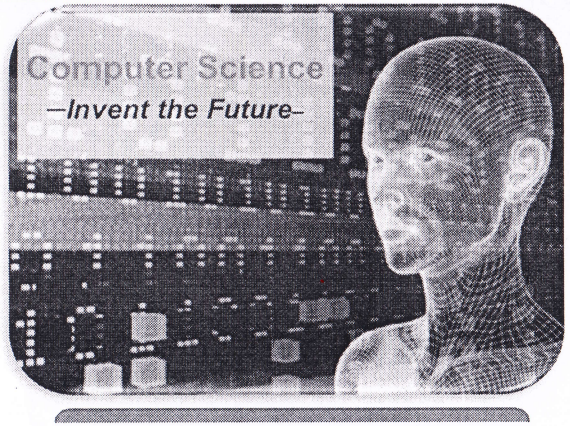
SCHEME AND SYLLABUS



22 SCHEME

Computer Science and Engineering

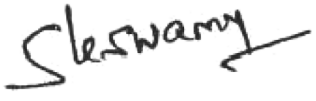
B.E

H.M. Rajasheekar Swamy
Dean Academic
Global Academy of Technology,
Rajarajeshwarinagar, Bengaluru-98

GLOBAL ACADEMY OF TECHNOLOGY
(Autonomous Institution Affiliated to VTU, Belagavi)
Accredited by NAAC with 'A' Grade,
NBA Accredited - CSE, ISE, ECE, EEE, ME, CV
Ideal Homes Township,
Raja Rajeshwari Nagar, Bengaluru-560098

Sk Swamy
Head of Department
Computer Science Engineering
Global Academy of Technology
Bengalore - 98

VISION, MISSION, PEO, PO and PSO Statements



GLOBAL ACADEMY OF TECHNOLOGY

Rajarajeshwarinagar,Ideal Homes Township, Bengaluru-560098

Ph: 080-28603158, Fax: 080-28603157

Department: Computer Science and Engineering

Vision

To achieve academic excellence and strengthen the skills to meet emerging challenges of computer science and engineering.

Mission

- To impart strong theoretical foundation in the field of Computer Science and Engineering accompanied with extensive practical skills.
- To inculcate research and innovation spirit through interaction with industry and carry out projects that address societal needs.
- Instill professional ethics and values with a concern for environment.

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Program Educational Objectives [PEOs]

After successful completion of the program, the CSE graduates will be able to:

PEO1: Succeed in engineering/management positions with professional ethics.

PEO2: Engage in improving professional knowledge through certificate/post-graduate programs in engineering or management.

PEO3: Establish themselves as entrepreneurs and contribute to the society.

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Program Outcomes (POs)

Engineering Graduates will be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering

practice.

7. **Environment and sustain ability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multi disciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multi disciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

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Program Specific Outcomes (PSO)

At the end of the program, the CSE graduates will be able to :

PSO1: Design, Implement and test system software and application software to meet the desired needs.

PSO2: Develop solutions in the area of communication networks, database systems and computing systems.

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SCHEME AND SYLLABUS

22 SCHEME

Computer Science and Engineering

III – IV Semester

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III SEMESTER

Sl. No.	Course Code	Course Title	Course Type	Teaching Dept.	Teaching Hours/Week			Examination			CREDITS
					L	T	P	CIE	SEE	Total	
1	22MAT31A	**Discrete Mathematics and Graph Theory**	BS	MAT	2	2	0	50	50	100	3
2	22CSE32	Data Structures (Integrated)	IPC	CSE	3	0	2	50	50	100	4
3	22CSE33	Digital Design and Computer Organization (Integrated)	IPC		3	0	2	50	50	100	4
4	22CSE34	Operating Systems	PC		3	0	0	50	50	100	3
5	22CSE35	Introduction to Web Technologies (Integrated)	PLC		2	0	2	50	50	100	3
6	22CSE36	Unix and Shell Programming (Integrated)	AEC		2	0	2	50	50	100	3
Total								**300**	**300**	**600**	**20**

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IV SEMESTER

Sl. No.	Course Code	Course Title	Course Type	Teaching Dept.	Teaching Hours/Week			Examination			CREDITS
					L	T	P	CIE	SEE	Total	
1	22MAT41A	**Probability and Linear Algebra**	BS	MAT	2	2	0	50	50	100	3
2	22CSE42	Object Oriented Programming with Java (Integrated)	IPC	CSE	3	0	2	50	50	100	4
3	22CSE43	Design and Analysis of Algorithms (Integrated)	IPC		3	0	2	50	50	100	4
4	22CSE44	Software Engineering	PC		3	0	0	50	50	100	3
5	22CSE45	Data Visualization (Integrated)	ETC		2	0	2	50	50	100	3
6	22CSE46	Full Stack Frameworks - Frontend (Integrated)	AEC		2	0	2	50	50	100	3
Total								**300**	**300**	**600**	**20**

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SEMESTER – III

Course: Discrete Mathematics and Graph Theory
(Common for CSE/ISE/AI&DS /AI&ML/AI&ML/CS(AIML))

Course Code	**22MAT31A**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**2:2:0**	**SEE Marks**	**50**
No. of Credits	**3**	**Examination Hours**	**03**

Course Objectives: To enable students to apply the knowledge of Mathematics in fields of computer science and allied branches by making them to learn:

CLO1	Counting Principles
CLO2	Mathematical Logic and Set Theory
CLO3	Relations and Functions
CLO4	Graph Theory

Content	No. of Hours/ RBT levels
Module 1 The Rules of Sum and Product, The Pigeon-hole Principle, Permutations, Combinations, The Binomial Theorem, Combinations with Repetition.	**08 Hours L2, L3**
Module 2 Sets and Subsets, Set operations and Laws of Set Theory. Counting and Venn Diagrams. Probability, Conditional probability and Bayes Theorem.	**08 Hours L2, L3**
Module 3 Basic Connectives and Truth Tables, Logical Equivalence: The Laws of Logic, Logical Implications: Rules of Inference. Quantifiers, Definitions and the Proofs of Theorems.	**08 Hours L2, L3**
Module 4 Relations and properties of relations, Representation of relations. Equivalence Relations and Partitions. Functions, Types of Functions, Function Composition and Inverse Functions.	**08 Hours L2, L3**
Module 5 Graphs, Subgraphs, Complements, and Graph Isomorphism, Vertex Degree, Euler Trails and Circuits. Planar Graphs, Trees and Rooted Trees.	**08 Hours L2, L3**

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

CO31.1	Use computational techniques essential for the study of mathematical logic, set operations, relations and functions.
CO31.2	Solve problems using basic graph theory

Textbooks:

1. Ralph P. Grimaldi: Discrete and Combinatorial Mathematics, 5th Edition, Pearson Education. 2020.

Reference books:

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1. Kenneth H. Rosen: Discrete Mathematics and its Applications, 6th Edition, McGraw Hill, 2007

Scheme of Examination:

Semester End Examination (SEE):
SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question from each module.**

Continuous Internal Evaluation (CIE):
Three Tests are to be conducted for 40 marks each. Average of Marks scored in all three tests is added to test component. CIE is executed by way of quizzes / Alternate Assessment Tools (AATs), and three tests. **Some possible AATs:** seminar/assignments/ mini-projects/ concept videos/ partial reproduction of research work/ group activity/ any other.

Typical Evaluation pattern for regular courses is shown in Table 2.

Table 2: Distribution of weightage for CIE & SEE of Regular courses

Component		Marks	Total Marks
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	CIE Test-3	**40**	
	Assignments	**10**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

CO/PO Mapping																
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO31.1	3	2	1									3				
CO31.2	3	2	1									3				
Average	3	2	1									3				

Low-1: Medium-2: High-3

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SEMESTER - III

SUBJECT: DATA STRUCTURES (Integrated)

Subject Code	**22CSE32**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:2**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**3**
No. of Credits: 04			

Course Learning Objectives:
The course will enable students to:

CLO1	Discuss the classification of data structures, arrays, pointers, dynamic memory allocation
CLO2	Explain the working of Stacks, Queues and their operations
CLO3	Apply the concepts of singly linked lists, doubly linked lists, circular linked lists to solve a given problem
CLO4	Apply the concepts of different non-linear tree data structure to practical problems

CONTENTS	**# of Hours / RBT Levels**
MODULE 1 **Introduction:** Data Structures, Classifications of Data Structures, Data structure Operations, Review of Arrays, type of Structures, Self-Referential Structures, and Unions. Review of Pointers, Dynamic Memory Allocation Functions, Dynamically allocated arrays **Array Operations**: Traversing, inserting, deleting, searching, and sorting, Selection Sort, Insertion Sort, Multidimensional arrays, Sparse matrices, and transpose of sparse matrices **Text Book: T1 Chapter: 2 Text Book: T2 Chapters:1, 4**	**08** **L3**
MODULE 2 **Stacks:** Definition, Stack Operations, Array Representation of Stacks, Polish notation **Applications of stack:** Infix to postfix conversion, evaluation of postfix expression, Recursion- Fibonacci Sequence, Tower of Hanoi, Ackermann Functions **Queues:** Definition, Queue Operations, Array Representation of Queues, Circular Queues and operations, Priority Queue **Text Book: T1 Chapter: 3 Text Book: T2 Chapter: 6**	**08** **L3**
MODULE 3 **Linked Lists:** Definition, Representation of linked lists in Memory, Linked list operations: Traversing, Searching, Insertion, and Deletion. Stack operation using linked list and queue operation using linked list. Doubly Linked lists, Circular linked lists, and header linked lists, Applications of Linked lists –Polynomial Representation and Addition of Polynomial **Text Book: T1 Chapter: 4 Text Book: T2 Chapter: 5**	**08** **L3**
MODULE 4 **Trees:** Terminology, Binary Trees, Properties of Binary Trees, Array and Linked representation of Binary Trees, Types of Binary tree, Construction of Binary Tree, Binary Tree Traversals - Inorder, Postorder, Preorder **Binary Search Trees:** Definition, Construction of Binary Search Tree, Insertion, Deletion, Traversal and Searching **Text Book: T1 Chapter: 5 Text Book: T2 Chapters: 7**	**08** **L3**

