

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 Information Storage: Information Storage, Evolution of Storage Architecture, Data Center Infrastructure, Virtualization and Cloud Computing.	**8 Hours**

Data Center Environment: Application, Database Management System (DBMS), Host (Compute), Connectivity, Storage, Disk Drive Components, Disk Drive Performance, Host Access to Data, Direct-Attached Storage, Storage Design Based on Application Requirements and Disk Performance.	
MODULE - II	
Data Protection: RAID - RAID Implementation Methods, RAID Array Components, RAID Techniques, RAID Levels, RAID Impact on Disk Performance, RAID Comparison, Hot Spares. **Intelligent Storage Systems:** Components of an Intelligent Storage System, Storage Provisioning, Types of Intelligent Storage Systems.	**8 Hours**
MODULE - III	
Fibre Channel Storage Area Networks - Fibre Channel: Overview, The SAN and Its Evolution, Components of FC SAN, FC Connectivity, Switched Fabric Ports, Fibre Channel Architecture, Fabric Services, Switched Fabric Login Types, Zoning, FC SAN Topologies, Virtualization in SAN. **Network-Attached Storage (NAS)**: General-Purpose Servers versus NAS Devices, Benefits of NAS, File Systems and Network File Sharing, Components of NAS, NAS I/O Operation, NAS Implementations, NAS File-Sharing Protocols, Factors Affecting NAS Performance, File Level Virtualization.	**8 Hours**
MODULE - IV	
Introduction to Business Continuity: Information Availability, BC Terminology, BC Planning Life Cycle, Failure Analysis, Business Impact Analysis, BC Technology Solutions. **Backup and Archive:** Backup Purpose, Backup Considerations, Backup Granularity, Recovery Considerations, Backup Methods, Backup Architecture, Backup and Restore Operations, Backup Topologies, Backup in NAS Environments, Backup Targets, Data Archive, Archiving Solution Architecture.	**8 Hours**
MODULE - V	
Local Replication: Replication Terminology, Uses of Local Replicas, Replica Consistency, Local Replication Technologies, Tracking Changes to Source and Replica, Restore and Restart Considerations, Creating Multiple Replicas, Local Replication in a Virtualized Environment. **Remote Replication:** Modes of Remote Replication, Remote Replication Technologies, Three Site Replication, Data Migration Solutions, Remote replication and migration in a virtualized environment.	**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	Describe the evolution of information storage architecture and data center environment. Also identify the storage requirements for the applications.	CL3
CO2	Explain the importance of RAID and an intelligent storage system for the effective maintenance and protection of data. Also, identify the disk load in different types of RAID.	CL3
CO3	Discuss the different storage networking technologies including FC SAN and NAS.	CL2
CO4	Explain the process of business continuity, backup, and recovery to ensure information availability for vital business operations.	CL2
CO5	Explain the process of replication to minimize the risk of business disruption and ensure business continuity.	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
CO1	3	3	2									2	1	
CO2	3	3	2		2							2	1	1
CO3	3	3	3		2							2	1	
CO4	3	3	3		2							2	1	
CO5	3	3	3									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%)				**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%**
M I			M I	M I
M II			M II	M II
	M III		M III	M III
	M IV	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. Somasundaram Gnanasundaram, Alok Shrivastava: "Information Storage and Management", 2nd Edition, EMC Education Services, Wiley India Publications. ISBN: 978-81-265-3750-1
2. Ulf Troppens, Rainer Erkens and Wolfgang Muller: Storage Networks Explained, Wiley India, 2003.
3. Rebert Spalding: Storage Networks, The Complete Reference, Tata McGraw Hill, 2003.
4. Richard Barker and Paul Massiglia: Storage Area Networks Essentials A Complete Guide to Understanding and Implementing SANs, Wiley India, 2002.

Reference Web Links and Video Lectures (E-Resources):

1. https://nptel.ac.in/courses/106108058

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INDUSTRIAL IOT and ANALYTICS
(Effective from the Academic Year 2023 - 2024)
V SEMESTER

Course Code	**IS52216IB**	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 Industrial IOT Systems.

COURSE OBJECTIVES:

- To provide students with good depth of knowledge of Designing Industrial IOT Systems for various application.
- Knowledge for the design and analysis of Industry 4.0 Systems.

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 Industrial IoT (IIoT) Systems: The Various Industrial Revolutions, Role of Internet of Things (IoT) & Industrial Internet of Things (IIoT) in Industry, Industry 4.0 revolutions, Support System for Industry 4.0, Smart Factories.	**8 Hours**

MODULE - II

Implementation systems for IIoT: Sensors and Actuators for Industrial Processes, Sensor networks, Process automation and Data Acquisitions on IoT Platform, Microcontrollers and Embedded PC roles in IIoT, Wireless Sensor nodes with Bluetooth, WiFi, and LoRa Protocols and IoT Hub systems.	**8 Hours**
MODULE - III	
IIoT Data Analytics: IoT Gate way, IoT Edge Systems and It's Programming, Cloud computing, Real Time Dashboard for Data Monitoring, Data Analytics and Predictive Maintenance with IIoT technology.	**8 Hours**
MODULE - IV	
Cyber Physical Systems: Next Generation Sensors, Collaborative Platform and Product Lifecycle Management, Augmented Reality and Virtual Reality, Artificial Intelligence, Big Data and Advanced Analysis	**8 Hours**
MODULE - V	
Industrial IoT- Applications: Healthcare, Power Plants, Inventory Management & Quality Control, Plant Safety and Security (Including AR and VR safety applications), Facility Management.	**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	Knowledge of theory and practice related to Industrial IoT Systems.	CL2
CO2	Ability to identify, formulate and solve engineering problems by using Industrial IoT.	CL3
CO3	Analyze data Analytics for Industrial Internet of Things	CL3
CO4	Demonstrate Cyber Physical systems.	CL3
CO5	Ability to implement real field problem by gained knowledge of Industrial applications with IoT capability.	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	2	1											1	1
CO2	2	1	3										1	1
CO3	2	1	3				2						1	1
CO4	2	1					2						1	1
CO5	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**
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	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
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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. Industry 4.0: The Industrial Internet of Things Alasdair Gilchrist Publications.
2. Dr. OvidiuVermesan, Dr. Peter Friess, “Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems”, River Publishers.
3. Embedded System: Architecture, Programming and Design by Rajkamal, TMH3.
4. The Concept Industry 4.0 “An Empirical Analysis of Technologies and Applications in Production Logistics” Authors: Bartodziej, Christoph Jan Springer: Publication in the field of economic science.
5. The Internet of Things: Key Applications and Protocols, ISBN: 978-1-119-99435-0, 2nd Edition, Willy Publications.
6. Internet of Things- From Research and Innovation to Market Deployment; By Ovidiu & Peter; River Publishers Series.

REFERENCE WEB LINKS AND VIDEO LECTURES (E - RESOURCES):

1. https://www.cisco.com/c/en/us/solutions/internet-of-things
2. https://www.tibco.com/reference-center/what-is-iiot

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SOCIAL NETWORK ANALYSIS
(Effective from the Academic Year 2023 - 2024)
VI SEMESTER

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

COURSE PREREQUISITES:

- Fundamental knowledge of Mathematics, Data Structures and algorithms.

COURSE OBJECTIVES:

- To develop semantic web related applications.
- To represent knowledge using ontology.
- T predict human behavior in social web and related communities.
- To visualize social networks.

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 - Introduction to Semantic Web: Limitations of current Web - Development of Semantic Web - Emergence of the Social Web - Social Network analysis: Development of Social Network Analysis - Key concepts and measures in network analysis - Electronic sources for network analysis: Electronic discussion networks, Blogs and online communities - Web-based networks - Applications of Social Network Analysis.	**8 Hours**

MODULE - II	
Modelling, aggregating and knowledge representation: Ontology and their role in the Semantic Web: Ontology-based knowledge Representation - Ontology languages for the Semantic Web: Resource Description Framework - Web Ontology Language - Modelling and aggregating social network data: State-of-the-art in network data representation - Ontological representation of social individuals - Ontological representation of social relationships - Aggregating and reasoning with social network data - Advanced representations.	**8 Hours**
MODULE - III	
Extraction and mining communities in web social networks: Extracting evolution of Web Community from a Series of Web Archive - Detecting communities in social networks - Definition of community - Evaluating communities - Methods for community detection and mining - Applications of community mining algorithms - Tools for detecting communities social network infrastructures and communities - Decentralized online social networks - Multi-Relational characterization of dynamic social network communities.	**8 Hours**
MODULE - IV	
Predicting human behaviour and privacy issues: Understanding and predicting human behaviour for social communities - User data management - Inference and Distribution - Enabling new human experiences - Reality mining - Context - Awareness - Privacy in online social networks - Trust in online environment - Trust models based on subjective logic - Trust network analysis - Trust transitivity analysis - Combining trust and reputation - Trust derivation based on trust comparisons - Attack spectrum and countermeasures.	**8 Hours**
MODULE - V	
Visualization and applications of social networks: Graph theory - Centrality - Clustering - Node-Edge Diagrams - Matrix representation - Visualizing online social networks, Visualizing social networks with matrix-based representations - Matrix and Node-Link Diagrams - Hybrid representations - Applications - Cover networks - Community welfare - Collaboration networks - Co-Citation networks.	**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 and significance of web technologies and social network analysis.	CL2
CO2	Apply ontological representations to enhance social network data aggregation and reasoning.	CL3

CO3	Implement community mining algorithms to discover and analyse social network communities.	CL3
CO4	Demonstrate proficiency in managing user data responsibly and securely, considering ethical and legal considerations in data handling and storage.	CL3
CO5	Apply various visualization techniques to analyse and solve real world problems using social network 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
CO1	3	3	2	1				2				2		
CO2	3	3	2					2				2		
CO3	3	3	3					2				2		
CO4	3	3	3					2				2		
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. Peter Mika, ―Social Networks and the Semantic Web‖, First Edition, Springer 2007.
2. Borko Furht, ―Handbook of Social Network Technologies and Applications‖, 1st Edition, Springer, 2010.
3. Guandong Xu ,Yanchun Zhang and Lin Li, ―Web Mining and Social Networking – Techniques and applications‖, First Edition, Springer, 2011.
4. Dion Goh and Schubert Foo, ―Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively‖, IGI Global Snippet, 2008.
5. Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, ―Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modelling‖, IGI Global Snippet, 2009.

6. John G. Breslin, Alexander Passant and Stefan Decker, ―The Social Semantic Web‖, Springer, 2009.

REFERENCE WEB LINKS AND VIDEO LECTURES (E - RESOURCES):

1. https://onlinecourses.nptel.ac.in/noc22_cs117/preview

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DRONE TECHNOLOGY and APPLICATIONS
(Effective from the Academic Year 2023 - 2024)
V SEMESTER

Course Code	**IS52216ID**	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:

- To understand the basics of drone concepts.
- To learn and understand the fundaments of design, fabrication and programming of drone.
- To impart the knowledge of a 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,	**8 Hours**

Opportunities/applications for entrepreneurship and employability.	
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

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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	2	1											1	1
CO2	2	1				2							1	1
CO3	2	1				2							1	1
CO4	2	1				1							1	1
CO5	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. 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.

REFERENCE WEB LINKS AND VIDEO LECTURES (E - RESOURCES):

1. https://www.dronedeploy.com/resources
2. https://www.techtarget.com/iotagenda/definition/drone

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RESEARCH METHODOLOGY and IPR
(Effective from the Academic Year 2023- 2024)
V SEMESTER

Course Code	**BS52298X**	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	1:0:0:0	SEE Marks	50
Total Hours of Pedagogy	**16L**	Exam Hours	01

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.	**3 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.	**3 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.	**3 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	**4 Hours**

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.	
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.	**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	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

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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	1	1			1		1	1		2			
CO2	3	2	1	1	1	1		1	1		2			
CO3	3	1	1			2		3	1	1	1	2		
CO4	3	2	2	2	1	2		3	1	1	1	2		
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
	MIII		MIII	MIII
	MIV	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:

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

REFERENCE WEB LINKS AND VIDEO LECTURES (E - RESOURCES):

1. https://nptel.ac.in/courses/106/105/106105077/
2. https://youtu.be/oPXyj3mAEKg
3. https://youtu.be/E2gGF1rburw
4. https://www.youtube.com/watch?v=VzIgPfAd0Fs&list=RDCMUCLVol4Vq_9CKVYNv4tDZhX

w&start_radio=1&rv=VzIgPfAd0Fs&t=0

Assignments:

1. **Case Study:** Conduct a literature survey on a suitable research topic and prepare a report with a minimum of 10 references that adheres to standard journal specifications.
2. **Case Study:** Download 5 quality research papers published within the last five years from reputed journals on the topic of your choice and provide your analysis and perspective on the chosen topic
3. **Case Study:** Conduct a prior art search using free online databases and prepare a report.

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ENVIRONMENTAL STUDIES
(Effective from the Academic Year 2023- 2024)
V SEMESTER

Course Code	**BS52299X**	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	1:0:0:0	SEE Marks	50
Total Hours of Pedagogy	**16L**	Exam Hours	01

CREDITS – 1

COURSE PREREQUISITES:

- Fundamental knowledge of Ecosystems, Environment Pollution and its effects.

COURSE OBJECTIVES:

- To create environmental and sustainability awareness among the students.
- To educate the students to understand the various environmental pollutants, waste management techniques, and the legal framework governing environmental protection.