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MODULE 5	
Construction and Evaluation of Expression Trees, Threaded binary trees **Hashing:** Hash functions, collision resolution-separate chaining, open addressing-linear probing, quadratic probing, double hashing **Sorting:** Radix sort, Address Calculation Sort **Text Book: T1 Chapter: 5 Text Book: T2 Chapter:9**	**08** **L3**

Laboratory Component
List of Experiments

Implement the following programs using C in Ubuntu

1. Design, Develop and Implement a menu driven Program for the following Array operations
   a. Creating an Array of N Integer Elements
   b. Display of Array Elements with suitable headings
   c. Inserting an element (ELEM) at a given valid position (POS)
   d. Deleting an element at a given valid position (POS)
   e. Exit
   Support the program with functions for each of the above operations.
2. Design, Develop and Implement a program to sort the given list of 'n' integers in increasing/decreasing order using Insertion sort algorithm
3. Design, Develop and Implement a menu driven Program for the following operations on STACK of Integers (Array Implementation of Stack with maximum size MAX)
   a. Push an Element on to Stack
   b. Pop an Element from Stack
   c. Demonstrate Overflow and Underflow situations on Stack
   d. Display the status of Stack
   e. Exit
   Support the program with appropriate functions for each of the above operations
4. Design, Develop and Implement a Program for converting an Infix Expression to Postfix Expression. Program should support for both parenthesized and free parenthesized expressions with the operators: +, -, *, /, %(Remainder), ^(Power) and alphanumeric operands.
5. Design, Develop and Implement a Program for evaluation of Stack Suffix expression with single digit operands and operators: **+, -, *, /, %, ^**
6. Design, Develop and Implement a menu driven Program for the following operations on Ordinary QUEUE of Characters (Array Implementation of Queue with maximum size MAX)
   a. Insert an Element on to Ordinary QUEUE
   b. Delete an Element from Ordinary QUEUE
   c. Demonstrate Overflow and Underflow situations on Ordinary QUEUE
   d. Display the status of Ordinary QUEUE
   e. Exit
   Support the program with appropriate functions for each of the above operations.
7. Design, Develop and Implement a menu driven Program for the following operations on Circular QUEUE of Characters (Array Implementation of Queue with maximum size MAX)
   a. Insert an Element on to Circular QUEUE
   b. Delete an Element from Circular QUEUE
   c. Demonstrate Overflow and Underflow situations on Circular QUEUE
   d. Display the status of Circular QUEUE
   e. Exit
   Support the program with appropriate functions for each of the above operations.

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8. Design, Develop and Implement a menu driven Program for the following operations on Singly Linked List (SLL) of Student Data with the fields: USN, Name, Branch, Sem, PhNo
   a. Create a SLL of N Students Data by using front insertion.
   b. Display the status of SLL and count the number of nodes in it
   c. Perform Insertion / Deletion at End of SLL
   d. Exit
9. Design, Develop and Implement a menu driven Program for the following operations on Doubly Linked List (DLL) of Employee Data with the fields: emp_id, Name, Dept, Designation, Sal.
   a. Create a DLL of N Employees Data by using end insertion.
   b. Display the status of DLL and count the number of nodes in it
   c. Perform Insertion and Deletion at Front of DLL
   d. Demonstrate how this DLL can be used as Double Ended Queue
   e. Exit
10. Develop a C program for performing the following operations on Binary Search Tree (BST) of Integers
    a. Create a BST of N Integers: 6, 9, 5, 2, 8, 15, 24, 14, 7, 8, 5, 2
    b. Traverse the BST in Inorder, Preorder and Post Order
    c. Search the BST for a given element (KEY) and report the appropriate message.
    d. Exit

Course Outcomes:

Upon successful completion of this course, student will be able to

CO32.1	Apply array concepts to sort the elements, transpose the sparse matrix
CO32.2	Develop programs on operations of stack and its applications, recursion, queue operations
CO32.3	Apply the concepts of singly linked lists, doubly linked lists, circular linked lists into different applications
CO32.4	Illustrate the construction of binary trees, binary search tress, and its traversal techniques
CO32.5	Write algorithms related to expression tree, hashing and hashing-based sorting techniques

Text Books:

1. Ellis Horowitz, Sartaz Sahni, Anderson, Freed, "Fundamentals of Data Structures in C", 2nd Edition, University Press, 2008, Reprinted 2016.
2. Lipschutz, Schaum's Outlines, "Data Structures using C", Seymour McGraw Hill Special Indian Edition, 13th Reprint 2015.

Reference Books:

1. Yedidyah Langsam, Moshe J Augenstein and Aaron M Tanenbaum, "Data Structures using C & C++", 2nd Edition, Pearson, 10th Impression 2020.
2. Richard F. Gilberg and Behrouz A. Forouzan, "Data Structures - A Pseudo code approach with C", 2nd Edition, Cengage Learning, Sixth Indian Reprint 2016.

E-Books / Web References:

1. https://www.freebookcentre.net/ComputerScience-Books-Download/Data-Structures-and-Algorithms.html
2. http://www.uoitc.edu.iq/images/documents/informatics-institute/Competitive_exam /DataStructures.pdf
3. https://people.cs.vt.edu/shaffer/Book/Java3e20110103.pdf

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MOOCs:

1. https://www.edx.org/course/introduction-to-data-structures
2. https://nptel.ac.in/courses/106/102/106102064/

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO32.1	3	3	2	-	-	-	-	-	1	1	-	2	3	-
CO32.2	3	3	2	-	-	-	-	-	1	1	-	2	3	-
CO32.3	3	3	2	-	-	-	-	-	1	1	-	2	3	-
CO32.4	3	3	2	-	-	-	-	-	1	1	-	2	3	-
CO32.5	3	3	2	-	-	-	-	-	1	1	-	2	3	-
Average	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**1**	**1**	**-**	**2**	**3**	**-**

Low-1: Medium-2: High-3

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SUBJECT: DIGITAL DESIGN AND COMPUTER ORGANIZATION (Integrated)

Subject Code	**22CSE33**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:2**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**3**
No. of Credits: 04			

Course Learning Objectives:
The course will enable students to:

CLO1	Understand the basic digital principles and working of various logic gates, and different techniques for simplification of Boolean function
CLO2	Design combinational logic circuits and describe their applications
CLO3	Understand the working of Flip-Flops and Counters
CLO4	Understand the basic sub systems of a computer, their organization, structure and operation
CLO5	Learn arithmetic and logical operations with integer and floating-point operands

CONTENTS	# of Hours / RBT Levels
MODULE 1 **Combinational Logic Circuits:** Boolean functions, The Map Method: Two, Three, Four Variable Maps, Map Manipulation, Product-of-Sums, Sum-of-Products Optimization, Don't Care Conditions, The Tabulation Method, Determination of Prime Implicants **Text Book: T1 Chapters: 4, 5, 6**	**08** **L3**
MODULE 2 **Data Processing Circuits:** Adders, Subtractors, Code Converters, Magnitude Comparators, Multiplexers, Demultiplexers, Encoders, Decoders, Programmable Array Logic, Programmable Logic Arrays **Text Book:T1 Chapters: 9**	**08** **L3**
MODULE 3 **Sequential Logic**: Introduction to Flip-Flops, Types of Flip flops, Various Representation of Flip-Flops, JK Master-Slave Flip-Flop, Flip-Flop Turning, Switch Contact Bounce Circuits **Registers:** Types of Registers. Serial In - Serial Out, Serial In - Parallel out, Parallel ln - Serial Out, Parallel ln - Parallel Out, Applications of Shift Registers **Counters:** Asynchronous Counters, Synchronous Counters, Counter Design as a Synthesis problem **Text Book:T1 Chapter: 11,12**	**08** **L3**
MODULE 4 **Machine Instructions and Programs:** Memory Location and Addresses, Memory Operations, Instructions and Instruction Sequencing, Addressing Modes, Assembly Language **Input/Output Organization:** Basic Input and Output Operations, Accessing IO Devices, Interrupts - Interrupt Hardware, Enabling and Disabling Interrupts, Direct Memory Access, Buses **Text Book: T2 Chapters: 2, 4**	**08** **L2**
MODULE 5 **Arithmetic:** Numbers, Arithmetic Operations and Characters, Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Positive Numbers, Signed	**08** **L3**

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Operand Multiplication, Fast Multiplication- Bit-pair recoding of multipliers, Integer Division, Floating-point Numbers and Operations **Text Book: T2 Chapter: 6**	

Laboratory Component

Hardware experiments to be conducted using logic trainer kits and simulation experiments to be conducted using open-source software like Logisim.

List of Experiments

1. a. Study and verify the truth tables of AND, OR, NOT, NOR, NAND and XOR Logic Gates.
   b. Simplify the given Boolean expression and realize it using Basic gates and Universal Gates.
2. Design and implement Half Adder, Full Adder, Half Subtractor, Full Subtractor using Logic Gates. Also simulate their working.
3. Given a 4-variable logic expression, simplify it using appropriate technique and realize the simplified logic expression using 8:1 multiplexer IC.
4. Design and implement 4-bit Parity checker.
5. Design and implement Code converter i) Binary to Gray ii) Gray to Binary Code using Logic gates.
6. Realize a J-K Master Slave flip-flop using NAND gates and verify its truth table.
7. Design and implement 4-bit Ring and Johnson Counters. Also simulate their working.
8. Design and implement mod-n (n<8) synchronous up counter using JK flip-flop ICs and demonstrate its working.
9. Design and implement an asynchronous counter using decade counter IC to count up from 0 to n (n<=9).
10. Design and implement a pseudo-random sequence generator using shift register IC7495.