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

Ecosystem and Sustainability: Structure and Function of ecosystems in Forest, Desert, Wetlands, River, Oceanic and Lakes. Sustainability: 17 SDGs- History, targets, implementation, Capacity Development.	**3 Hours**

Success stories - Best practices related to ecosystem conservation and sustainable computing and IT practices.	
MODULE - II	
Advances in Energy Systems and Sustainable Practices: Hydrogen, Solar, OTEC, Tidal, and Wind energy systems: Merits and Demerits. Global status and applications of renewable energy sources. Concepts and case studies in disaster management with a focus on technology and data-driven solutions. Sustainable mining practices and their environmental impact. Carbon trading and its role in reducing carbon emissions in the IT industry.	**3 Hours**
MODULE - III	
Environmental Pollution, Global Issues, and Health Environmental Pollution: Sources, impacts, and control of surface and ground water pollutants. Soil pollutants and their effects on ecosystems. Air pollutants and their consequences on air quality. Radon and fluoride concentration in drinking water and potential health risks. Environmental toxicology - causes and control measures.	**4 Hours**
MODULE - IV	
E-Waste and Plastic Waste Management Solid waste management: sources, characteristics, health hazards, and disposal methods of E-Waste and Plastic waste. Different approaches of recycling and metal recovery from E-Waste. Role of stake holders in environmental management of e-waste (producers, consumers, recyclers, and statutory bodies). Strategies for plastic pollution control.	**3 Hours**
MODULE - V	
Sustainable Green Technologies Sustainable agriculture practices and green technologies. Waste-to-Energy Technologies. Introduction to circular economy principles and green data centre technologies in IT sectors. Green certification. Marine conservation.	**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	Summarize the role of IT Engineers in maintaining the ecosystem functionalities and	CL2

	sustainable development in the field of environmental science.	
CO2	Understand the advances in energy systems and approaches relevant to natural resource management.	CL2
CO3	Illustrate the sources, impacts & control of environmental pollution and understand the process involved in sustainable agriculture and marine conservation.	CL2
CO4	Identify the sources of environmental pollution, measures for control and understand the process involved in E-Waste management.	CL2
CO5	Understand the importance of Eco- friendly Technologies in the conservation of biological diversity	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
CO1	1					2	3	1	2	2		1		
CO2	1					2	3	1	2	2		1		
CO3	1					2	3	1	2	2		1		
CO4	1					2	3	1	2	2		1		
CO5	1					2	3	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
	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	Syllabus Coverage

			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

SEE QUESTION PAPER PATTERN:

- The Question paper will have **FIFTY** multiple choice questions covering the entire five module syllabus.
- Each question may have a maximum of four sub-questions and each question will be for 01 marks.
- Examination will be **ONLINE** and students will have to answer all the questions.
  The Duration of the Exam will be 01 hours.

REFERENCE BOOKS:

1. Environmental Studies, Benny Joseph, Tata Mc Graw – Hill., 2ndEdition, 2012.
2. Environmental Studies, S M Prakash, Pristine Publishing House, Mangalore, 3rdEdition, 2018.
3. Environmental Studies – From Crisis to Cure, R Rajagopalan, Oxford Publisher, 2005

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

Field work: Visit to Zero Waste Management Plant / Solid waste management plant/Biogas production plant.

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SOFTWARE ENGINEERING AND PROJECT MANAGEMENT
(Effective from the Academic Year 2023 - 2024)
VI SEMESTER

Course Code1	**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:

- 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.
- Explain the role of DevOps in Agile Implementation.
- Discuss various types of software testing practices and software evolution processes.
- Recognize the importance Project Management with its methods and methodologies.
- Identify software quality parameters and quantify software using measurements and metrics. List software quality standards and outline the practices involved

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

8 Hours

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.

Requirements Engineering: Requirements Engineering Task, Initiating the Requirement Engineering process, Eliciting Requirements, Negotiating Requirements, Validating Requirements, Software Requirement Document.

MODULE - II

8 Hours

Introduction, Modeling Concepts and Class Modeling: What is Object orientation? What is 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.

MODULE - III

8 Hours

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.

MODULE - IV

8 Hours

Introduction to Project Management: Introduction, Project and 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.	

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, Activity on Nodes Network. **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	Explain the basics of object-oriented concepts and build a suitable class model using modeling techniques	CL2
CO3	Interpret various software testing methods and to understand the importance of agile methodology.	CL2
CO4	Understand the Concepts of project planning and contract management in software development	CL2
CO5	Illustrate the importance of activity planning and its models and develop network models for project specification.	CL3

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)	
	1	**2**	**3**	**1**	**2**	**6**	**1**	**2**	**9**	**1**	**2**	**12**	**1**	**2**
CO1	2	1				1		2	1	1		2	1	1
CO2	2	2	2		2	1		2	2	2	2	2	2	1
CO3	2	2	2		2			2	2	3	1	2	3	1

CO4	2	2	2		2			2	3	3	2	2	3	1
CO5	2	2	2		2	2	2	2	3	3	2	2	3	1
3: Substantial (High)					**22: 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**
Sl. No.	**Assessment Description**	**Weightage (%)**	**Max. Marks**
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Continuous Internal Evaluation (CIE)	60 %	30
2	Assignments	40 %	20

ASSESSMENT DETAILS

Continuous Internal Assessment (CIA) (50%)				**Continuous Internal Assessment (CIA) (50%)**
Continuous Internal Evaluation (CIE) (60%)			**Continuous Internal Evaluation (CIE) (60%)**	**Continuous Internal Evaluation (CIE) (60%)**
I	**I**	**I**	**I**	**I**
Syllabus Coverage			**Syllabus Coverage**	**Syllabus Coverage**
40%	**40%**	**40%**	**40%**	**40%**
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	Real time Case Studies	50 %	10
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.

REFRENECE BOOKS:

1. Roger S. Pressman: Software Engineering-A Practitioners approach, 7th Edition, Tata McGraw Hill.
2. Michael Blaha, James Rumbaugh: Object Oriented Modelling and Design with UML, 2nd Edition, Pearson Education, 2005.
3. Bob Hughes, Mike Cotterell, Rajib Mall: Software Project Management, 6th Edition, McGraw Hill Education, 2018.
4. Deepak Gaikwad, Viral Thakkar, DevOps Tools from Practitioner's Viewpoint, Wiley.
5. Ian Sommerville: Software Engineering, 9th Edition, Pearson Education, 2012.
6. Pankaj Jalote: An Integrated Approach to Software Engineering, Wiley India.

REFERENCE WEB LINKS AND VIDEO LECTURES (E - RESOURCES):

1. https://onlinecourses.nptel.ac.in/noc20_cs68/preview
2. https://www.youtube.com/watch?v=WxkP5KR_Emk&list=PLrjkTql3jnm9b5nrggx7Pt1G4UAHeFlJ
3. http://elearning.vtu.ac.in/econtent/CSE.php
4. http://elearning.vtu.ac.in/econtent/courses/video/CSE/15CS42.html
5. https://nptel.ac.in/courses/128/106/128106012/ (DevOps)

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BIG DATA ANALYTICS
(Effective from the Academic Year 2023- 2024)
SEMESTER - VI

Course Code	IS622I2I	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	03
CREDITS – 4			

COURSE PREREQUISITES:

- Fundamental knowledge of database management systems and any programming language.

COURSE OBJECTIVES:

- To understand the need of Big Data, challenges and different analytical architectures
- Installation and understanding of Hadoop Architecture and its ecosystems
- Processing of Big Data with Advanced architectures like Spark.
- Describe graphs and streaming data in Spark.

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 - 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: Introduction, 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.	**8 Hours**
MODULE - III	
NoSQL Big Data Management, MongoDB and Cassandra: Introduction, NoSQL Data Store, NoSQL Data Architecture Patterns, NoSQL to Manage Big Data, Shared-Nothing Architecture for Big Data Tasks, MongoDB, Databases, Cassandra Databases.	**8 Hours**
MODULE - IV	
MapReduce , Hive and Pig : Introduction, MapReduce Map Tasks, Reduce Tasks and MapReduce Execution, Composing MapReduce for Calculations and Algorithms, Hive, HiveQL, Pig..	**8 Hours**
MODULE - V	
Spark and Big Data Analytics: Introduction, Spark, Data Analysis with Spark, Programming using RDD and MLIB, Data ETL, Introduction to Analytics, Reporting and Visualizing.	**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 Big Data analytics with its various applications and overview of data sources, pre-processing and storing.	CL2
CO2	Summarize the conceptualization of Hadoop and its ecosystem, Hadoop Distributed File system and discuss various essential Hadoop Tools.	CL2
CO3	Illustrate the concepts and applications of No SQL for Bigdata Analytics using MongoDB and Cassandra.	CL3
CO4	Demonstrate the Map Reduce programming model to process the big data along with Hadoop tools.	CL3

CO5	Examine overview and applications of spark used for Bigdata Analytics.	CL3

LABORATORY CONTENTS

Exp. No.	Experiment Description	CO No.	Bloom's Taxonomy Level
1.	Set up a pseudo-distributed, single-node Hadoop cluster backed by the Hadoop Distributed File System, running on Ubuntu Linux. After successful installation on one node, configuration of a multi-node Hadoop cluster (one master and multiple slaves).	CO1	CL2
2.	Write a program to analyze the Web server log stream data using Apache Flume Framework.	CO2	CL3
3.	Write a program to implement MongoDB CRUD operations.	CO3	CL3
4.	Develop a MapReduce program to calculate the frequency of a given word in a given file.	CO4	CL3
5.	Develop a MapReduce program to find the maximum temperature in each year.	CO4	CL3
6.	Develop a MapReduce program to find the grades of students.	CO4	CL3
7.	Write Pig Latin scripts to implement sort, group, join, project and filter the data operations.	CO4	CL3
8.	Use Hive to Create, alter and drop databases, tables, views, functions and Indexes.	CO4	CL3
9.	Implement clustering techniques using SPARK.	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**
CO1	3	2	1		3							2	3	1
CO2	3	2	1	1	3							2	3	1
CO3	3	2	1	2	3							2	3	1
CO4	3	2	1	2	3							2	3	1

CO5	3	3	2	2	3							2	3	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%)			**Practical Sessions (40%)**	
	I	**II**	**III**		
	Syllabus Coverage				
	40 %	**30%**	**30%**	**100%**	**100%**
CO1	MI			MI	MI
CO2	MII	MII		MII	MII
CO3		MIII		MIII	MIII
CO4			MIV	MIV	MIV
CO4			MV	MV	MV

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 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 MachineLearning”, 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", 1 stEdition, Pearson Education, 2016. ISBN13: 978- 9332570351
3. Tom White, Hadoop: The Definitive Guide, O’Reilly Media, Inc., Fourth Edition, 2015.
4. Vignesh Prajapati, Big data analytics with R and Hadoop, SPD 2013.
5. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.
6. Lars George, "HBase: The Definitive Guide", O'Reilley, 2011
7. Alan Gates, "Programming Pig", O'Reilley, 2011

REFERENCE WEB LINKS AND VIDEO LECTURES (E - RESOURCES):

1. https://onlinecourses.nptel.ac.in/noc20_cs92

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ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING
(Effective from the Academic Year 2023 - 2024)
VI SEMESTER

Course Code:	**IS622T3I**	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 concepts like probability.

COURSE OBJECTIVES:

- To Gain a historical perspective of AI and its foundations
- To understand the basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning.
- To describe Artificial Intelligence and Machine Learning algorithms and evaluate their performance
- To understand a range of machine learning algorithms along with their strengths and weaknesses.
- To Illustrate AI and ML algorithm and their use in appropriate applications.
- To Describe the applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models
- To apply the classification, clustering and regression-based machine learning algorithms techniques to solve real time problems.
- To apply the algorithms to a real-world problem, optimize the models learned and report on the expected accuracy that can be achieved by applying the models

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 AI: Intelligent systems, Foundations and Sub area of AI, Applications, Tic-Tac-Toe Game playing, Currents trend and developments of AI, General problem solving, Characteristics of problem, Constraint satisfaction.	**8 Hours**

MODULE - II

Heuristic search techniques: Generate and Test, Hill Climbing, Best First Search, Problem Reduction. Knowledge representation issues: Representation and Mapping, Approaches to Knowledge Representation.	**8 Hours**

MODULE - III

Introduction: Machine Learning, Types of Machine Learning, Main challenges of Machine Learning, Testing and Validating, Performance measures, Concept Learning tasks, Concept Learning as search, Find S algorithm, Version Spaces and Candidate Elimination algorithm. **Decision Tree Learning:** Introduction, Decision tree representation, Appropriate problems, ID3 algorithm.	**8 Hours**

MODULE - IV

Artificial Neural Network: Introduction, NN representation, Appropriate problems, Perceptron, Back propagation algorithm. **Bayesian Learning:** Introduction, Bayes theorem, Bayes theorem and concept learning, Naive Bayes Classifier, Bayesian Belief Network (BBN).	**8 Hours**

MODULE - V

Unsupervised Learning Techniques: Clustering algorithms: K-Means. **Instance-Base Learning:** Introduction, k-Nearest Neighbor Learning, Locally Weighted Regression, Linear SVM classification, Nonlinear SVM classification, SVM Regression. **Reinforcement Learning:** Introduction, The 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	Illustrate the theory of artificial intelligence for various problem-solving techniques.	CL3
CO2	Apply artificial intelligence concepts in Heuristic Search Techniques and knowledge representation.	CL3
CO3	Demonstrate the ability to evaluate concept learning tasks and decision tree algorithms to solve classification problems.	CL3
CO4	Apply the concept of neural networks for learning linear and non-linear activation functions and Bayesian classifier to label data.	CL3
CO5	Illustrate clustering, instant based and reinforcement learning algorithms and identify its applicability in real life 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**
CO1	3	3	1						1	1	2	1	2	2
CO2	3	3	1						1	1	2	1	2	2
CO3	3	3	1						1	1	2	1	2	2
CO4	3	3	1						1	1	2	1	2	2
CO5	3	3	1						1	1	2	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. Elaine Rich,KevinKandSBNair,**"ArtificialInteligence",**3rdEdition,McGrawHillEducation,2017
2. Aurelien Geron, Hands-on Machine Learning with Scikit-Learn &TensorFlow, O'Reilly Media

Publications, 3rd Edition, 2022, ISBN: 978-93-5542-198-2
3. Tom M Mitchell,**"MachineLerning",**1st Edition,McGrawHillEducation,2017.
4. Saroj Kaushik, Artificial Intelligence, Cengage learning
5. Stuart Rusell, Peter Norving,ArtificialIntelligence:AModernApproach,PearsonEducation2ndEdition
6. Aur Èlien GÈron,"Hands-On Machine Learning with Scikit Learn and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems",1stEdition, Shroff/O'ReillyMedia, 2017.
7. Trevor Hastie, Robert Tibshirani,Jerome Friedmanh The Elements of Statistical Learning,2nd edition, springer series in statistics.
8. Ethem Alpaydın, Introduction To machine learning, second edition, MIT press
9. Srinvivasa K G and Sridhar, "Artificial Intelligence and Machine Learning",Cengage

REFERENCE WEB LINKS AND VIDEO LECTURES (E - RESOURCES):

1. https://www.youtube.com/watch?v=wnqkfpCpK1g
2. https://www.youtube.com/watch?v=t4K6lney7Zw
3. https://www.youtube.com/watch?v=VOaoabf3LPM

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BLOCKCHAIN AND APPLICATIONS
(Effective from the Academic Year 2023 - 2024)
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

COURSE OBJECTIVES:

- Explore the concepts of Blockchain, cryptography behind the blockchain
- Understanding the technology behind bitcoin, Ethereum, smart contract and Hyper ledger

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 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 , Hashfucntions, financial markets and	**8 Hours**

trading	
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, Etherium 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 Etherium : 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	Apply basic concepts of Blockchain and evaluate the benefits and limitation of Blockchain	CL3
CO2	Examine the decentralization concepts and apply thee cryptography techniques in Blockchain	CL3
CO3	Demonstrate the usage of Bitcoin and Alternative coin	CL3
CO4	Demonstrate Application development using Ethereum	CL3
CO5	Interpret the usage of Smart contract and Hyperledger	CL3

CO-PO-PSO MAPPING

CO	Programme Outcomes (PO)	Programme Specific

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

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

REFERENCE WEB LINKS AND VIDEO LECTURES (E - RESOURCES):

1. https://ethereum.org/en/
2. https://www.blockchain.com/explorer

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MANGALURU

COMPUTER VISION
(Effective from the Academic Year 2024 - 2025)
VI SEMESTER

Course Code	**IS62214IB**	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 Image Processing.

COURSE OBJECTIVES:

- To understand the fundamental concepts related to Image formation and processing.
- To learn feature detection, matching and detection
- To become familiar with feature based alignment and motion estimation.
- To develop skills on 3D reconstruction.
- To understand image based rendering and recognition

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 Image Formation and Processing: Computer Vision - Geometric primitives and transformations - Photometric image formation - The digital camera - Point operators - Linear filtering - More neighbourhood operators - Fourier transforms - Pyramids and wavelets - Geometric transformations - Global optimization.	**8 Hours**

MODULE - II

Feature Detection, Matching and Segmentation: Points and patches - Edges - Lines - Segmentation - Active contours - Split and merge - Mean shift and mode finding - Normalized cuts - Graph cuts and energy-based methods.	**8 Hours**
MODULE - III	
Feature Based Alignment and Motion Estimation: 2D and 3D feature-based alignment - Pose estimation - Geometric intrinsic calibration - Triangulation - Two-frame structure from motion - Factorization - Bundle adjustment - Constrained structure and motion - Translational alignment - Parametric motion - Spline-based motion - Optical flow - Layered motion.	**8 Hours**
MODULE - IV	
3D Reconstruction: Shape from X - Active range finding - Surface representations - Point-based representations- Volumetric representations - Model-based reconstruction - Recovering texture maps.	**8 Hours**
MODULE - V	
Image- Based Rendering and Recognition: View interpolation Layered depth images - Light fields and Lumigraphs - Environment mattes - Video-based rendering-Object detection - Face recognition - Instance recognition - Category recognition - Context and scene understanding- Recognition databases and test sets.	**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 understand basic knowledge, theories and methods in image processing and computer vision.	CL2
CO2	To implement basic and some advanced image processing techniques in Open CV.	CL3
CO3	To apply 2D a feature-based based image alignment, segmentation and motion estimations.	CL3
CO4	To apply 3D image reconstruction techniques.	CL3
CO5	To design and develop innovative image processing and computer vision applications.	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	1	1	1	1				2	1	3	2	2	1
CO2	3	3	3	2	3		1		2	1	2	2	3	1
CO3	3	3	2	2	3				1	1	2	2	3	2
CO4	2	3	3	2	3				2	1	2	3	2	2
CO5	2	3	3	2	2	2			3	1	2	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
	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. Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer- Texts in Computer Science, Second Edition, 2022.
2. Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education, Second Edition, 2015.
3. Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, March 2004.
4. Christopher M. Bishop; Pattern Recognition and Machine Learning, Springer, 2006.
5. E. R. Davies, Computer and Machine Vision, Fourth Edition, Academic Press, 2012.

REFERENCE WEB LINKS AND VIDEO LECTURES (E - RESOURCES):

1. https://opencv.org/opencv-free-course/
2. https:// docs.opencv.org

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CRYPTOGRAPHY AND NETWORK SECURITY
(Effective from the Academic Year 2023 – 2024)
VI SEMESTER

Course Code	**IS62214IC**	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 Cryptography Theories and Network security.

COURSE OBJECTIVES:

- This course is aimed at providing students with a practical and theoretical knowledge of cryptography and network security.
- To develop an understanding of different cryptographic protocols and techniques.
- To understand methods for authentication, access control, intrusion detection and prevention.

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 Network Security: Introduction - Need for Security, Security Approaches, Principles of Security, Security services, Types of Attacks – General View - Technical View, Programs that Attack, Specific Attacks.	**8 Hours**

MODULE - II

Basics of Cryptography and Encryption: Introduction to Cryptography, Plain Text and Cipher Text, Symmetric Cipher Model, Cryptography, Cryptanalysis, Brute Force Attacks,	**8 Hours**

Substitution Techniques - Caesar Cipher and Modified Caesar Cipher, Mono Alphabetic cipher, Poly-Alphabetic Cipher, Playfair Cipher, Transposition Techniques- Rail Fence technique, Simple Columnar transposition Technique.	
MODULE - III	
Block ciphers and Data encryption standards: Stream ciphers Block ciphers, Data Encryption Standard, a DES example, AES- structure, AES transformation functions.	**8 Hours**
MODULE - IV	
Public key cryptography and RSA: Principles of public key cryptosystems - public key cryptosystems - applications for public key cryptosystems, RSA algorithm - algorithm and example. **Cryptographic Data integrity algorithms** - Cryptographic Hash functions - applications, Message Authentication – Requirements and Functions.	**8 Hours**
MODULE - V	
Applications of network and internet security: Cloud computing- Data protection on the cloud, cloud security as a service, Web/Internet security protocols- HTTPS, SSL, SSH, Wireless network security, Mobile device security, Email Security-Pretty good privacy, S/MIME. **Legal and Ethical issues-** Introduction to Cybercrime & computer crime, Intellectual property, Privacy, Ethical issues.	**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 networks security, security architecture, threats and vulnerabilities	CL2
CO2	Apply the different cryptographic operations of symmetric cryptographic algorithms.	CL3
CO3	Apply the different cryptographic operations of public key cryptography	CL3
CO4	Apply the various Authentication schemes to simulate different applications.	CL3
CO5	Understand various Security practices and System security standards.	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	1	1	1	1				2	1	3	2	2	1
CO2	3	3	3	2	3		1		2	1	2	2	3	1
CO3	3	3	2	2	3				1	1	2	2	3	2
CO4	2	3	3	2	3				2	1	2	3	2	2
CO5	2	3	3	2	2	2			3	1	2	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
	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.AtulKahate, Cryptography and Network Security, 4th Edition,2019

2. William Stallings, Cryptography and Network Security: Principles and Practices, 7th Edition,2019.

1. Nina Godbole and SunitBelapure, Cyber Security, 1st Edition, 2019.

REFERENCE WEB LINKS AND VIDEO LECTURES (E - RESOURCES):

1. https://www.geeksforgeeks.org/cryptography-and-network-security-principles
2. https://www.codingninjas.com/studio/library/cryptography-and-network-security

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MANGALURU

SOFTWARE ARCHITECTURE AND DESIGN PATTERNS
(Effective from the Academic Year 2023 - 2024)
VI SEMESTER

Course Code	**CS62214CD**	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
- Fundamental Knowledge of Object-Oriented Programming Concepts
- Fundamental concepts of Software Engineering

COURSE OBJECTIVES:

- Learn and apply various modeling techniques used for the design of Object-Oriented systems
- Learn various UML diagrams used for the design of Object-Oriented systems
- Identify and apply various design patterns for building the structure of the Object-oriented systems
- Identify and apply various design patterns for specifying the behaviors of the components of an Object-oriented system
- Learn and apply the MVC architecture for building 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

Class Modeling: Advanced Object and Class Concepts, N-ary Associations, Aggregation,	**8 Hours**

Abstract Classes, Packages. **State Modeling:** Events, States, Transitions and Conditions, State Diagram, State Diagram Behaviors, Nested State Diagrams, Nested States, Concurrency **Interaction Modeling:** Use Case Models, Sequence models, Activity Models, Use-Case relationships, Procedural Sequence Model, Special Construct for Activity Models	
MODULE – II	
Analysing a System: Overview of Analysis Phase, Stage-1: Gathering Requirements, Functional Requirement Specification, Defining Conceptual Classes and Relationships, Design and Implementation **The Unified Modeling Language:** Communication Diagrams, Timing Diagrams, Activity Diagrams, Interaction overview Diagrams, Component Diagrams, Composite Structure Diagrams, Package Diagrams, Object Diagrams, Deployment Diagrams	**8 Hours**
MODULE - III	
Design Patterns: Design Pattern and its Description, Catalog of Design pattern, organizing the catalog, how design patterns solve design problems, Selecting Design Pattern, Using Design patterns. **Structural patterns:** Adapter, bridge, composite, decorator, facade, flyweight, proxy.	**8 Hours**
MODULE - IV	
Behavioral Patterns: Chain of Responsibility, Command, Interpreter, Iterator, Mediator, Memento, Observer, State, Template Method	**8 Hours**
MODULE – V	
Interactive systems and the MVC architecture: Introduction, The MVC architectural pattern, analyzing a simple drawing program, designing the system, designing of the subsystems, getting into implementation, implementing undo operation, drawing incomplete items, adding a new feature, pattern-based solutions.	**8 Hours**

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**

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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 R Blaha, James R Rumbaugh, "Object Oriented Modeling and Design with UML", 2nd Edition, 2005 (Twelfth Impression, 2012)
2. Brahma Dathan, Sarnath Ramnath, "Object Oriented Analysis, Design and Implementation: An Integrated Approach", Second Edition, Universities Press (India) Private Limited, 2010 (Reprinted 2018)
3. Erich Gamma, Richard Helm, "Design Patterns – Elements of Reusable Object-Oriented Software", Pearson Education, 2006 (Fifteenth Impression)
4. Craig Larman, "Applying UML and Patterns – An Introduction to Object Oriented Analysis & Design and the Unified Process", Second Edition.

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FUNDAMENTALS OF OPERATING SYSTEM
(Effective from the Academic Year 2023 - 2024)
VI SEMESTER

Course Code	**IS62225IA**	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 Unix and of operating system.

COURSE OBJECTIVES:

- Explain the fundamentals of operating system
- Comprehend multithreaded programming, process management, memory management and
- storage management.
- Familiar with various types of operating systems

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: What OS do, Computer system organization, architecture, structure, Operations, Process, memory and storage management, Protection and security, Distributed systems, Special purpose systems, computing environments. **System Structure:** OS Services, User OSI, System calls, Types of system calls, System programs, OS design and implementation, OS structure, Virtual machines, OS generation, system boot	**8 Hours**

MODULE - II

Process Concept: Overview, Process scheduling, Operations on process, IPC, Examples in IPC, Communication in client-server systems. Multithreaded Programming: Overview, Models, Libraries, Issues, OS Examples	**8 Hours**
MODULE - III	
Process Scheduling: Basic concept, Scheduling criteria, Algorithm, multiple processor scheduling, thread scheduling, OS Examples, Algorithm Evaluation. **Synchronization:** Background, the critical section problem, Petersons solution, Synchronization hardware, Semaphores, Classic problems of synchronization, Monitors, Synchronization examples, Atomic transactions	**8 Hours**
MODULE - IV	
Deadlocks: System model, Deadlock characterization, Method of handling deadlock, Deadlock prevention, Avoidance, Detection, Recovery from deadlock **Memory management strategies:** Background, swapping, contiguous memory allocation, paging, structure of page table, segmentation	**8 Hours**
MODULE - V	
Virtual Memory management: Background, Demand paging, Copy-on-write, Page replacement, allocation of frames, Trashing, Memory mapped files, Allocating Kernel memory, Operating system examples **File system:** File concept, Access methods, Directory structure, File system mounting, File sharing, protection	**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 fundamentals of operating system	CL2
CO2	Comprehend process management, memory management and storage management.	CL2
CO3	Familiar with various types of operating systems	CL2
CO4	Explore the concept of memory management, working of various page replacement algorithms and file system operations.	CL2
CO5	Analyze Disk Storage Structures and the concepts of OS 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
CO1	3	2	1	1	1	1	1	2	1	1		2	2	1
CO2	2	2	1	1	2	1		2	1	1		2	2	
CO3	2	2	1	1	1	1		2	1	1		2	1	
CO4	3	2	1	1	1	1		2	1	1		2	1	
CO5	2	2	1	1	1	1		2	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
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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 AssignmentSubmissions	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.