Demonstration using of virtual lab

https://www.vlab.co.in/

- Representation of Integers and their Arithmetic
- Floating Point Numbers Representation

Course Outcomes:

Upon successful completion of this course, student will be able to

CO33.1	Illustrate the minimization of combinational logic expressions using K-map and Quine McCuskey methods
CO33.2	Interpret different combinational logic circuits like Adders, Subtractors, Multiplexers, Decoders and programmable Logic Arrays
CO33.3	Implement the Flip Flops, Registers and Counters
CO33.4	Explain the basic structure of computers, machine instructions & addressing modes
CO33.5	Solve Arithmetic operations on binary numbers

Text Books:

1. Charles H. Roth, Jr. and Larry L Kinney, "Fundamentals of Logic Design", 6th Edition, Thomson, 2010.
2. Carl Hamacher, Zvonko Vranesic and Safwat Zaky, "Computer Organization", McGraw Hill Education India, 5th Edition, 2011.

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Reference Books:

1. Neal S Widmer, Greg Moss and Ronald J Tocci, "Digital Systems Principles and Applications", 12th Edition, 2022, Pearson.
2. William Stallings, "Computer Organization & Architecture", 9th Edition, Pearson. 2015.

E-Books / Web References:

1. Computer Organization & Architecture - William Stallings, http://home.ustc.edu.cnl-louwenqi/reference-books-%20WiIIiarm%20StaIIings.pdf

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO33.1	3	2	2	1	-	-	-	-	-	1	-	-	-	1
CO33.2	3	2	2	-	2	-	-	-	-	1	-	-	-	1
CO33.3	3	2	2	-	2	-	-	-	-	1	-	-	-	1
CO33.4	2	1	-	-	-	-	-	-	-	-	-	-	-	1
CO33.5	2	1	2	-	-	-	-	-	-	-	-	-	-	1
Average	**2**	**1**	**2**	**1**	**2**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**1**

Low-1: Medium-2: High-3

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SUBJECT: OPERATING SYSTEMS

Subject Code	**22CSE34**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**03**
No. of Credits: 03			

Course Learning Objectives:

The course will enable students to

CLO1	Understand the fundamentals of an Operating Systems and its structures, concept of processes and threads
CLO2	Understand the implement efficient Process scheduling mechanisms and software solutions for process synchronization
CLO3	Discuss Deadlock handling mechanism
CLO4	Understand Operations in Memory Management
CLO5	Study the Virtual memory and mass storage Concepts

CONTENTS	# of Hours / RBT Levels
MODULE 1 **Introduction to operating System:** What operating system do, Operating System Services, Systems Calls, **Processes:** Process Concepts, Process Scheduling, Inter Process Communication, Thread Overview, Multicore Programming, Multithreading Models **Text Book: T1 Chapters: 1.1, 2.1, 2.3, 3.1, 3.2, 3.4, 4.1, 4.2, 4.3**	**08** **L2**
MODULE 2 **Process Scheduling:** CPU Scheduling - Basic concepts, Scheduling Criteria, Scheduling Algorithms **Process Synchronization:** Background, Critical Section Problem, Peterson's Solution, Mutex Locks, Semaphores. Classic problems of Synchronization **Text Book: T1 Chapters: 5.1, 5.2, 5.3, 6.1, 6.2, 6.3, 6.5, 6.6, 7.1**	**10** **L2**
MODULE 3 **Deadlocks:** System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention. Deadlock Avoidance: Banker's Algorithm, Deadlock Detection and recovery from Deadlock **Text Book: T1 Chapters: 8.1, 8.3, 8.4, 8.5, 8.6, 8.7, 8.8**	**07** **L2**
MODULE 4 **Memory management:** Background**,** Contiguous memory allocation, paging, Structure of page table, Swapping **Text Book: T1 Chapters: 9.1, 9.2, 9.3, 9.4, 9.5**	**08** **L2**
MODULE 5 **Virtual memory management** Background, Demand Paging, Page Replacement algorithms: FIFO page replacement, Optimal page replacement, LRU page replacement, **Thrashing:** Cause of Thrashing **Secondary Storage Structures** HDD Scheduling, Storage Device Management, RAID Structure-Redundancy, Parallelism, RAID levels, Selecting a RAID Level **Text Book: T1 Chapters: 10.1, 10.2, 10.4.1, 10.4.2, 10.4.3, 10.4.4, 10.6.1, 11.2, 11.5, 11.8.1, 11.8.2, 11.8.3, 11.8.4**	**07** **L2**

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Course Outcomes:

Upon successful completion of this course, student will be able to

CO34.1	Discuss the basic concepts of operating systems and concept of processes and threads
CO34.2	Explain the process management, CPU scheduling and synchronization tools
CO34.3	Explain the deadlock handling methods
CO34.4	Describe memory management mechanisms
CO34.5	Illustrate Virtual memory concepts and mass storage structure

Text Books:

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, "Operating System Principles", 10th Edition, Wiley-India, 2018.

Reference Books:

1. Stallings, William, "Operating systems: Internals and design principles", Prentice Hall Press, 2011.
2. Andrew S Tanenbaum and Herbert Bos, "Modern Operating Systems", 4th Edition, Pearson Education, 2014.
3. Thomas Anderson and Michael Dahlin, "Operating Systems: Principles and Practice", Recursive Books, 2014.
4. P.C.P. Bhatt, "An Introduction to Operating Systems: Concepts and Practice", 4th Edition, PHI, 2014.
5. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne. "Operating System Concepts", Wiley India, 10th Edition, 2018.
6. Andrew S. Tanenbaum, "Modern Operating Systems", PHI, 3rd Edition, 2009.

E-Books / Web References:

1. http://edclap.com/mod/resource/view.php?id=1445&forceview=1
2. https://www.cs.uic.edu/~jbell/CourseNotes/OperatingSystems/

MOOCs:

1. http://onlinevideolecture.com/?course=computer-science&subject=operating-systems
2. https://nptel.ac.in/courses/106/106/106106144/
3. http://www.nptel.ac.in/courses/106108101/

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO34.1	3	3	3	-	-	-	-	-	-	-	-	3	1	-
CO34.2	3	3	3	-	-	-	-	-	-	-	-	3	1	-
CO34.3	3	3	3	-	-	-	-	-	-	-	-	3	1	-
CO34.4	3	3	3	-	-	-	-	-	-	-	-	3	1	-
CO34.5	3	3	3	-	-	-	-	-	-	-	-	3	1	-
Average	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**1**	**-**

Low-1: Medium-2: High-3

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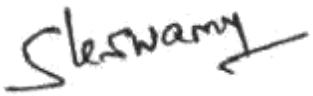
SUBJECT: INTRODUCTION TO WEB TECHNOLOGIES (Integrated)

Subject Code	**22CSE35**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**2:0:2**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**03**
No. of Credits: 03			

Course Learning Objectives:
The course will enable students to

CLO1	Illustrate the Semantic Structure of HTML and CSS
CLO2	Create forms and tables using HTML and CSS
CLO3	Understand different approaches for creating page layout
CLO4	Understand Responsive Web Design with the help of the Bootstrap framework

CONTENTS	# of Hours / RBT Levels
MODULE 1 **Introduction to HTML:** HTML Syntax, Semantic Markup, Structure of HTML Documents, Quick Tour of HTML Elements, HTML5 Semantic Structure Elements **Text Book: 1, Chapter 1**	**08** **L2**
MODULE 2 **Introduction to CSS:** What is CSS, CSS Syntax, Location of Styles, Selectors, The Cascade: How Styles Interact, The Box Model, CSS Text Styling **Text Book: 1, Chapter 2**	**08** **L3**
MODULE 3 **HTML Tables and Forms:** Introducing Tables, Styling Tables, Introducing Forms, Form Control Elements **Text Book: 1, Chapter 3**	**08** **L3**
MODULE 4 **Advanced CSS:** Layout, Normal Flow, Positioning Elements, Floating Elements, Constructing Multicolumn Layouts **Text Book: 1, Chapter 5**	**08** **L3**
MODULE 5 **Bootstrap:** Introduction, applying Bootstrap for Creating a simple HTML Page and adding basic design to the page using CSS, formatting text elements, buttons, and links, and working with images **Text Book: 2, Chapter 1, 2, 3**	**08** **L3**



Laboratory Component

- Student can execute the programs on any browsers by enabling the Javascript option in the browser.
- VSCode editor
- Download Bootstrap to get the compiled CSS and JavaScript, source code.

List of Sample Experiments

1. Design a clean and organized layout for the webpage using HTML.
   a. Include a header section with the event title, date, and location.
   b. Create a navigation bar with links to sections like "About," "Speakers," "Agenda," "Registration," and "Contact."
   c. In the "About" section, provide a brief description of the conference's theme and purpose.
   d. Design a "Speakers" section that lists at least three keynote speakers with their names, titles, and photos.

   Note: Use semantic elements to structure this section.

2. Design a simple webpage layout containing text and an image using CSS selectors
   a. Apply CSS styles to change the font family, size, color, and line height of the text content.
   b. Use selectors to target specific headings and paragraphs.
   c. Select the image using an element selector and apply a border with a defined width and color.
   d. Implement a hover effect that slightly increases the image's size
   e. Use class selectors to adjust the text alignment and spacing within paragraphs.
   f. Apply margin and padding to create a balanced layout.
   g. Apply a background color to the entire layout using an element selector.