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

REFERENCE BOOKS:

1. A. Silberschatz, P B Galvin, G Gagne, Operating systems, 7th edition, John Wiley and sons.
2. William Stalling,"Operating Systems: Internals and Design Principles", Pearson Education, 1st Edition, 2018.
3. Andrew S Tanenbaum, Herbert BOS, "Modern Operating Systems", Pearson Education, 4th Edition, 2016

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INTRODUCTION TO JAVA PROGRAMMING
(Effective from the Academic Year 2023 - 2024)
VI SEMESTER

Course Code	**IS62225IB**	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 and Programming.

COURSE OBJECTIVES:

- To define the object-oriented concepts of Java.
- To illustrate the Java fundamentals using programming constructs.
- To understand the usage of Java classes, objects, and interfaces.
- To develop computer programs to solve real world problems in Java.

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

The Background: Java's Lineage, The Creation of Java, How Java Changed the Internet, Java's Magic: The Bytecode, The Java Buzzwords, The Evolution of Java, A Culture of Innovation. **Overview of Java:** Object-Oriented Programming, A First Simple Program, A Second Short Program, Two Control Statements, Using Blocks of Code, Lexical Issues, The Java Class	**8 Hours**

Libraries	
MODULE - II	
Data Types, Variables Java Is a Strongly Typed Language, Primitive Types, Integers, Floating-Point Types, Characters, Booleans, A Closer Look at Literals, Variables, Type Conversion and Casting, Automatic Type Promotion in Expressions. **Arrays, Strings**: One-dimensional Arrays, Multidimensional Arrays, A Few Words About Strings.	**8 Hours**
MODULE - III	
Java Operators and Control Statements: Arithmetic Operators, The Bitwise Operators, Relational Operators, Boolean Logical Operators, The Assignment Operator, The? Operator, Operator Precedence, Using Parentheses, **Control Statements**: Java's Selection Statements, Iteration Statements, and Jump Statements.	**8 Hours**
MODULE - IV	
Introducing Classes and Objects: Class Fundamentals, Declaring Objects, Assigning Object Reference Variables, Introducing Methods, Constructors, The this Keyword, Garbage Collection, The finalize() method. **Closer Look at Methods and Classes:** Overloading Methods, Using Objects as Parameters, A Closer Look at Argument Passing, Returning Objects, Recursion, Introducing Access Control, Understanding static, Introducing final, Arrays Revisited.	**8 Hours**
MODULE - V	
Inheritance: Inheritance, Using super, Creating a Multilevel Hierarchy, When Constructors Are Called, Method Overriding, Dynamic Method Dispatch, Using Abstract Classes, Using final with Inheritance, The Object Class. **Packages and Interfaces:** Packages, Access Protection, Importing Packages, Interfaces, Defining Interfaces, Implementing Interfaces, Nested Interfaces. **Exception Handling:** Exception-Handling Fundamentals, Exception Types, Uncaught Exceptions, Using try and catch, Multiple catch Clauses, Nested try Statements, throw, throws, finally.	**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 fundamentals of Object Oriented Programming and **Illustrate** the diverse Java programming constructs.	CL3
CO2	**Develop** the Java programming constructs to show the use of Java Data types, Variables, Arrays and Strings in Object Oriented Programming.	CL3

CO3	**Illustrate** the usage of Operators and Control Statements in developing Java programming applications.	CL3
CO4	**Apply** the concepts of classes and objects to find solutions for the real world situations.	CL3
CO5	**Demonstrate** how to achieve reusability using Inheritance, apply the concepts of Packages and Interfaces and examine the use of different Exception Handling mechanisms.	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
CO1	3	3	2	1				2				2		
CO2	3	3	2					2				2		
CO3	3	3	3					2				2		
CO4	3	3	3					2				2		
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. Herbert Schildt, Java The Complete Reference, 7th Edition, Tata McGraw Hill, 2007.
2. Cay S Horstmann, "Core Java - Vol. 1 Fundamentals", Pearson Education, 10th Edition, 2016.
3. Raoul-Gabriel Urma, Mario Fusco, Alan Mycroft, "Java 8 in Action", Dreamtech Press/Manning Press, 1st Edition, 2014.

REFERENCE WEB LINKS AND VIDEO LECTURES (E - RESOURCES):

1. https://www.youtube.com/watch?v=GoXwIVyNvX0
2. https://www.youtube.com/watch?v=mG4NLNZ37y4

SAHYADRI
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MANGALURU

INTRODUCTION TO HIGH PERFORMANCE COMPUTING
(Effective from the Academic Year 2022 - 2023)
VI SEMESTER

Course Code	**IS62225IC**	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 Computer Organization and Architecture

COURSE OBJECTIVES:

- Introduce the design, analysis, and implementation, of high performance computational science and engineering applications.
- Illustrate on advanced computer architectures, parallel algorithms, parallel languages, and performance-oriented computing

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 Parallel Computing: Motivating Parallelism, Scope of Parallel Computing. **Parallel Programming Platforms:** Implicit Parallelism: Trends in Microprocessor Architectures, Limitations of Memory System Performance, Dichotomy of Parallel Computing Platforms, Physical Organization of Parallel Platforms, Communication Costs in Parallel Machines, Routing Mechanisms for Interconnection Networks, Impact of Process-Processor	**8 Hours**

Mapping and Mapping Techniques.	
MODULE - II	
Principles of Parallel Algorithm Design: Preliminaries, Decomposition Techniques, Characteristics of Tasks and Interactions, Mapping Techniques for Load Balancing, Methods for Containing Interaction Overheads, Parallel Algorithm Models. **Basic Communication Operations:** One-to-All Broadcast and All-to-One Reduction, All-to-All Broadcast and Reduction, All-Reduce and Prefix-Sum Operations, Scatter and Gather, All-to-All Personalized Communication, Circular Shift, Improving the Speed of Some Communication Operations	**8 Hours**
MODULE - III	
Analytical Modeling of Parallel Programs: Sources of Overhead in Parallel Programs, Performance Metrics for Parallel Systems, The Effect of Granularity on Performance, Scalability of Parallel Systems. Minimum Execution Time and Minimum Cost-Optimal Execution Time, Asymptotic Analysis of Parallel Programs Section 5.7. Other Scalability Metrics, **Programming Using the Message-Passing Paradigm:** Principles of Message-Passing Programming, The Building Blocks: Send and Receive Operations, MPI: The Message Passing Interface, Topologies and Embedding, Overlapping Communication with Computation, Collective Communication and Computation Operations, Groups and Communicators	**8 Hours**
MODULE - IV	
Programming Shared Address Space Platforms: Thread Basics, Why Threads? The POSIX Thread API, Thread Basics: Creation and Termination, Synchronization Primitives in Pthreads, Controlling Thread and Synchronization Attributes, Thread Cancellation, 08 Composite Synchronization Constructs, Tips for Designing Asynchronous Programs, **OpenMP:** A Standard for Directive Based Parallel Programming **Dense Matrix Algorithms:** Matrix-Vector Multiplication, Matrix-Matrix Multiplication, Solving a System of Linear Equations **Sorting:** Issues in Sorting on Parallel Computers, Sorting Networks, Bubble Sort and its Variants, Quicksort, Bucket and Sample Sort.	**8 Hours**
MODULE - V	
Graph Algorithms: Definitions and Representation, Minimum Spanning Tree: Prim's Algorithm, Single-Source Shortest Paths: Dijkstra's Algorithm, All-Pairs Shortest Paths, Transitive Closure, Connected Components, Algorithms for Sparse Graphs, **Search Algorithms for Discrete Optimization Problems:** Definitions and Examples, Sequential Search Algorithms, Search Overhead Factor, Parallel Depth-First Search, Parallel Best-First Search, Speedup, Anomalies in Parallel Search Algorithms	**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 the concepts of parallel computing to address and resolve computational problems that require parallelism.	CL3
CO2	Use decomposition techniques and basic communication operations to develop efficient parallel algorithms.	CL3
CO3	Illustrate the performance metrics and scalability factors to optimize the execution of parallel programs.	CL3
CO4	Apply parallel programs using threading and synchronization constructs, including POSIX Threads and OpenMP.	CL3
CO5	Execute parallel algorithms to solve graph-related problems and assess their performance in terms of efficiency and scalability.	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**
CO1	3	3	2	1				2				2		
CO2	3	3	2					2				2		
CO3	3	3	3					2				2		
CO4	3	3	3					2				2		
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)**

Continuous Internal Evaluation (CIE) (60%)			Assignment/ Activities (40%)	(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. Introduction to Parallel Computing, AnanthGrama, Anshul Gupta, George Karypis, and Vipin

Kumar, 2nd edition, Addison-Welsey, 2003.

2. Grama, A. Gupta, G. Karypis, V. Kumar, An Introduction to Parallel Computing, Design and Analysis of Algorithms: 2/e, Addison-Wesley, 2003.
3. G.E. Karniadakis, R.M. Kirby II, Parallel Scientific Computing in C++ and MPI: A Seamless Approach to Parallel Algorithms and their Implementation, Cambridge University Press,2003.
4. Wilkinson and M. Allen, Parallel Programming: Techniques and Applications Using Networked Workstations and Parallel Computers, 2/E, Prentice Hall, 2005.
5. M.J. Quinn, Parallel Programming in C with MPI and OpenMP, McGraw-Hill, 2004.
6. G.S. Almasi and A. Gottlieb, Highly Parallel Computing, 2/E, Addison-Wesley, 1994.
7. David Culler Jaswinder Pal Singh,"Parallel Computer Architecture: A hardware/Software Approach", Morgan Kaufmann, 1999.
8. Kai Hwang, "Scalable Parallel Computing", McGraw Hill 1998.

REFERENCE WEB LINKS AND VIDEO LECTURES (E - RESOURCES):

1. https://www.youtube.com/watch?v=GoXwIVyNvX0
2. https://www.youtube.com/watch?v=mG4NLNZ37y4

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INTRODUCTION TO DATA SCIENCE
(Effective from the Academic Year 2023 - 2024)
VI SEMESTER

Course Code	**IS62225ID**	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	3:0:2:0	SEE Marks	50
Total Hours of Pedagogy	**40L**	Exam Hours	03

CREDITS –

COURSE PREREQUISITES:

- Fundamental knowledge of mathematical concepts, analytical skills and programming.

COURSE OBJECTIVES:

- Develop relevant programming abilities.
- Demonstrate proficiency with statistical analysis of data.
- Develop the ability to build and assess data-based models.
- Learn to execute statistical analyses.

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: The Ascendance of Data, What Is Data Science? , Visualizing Data, matplotlib, Bar Charts, Line Charts, Scatterplots, Statistics, Describing a Single Set of Data, Correlation, Simpson's Paradox, Dependence and Independence, Conditional Probability, Bayes's Theorem, Random Variables, Continuous Distributions, The Normal Distribution, The Central Limit	**8 Hours**

Theorem.	
MODULE - II	
Working with data: Getting Data, stdin and stdout, Reading Files, Scraping the Web, Using APIs, Exploring the Data, Using NamedTuples, Dataclasses, Cleaning and Munging, Manipulating Data, Rescaling, An Aside: tqdm, Dimensionality Reduction. The Curse of Dimensionality, PCA	**8 Hours**
MODULE - III	
Training: Gradient Descent, The Idea Behind Gradient Descent, Estimating the Gradient, Batch Gradient Descent, Stochastic Gradient Descent, Mini-batch Gradient Descent, Linear Regression, Multiple Regression.	**8 Hours**
MODULE - IV	
Machine Learning and Deep Learning: Machine Learning, Modeling, What Is Machine Learning, Overfitting and Underfitting, Correctness, The Bias-Variance Tradeoff, Feature Extraction and Selection, Neural Networks, Perceptrons, Feed-Forward Neural Networks, Backpropagation	**8 Hours**
MODULE – V	
Network Analysis, Recommender System and MapReduce: Betweenness Centrality, Eigenvector Centrality, Directed Graphs and PageRank, Recommender Systems, Manual Curation, Recommending What's Popular, User-Based Collaborative Filtering, Item-Based Collaborative Filtering, MapReduce, Why MapReduce, MapReduce more generally.	**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 and demonstrate data using visualization tools and apply statistical analysis methods, to analyze and interpret data effectively in various real-world contexts.	CL3
CO2	Apply techniques for data acquisition, exploring and preparing data, dimensionality reduction, to reduce dataset complexity while preserving key information.	CL3
CO3	Apply gradient descent optimization techniques, to train linear regression, polynomial regression and logistic regression effectively.	CL3
CO4	Demonstrate the use of machine learning and deep learning models to implement	CL3

	efficient data-driven solutions for real-world problems.	
CO5	Demonstrate knowledge about the recommender system, MapReduce and understand the importance of data ethics.	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
CO1	3	3	3	2	3						2	2	3	2
CO2	3	3	3	2	3						2	2	3	2
CO3	3	3	3	2	3						2	2	3	2
CO4	3	3	3	2	3						2	2	3	2
CO5	3	3	3	2	3						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
	Practical Session (Laboratory Component)	40 %	20
2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT DETAILS

Continuous Internal Assessment (CIA) (50%)				
Continuous Internal Evaluation (CIE) (60%)			Practical Sessions (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:

- 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. Joel Grus, Data Science from Scratch-First Principles with Python, O' Reilly Publications, 2nd Edition, 2019, ISBN: 978-9352138326.
2. Emily Robinson, Jacqueline Nolis, Build a Career in Data Science, Manning Publications, 1st Edition, 2020, ISBN: 9781638350156.
3. Aurelien Geron, Hands-on Machine Learning with Scikit-Learn & TensorFlow, O'Reilly Media Publications, 3rd Edition, 2022, ISBN: 978-93-5542-198-2.

REFERENCE WEB LINKS AND VIDEO LECTURES (E - RESOURCES):

1. https://onlinecourses.nptel.ac.in/noc21_cs69
2. https://onlinecourses.nptel.ac.in/noc22_cs32

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ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING LABORATORY
(Effective from the Academic Year 2023 - 2024)
VI SEMESTER

Course Code	**IS622L71**	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 Python programming and mathematics concepts like probability.

Description

1. The programs can be implemented in either JAVA or Python.
2. Data sets can be taken from standard repositories

COURSE OBJECTIVES:

- To Learn basic concepts of Python through illustrative examples and small exercises
- To prepare students to become Familiarity with the Python programming in AI environment.
- To train Students with python programming as to comprehend, analyze, design and create AI platforms and solutions for the real-life 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
- 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	CO No.

1	Write a program to implement Tic-Tac-Toe game.	CO1
2	Write a program to implement A* Search Algorithm.	CO1
3	Implement and demonstrate the FIND-S Algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.	CO2
4	For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.	CO2
5	Write a program to 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. Built-in Java classes/API can be used to write the program.	CO3
6	Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.	CO3
7	Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.	CO4
8	Demonstrate the working of SVM classifier for a suitable dataset.	CO4
9	Write a program to implement k-Nearest Neighbor algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.	CO5
10	Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.	CO5

COURSE OUTCOMES

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

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Implement and demonstrate artificial intelligence algorithms problem-solving skills.	CL3
CO2	Apply FIND-S and Candidate-Elimination for hypothesis generation and refinement using real-world datasets.	CL3

CO3	Demonstrate proficiency in implementing Decision Tree-based ID3 and Artificial Neural Networks using backpropagation for classification tasks.	CL3
CO4	Demonstrate the implementation of Naïve Bayesian Classifier and Support Vector Machine (SVM) to evaluate, and interpret classification models through performance metrics analysis.	CL3
CO5	Implement and evaluate non-parametric machine learning algorithms such as k-Nearest Neighbor and Locally Weighted Regression to visualize and interpret model performance.	CL3

CO-PO-PSO MAPPING

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

REFERENCE WEB LINKS AND VIDEO LECTURES (E – RESOURCES):

1. https://www.edureka.co/blog/artificial-intelligence-with-python/
2. https://www.youtube.com/watch?v=c8W7dRPdIPE
3. https://www.youtube.com/watch?v=YcETNp4ea-Y

SAHYADRI
COLLEGE OF ENGINEERING & MANAGEMENT
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MANGALURU

MongoDB
(Effective from the Academic Year 2023 - 2024)
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	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
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	1
CO4	3	2	3		2						1	1	1	1
CO5	3	2	3		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**
	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.

REFERENCE WEB LINKS AND VIDEO LECTURES (E – RESOURCES):

1. https://www.youtube.com/watch?v=8eJJe4Slnik&ab_channel=Simplilearn
2. https://www.youtube.com/watch?v=ExcRbA7fy_A
3. https://www.youtube.com/watch?app=desktop&v=Www6cTUymCY&ab_channel=Amigoscode
4. https://www.mongodb.com/docs/manual/tutorial/

SAHYADRI
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GAME DEVELOPMENT
(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	02

CREDITS – 1

COURSE PREREQUISITES:

- Basic Knowledge of Mathematics and programming skills.

COURSE OBJECTIVES:

- 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, Unreal Engine, familiarization of the GUI. Conceptualize the theme for a 2D game.
2	Character design, sprites, movement and character control.
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 of menus and user interaction in mobile platforms.
8	Developing a 3D Game using Unreal
9	Developing a Multiplayer game using unity.

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**
CO1	3	2	3		2							1	1	1
CO2	3	2	3		2							1	1	1
CO3	3	2	3		2							1	1	1
CO4	3	2	3		2							1	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:

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 WEB LINKS AND VIDEO LECTURES (E – RESOURCES):

1. https://getstream.io/blog/unreal-unity-engine/
2. https://logicsimplified.com/newgames/unity3d-vs-unreal-engine-which-game-engine-is-the-best-fit-for-your-game/

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CISCO PACKET TRACER
(Effective from the Academic Year 2023 - 2024)
VI SEMESTER

Course Code	**IS62298IC**	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 Mathematics and Embedded Systems.

COURSE OBJECTIVES:

- To conduct experiments to assess the performance of various LAN configurations and protocols employing Cisco Packet Tracer to analyse network behaviour.
- To design and construct VLANs, configuring switches and PCs to enable communication within a VLAN.
- To create and configure inter VLAN routing solutions to facilitate communication between devices in different VLANs
- To set up and configure wireless LANs including access points and wireless devices.
- To remotely access and manage routers using TELNET and SSH protocols, ensuring secure and efficient network administrative practices.

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	To analyze the performance of various configurations and protocols in LAN
2	To construct a VLAN and make the PC's communicate among a VLAN
3	To construct a Inter - VLAN and make the PC's communicate among a VLAN
4	To construct a Wireless LAN and make the PC's communicate wirelessly
5	To construct simple LAN and understand the concept and operation of Address Resolution Protocol (ARP)
6	To understand the concept and operation of Routing Information Protocol (RIP)
7	To construct multiple router networks and understand the operation of OSPF Protocol
8	To construct multiple router networks and understand the operation of EIGRP Protocol
9	To understand the operation of TELNET by accessing the router in server room from a PC in IT office.
10	To understand the operation of SSH by accessing the routers remotely by PCs

COURSE OUTCOMES

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

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Apply knowledge of various LAN configurations and protocols to analyse network performance using cisco packet tracer.	CL3
CO2	Design and implement VLANS and configure switches to enable communication among devices within a VLAN.	CL3
CO3	Implement inter VLAN routing solutions to enable communication among devices in different VLANs	CL3
CO4	Configure wireless LANs including access points and wireless devices, facilitating wireless communication between devices.	CL3
CO5	Apply understanding of OSPF and EIGRP protocols to construct and manage multiple router 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

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.

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JULIA
(Effective from the Academic Year 2023 - 2024)
VI SEMESTER

Course Code	**IS62298I**	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

COURSE PREREQUISITES:

- Knowledge of Python/Java/R

COURSE OBJECTIVES:

- To introduce the basics of Julia programming language
- To illustrate the data structures of Julia programming language
- To make use of built-in functions and packages

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. Develop a Julia program to simulate a calculator (for integer and real numbers). b. Develop a Julia program to add, subtract, multiply and divide complex numbers. c. Develop a Julia program to evaluate expressions having mixed data types (integer, real, floating-point number and complex).
2	a. Develop a Julia program for the following problem: A computer repair shop charges $100 per hour for labour plus the cost of any parts used in the repair. However, the minimum charge for any job is $150. Prompt for the number of hours worked and the cost of parts

	(which could be $0) and print the charge for the job. b. Develop a Julia program to calculate a person's regular pay, overtime pay and gross pay based on the following: If hours worked is less than or equal to 40, regular pay is calculated by multiplying hours worked by rate of pay, and overtime pay is 0. If hours worked is greater than 40, regular pay is calculated by multiplying 40 by the rate of pay, and overtime pay is calculated by multiplying the hours in excess of 40 by the rate of pay by 1.5. Gross pay is calculated by adding regular pay and overtime pay.
3	a. An amount of money P (for principal) is put into an account which earns interest at r% per annum. So, at the end of one year, the amount becomes P + P×r/100. This becomes the principal for the next year. Develop a Julia program to print the amount at the end of each year for the next 10 years. However, if the amount ever exceeds 2P, stop any further printing. Your program should prompt for the values of P and r. b. Develop a Julia program which reads numbers from a file (input.txt) and finds the largest number, smallest number, count, sum and average of numbers.
4	a. Develop a Julia program and two separate functions to calculate GCD and LCM. b. Develop a Julia program and a recursive function to calculate factorial of a number. Develop a Julia program and a recursive function to generate Fibonacci series.
5	a. Develop a Julia program which reads a string (word) and prints whether the word is palindrome. b. Develop a Julia program which reads and prints the words present in a file (input.txt) having Random Data in which words are dispersed randomly (Assumption: a word is a contiguous sequence of letters. A word is delimited by any non-letter character or end-of-line).
6	a. Develop a Julia program to determine and print the frequency with which each letter of the alphabet is used in a given line of text. b. A survey of 10 pop artists is made. Each person votes for an artist by specifying the number of the artist (a value from 1 to 10). Develop a Julia program to read the names of the artists, followed by the votes, and find out which artist is the most popular.
7	a. Given a line of text as input, develop a Julia program to determine the frequency with which each letter of the alphabet is used (make use of dictionary) b. Develop a Julia program to fetch words from a file with arbitrary punctuation and keep track of all the different words found (make use of set and ignore the case of the letters: e.g. to and To are treated as the same word).
8	a. Develop a Julia program to evaluate expressions consisting of rational, irrational number and floating- point numbers) b. Develop a Julia program to determine the following properties of a matrix: determinant,

	inverse, rank, upper & lower triangular matrix, diagonal elements, Euclidean norm and Square Root of a Matrix.
9	a. Develop a Julia program to determine addition and subtraction of two matrices (element -wise). b. Develop a Julia program to perform multiplication operation on matrices: scalar multiplication, element-wise multiplication, dot product, cross product.
10	a. Develop a Julia program to generate a plot of (solid & dotted) a function: $y=x^2$ (use suitable data points for x). b. Develop a Julia program to generate a plot of mathematical equation: y = sin(x) + sin(2x). c. Develop a Julia program to generate multiple plots of mathematical equations: y = sin(x) + sin(2x) and y = sin(2x) + sin(3x).

COURSE OUTCOMES

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

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Apply concepts of data-types, selection and looping constructs of Julia programming language.	CL3
CO2	Demonstrate the use of strings, functions, arrays and matrix operations in solving problems.	CL3
CO3	Develop programs involving data structures to handle multi-valued data items.	CL3
CO4	Make use of packages to generate plots of mathematical functions and equations.	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**
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:

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

Continuous Internal Evaluation (CIE):

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

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

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

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

SEE QUESTION PAPER PATTERN:

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

General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)

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

The minimum duration of SEE is 02 hours

REFERENCE WEB LINKS AND VIDEO LECTURES (E – RESOURCES):

1. https://doi.org/10.1007/978-3-030-73936-2, 2021.
2: https://doi.org/10.1007/978-1-4842-3171-5, 2017.

CLOUD COMPUTING , SECURITY AND PRIVACY
(Effective from the Academic Year 2023 - 2024)
VII SEMESTER

Course Code	**IS722I1I**	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:

- Fundamental knowledge of databases, Operating Systems and Networking

Course Objectives:

This course will enable students to:

- Discuss the concepts, characteristics, delivery models and benefits of cloud computing.
- Explore the key technical, organisational and compliance challenges of cloud computing.
- Explore the security issues that arise from cloud computing architectures intended for delivering Cloud based enterprise IT services.

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: The Evolution of Cloud Computing; **What Is Cloud Computing?:** Cloud Computing Defined, The SPI Framework for Cloud Computing, The Traditional Software Model, The Cloud Services Delivery Model, Cloud Deployment Models, Key Drivers to Adopting the Cloud, The Impact of Cloud Computing on Users, Governance in the Cloud, Barriers to Cloud Computing Adoption in the Enterprise.	**8 Hours**

MODULE - II

Infrastructure Security: Infrastructure Security: The Network Level, Infrastructure Security: The Host Level, Infrastructure Security: The Application Level. **Data Security and Storage:** Aspects of Data Security, Data Security Mitigation, Provider Data	**8 Hours**

and Its Security.	
MODULE - III	
Identity and Access Management: Trust Boundaries and IAM, Why IAM?, IAM Challenges, IAM Definitions, IAM Architecture and Practice, Relevant IAM Standards and Protocols for Cloud Services, IAM Standards, Protocols, and Specifications for Consumers, Comparison of Enterprise and Consumer Authentication Standards and Protocols, IAM Practices in the Cloud, Cloud Authorization Management, Cloud Service Provider IAM Practice	**8 Hours**
MODULE - IV	
Security Management in the Cloud: Introduction, Security Management Standards, Security Management in the Cloud, Availability Management, SaaS Availability Management, PaaS Availability Management, IaaS Availability Management, Access Control, Security Vulnerability, Patch, and Configuration Management.	**8 Hours**
MODULE - V	
Privacy: What Is Privacy?, What Is the Data Life Cycle?, What Are the Key Privacy Concerns in the Cloud?, Who Is Responsible for Protecting Privacy? Changes to Privacy Risk Management and Compliance in Relation to Cloud Computing, Legal and Regulatory Implications, U.S. Laws and Regulations, International Laws and Regulations. **Audit and Compliance:** Internal Policy Compliance, Governance, Risk, and Compliance (GRC), Illustrative Control Objectives for Cloud Computing, Incremental CSP-Specific Control Objectives, Additional Key Management Control Objectives, Control Considerations for CSP Users, Regulatory/External Compliance, Other Requirements, Cloud Security Alliance, Auditing the Cloud for Compliance.	**8 Hours**