3. Develop an HTML table to display the weekly class timetable, spanning Monday through Friday.
   a. Populate the table with precise class information, including course codes
   b. Utilize colspan or rowspan to merge cells horizontally or vertically, creating space for breaks or gaps in the schedule.
   c. Implement distinct background colors for cells to differentiate between different subjects.

4. Design a registration form
   a. Include fields for the attendee's name, email address, organization, radio button for gender and a checkbox for dietary preferences (vegetarian, vegan, etc.).
   b. Include a "Submit" button to process the registration

5. Design a multicolumn layout using CSS positioning and z-index to achieve overlapping columns
   a. Create an HTML structure for the multicolumn layout, including three columns.
   b. Use CSS positioning properties to arrange the columns side by side.
   c. Utilize z-index and CSS positioning to achieve an overlapping effect for the columns.
   d. Ensure that the columns partially overlap each other while maintaining readability.
   e. Populate each column with different content sections, including headings, paragraphs, and images.
   f. Apply background colors or patterns to the columns to enhance the visual separation between them.

6. Design multicolumn layout using float element in HTML
   a. Create an HTML structure that includes a main content area and a sidebar.
   b. Use CSS floats to position the main content on the left and the sidebar on the right.
   c. Populate the main content area with blog articles, including headings, images, and text.
   d. Populate the sidebar with widgets such as recent posts, categories, and social media links.

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e. Apply styling to the widgets to create a cohesive design that complements the layout.

7. Design a portfolio webpage using Bootstrap to showcase your skills and projects
   a. Design a header section with your name or a logo.
   b. Use Bootstrap's navbar component to create a simple navigation bar.
   c. Add a brief introduction about yourself or your work.
   d. Utilize Bootstrap's typography classes for consistent styling.
   e. Create a section to list your skills or areas of expertise.
   f. Use Bootstrap's card component to present each skill.
   g. Display a grid of project cards, each with a project name, image, and brief description

Course Outcomes:

Upon successful completion of this course, student will be able to

CO35.1	Adapt HTML and CSS syntax and semantics to build web pages
CO35.2	Construct and visually format tables and forms using HTML and CSS
CO35.3	Construct complex layouts to build web pages
CO35.4	Develop responsive designs for web pages using Bootstrap

Text Books:

1. Randy Connolly, Ricardo Hoar, "Fundamentals of Web Development", 4th Edition, Pearson Education India, 2016.
2. Jake Spurlock, "Bootstrap: responsive web development", O'Reilly Media, Inc., 2013.

Reference Books:

1. Jon Duckett, "HTML and CSS: Design and Build Websites", 1st Edition, Wiley, 2011.
2. David DuRocher, "HTML and CSS Quickstart Guide", Clydebank Media LLC, 2021.
3. Elizabeth Robson and Eric Freeman, "Head First HTML and CSS", Second Edition, O'Reilly, 2012.
4. Istvan Novak, "Unraveling Bootstrap 3.3", Kindle Edition, 2014.

E-Books / Web References:

1. http://www.pearsonglobaleditions.com/connolly
2. https://www.w3schools.com/css/
3. https://www.w3schools.com/jS/default.asp
4. https://www.w3schools.com/bootstrap/default.asp

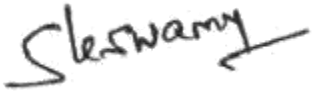
MOOCs:

1. https://nptel.ac.in/courses/106105084
2. https://www.udemy.com/topic/web-app-development/

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO35.1	2	2	3	-	3	-	-	-	-	-	-	2	1	-
CO35.2	2	2	2	-	3	-	-	-	-	-	-	3	1	-
CO35.3	2	1	2	-	3	-	-	-	-	-	-	3	1	-
CO35.4	2	2	2	-	3	-	-	-	-	-	-	3	1	-
Average	**2**	**1**	**2**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**1**	**-**

Low-1: Medium-2: High-3



SUBJECT: UNIX AND SHELL PROGRAMMING

Subject Code	**22CSE36**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**2:0:2**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**03**
No. of Credits: 03			

Course Learning Objectives

The course will enable students to

CLO1	Understand the features, architecture of UNIX and its commands.
CLO2	Discuss different UNIX files, attributes and permissions.
CLO3	Discuss filter programs and regular expressions.
CLO4	Understand essential facets of shell programming in order solve the shell script Problems.

CONTENTS	# of Hours / RBT Levels
MODULE 1 UNIX Architecture and Command Usage: Unix Architecture, Features of UNIX, Internal and External Commands General-Purpose Utilities: cal, date, echo, printf, bc, passwd, who, uname, tty, stty. The File System: The Parent-Child Relationship, the HOME variable, pwd, cd, mkdir, rmdir, Absolute Pathnames, Relative Pathnames **Text Book: T1 Chapters: 2.1, 2.2, 2.5, 3.1 to 3.5, 3.9 to 3.13, 4.1 to 4.10**	**08** **L2**
MODULE 2 Handling Ordinary Files: cat, cp, rm, mv, more, file, wc, cmp, comm, diff, Basic File Attributes: ls –l, file ownership, file permissions, chmod, directory permissions, changing file ownership More File Attributes: File Systems and Inodes, Hard Links, Symbolic Links and ln, umask Modification and Access Times **Text Book: T1 Chapters: 5.1 to 5.5, 5.10 to 5.12, 6.1 to 6.7, 11.1 to 11.6**	**08** **L3**
MODULE 3 Simple Filters: The sample database, head, tail, cut, paste, sort, uniq, tr Filters using Regular Expression: grep. egrep **Text Book: T1 Chapters: 12.1, 12.3 to 12.9, 13.1 to 13.3**	**08** **L3**
MODULE 4 Essential Shell Programming Part I: Shell Scripts, read, Using command line arguments, exit and exit status of command, the logical operators && and || - conditional execution **Text Book: T1 Chapters: 14.1 to 14.5**	**08** **L2**
MODULE 5 Essential Shell Programming Part II : the if conditional, using test and [ ] to evaluate expressions, the case conditional, expr, $0, while, for, set and shift **Text Book: T1 Chapters: 14.6 to 14.13**	**08** **L3**

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Laboratory Component
List of Sample Experiments

1 Working on general purpose commands and General-Purpose Utilities
2 Working on general purpose commands and General-Purpose Utilities (contd)
3 Working on Ordinary files and Attributes
4 Working on Ordinary files and Attributes (contd)
5 Working on Filter programs and filters using regular expression
6 Working on Filter programs and filters using regular expression
7 a) Write a shell script which displays a list of all the files in the current directory to which you have read, write and execute permissions.
b) Write a shell script which will accept a filename and starting and ending line numbers and displays these lines from given file.
c) Write a shell script which is expected to accept two filenames as its arguments. Check the number of arguments and display the contents of the argument files if the arguments is two, otherwise display an error message an exit.

8 a) Write a shell program that will do the following tasks in order:
i) clear the screen ii) print the current directory iii) display current login users
iv) list of users v) list of processes vi) list of files
vii) today's date viii) Quit to UNIX
b) Write a shell script that reads data from a text file and appends the lines starting with an alphabet from 'a' through 'k' to a file named "ak" and the lines from 'l' through 'r' to a file named "lr" and the lines from 's' through 'z' to a file named "sz". Then display the number of lines in each of the files ak, lr and sz individually.
c) Write a shell script which will receive login name during execution, obtain information about it from /etc/passwd and display this information on screen in easily understandable format.

9 a) A shell script receives even number of filenames as arguments. Suppose four files are supplied as arguments then the first file should get copied into second, third file into fourth and so on. If odd number of filenames is supplied then no copying should take place and an error message should be displayed.
b) Write a shell script which will receive any number of filenames as arguments. The shell script should check whether every argument supplied is a file or a directory. If it a directory it should be appropriately reported. If it is a filename then name of the file as well as the number of lines present in it should be reported.

10 a) Write a shell script which expects two parameters, a file name and a number. The script deletes the line with given number from given file.
b) Write a shell script which accepts any number of arguments and prints them in reverse order.
Ex : If file name is test then $ sh test A B C should produce C B A.
c) Write script average which computes the average value (rounded to an integer as computed with expr) of the numeric values given in the parameters and writes the result to standard output.
For example average 4 13 112 7 outputs 34.

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Course Outcomes: Upon successful completion of this course, student will be able to

CO36.1	Explain the fundamental concepts of UNIX Operating system along with the working of various commands
CO36.2	Illustrate various filters to solve variety of applications
CO36.3	Write Regular Expressions for pattern matching
CO36.4	Write shell scripts

Text Books:

1. Sumitabha Das, "UNIX – Concepts and Applications", 4th Edition, McGraw Hill, 2017.

Reference Books:

1. Behrouz A Forouzan and Richard F Gilberg, "UNIX and SHELL Programming", India Edition, Cengage Learning, Third Reprint 2008
2. Kenneth Rosen et al, "UNIX – The Complete Reference", 2nd Edition, Tata McGraw Hill Fourth Reprint 2008.