LABORATORY COMPONENTS

Exp. No.	Experiment Description	CO No.	Bloom's Taxonomy Level
1.	Create a simple web application that gets a token from KMS or Keycloak (open source). The token exchange should be enabled by cacerts verification. The token should be valid for a session only and set expiration timer. Validate by trying to access the application. **Cloud Security Feature:** Web application security on Cloud using Tokens and Oauth **Expected Outcome:** When session closed or token expired, user should get invalid token or permissions error.	CO2	CL3
2.	Develop a small Java client server application that sends messages and receives acknowledgement. Encrypt the message using AECS or equivalent mechanism. Decrypt at the	CO2	CL3

	server and provide appropriate response. Validate by sending non-encrypted messages. **Cloud Security Feature:** Secure messaging over Cloud **Expected Outcome:** Only encrypted messages should be processed.		
3.	Create a public cloud account (AWS/Azure/GCP) with free trial credit. Create IAM roles; define policies for admin, developers, customer and maintainer. Create users for each role and validate if users access are within defined limits. **(Optional:** Write a Java program to access AWS service) **Cloud Security Feature:** Authentication and Authorization **Expected Outcome:** Only admin should have complete access. Other users should have limited accesses.	CO3	CL3
4.	On the VPC and VM created in experiment #2, deploy a "Hello World" Java web application. Control the application by creating a load balancer and API gateway or service registry. Define rules to limit access to few users. Validate the rules are working, by trying to access the webpage. **Cloud Security Feature:** Cloud application access **Expected Outcome:** Application should be working for only users with access. Others should get access denied.	CO3	CL3
5.	Create a VPC, create a small VM, provision disk storage, and store a file in the storage. Define VPC rules, security groups for VM, access controls for storage Validate the defined security controls by creating different users. **Cloud Security Feature:** Cloud infrastructure access control **Expected Outcome:** Only admin and users with particular access should be able to connect to the VM, get file on disk. Other users should be denied.	CO4	CL3

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 concept of cloud computing and discuss the types of services offered through cloud computing.	CL2
CO2	Describe the IT infrastructure security capabilities offered by the cloud services. Also identify the current state of data security and the data storage in the cloud.	CL3
CO3	Explain the identity and access management (IAM) practice and make use of capabilities for Authentication, authorization, and auditing of users who access cloud services.	CL3
CO4	Identify the security management frameworks and the standards that are relevant for the Cloud.	CL3

CO5	Outline the privacy aspects to consider within the context of cloud computing and illustrate the importance of audit and compliance functions within the cloud.	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
CO1	3	3	2	2								2	2	2
CO2	3	3	2	2	3							2	3	3
CO3	3	3	3	2	3						2	2	3	2
CO4	3	3	3	2	3						2	2	3	3
CO5	3	3	3	2							2	2	3	3

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.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment**	**100 %**	**50**
	Continuous Internal Evaluation	60 %	30
	Assignments	40 %	20
2	**Semester End Examination**	**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%
M I			M I	M I
M II			M II	M II
	M III		M III	M III
	M IV	M IV	M IV	M IV
		M V	M V	M V

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. Tim Mather, Subra Kumaraswamy, Shahed Latif: "Cloud Security and Privacy, An Enterprise Perspective on Risks and Compliance", Oreilly Media, 2009.
2. Vic (J.R.) Winkler: "Securing the Cloud, Cloud Computer Security Techniques and Tactics", Syngress, 2011

Reference Web Links And Video Lectures (E-Resources):

1. https://www.digimat.in/nptel/courses/video/106105167/L01.html
2. https://www.youtube.com/watch?v=44IBhZwa4ZM
3. https://www.digimat.in/nptel/courses/video/106104182/L01.html

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SOFTWARE TESTING
(Effective from the Academic Year 2023 - 2024)
VII SEMESTER

Course Code	**IS722T2I**	CIA Marks	40
Number of Contact Hours/Week (L: T: P: S)	3:2:0	SEE Marks	60
Total Hours of Pedagogy	**50**	Exam Hours	03

CREDITS – 4

COURSE PREREQUISITES:

- Software engineering and C language

Course Objectives:

This course will enable students to:

- Differentiate the various testing techniques
- Analyze the problem and derive suitable test cases.
- Apply suitable technique for designing of flow graph
- Learn about automation testing and when to automate the application

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

BASICS OF SOFTWARE TESTING: Basic definitions, Software Quality , Requirements, Behavior and Correctness, Correctness versus Reliability, Testing and Debugging, Test cases, Insights from a Venn diagram, Identifying test cases, Test-generation Strategies, Test Metrics, Error and fault taxonomies , Levels of testing, Testing and Verification, Static Testing. **PROBLEM STATEMENTS**: Generalized pseudocode, the triangle problem, the NextDate function, the commission problem, the SATM (Simple Automatic Teller Machine) problem, the currency converter, Saturn windshield wiper.	**8 Hours**

MODULE - II

FUNCTIONAL TESTING: Boundary value analysis, Robustness testing, Worst-case testing, Robust Worst testing for triangle problem, NextDate problem and commission problem, Equivalence classes, Equivalence test cases for the triangle problem, NextDate function, and the commission problem, Guidelines and observations, Decision tables, Test cases for the triangle problem, NextDate function, and the commission problem, Guidelines and observations. FAULT BASED TESTING: Overview, Assumptions in fault based testing, Mutation analysis, Fault-based adequacy criteria, Variations on mutation analysis.	**8 Hours**
MODULE - III	
STRUCTURAL TESTING: Overview, Statement testing, Programme testing, Condition testing, Path testing: DD paths, Test coverage metrics, Basis path testing, guidelines and observations, Data –Flow testing: Definition-Use testing, Slice-based testing, Guidelines and observations. TEST EXECUTION: Overview of test execution, from test case specification to test cases, Scaffolding, Generic versus specific scaffolding, Test oracles, Self-checks as oracles, Capture and replay.	**8 Hours**
MODULE - IV	
AUTOMATION TESTING: From Manual to Automation testing: First attempt record and playback, Getting the most out of test automation, Difference between Manual and automated test, Exploratory testing. **Variety of tools**: Classification of tools, IDEs and Programming language, unit testing frameworks, BDD-style Frameworks, SUT interaction technologies.	**8 Hours**
MODULE - V	
Introduction to Web drivers: First Steps, What is WebDriver? How WebDriver works? The history of Selenium, The tools you need to get started. **Locating elements on a page**: Locating one or more elements based on ID, class, or name, Fine-grained targeting using complex CSS selectors, Making pages amenable to element locating.	**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 concepts of testing and apply to derive different test cases	CL2
CO2	Analyze and compare the different testing techniques	CL2
CO3	Apply the appropriate testing techniques in classifying the problem	CL3
CO4	Analyze the different approach in software test automation problems and solutions.	CL3
CO5	Evaluate the techniques and skills on how to use modern software testing tools to support software testing projects.	CL5

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			2							3	2	3
CO2	3	2			2							3	2	3
CO3	3	2			2							3	2	3
CO4	3	2			2							3	2	3
CO5	3	2			2							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 BOOKS:

1. Paul C. Jorgensen: Software Testing, A Craftsman's Approach, 3rd Edition, Auerbach Publications, 2008. (Listed topics only from Chapters 1, 2, 5, 6, 7, 9, 10, 12, 13)
2. Mauro Pezze, Michal Young: Software Testing and Analysis – Process, Principles and Techniques, Wiley India, 2009. (Listed topics only from Chapters 3, 4, 16, 17, 20,21, 22,24)
3. Aditya P Mathur: Foundations of Software Testing, Pearson Education, 2008.(Listed topics only from Section 1.2 , 1.3, 1.4 ,1.5, 1.8,1.12,6. 2.1,6. 2.4)
4. Complete guide to test automation ,Techniques, Practices, and Patterns for Building and Maintaining Effective Software Projects Arnon Axelrod,2018.
5. Selenium Web driver from foundations to framework , Yujun Liang and Alex Collins,2016

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ROBOTIC PROCESS AUTOMATION
(Effective from the Academic Year 2023 - 2024)
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	**40 L + 20 S**	Exam Hours	03

CREDITS – 3

Prerequisites:

- Fundamental knowledge of any programming language

Course Objectives:

This course will enable students to:

- To understand basic concepts of RPA.
- To Describe RPA, where it can be applied and how its implemented
- To Describe the different types of variables, Control Flow and data manipulation techniques
- To Understand Image, Text and Data Tables Automation
- To Describe various types of Exceptions and strategies to handle

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**
RPA Foundations: What is RPA – Flavors of RPA- History of RPA- 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-	**8 Hours**

Agile, Scrum, Kanban and Waterfall, DevOps- Flowcharts.	
MODULE - 2	
RPA Platforms: 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 Ui Explorer- 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	Discuss various Components of Robotic Process Automation and understand the management of process, memory and storage. Also discuss various types of RPA tools, operations on processes and the communication pattern between two processes.	CL2
CO2	Explain the concept of Activities involved in project Automation and discuss various Advanced concepts of RPA	CL2

CO3	Describe the various RPA packages, its characteristics and its applications in process Automation	CL2
CO4	Discuss the role of process automation in building interactive user interface and handling various file types	CL2
CO5	Explain the various phases of E-mail automation technique and use various tools for debugging and Exception Handling.	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**
CO1	**3**	**3**											**2**	
CO2	**3**	**3**											**2**	
CO3	**3**	**2**	**2**										**2**	
CO4	**3**	**2**	**2**										**2**	
CO5	**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	MI			MI	MI
CO2	MII	MII		MII	MII
CO3		MIII		MIII	MIII
CO4			MIV	MIV	MIV
CO4			MV	MV	MV

Assessment Strategy:

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

Sl.	**Assessment Description**	**Weightage (%)**	**Max. Marks**

No.			
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. 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, Iieidi Jaynes,Lauren Livingston,"lntroduction to Robotic Process Automation: a Primer", Institute of Robotic Process Automation.
4. Richard Murdoch, I{obotic 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.

Reference Web Links and Video Lectures (e - Resources):

1. https://www.uipath.com/
2. https://www.uipath.com/rpa/robotic-process-automation

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DATA VISUALIZATION USING PYTHON
(Effective from the Academic Year 2023 - 2024)
VII SEMESTER

Course Code	**IS72213IB**	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:

- To understand the essential acquisition techniques
- To analyze and visualize data
- To gain hands-on experience of using software tools for 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

The Importance of Data Visualization and Data Exploration Introduction: Data Visualization, Importance of Data Visualization, Data Wrangling, Tools and Libraries for Visualization **Overview of Statistics:** Measures of Central Tendency, Measures of Dispersion, Correlation, Types od Data, Summary Statistics **Numpy**: Numpy Operations - Indexing, Slicing, Splitting, Iterating, Filtering, Sorting, Combining, and Reshaping **Pandas:** Advantages of pandas over numpy, Disadvantages of pandas, Pandas operation - Indexing, Slicing, Iterating, Filtering, Sorting and Reshaping using Pandas	**8 Hours**

MODULE - II

Plots Comparison Plots: Line Chart, Bar Chart and Radar Chart; Relation Plots: Scatter Plot, Bubble Plot , Correlogram and Heatmap; Composition Plots: Pie Chart, Stacked Bar Chart, Stacked Area Chart, Venn Diagram; Distribution Plots: Histogram, Density Plot, Box Plot, Violin Plot; Geo Plots: Dot Map, Choropleth Map, Connection Map; What Makes a Good Visualization? **A Deep Dive into Matplotlib:** Introduction, Overview of Plots in Matplotlib, Pyplot Basics: Creating Figures, Closing Figures, Format Strings, Plotting, Plotting Using pandas DataFrames, Displaying Figures, Saving Figures; Basic Text and Legend Functions: Labels, Titles, Text, Annotations, Legends; Basic Plots:Bar Chart, Pie Chart, Stacked Bar Chart, Stacked Area Chart, Histogram, Box Plot, Scatter Plot, Bubble Plot; **Layouts:** Subplots, Tight Layout, Radar Charts, GridSpec; Images: Basic Image Operations, Writing Mathematical Expressions	**8 Hours**
MODULE - III	
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, Diverging Color Palettes; Interesting Plots in Seaborn: Bar Plots, Kernel 10 JBoS 31.05.2021 EC 2.2.1., Dated: 29.06.2021 Density Estimation, Plotting Bivariate Distributions, Visualizing Pairwise Relationships, Violin Plots;	**8 Hours**
MODULE - IV	
Plotting Geospatial Data Introduction, Geoplotlib, The Design Principles of Geoplotlib, Geospatial Visualizations, Tile Providers, Custom Layers, Introduction to Folium **Visualizing Data**: Building a Google map from geocoded data, Visualizing networks and interconnection and Visualizing mail data	**8 Hours**
MODULE - V	
Making Things Interactive with Bokeh Introduction, Bokeh, Concepts of Bokeh, Interfaces in Bokeh, Output, Bokeh Server, Presentation, Integrating, Adding Widgets **Networked Programs** HyperText Transfer Protocol – HTTP, The World‟s Simplest Web Browser, Retrieving an image over HTTP, Retrieving web pages with urllib, Parsing HTML and scraping the web, Parsing HTML using regular expressions, Parsing HTML using BeautifulSoup, Reading binary files using urllib	**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 use various plot types with Python	CL3
CO2	Explore and work with different plotting libraries	CL3
CO3	Create effective visualizations	CL3

CO4	Implement exemplary applications related to Network Programming and Web Service	CL3
CO5	Exhibit the awareness of the importance and limitation of the exploratory data analysis paradigm	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
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 BOOKS:

1. Data Visualization workshop, Tim Grobmann and Mario Dobler, Packt Publishing
2. Python for Everybody: Exploring Data Using Python 3, Charles R. Severance, Create Space Independent Publishing Platform, 1st Edition
3. "Data Visualization": A Successful Design Process, Kirk, Andy, Packt Publishing Ltd,2012
4. Think Python: How to Think Like a Computer Scientist ,Allen B. Downey, Green Tea Press, 2nd Edition, 2015
5. Interactive Data visualization for the Web, Murray, Scott, O"Reilly Media, Inc., 2013
6. Visualizing Data: Exploring and Explaining Data with The Processing Environment, Fry, Ben, O"Reilly Media, Inc., 2007

NATURAL LANGUAGE PROCESSING

(Effective from the Academic Year 2023 - 2024)

VII SEMESTER

Course Code	**IS72213IC**	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:

- 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: Overview: 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.	**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. **Syntactic Analysis:** Context-free Grammar, Constituency, top-down and bottom-up Parsing,	**8 Hours**

CYK parsing.	
MODULE - III	
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 - IV	
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**: Word Net, Frame Net, Stemmers, POS Tagger- Research Corpora.	**8 Hours**
MODULE - V	
Machine Translation: Language Divergences and Typology, Machine Translation using Encoder-Decoder, Details of the Encoder-Decoder Model, Translating in low-resource situations, MT Evaluation, Bias and Ethical Issues.	**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 concept of NLP; define grammar-based language model and statistical-based language model.	CL2
CO2	Demonstrate the use of morphological analysis and parsing using Finite State Transducers, spelling error detection and correction, parts of speech tagging, context-free grammar, and different parsing approaches.	CL3
CO3	Apply the Naïve Bayes classifier and sentiment analysis for Natural language problems and text classifications.	CL3
CO4	Illustrate the use of Information Retrieval in the context of NLP and understand the concept of lexical semantics, lexical dictionaries such as WordNet, lexical computational semantics, and distributional word similarity.	CL3
CO5	Discuss the Machine Translation applications of NLP using Encode and Decoder. Understand the MT evaluation, translating in low resource situations, bias and ethical issues.	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

CO1	**3**	**2**	**1**		**2**			**2**	**1**		**2**	**2**	**1**	**1**
CO2	**3**	**2**	**2**		**2**			**2**	**1**		**2**	**2**	**2**	**2**
CO3	**3**	**2**	**2**		**2**			**2**	**1**		**2**	**2**	**2**	**2**
CO4	**3**	**2**	**2**		**2**			**2**	**1**		**2**	**2**	**2**	**2**
CO5	**3**	**2**	**1**		**2**			**2**	**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 %**	**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. 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

Reference Web Links And Video Lectures (E-Resources):

1. https://www.youtube.com/watch?v=M7SWr5xObkA
2. https://youtu.be/02QWRAhGc7g
3. https://www.youtube.com/watch?v=CMrHM8a3hqw

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HIGH PERFORMANCE COMPUTING
(Effective from the Academic Year 2023 - 2024)
VII SEMESTER

Course Code	**IS72213ID**	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 and Programming.

COURSE OBJECTIVES:

- Introduce the design, analysis, and implementation, of high-performance computational science and engineering applications.
- Illustrate on advanced computer architectures, parallel algorithms, parallel languages, and performance-oriented computing.

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 Parallel Computing: Motivating Parallelism, Scope of Parallel Computing. **Parallel Programming Platforms:** Implicit Parallelism: Trends in Microprocessor Architectures, Limitations of Memory System Performance, Dichotomy of Parallel Computing Platforms, Physical Organization of Parallel Platforms, Communication Costs in Parallel Machines, Routing Mechanisms for Interconnection Networks, Impact of Process-Processor Mapping and Mapping Techniques.	**8 Hours**

MODULE - II

Principles of Parallel Algorithm Design: Preliminaries, Decomposition Techniques, Characteristics of Tasks and Interactions, Mapping Techniques for Load Balancing, Methods for Containing Interaction Overheads, Parallel Algorithm Models. **Basic Communication Operations:** One-to-All Broadcast and All-to-One Reduction, All-to-All Broadcast and Reduction, All-Reduce and Prefix-Sum Operations, Scatter and Gather, All-to-All Personalized Communication, Circular Shift, Improving the Speed of Some Communication Operations	**8 Hours**
MODULE - III	
Analytical Modeling of Parallel Programs: Sources of Overhead in Parallel Programs, Performance Metrics for Parallel Systems, The Effect of Granularity on Performance, Scalability of Parallel Systems. Minimum Execution Time and Minimum Cost-Optimal Execution Time, Asymptotic Analysis of Parallel Programs Section 5.7. Other Scalability Metrics, **Programming Using the Message-Passing Paradigm:** Principles of Message-Passing Programming, The Building Blocks: Send and Receive Operations, MPI: The Message Passing Interface, Topologies and Embedding, Overlapping Communication with Computation, Collective Communication and Computation Operations, Groups and Communicators	**8 Hours**
MODULE - IV	
Programming Shared Address Space Platforms: Thread Basics, Why Threads? The POSIX Thread API, Thread Basics: Creation and Termination, Synchronization Primitives in Pthreads, Controlling Thread and Synchronization Attributes, Thread Cancellation, 08 Composite Synchronization Constructs, Tips for Designing Asynchronous Programs, **OpenMP:** A Standard for Directive Based Parallel Programming **Dense Matrix Algorithms:** Matrix-Vector Multiplication, Matrix-Matrix Multiplication, Solving a System of Linear Equations **Sorting:** Issues in Sorting on Parallel Computers, Sorting Networks, Bubble Sort and its Variants, Quicksort, Bucket and Sample Sort.	**8 Hours**
MODULE - V	
Graph Algorithms: Definitions and Representation, Minimum Spanning Tree: Prim's Algorithm, Single-Source Shortest Paths: Dijkstra's Algorithm, All-Pairs Shortest Paths, Transitive Closure, Connected Components, Algorithms for Sparse Graphs, **Search Algorithms for Discrete Optimization Problems:** Definitions and Examples, Sequential Search Algorithms, Search Overhead Factor, Parallel Depth-First Search, Parallel Best-First Search, Speedup, Anomalies in Parallel Search Algorithms	**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 the concepts of parallel computing to address and resolve computational problems that require parallelism.	CL3
CO2	Use decomposition techniques and basic communication operations to develop efficient parallel algorithms.	CL3
CO3	Illustrate the performance metrics and scalability factors to optimize the execution of parallel programs.	CL3
CO4	Apply parallel programs using threading and synchronization constructs, including POSIX Threads and OpenMP.	CL3
CO5	Execute parallel algorithms to solve graph-related problems and assess their performance in terms of efficiency and scalability.	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**
CO1	3	3	2	1				2				2	1	
CO2	3	3	2					2				2	1	
CO3	3	3	3					2				2	1	
CO4	3	3	3					2				2	1	
CO5	3	3	3					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. Introduction to Parallel Computing, AnanthGrama, Anshul Gupta, George Karypis, and Vipin Kumar, 2nd edition, Addison-Welsey, 2003.
2. Grama, A. Gupta, G. Karypis, V. Kumar, An Introduction to Parallel Computing, Design and Analysis of Algorithms: 2/e, Addison-Wesley, 2003.
3. G.E. Karniadakis, R.M. Kirby II, Parallel Scientific Computing in C++ and MPI: A Seamless Approach to Parallel Algorithms and their Implementation, Cambridge University Press,2003.
4. Wilkinson and M. Allen, Parallel Programming: Techniques and Applications Using Networked Workstations and Parallel Computers, 2/E, Prentice Hall, 2005.
5. M.J. Quinn, Parallel Programming in C with MPI and OpenMP, McGraw-Hill, 2004.
6. G.S. Almasi and A. Gottlieb, Highly Parallel Computing, 2/E, Addison-Wesley, 1994.
7. David Culler Jaswinder Pal Singh,"Parallel Computer Architecture: A hardware/Software Approach", Morgan Kaufmann, 1999.
8. Kai Hwang, "Scalable Parallel Computing", McGraw Hill 1998.

REFERENCE WEB LINKS AND VIDEO LECTURES (E - RESOURCES):

1. https://www.youtube.com/watch?v=GoXwIVyNvX0
2. https://www.youtube.com/watch?v=mG4NLNZ37y4

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INFORMATION MANAGEMENT SYSTEM
(Effective from the Academic Year 2023 - 2024)
VII - SEMESTER

Course Code: OEC	**IS72224IA**	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	03

CREDITS – 3

Prerequisites:

- Fundamental knowledges of software engineering and project management

Course Objectives:

This course will enable students to:

- To Understand the Role of information management system in business and decision-making process.
- Evaluate the role of the major types of information systems in a business environment and their relationship to each other.

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 - 1

Module Contents	Lecture Hours
Information Systems in Business: Introduction, The real world of Information Systems, Networks, What you need to know, The fundamental role of IS in business, Trends in IS, Managerial challenges of IT. System Concepts: A foundation, Components of an Information System, Information System Resources, Information System activities, Recognizing Information Systems. Fundamentals of strategic advantages: Strategic IT, Competitive strategy concepts, The competitive advantage of IT, Strategic uses of IT, Building a customer-focused business, The value chain and strategic IS, Reengineering business processes, Becoming an agile company Creating a virtual company, Building a	**8 Hours**

knowledge creating company.	
MODULE - 2	
Enterprise Business Systems: Introduction, Cross-functional enterprise applications, Enterprise application integration, Transaction processing systems, Enterprise collaboration systems. Functional Business Systems: Introduction, Marketing systems, Manufacturing systems, Human resource systems, Accounting systems, Financial management systems.	**8 Hours**
MODULE - 3	
Customer relationship management: Introduction, what is CRM? The three phases of CRM, Benefits and challenges of CRM, Trends in CRM Enterprise resource planning: Introduction, What is ERP? Benefits and challenges of ERP, Trends in ERP. Supply chain Management: Introduction, What is SCM? The role of SCM, Benefits and challenges of SCM, Trends in SCM.	**8 Hours**
MODULE - 4	
Electronic commerce fundamentals: Introduction, The scope of ecommerce, Essential ecommerce, processes, Electronic payment processes. e-Commerce applications and issues: Ecommerce application trends, Business-to- Consumer e-commerce, Web store requirements, Business-to- Business e-commerce, e-commerce marketplaces, Clicks and bricks in ecommerce	**8 Hours**
MODULE - 5	
Decision support in business: Introduction, Decision support trends, Decision support systems (DSS), Management Information Systems, Online analytical processing, Using DSS, Executive information systems, Enterprise portals and decision support, Knowledge management systems, Business and Artificial Intelligence (AI), An overview of AI, Expert systems.	**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 importance and the roles of Information Systems in the business processes and also understand the basic competitive strategies.	CL2
CO2	Determine various cross functional enterprise systems and how they can provide significant business value to a company.	CL3
CO3	Summarizing the benefits and challenges of CRM, ERP and SCM.	CL2
CO4	Examine the needs of essential processes, categories and business values of e-commerce applications	CL3

CO5	Explain the business process evolutions and the use of decision support systems to tackle the changes.	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
CO1	3	1			2	1				2	1	3	2	2
CO2	3	1			2	1				2	1	3	2	2
CO3	3	1			2	1				2	1	3	2	2
CO4	3	1			2	1				2	1	3	2	2
CO5	3	1			2	1				2	1	3	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	MI			MI	MI
CO2	MII	MII		MII	MII
CO3		MIII		MIII	MIII
CO4			MIV	MIV	MIV
CO4			MV	MV	MV

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 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. James A.O'Brien, George M Marakas, Management Information Systems, 7th Edition, Tata McGrawHill.
2. Kenneth C. Laudon and Jane P.Laudon, Management Information System, Managing the Digital Firm, 9th Edition, Pearson Education.
3. Steven Alter, Information Systems the Foundation of E-Business, 4th Edition, Pearson Education.
4. W.S.Jawadekar, Management Information System, Tata McGraw Hill.

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INTRODUCTION TO CLOUD COMPUTING
(Effective from the Academic Year 2023 - 2024)
VII SEMESTER

Course Code	**IS72224IB**	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 databases, Operating Systems and Networking

Course Objectives:

This course will enable students to:

- Discuss the concepts, characteristics, delivery models and benefits of cloud computing.
- Explore the key technical, organizational and compliance challenges of cloud computing.
- Grasp the concepts of virtualization efficiently.
- Explore the security issues that arise from cloud computing architectures intended for delivering Cloud based enterprise IT services.