E-Books / Web References:

1. http://www.ee.surrey.ac.uk/Teaching/Unix/unixintro.html
2. https://www.tutorialspoint.com/unix/index.htm

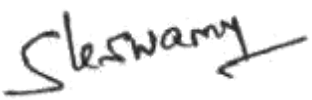
MOOCs:

1. https://nptel.ac.in/courses/117106113
2. https://onlinecourses.swayam2.ac.in/aic20_sp05/preview
3. http://elearning.vtu.ac.in/econtent/courses/video/CSE/CS36.htm

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO36.1	3	3	2	-	3	-	-	-	-	-	-	2	-	-
CO36.2	3	3	2	-	3	-	-	-	-	-	-	2	-	-
CO36.3	3	3	2	-	3	-	-	-	-	-	-	2	-	-
CO36.4	3	3	2	-	3	-	-	-	-	-	-	2	-	-
Average	**3**	**3**	**2**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**

Low-1: Medium-2: High-3



SEMESTER – IV

Course: Probability and Linear Algebra

(Common for CSE/ISE/AI&DS/AIML/CS(AIML))

Course Code	**22MAT41A**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**2:2:0**	**SEE Marks**	**50**
No. of Credits	**3**	**Examination Hours**	**03**

Course Objectives: To enable students to apply the knowledge of Mathematics in fields of computer science and allied branches by making them to learn:

CLO1	Probability and Random Variables
CLO2	System of linear equations
CLO3	Vector spaces, linear transformations
CLO4	Eigenvalues, Eigenvectors, diagonalization and Singular value decomposition

Content	No. of Hours/ RBT levels
Module 1 Random Variable, Binomial, Poisson, Exponential and Normal distributions. Joint distributions (both discrete and continuous), Expectation and Covariance. Central limit theorem and law of large numbers.	**08 Hours L2, L3**
Module 2 System of linear equations, row reduction and echelon form, vector equations, The matrix equation AX = b. Linear independence and introduction to linear transformations. Matrix of linear transformation, invertible matrix, inverse of a matrix by Gauss Jordan method.	**08 Hours L2, L3**
Module 3 Vector space, subspaces, linearly independent sets, Bases. Coordinate systems, the dimensions of a vector space, Rank, Change of basis. Eigen vectors and Eigen values, diagonalization, Eigen vectors and linear transformations.	**08 Hours L2, L3**
Module 4 Inner products; inner product spaces; orthogonal sets and projections; Gram-Schmidt process; QR-factorization.	**08 Hours L2, L3**
Module 5 Least square solutions and fittings, diagonalization of symmetric matrices, quadratic forms, constrained optimization; Singular value decomposition.	**08 Hours L2, L3**

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

CO41.1	Solve problems associated with random variables using probability distributions
CO41.2	Solve systems of linear equations.
CO41.3	Work within vector spaces.
CO41.4	Use computational techniques for the study of Eigenvalues, Eigenvectors, and diagonalization

Textbooks:

1 T Veerarajan, Probability, Statistics and Random Processes for Engineers, Tata McGraw Hill, 3rd Edition, 2008

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2 David C Lay, Linear Algebra and its applications, Pearson, 4th Edition, 2012.

Reference books:

1 Richard H Williams, Probability, Statistics and Random Processes for Engineers, Cengage Learning, 1st Edition, 2003
2 Gilbert Strang, Linear Algebra and its Applications, Cengage Learning, 4th Edition, 2006
3 K. Hoffman and R. Kunze, Linear Algebra, Prentice Hall, 2nd Edition, 2004.

Scheme of Examination:

Semester End Examination (SEE):
SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question from each module.**

Continuous Internal Evaluation (CIE):
Three Tests are to be conducted for 40 marks each. Average of Marks scored in all three tests is added to test component. CIE is executed by way of quizzes / Alternate Assessment Tools (AATs), and three tests. **Some possible AATs:** seminar/assignments/ mini-projects/ concept videos/ partial reproduction of research work/ group activity/ any other.

Typical Evaluation pattern for regular courses is shown in Table 2.

Table 2: Distribution of weightage for CIE & SEE of Regular courses

Component		Marks	Total Marks
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	CIE Test-3	**40**	
	Assignments	**10**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

CO/PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO41.1	3	2	1									3				
CO41.2	3	2	1									3				
CO41.3	3	2	1									3				
CO41.4	3	2	1									3				
Average	3	2	1									3				

Low-1: Medium-2: High-3

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SEMESTER - IV

SUBJECT: OBJECT ORIENTED PROGRAMMING WITH JAVA (Integrated)

Subject Code	**22CSE42**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:2**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**03**
No. of Credits: 04			

Course Learning Objectives:
The course will enable students to

CLO1	Learn fundamental features of Java Programming
CLO2	Setup Java JDK environment to create, debug and run Java Programs
CLO3	Learn Object Oriented concepts using Java programs
CLO4	Apply the concepts of multiprogramming, exception handling, Regular Expressions to develop robust Java programs
CLO5	Apply String handling methods to write Java programs

CONTENTS	# of Hours / RBT Levels
MODULE 1 **Introduction to Object Oriented Concepts:** Member functions and data, objects and functions, Constructors, Destructors. **The History and Evolution of Java:** Java's magic: the Bytecode; The Java Buzzwords **An Overview of Java:** Object-Oriented Programming; A First Simple program, Lexical Issues **Data types, variables and Arrays:** The primitive types, A closer look at Literals, Variables, Type conversion and casting, Automatic type promotion in Expressions, Arrays **Operators:** Arithmetic operators, The Bitwise operators, Relational operators, Boolean Logical operators, Assignment operator, The? operator, Operator precedence **Control Statements:** Java's selection statements, iteration statements, Jump statements **Text Book: 1 Chapters: 1, 2, 3, 4, 5 Text Book: 2 Chapter: 1**	**08** **L3**
MODULE 2 **Introducing Classes:** Classes fundamentals; Declaring objects; Introducing methods, Constructors, this keyword, garbage collection **Inheritance:** Inheritance basics, using super, creating a Multilevel hierarchy, method overriding, Dynamic Method dispatch, Using Abstract classes **Text Book: 1 Chapters: 6, 8**	**08** **L3**
MODULE 3 **Packages and Interfaces:** Packages, Member Access, Importing Packages, Interfaces **Exception handling:** Exception handling fundamentals, Exception Types, Uncaught Exceptions, using try and catch, multiple catch clause, throw, throws, finally **Text Book: 1 Chapters: 9, 10**	**08** **L3**
MODULE 4 **Multithreaded Programming:** The Java Thread Model, The Main Thread, Creating a Thread, creating multiple threads, using isAlive() and join(), Thread priorities, Synchronization **Regular Expressions:** Regular Expression processing, Pattern, Matcher, Regular	**08** **L3**

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Expression Syntax, Demonstrating Pattern matching, Two-pattern matching options, Exploring Regular Expressions **Text Book: 1 Chapters: 11, 30**	
MODULE 5 **String handling:** The String Constructors, String Length, Special String Operations, Character Extraction, String Comparison, Searching Strings, Modifying a String, Data Conversion Using valueOf( ), Changing the case of characters within a String, Joining Strings, Additional String Methods, StringBuffer, StringBuilder **Text Book: 1 Chapter: 17**	**08** **L3**

Laboratory Component
List of Experiments

Implement the following programs using Java in Eclipse IDE

1. Implement a Java program to simulate a simple calculator using switch statement. The program must continue executing until the user presses the key 'E'.
2. Implement a Java program to create a class called Student which stores USN, name and marks of a student. Calculate the Grade according to the following criteria. Input N number of student details, find grade and print all the members.

Marks	Grade
90 to 100	O
80 to 89	A+
70 to 79	A
60 to 69	B+
55 to 59	B
50 to 54	C
40 to 49	P
0 to 39	F

3. Implement a Java program to create a super class called Staff with the members - staffID, name, phone and salary of the staff members. Extend this class by creating three sub classes namely Teaching (domain, publications), Technical (skills) and Contract (contract_period). Read and display the details of all the sub classes.
4. Implement a Java program to create a super class called Box with the members - width, height and depth and find the volume of the Box. Extend Box by creating a sub class called BoxWeight to find weight of the Box. Extend BoxWeight by creating a sub class called Shipment to find the cost of the shipment. Create two instances of class Shipment to read and display the data.
5. Implement a Java program that uses the concept of Interface to find the area of Rectangle and Triangle.
6. Implement a Java program that implements a multi-threaded application that has three threads. The first thread generates a random integer every 1 second. The second thread computes the square of the number and prints it. The third thread computes cube of the number and prints it.
7. Implement a Java program to input N no. of strings, count the number of vowels and digits in each string using Regular Expressions.
8. Implement a Java program to validate USN and email ID of N students using Regular Expressions.
9. Implement a Java program to replace all instances of a substring with another within a string.
10. Implement a Java Program to input a string and implement Monoalphabetic Cipher.

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Course Outcomes:

Upon successful completion of this course, student will be able to

CO42.1	Apply the fundamental constructs of Java Programming to create, debug and run programs with modern tools
CO42.2	Illustrate the concepts of Object Oriented Programming using Java Programs
CO42.3	Implement reusable Java programs using Interfaces and Packages
CO42.4	Apply Exception handling mechanism and thread synchronization
CO42.5	Design Java programs using Regular Expressions to validate the input data
CO42.6	Implement Java programs using String handling methods

Text Books:

1. Herbert Schildt, "Java: A beginner's guide", 11th Edition, McGraw-Hill Education, 2022.
2. E Balagurusamy, "Object Oriented Programming with C++", 8th Edition, 2020.

Reference Books:

1. E Balaguruswamy, "Programming with Java", 6th Edition, McGraw-Hill Education, 2019.
2. Surbhi Kakar, "A Textbook of Java Programming", 1st Edition, Dreamtech Press, 2019.
3. R. Nageswara Rao, "Core Java: An Integrated Approach", 1st Edition, Dreamtech Press, 2016.

E-Books / Web References:

1. https://docs.oracle.com/javase/tutorial/essential/index.html
2. http://www.onlinecomputerbooks.com/free-java-books.php

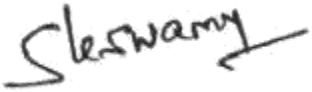
MOOCs:

1. https://www.udemy.com/course/java-programming-tutorial-for-beginners/
2. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013847939122315264565 22_shared/overview

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO42.1	3	3	3	-	3	-	-	-	1	-	-	2	-	2
CO42.2	3	3	3	-	3	-	-	-	1	-	-	2	-	2
CO42.3	3	3	3	-	3	-	-	-	1	-	-	2	-	2
CO42.4	3	3	3	-	3	-	-	-	1	-	-	2	-	2
CO42.5	3	3	3	-	3	-	-	-	1	-	-	2	-	2
CO42.6	3	3	3	-	3	-	-	-	1	-	-	2	-	2
Average	**3**	**3**	**3**	**-**	**3**	**-**	**-**	**-**	**1**	**-**	**-**	**2**	**-**	**2**

Low-1: Medium-2: High-3



SUBJECT: DESIGN AND ANALYSIS OF ALGORITHMS (Integrated)

Subject Code	**22CSE43**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:2**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**3**
No. of Credits: 04			

Course Learning Objectives:
The course will enable students to

CLO1	Apply mathematical concepts and notations to define a problem
CLO2	Understand and apply algorithms design techniques
CLO3	Gain ability to solve real life problems using algorithms techniques
CLO4	Understand the limitations of Algorithmic power

CONTENTS	# of Hours / RBT Levels
MODULE 1 **Introduction:** What is an Algorithm?, Fundamentals of Algorithmic Problem Solving, Important Problem Types, Algorithm Specification, Performance Analysis: Space complexity, Time complexity Asymptotic Notations: Big-Oh notation (O), Omega notation (Ω), Theta notation (Θ), Mathematical analysis of Non-Recursive and recursive Algorithms with Examples **Text Book 1: Chapters: 1, 2.1-2.4 Text Book 2: Chapters: 1.2, 1.3**	**06** **L2**
MODULE 2 **Brute Force:** Brute force string matching algorithms **Divide & Conquer:** General method, Recurrence equation for divide and conquer, Binary Search, Merge sort, Quick sort, Strassen's matrix multiplication, Advantages and Disadvantages of divide and conquer **Text Book 1: Chapters: 3.2, 5.1, 5.2, 5.4 Text Book 2 : Chapters: 3.1, 3.3**	**08** **L3**
MODULE 3 **Greedy Method:** Introduction, General method, Knapsack Problem, Job sequencing with deadlines **Minimum cost spanning trees:** Prim's Algorithm, Kruskal's Algorithm, **Single source shortest paths:** Dijkstra's Algorithm**, Optimal Tree problem:** Huffman Trees and Codes **Transform and Conquer Approach:** Heaps and Heap Sort, AVL Tree, 2-3 Tree **Text Book 1: Chapters: 6.3-6.4, 9.1-9.4 Text Book 2 : Chapters: 4.3, 4.5**	**10** **L3**
MODULE 4 **Dynamic Programming:** Introduction, Transitive closure - Warshall's and Floyds algorithm, Knapsack problem & memory functions, Bellman Ford algorithm **Decrease & Conquer:** Introduction – Decrease by constant, decrease by constant factor, variable size decrease, Breadth First search traversal, Depth First search traversal, Topological sorting using DFS and source removal method **Text Book 1: Chapters 3.5, 4.2, 8.2, 8.4 Text Book 2: Chapters 5.4, 5.9**	**08** **L3**
MODULE 5 **Backtracking:** N-Queens problem, Sum of subsets problem, Hamiltonian cycles **Branch & Bound:** Introduction, Travelling Salesman problem, Knapsack problem, Assignment problem	**08** **L3**

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Limitations of Algorithm Power: Decision Trees for sorting and searching Approximation Algorithms for NP-Hard Problems – Traveling Salesperson Problem using Nearest-neighbor algorithms **Text Book 1 : Chapters 11.2-11.3, 12.1-12.2**	

Laboratory Component
List of Experiments

1. Write a C program to sort a given set of 'n' integer elements using Quick Sort method and compute its time complexity.
2. Write a C program to sort a given set of 'n' integer elements using Merge Sort method and compute its time complexity.
3. Write a C program to find Minimum Cost Spanning Tree of a given connected undirected graph using i) Kruskal's algorithm. ii) Prim's algorithm.
4. Write a C program to find the shortest path using Dijkstra's algorithm.
5. Write a C program to implement All-Pairs Shortest Paths problem using Floyd's algorithm.
6. Write a C program to solve the given instance of 0/1 Knapsack problem using Dynamic Programming
7. Write a C program to print all the nodes reachable from a given starting node in a digraph using BFS method.
8. Write a C program to check whether a given graph is connected or not using DFS method.
9. Write a C program to solve N-Queen's problem using Back Tracking.
10. Write a C program to develop Back Tracking solution for Sum of Subset Problem.

Course Outcomes:
Upon successful completion of this course, student will be able to

CO43.1	Explain the basic techniques of analyzing the algorithms using time & space complexity and asymptotic notations
CO43.2	Devise algorithms using brute force and Divide and Conquer techniques for a given problem.
CO43.3	Demonstrate Graph Algorithms using greedy method, Transform and Conquer Approach to model Engineering Problems.
CO43.4	Employ Dynamic Programming and Decrease & Conquer strategies to solve a given problem
CO43.5	Use Back Tracking, Branch and Bound design techniques for solving Computationally hard problems.

Text Books:

1. Anany Levitin, "Introduction to The Design and Analysis of Algorithms", 3rd Edition, Pearson, Tenth Impression 2020.
2. Ellis Horowitz, Sartaj Sahni & Sanguthevar Rajasekaran, "Computer Algorithms/C++", University Press, 2nd Edition, Reprint 2017.

Reference Books:

1. Cormen, Thomas H., Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, "Introduction to Algorithms", MIT press, 2022.

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E-Books / Web References:

1. http://www.facweb.iitkgp.ac.in/~sourav/daa.html
2. https://freevideolectures.com/course/2281/design-and-analysis-of-algorithms

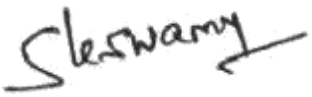
MOOCs:

1. https://nptel.ac.in/courses/106101060/
2. https://www.coursera.org/specializations/algorithms

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO43.1	3	3	3	-	3	-	-	-	-	-	-	2	3	-
CO43.2	3	3	3	-	3	-	-	-	-	-	-	2	3	-
CO43.3	3	3	3	-	3	-	-	-	-	-	-	2	3	-
CO43.4	3	3	3	-	3	-	-	-	-	-	-	2	3	-
CO43.5	3	3	3	-	3	-	-	-	-	-	-	2	3	-
Average	**3**	**3**	**3**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**-**

Low-1: Medium-2: High-3



SUBJECT: SOFTWARE ENGINEERING

Subject Code	**22CSE44**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**3**
No. of Credits: 03			

Course Learning Objectives:
The course will enable students to

CLO1	Outline Software Engineering principles and activities involved in building large software programs
CLO2	Introduce Software design using UML tools and various system models
CLO3	Introduce Agile Software development and Agile methods – SCRU
CLO4	Introduce Software Testing and Software Evolution processes in detail
CLO5	Explain project planning, Cost estimation techniques and Software quality, standards and metrics

CONTENTS	**# of Hours / RBT Levels**
MODULE 1 **Introduction:** Professional Software Development - Software Engineering, Case Studies. **Software Processes:** Software process models - Waterfall Model, Incremental Model, and Spiral Model, Software Process Activities. **Requirement Engineering:** Requirements Specification, Requirement elicitation and analysis, Requirements Validation, Requirements change, Functional Specification, and Non-Functional Requirements, The software requirements document **Case Study:** Create a SRS document for the following software projects 1. Online Ticket Reservation System 2. Stock Maintenance 3. Student's Marks Analyzing System 4. Stock Maintenance **Text Book:1 Chapters: 1.1-1.3, 2.1-2.2, 4.1-4.6**	**08** **L2**
MODULE 2 **System Models:** Context models. Interaction models. Structural models. Behavioral models. Model-driven engineering **Software Design and Planning:** Object-oriented design concepts using UML tool: Star UML application, Design patterns, Implementation issues, Open-Source Development **Text Book:1 Chapters: 5.1-5.5, 7.1-7.4**	**08** **L2**
MODULE 3 **Agile Software Development:** Agile methods, Plan-driven and agile development, Extreme programming, Agile project management, Scaling agile methods. SCRUM Methodology, SCRUM **Text Book:1 & 3 Chapters: 3.1-3.4**	**08** **L2**
MODULE 4 **Software testing strategies:** A Strategic Approach to Software Testing, Strategic Issues, Test Strategies for Conventional software, Test Strategies for Object-Oriented Software, Test Strategies for web apps, Validation Testing, and System Testing **Testing Conventional Applications:** Software Testing Fundamentals, Internal and	**08** **L2**

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External views of Testing, White-Box Testing, Basic path Testing, Control structure Testing, and Black-box Testing **Case study:** 1. Design the test case for finding the roots of the quadratic equation 2. Design the test case for the e-commerce application **Text Book:2 Chapters: 17.1-17.7, 18.1-18.6**	
MODULE 5 **Project planning:** Software pricing, Plan-driven development, Project scheduling, Agile planning, and Estimation techniques **Quality management:** Software quality, Software standards, Reviews and inspections, Software measurement, and metrics **Text Book:1 Chapters: 23.1-23.5, 24.1-24.3 & 24.5**	**08** **L2**

Course Outcomes:

Upon successful completion of this course, student will be able to

CO44.1	Understand the fundamentals of Software Engineering, Software process models, and Requirements Engineering
CO44.2	Understand the different types of System Models, Software Design and Planning by using UML tool
CO44.3	Understand Agile Software Development and Agile Methods – SCRUM
CO44.4	Describe Software testing methods and Conventional Applications
CO44.5	Discuss the project planning process, Cost estimation models, Software Quality standards, and metrics

Text Books:

1. Ian Sommerville, "Software Engineering", 10th Edition, Pearson Education, 2016.
2. Roger S Pressman, "Software Engineering: A Practitioner's Approach", 7th Edition, Tata McGraw-Hill, 2014.
3. The SCRUM Primer, Ver 2.0, http://www.goodagile.com/scrumprimer/scrumprimer20.pdf

Reference Books:

1. Pankaj Jalote, "An integrated approach to Software Engineering", Springer US, 3rd Edition, 2005.
2. Michael Blaha, James Rumbaugh, "Object Oriented Modelling and Design with UM", Pearson Education, 2nd Edition, 2005.
3. Rajib Mall, "Fundamentals of Software Engineering", 4th Edition, PHI Learning Private Limited, 2014.
4. Tom Pender, "UML Bible", Wiley Publishing, 2003.