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 Infrastructure: Cloud computing, Cloud computing delivery models and services, Ethical issues, Cloud vulnerabilities, Cloud computing at Amazon, Cloud computing the Google perspective, Microsoft Windows Azure and online services, Open-source software platforms for private clouds, Cloud storage diversity and vendor lock-in, Energy use and ecological impact, Service level agreements, User experience and software licensing. Exercises and problems	**8 Hours**

MODULE - II	
Cloud Computing: Application Paradigms.: Challenges of cloud computing, Architectural styles of cloud computing, Workflows: Coordination of multiple activities, Coordination based on a state machine model: The Zookeeper, The Map Reduce programming model, A case study: The Grep The Web application, Cloud for science and engineering, High performance computing on a cloud, Cloud computing for Biology research, Social computing, digital content and cloud computing**.**	**8 Hours**
MODULE - III	
Cloud Resource Virtualization: Virtualization, Layering and virtualization, Virtual machine monitors, Virtual Machines, Performance and Security Isolation, Full virtualization and paravirtualization, Hardware support for virtualization, Case Study: Xen a VMM based paravirtualization, Optimization of network virtualization.	**8 Hours**
MODULE - IV	
Cloud Resource Management and Scheduling: Policies and mechanisms for resource management, Application of control theory to task scheduling on a cloud, Stability of a two level resource allocation architecture, Feedback control based on dynamic thresholds, Coordination of specialized autonomic performance managers, A utility-based model for cloud-based Web services, Resourcing bundling: Combinatorial auctions for cloud resources, Scheduling algorithms for computing clouds, Fair queuing, Start-time fair queuing, Borrowed virtual time, Exercises and problems.	**8 Hours**
MODULE - V	
Cloud Security, Cloud Application Development: Cloud security risks, Security: The top concern for cloud users, Privacy and privacy impact assessment, Trust, Operating system security, Virtual machine Security, Security of virtualization, Security risks posed by shared images, Security risks posed by a management OS, A trusted virtual machine monitor, Amazon web services: EC2 instances, Connecting clients to cloud instances through firewalls, Security rules for application and transport layer protocols in EC2, How to launch an EC2 Linux instance and connect to it, How to use S3 in java.	**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, principles, and benefits of Cloud Computing in order to assess existing cloud infrastructures to choose an appropriate architecture that meets business needs.	CL2
CO2	Summarize the conceptualization of cloud architecture styles and workflows to coordinate multiple activities.	CL2
CO3	Demonstrate the working of VM and VMM on any cloud platforms (public/private), and run a software service on that.	CL3

CO4	Discuss the different cloud resource management and scheduling strategies.	CL2
CO5	Identify the known threats, risks, vulnerabilities and privacy issues associated with Cloud based IT services.	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
CO1	3	3	3		3			2	2			3	3	3
CO2	3	3	3		3			2	2			3	3	3
CO3	3	3	3		3			2	2			3	3	3
CO4	3	3	3		3			2	2			3	3	3
CO5	3	3	3		3			2	2			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
	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. Cloud Computing: Theory and Practice, Dan C Marinescu Elsevier (MK), 2013.
2. Computing Principles and Paradigms, RajkumarBuyya , James Broberg, Andrzej Goscinsk,i Willey, 2014.
3. Cloud Computing Implementation, Management and Security John W Rittinghouse, James F Ransome, CRC Press, 2013.
4. Vic (J.R.) Winkler: ”Securing the Cloud, Cloud Computer Security Techniques and Tactics”, Syngress, 2011

REFERENCE WEB LINKS AND VIDEO LECTURES (E - RESOURCES):

1. https://www.javatpoint.com/cloud-computing-tutorial
2. https://www.tutorialspoint.com/cloud_computing/index.htm
3. https://www.digimat.in/nptel/courses/video/106105167/L01.html
4. https://onlinecourses.nptel.ac.in/noc21_cs14/preview

SAHYADRI
COLLEGE OF ENGINEERING & MANAGEMENT
An Autonomous Institution
MANGALURU

DATA WAREHOUSING and DATA MINING
(Effective from the Academic Year 2023 - 2024)
VII SEMESTER

Course Code	**IS72224IC**	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 Database Management System

Course Objectives:

This course will enable students to:

- Describe the multi-dimensional data models and OLAP.
- Discuss the importance of data in the knowledge discovery process.
- Explain the process of frequent itemset generation and association rule mining.
- Discuss the concepts of classification and illustrate different classification algorithms.
- Understand the concepts of clustering and apply various clustering methods to cluster the given data.

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

Data Warehousing & Modeling: Data Warehouse: Basic Concepts – What is a Data Warehouse?; Differences between Operational Database Systems and Data Warehouses; But,	**8 Hours**

Why Have a Separate Data Warehouse?; Data Warehousing: A multitiered Architecture; Data Warehouse Models: Enterprise Warehouse, Data Mart and Virtual Warehouse; Extraction, Transformation, and Loading; Metadata Repository; **Data Warehouse Modeling: Data Cube and OLAP** – Data Cube: A Multidimensional Data Model; Stars, Snowflakes and Fact Constellations: Schemas for Multidimensional Data Models; Dimensions: The Role of Concept Hierarchies; Measures: Their Categorization and Computation; Typical OLAP Operations.	
MODULE - II	
Data Warehouse Implementation: Efficient Data Cube Computation: An Overview; Indexing OLAP Data: Bitmap Index and Join Index; Efficient Processing of OLAP Queries; OLAP Server Architectures: ROLAP versus MOLAP versus HOLAP. **Data Mining: Introduction -** What is Data Mining?; Motivating Challenges; The Origins of Data Mining; Data Mining Tasks; **Data -** Types of Data, Data Quality, Data Preprocessing, Measures of Similarity and Dissimilarity – Basics, Similarity, and Dissimilarity between Simple Attributes, Dissimilarities between Data Objects, Similarities between Data Objects, Examples of Proximity Measures.	**8 Hours**
MODULE - III	
Association Analysis: Basic Concepts and Algorithms - Problem Definition; Frequent Itemset Generation; Rule Generation; Compact Representation of Frequent Itemsets; Alternative Methods for Generating Frequent Itemsets; FP-Growth Algorithm; Evaluation of Association Patterns – Objective Measures of Interestingness.	**8 Hours**
MODULE - IV	
Classification: Preliminaries; General Approach to Solving a Classification Problem; Decision Trees Induction; Method for Comparing Classifiers; Rule-Based Classifier; Nearest Neighbor Classifiers; Bayesian Classifiers.	**8 Hours**
MODULE - V	
Cluster Analysis: Basic Concepts and Methods – Cluster Analysis: What is Cluster Analysis?, Requirements for Cluster Analysis, Overview of Basic Clustering Methods; Partitioning Methods - k-Means: A Centroid-Based Technique, k-Medoids: A Representative Object-Based Technique; Hierarchical Methods; Density-Based Methods; Evaluation of Clustering.	**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 data warehouse and OLAP technology for understanding the overall data mining and knowledge discovery process.	CL2
CO2	Discuss the implementation aspects of the data warehouse and illustrate the importance of data for the mining process.	CL3
CO3	Determine the frequent itemset and association rules for discovering important relationships hidden in large data sets.	CL2
CO4	Use the different classification techniques to solve diverse applications	CL2
CO5	Apply the concepts of clustering for understanding data and solving different practical problems.	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
CO1	3	3	2	2								2	2	2
CO2	3	3	2	2								2	3	3
CO3	3	3	3	3	3	2					2	2	3	2
CO4	3	3	3	3	3	2					2	2	3	3
CO5	3	3	3	3	3	2					2	2	3	3

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.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment**	**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%**
M I			M I	M I
M II			M II	M II
	M III		M III	M III
	M IV	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. Jiawei Han, Micheline Kamber, Jian Pei: Data Mining -Concepts and Techniques, 3rd Edition, Morgan Kaufmann Publisher, 2012. **(Chapters: 4, 10)**
2. Pang-Ning Tan, Michael Steinbach, Vipin Kumar: Introduction to Data Mining, Pearson, First

impression, 2014.
3. Sam Anahory, Dennis Murray: Data Warehousing in the Real World, Pearson, Tenth Impression, 2012.
4. Michael.J.Berry, Gordon.S.Linoff: Mastering Data Mining, Wiley Edition, Second Edition, 2012.

Reference Web Links And Video Lectures (E-Resources):

1. https://onlinecourses.swayam2.ac.in/cec20_cs12/preview
2. https://onlinecourses.nptel.ac.in/noc21_cs06/preview

SAHYADRI
COLLEGE OF ENGINEERING & MANAGEMENT
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INTRODUCTION TO ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

(Effective from the Academic Year 2023 - 2024)

VII SEMESTER

Course Code	**IS72224ID**	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 concepts like probability.

COURSE OBJECTIVES:

- To Gain a historical perspective of AI and its foundations
- To understand the basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning.
- To describe Artificial Intelligence and Machine Learning algorithms and evaluate their performance
- To understand a range of machine learning algorithms along with their strengths and weaknesses.
- To Illustrate AI and ML algorithm and their use in appropriate applications.
- To Describe the applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models
- To apply the classification, clustering and regression-based machine learning algorithms techniques to solve real time problems.
- To apply the algorithms to a real-world problem, optimize the models learned and report on the expected accuracy that can be achieved by applying the models

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	
What is artificial intelligence? AI Problems, what is AI technique Problems. Problem spaces and search: Defining the problem as a state space search, Production systems, Problem characteristics, Production system characteristics, Issues in design of search programs	**8 Hours**
MODULE - II	
Heuristic search techniques: Generate and Test, Hill Climbing, Best First Search, Problem Reduction. Knowledge representation issues: Representation and Mapping, Approaches to Knowledge Representation.	**8 Hours**
MODULE - III	
Introduction: Machine Learning, Types of Machine Learning, Main challenges of Machine Learning, Testing and Validating. Concept Learning tasks, Concept Learning as search, Find S algorithm, Version Spaces and Candidate Elimination algorithm. Decision Tree Learning: Introduction, Decision tree representation, Appropriate problems, ID3algorithm.	**8 Hours**
MODULE - IV	
Artificial Neural Network: Introduction, Neural Network representation, Appropriate problems, Perceptron, Back propagation algorithm. Bayesian Learning: Introduction, Bayes theorem, Bayes theorem and concept learning, Naïve Bayes Classifier.	**8 Hours**
MODULE - V	
Instance-Based Learning: Introduction, k Nearest Neighbor Learning, locally weighted regression, Radial basis function, Case-Based reasoning. Reinforcement Learning: Introduction, The 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	Illustrate the theory of artificial intelligence for various problem-solving techniques.	CL3
CO2	Apply artificial intelligence concepts in Heuristic Search Techniques and knowledge representation.	CL3
CO3	Examine a wide variety of learning algorithms and apply Decision tree learning algorithm for the data.	CL3
CO4	Apply the concept of neural networks for learning linear and non-linear activation functions and Bayesian classifier to label data.	CL3

CO5	Illustrate instant based and reinforcement learning algorithms and identify its applicability in real life 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
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
	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. Elaine Rich, Kevin Kand S B Nair, **"Artificial Intelligence",** 3rd Edition, McGraw Hill Education, 2017.
2. Tom M Mitchell, **"Machine Learning",** 1stEdition, McGraw Hill Education, 2017.
3. Aurelien Geron, Hands-on Machine Learning with Scikit-Learn & TensorFlow, O'Reilly Media Publications, 3rd Edition, 2022, ISBN: 978-93-5542-198-2.
4. Saroj Kaushik, Artificial Intelligence, Cengage learning.
5. Stuart Rusell, Peter Norving, Artificial Intelligence: A Modern Approach, Pearson Education 2nd Edition.

REFERENCE WEB LINKS AND VIDEO LECTURES (E - RESOURCES):

1. https://www.youtube.com/watch?v=wnqkfpCpK1g
2. https://www.youtube.com/watch?v=t4K6lney7Zw

SOFTWARE TESTING LABORATORY
(Effective from the Academic Year 2023 - 2024)
VII SEMESTER

Course Code	IS722L51	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 Software Engineering and C or JAVA.

COURSE OBJECTIVES:

This course will enable students to:

- Analyse the requirements for the given problem statement
- Design and implement various solutions for the given problem
- Employ various design strategies for problem solving.
- Construct control flow graphs for the solution that is implemented
- Create appropriate document for the software artefact.

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	Design and develop a program in a language of your choice to solve the triangle problem defined as follows: Accept three integers which are supposed to be the three sides of a triangle and determine if the three values represent an equilateral triangle, isosceles triangle, scalene triangle, or they do not form a triangle at all. Assume that the upper limit for the size of any side is 10. Derive test cases for your program based on boundary-value analysis, execute the test cases and

	discuss the results.
2	Design, develop, code and run the program in any suitable language to solve the commission problem. Analyze it from the perspective of boundary value testing, derive different test cases, execute these test cases and discuss the test results.
3	Design, develop, code and run the program in any suitable language to implement the NextDate function. Analyze it from the perspective of boundary value testing, derive different test cases, execute these test cases and discuss the test results.
4	Design and develop a program in a language of your choice to solve the triangle problem defined as follows: Accept three integers which are supposed to be the three sides of a triangle and determine if the three values represent an equilateral triangle, isosceles triangle, scalene triangle, or they do not form a triangle at all. Assume that the upper limit for the size of any side is 10. Derive test cases for your program based on equivalence class partitioning, execute the test cases and discuss the results.
5	Design, develop, code and run the program in any suitable language to solve the commission problem. Analyze it from the perspective of equivalence class testing, derive different test cases, execute these test cases and discuss the test results.
6	Design, develop, code and run the program in any suitable language to implement the NextDate function. Analyze it from the perspective of equivalence class value testing, derive different test cases, execute these test cases and discuss the test results.
7	Design and develop a program in a language of your choice to solve the triangle problem defined as follows: Accept three integers which are supposed to be the three sides of a triangle and determine if the three values represent an equilateral triangle, isosceles triangle, scalene triangle, or they do not form a triangle at all. Derive test cases for your program based on decision-table approach, execute the test cases and discuss the results.
8	Write and test a program to count number of check boxes on the page checked and unchecked count using SELENIUM IDE.
9	Write and test a program to provide total number of objects present available on the page SELENIUM IDE.
10	Write and test a program to update 10 student records into table into Excel file.
11	Write and test a program to provide total number of objects present/ available on the page.
12	Write and test a program to get the number of list items in a list /combo box.

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 develop testcases based on Boundary value Analysis testing method	CL4
CO2	Create testcases using Equivalence class partitioning ,execute testcases and discuss the results	CL4
CO3	Design and develop testcases using Decision table approach ,analyze the testcases along with the results	CL4
CO4	Analyze structural testing techniques using Data flow approach.	CL4
CO5	Design and develop test cases using SELENIUM IDE and analyze the test cases along with the results.	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	2	2	2							3	2	3
CO2	3	2	2	2	2							3	2	3
CO3	3	2	2	2	2							3	2	3
CO4	3	2	2	2	2							3	2	3
CO5	3	2	2	2	2							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**
	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.