E-Books / Web References:

1. https://www.softwaretestingmaterial.com/category/agile/
2. https://www.atlassian.com/agile/kanban

MOOCs:

1. https://www.coursera.org/learn/introduction-to-software-engineering
2. www.vtu.ac.in

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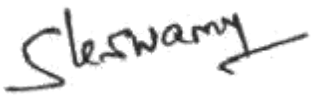
Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO44.1	3	-	-	-	-	1	1	1	-	3	-	2	3	3
CO44.2	3	-	3	-	-	1	1	1	-	3	-	2	3	3
CO44.3	3	-	3	-	-	1	1	1	-	3	-	2	3	3
CO44.4	3	3	3	3	-	3	-	-	3	3	3	3	3	3
CO44.5	3	1	-	-	-	1	1	1	-	3	2	2	3	3
Average	**3**	**2**	**3**	**3**	**-**	**2**	**1**	**1**	**3**	**3**	**3**	**3**	**3**	**3**

Low-1: Medium-2: High-3



SUBJECT: DATA VISUALIZATION (Integrated)

Subject Code	**22CSE45**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**2:0:2**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**3**
No. of Credits: 03			

Course Learning Objectives:
The course will enable students to:

CLO1	Demonstrate understanding of Data Visualization and key terms
CLO2	Design effective data visualization for visual mapping using Matplotlib
CLO3	Demonstrate skills on understanding relationship between variables
CLO4	Demonstrate skills on understanding Bivariate analysis
CLO5	Create dashboard and visualization report for Time Series analysis data

CONTENTS	**Hours / RBT Levels**
MODULE 1 **Exploratory Data Analysis:** EDA fundamentals, Understanding data science, Significance of EDA, Making sense of data, Comparing EDA with classical and Bayesian analysis, Software tools for EDA, Visual Aids for EDA, Data transformation techniques-merging database, reshaping and pivoting, Transformation techniques, Grouping Datasets, data aggregation, Pivot tables and cross-tabulations **Text Book: 1 Chapter: 1**	**08** **L2**
MODULE 2 **Visualizing Using Matplotlib:** Importing Matplotlib, Simple line plots, Simple scatter plots, visualizing errors, density and contour plots, Histograms, legends, colors, subplots, text and annotation, customization, three dimensional plotting, Geographic Data with Basemap, Visualization with Seaborn **Text Book: 2 Chapter: 4**	**08** **L3**
MODULE 3 **Univariate Analysis:** Introduction to Single variable: Distributions and Variables, Numerical Summaries of Level and Spread, Scaling and Standardizing, Inequality, Smoothing Time Series **Text Book: 3 Chapter: 1**	**08** **L3**
MODULE 4 **Bivariate Analysis:** Relationships between Two Variables, Percentage Tables, Analyzing Contingency Tables, Handling Several Batches, Scatterplots and Resistant Lines, Transformations **Multivariate And Time Series Analysis:** Introducing a Third Variable, Causal Explanations, Three-Variable Contingency Tables and Beyond, Longitudinal Data **Text Book: 3 Chapters: 2, 3**	**08** **L3**
MODULE 5 **Working with Data in Tableau:** A simple example, connecting to data, Tableau File types, filtering data, Basic Charts, Telling a Data Story with Dashboards, Analytics **Text Book: 4 Chapter: 2, 7**	**08** **L3**

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Laboratory Component
List of Sample Experiments

Considering suitable dataset

1. Develop a program to read a dataset and perform exploratory data analysis on the dataset
2. Develop a program to implement various types of plots using seaborn
3. Develop a program to implement various types of plots using matplotlib
4. Develop a program to visualize different types of correlation between features of the dataset
5. Develop a program to implement univariate analysis
6. Develop a program to implement bivariate analysis
7. Develop a program to implement multivariate analysis
8. Develop a program to implement various data distribution methods
9. Develop a program to implement various data preprocessing methods
10. Demonstrate and implement a dashboard using Tableau

Course Outcomes:
Upon successful completion of this course, students will be able to

CO45.1	Understand the fundamentals of exploratory data analysis
CO45.2	Implement the data visualization using Matplotlib
CO45.3	Perform univariate data exploration and analysis
CO45.4	Apply bivariate data exploration and analysis
CO45.5	Use Data exploration and visualization techniques for multivariate and time series data

Text Books:

1. Mukhiya, Suresh Kumar, Usman Ahmed, "Hands-On Exploratory Data Analysis with Python: Perform EDA techniques to understand, summarize, and investigate your data", Packt Publishing Ltd, 2020.
2. Jake Vander Plas, "Python Data Science Handbook: Essential Tools for Working with Data", Oreilly, 1st Edition, 2016
3. Catherine Marsh, Jane Elliott, "Exploring Data: An Introduction to Data Analysis for Social scientists" , Wiley Publications, 2nd Edition, 2008.
4. Joshua N. Milligan, "Learning Tableau", Packt Publishing Limited, 3rd Edition, 2019.

Reference Books:

1. Eric Pimpler, "Data Visualization and Exploration with R", GeoSpatial Training service, 2017
2. Claus O. Wilke, "Fundamentals of Data Visualization", O'reilly publications, 2019.
3. Matthew O. Ward, Georges Grinstein, Daniel Keim, "Interactive Data Visualization: Foundations, Techniques, and Applications", 2nd Edition, CRC press, 2015.

E-Books / Web References:

1. https://www.perlego.com/book/3815910/data-visualization-exploring-and-explaining-with-data-pdf

MOOCs:

1. https://www.coursera.org/specializations/data-analysis-visualization-foundation
2. https://www.coursera.org/learn/datavisualization

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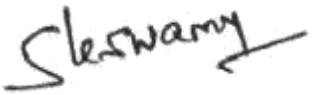
Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO45.1	3	3	-	-	3	-	-	3	-	-	-	-	3	-
CO45.2	3	3	-	-	3	-	-	3	-	-	-	-	3	-
CO45.3	3	3	-	-	3	-	-	3	-	-	-	-	3	-
CO45.4	3	3	-	-	3	-	-	3	-	-	-	-	3	-
CO45.5	3	3	-	-	3	-	-	3	-	-	-	-	3	-
Average	**3**	**3**	**-**	**-**	**3**	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**3**	**-**

Low-1: Medium-2: High-3



SUBJECT: FULL STACK FRAMEWORK -FRONTEND (Integrated)

Subject Code	**22CSE46**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**2:0:2**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**3**
No. of Credits: 03			

Course Learning Objectives:

The course will enable students to

CLO1	Illustrate the basics of JavaScript, its importance, and embed in a web page
CLO2	Build dynamic web pages using JavaScript
CLO3	Facilitate the usage of objects and events in web pages using JavaScript
CLO4	Understand the programming model provided by the React framework and Define React components
CLO5	Build applications using ReactJS

CONTENTS	**# of Hours / RBT Levels**
MODULE 1 **Basics of JavaScript:** Overview of JavaScript, Object orientation and JavaScript, Syntactic characteristics, Primitives, operations, and expressions, Screen output and keyboard input, Control statements, Object creation and modification, Arrays, Functions, Constructors, Examples **Text Book:1 Chapter: 4**	**08** **L3**
MODULE 2 **JavaScript and HTML Documents:** The JavScript execution environment, The Document Object Model, Element access in JavaScript, Events and event handling, Handling events from the Body elements, Button elements, Text box and Password elements. The DOM 2 event model, The navigator object, DOM tree traversal and modification **Text Book:1 Chapter: 5**	**08** **L3**
MODULE 3 **Dynamic Documents with JavaScript:** Introduction to dynamic documents, Positioning elements, Moving elements, Element visibility, Changing colors and fonts. Examples Dynamic content, Locating the mouse cursor, Reacting to a mouse click, Slow movement of elements, Dragging and dropping elements, Examples **Text Book:1 Chapter: 6**	**08** **L3**
MODULE 4 React Library: Fundamentals of React: Hello React, Requirements, setting up a React Project, Meet the React Component, React JSX, Lists in React, Meet another React Component, React Component Instantiation, React DOM, React state. **Text Book: 2 Topics: Fundamentals of React: till React Dom and React State**	**08** **L3**
MODULE 5 React Fragments, Forms in React, Styling in React, CSS in React, React Class Components. **Text Book: 2 Topics: React Fragments, React Legacy, Styling in React, and Forms in React**	**08** **L3**

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Laboratory Component

- Student can execute the programs on any browser by enabling the JavaScript option in the browser.
- Go through the installation procedure for ReactJS: https://react.dev/learn/installation

List of Sample Experiments

1. Implement a JavaScript function to design a simple calculator to perform the following operations: sum, product, difference and quotient.
2. Develop JavaScript code that displays text "TEXT-GROWING" with increasing font size in the interval of 100ms in RED COLOR, when the font size reaches 50pt it displays "TEXT-SHRINKING" in BLUE color. Then the font size decreases to 5pt.
3. Develop and demonstrate a HTML5 file that includes JavaScript script that uses functions to find the position of the left-most vowel in the given string.
4. Develop and demonstrate a HTML5 file that includes JavaScript script that uses functions to display the number with its digits in the reverse order.
5. Develop a program to fade the removal of a DOM Element using CSS and JavaScript
6. Implement a program to display a list of books using ReactJS
7. Create a simple login form with name, password, email, contact number, date of birth and submit using ReactJS.
8. Develop a program to build todo list app using reactJS
9. Build a simple search filter functionality to display a filtered list based on the search query entered by the user using ReactJS
10. Design and develop a program to create a BMI calculator using ReactJS
11. Develop a program to build counter app using ReactJS

Course Outcomes:

Upon successful completion of this course, student will be able to

CO46.1	Apply the concepts of JavaScript and pre-defined objects, properties and methods to design web pages
CO46.2	Develop applications using event handling in JavaScript
CO46.3	Analyze the dynamic documents with JavaScript
CO46.4	Apply the fundamentals of ReactJS to design webpages
CO46.5	Implement single-page applications in React with the help of React library and various React features including components and forms

Text Books:

1. Robert W. Sebesta, "Programming the World Wide Web", 7th Edition, Pearson publication, 2012.
2. Robin Wieruch, "The Road to React", 1st Edition, Zaccheus Entertainment, 2018.

Reference Books:

1. Kogent Learning Solutions Inc., "Web Technologies, HTML, JavaScript, PHP, Java, JSP, XML and AJAX, Black book", 1st Edition, Dream Tech, 2009.
2. Wang, Paul S., and Sanda Katila. "An introduction to Web design and programming", 1st Edition, Cengage Learning, 2004.
3. Randy Connolly, Ricardo Hoar, "Fundamentals of Web Development", 4th Edition, Pearson Education India, 2016.

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E-Books / Web References:

1. https://www.w3schools.com/js/
2. https://www.w3schools.com/react/default.asp
3. https://www.goodreads.com/work/editions/198800-programming-the-world-wide-web
4. https://vdocuments.mx/world-wide-web-sebesta-robert-w.html?page=1

MOOCs:

1. https://www.udemy.com/course/full-stack-website-development-technologies/
2. https://www.edx.org/learn/web-development/harvard-university-cs50-s-web-programming-with-python-and-javascript?hs_analytics_source=referrals&utm_source=%20%20%20mooc.org&utm_medium=referral&utm_campaign=mooc.org-course-list

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO46.1	2	3	3	-	3	-	-	-	3	-	-	-	2	-
CO46.2	2	3	3	-	3	-	-	-	3	-	-	-	2	-
CO46.3	2	3	3	3	3	-	-	-	3	-	-	-	2	-
CO46.4	2	3	3	3	3	-	-	-	3	-	-	-	2	-
CO46.5	2	3	3	3	3	-	-	-	3	-	-	-	2	-
Average	**2**	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**3**	**-**	**-**	**-**	**2**	**-**

Low-1: Medium-2: High-3

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SCHEME AND SYLLABUS

Department of
Computer Science and Engineering

22 SCHEME

Computer Science and Engineering

V – VI Semester

GLOBAL ACADEMY OF TECHNOLOGY
(Autonomous Institution Affiliated to VTU, Belagavi.)
Accredited by NAAC with 'A' Grade,
NBA Accredited - CSE, ISE, ECE, EEE, ME, CV
Ideal Homes Township,
Raja Rajeshwari Nagar, Bengaluru-560098

V SEMESTER

Sl. No.	Course Code	Course Title	Course Type	Teaching Dept.	Teaching Hours/Week			Examination			CREDITS
					L	T	P	CIE	SEE	Total	
1	22CSE51	Management, Economics and Finance for IT Engineers	PC	CSE	3	0	0	50	50	100	3
2	22CSE52	Database Management Systems (Integrated)	IPC		3	0	2	50	50	100	4
3	22CSE53	Machine Learning (Integrated)	IPC		3	0	2	50	50	100	4
4	22CSE54	Theory of Computation	PC		3	0	0	50	50	100	3
5	22CSE55X	Program Elective 1	PEC		3	0	0	50	50	100	3
6	22CSE56	Android Programming (Integrated)	AEC		1	0	2	50	50	100	2
7	22CIV57	Environmental Science	CV	Civil	1	0	0	50	50	100	1
	OR										
	22UHV57	Universal Human Values	BS	CSE							
Total								**350**	**350**	**700**	**20**

Program Elective 1*			
22CSE551	Robotic Process Automation	22CSE553	Unix System Programming
22CSE552	R Programming	22CSE554	Computer Graphics

***NPTEL for Credit transfer**: Students can take 12 weeks NPTEL course as an equivalent to Program elective. The NPTEL courses of duration less than 12 weeks will not be considered for credit transfer. The courses (only technical) taken are as per the recommendation of BOS of respective department. The similarity of the contents as offered by NPTEL should not exceed a maximum of 40% of the courses being registered by the student. The NPTEL course need to be completed before the registration of the elective. Any certificate obtained after the registration of elective would not be considered. The validity of NPTEL certificate is for two years and it cannot be used more than once to avail the benefit. The student is eligible to transfer a maximum of nine credits in the entire duration of the program. The grades will be awarded as equivalent to the grades obtained in the NPTEL course.

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VI SEMESTER

Sl. No.	Course Code	Course Title	Course Type	Teaching Dept.	Teaching Hours/Week			Examination			CREDITS
					L	T	P	CIE	SEE	Total	
1	22CSE61	Cloud Computing	PC	CSE	3	0	0	50	50	100	3
2	22CSE62	Advanced Java (Integrated)	IPC		3	0	2	50	50	100	4
3	22CSE63	Computer Networks (Integrated)	IPC		3	0	2	50	50	100	4
4	22CSE64X	Program Elective 2	PEC		3	0	0	50	50	100	3
5	22CSE65X	Open Elective 1	OEC	CSE	3	0	0	50	50	100	3
6	22CIV66	Environmental Science	HSM	Civil	1	0	0	50	50	100	1
	OR										
	22UHV66	Universal Human Values	BS	CSE							
7	22CSEMP67	Mini Project	MP	CSE	Two Contact hours per week			50	50	100	2
Total								**350**	**350**	**700**	**20**

Program Elective 2*			
22CSE641	System Software and Compiler Design	22CSE643	Dot Net Frameworks
22CSE642	Big Data Analytics	22CSE644	Augmented Reality and Virtual Reality
Open Elective 1 (Offered to other branch students)			
22CSE651	Advanced Python	22CSE653	Introduction To Cyber Security
22CSE652	Software Testing	22CSE654	Introduction to Java

*__NPTEL for Credit transfer__: Students can take 12 weeks NPTEL course as an equivalent to Program elective. The NPTEL courses of duration less than 12 weeks will not be considered for credit transfer. The courses (only technical) taken are as per the recommendation of BOS of respective department. The similarity of the contents as offered by NPTEL should not exceed a maximum of 40% of the courses being registered by the student. The NPTEL course need to be completed before the registration of the elective. Any certificate obtained after the registration of elective would not be considered. The validity of NPTEL certificate is for two years and it cannot be used more than once to avail the benefit. The student is eligible to transfer a maximum of nine credits in the entire duration of the program. The grades will be awarded as equivalent to the grades obtained in the NPTEL course.

SEMESTER - V

SUBJECT: Management, Economics and Finance for IT Engineers

Subject Code	**22CSE51**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**3**
No. of Credits: 03			

Course Learning Objectives:
The course will enable students to:

CLO1	Introduce the fundamentals, tools and theories of managerial economics
CLO2	Explain the principles of management, organization and entrepreneur
CLO3	Realize the importance of planning, organizing, staffing, directing and controlling and gain the leadership qualities required to run an enterprise
CLO4	Realize and plan how to launch and make an entrepreneurial career
CLO5	Familiarize the students with basic concepts of financial management and financial system

CONTENTS	# of Hours / RBT Levels
MODULE 1 **Nature and Scope of Managerial Economics** - Introduction, What is Economics?, What is Managerial Economics? , How Economics Contributes to Managerial Decisions, Application of Economics to Business Decision: An Example, The Scope of Managerial Economics, Some Other Disciplines of Managerial Economics , Managerial Economics Bridges the Gap between Theory & Practice **Objectives of Business Firms** - Introduction, Profit as Business Objective, Alternative Objectives of Business Firms, Baumol's Hypothesis of Sales Revenue Maximization, Marris's Hypothesis of Maximization of Firm's Growth Rate, Williamson's Hypothesis of Maximization of Managerial Utility Function **Text Book: 1 Chapters: 1 and 2**	**08** **L2**
MODULE 2 **Nature and Functions of Management** - Importance of Management, Definition of Management, Management Functions or the Process of Management, Levels of Management, Organisational or Business Functions, Roles of a Manager, Managerial Skills Managerial Effectiveness, Management and Administration, Management A Science or an Art? , Management A Profession?, Professional Management vs Family Management, Management of International Business **Planning:** Nature of Planning, Importance of Planning, Types of Plans, Steps in Planning, Difference between Strategic Planning and Tactical Planning, Limitations of Planning, Making Planning Effective, Planning Skills, Strategic Planning in Indian Industry **Organisation:** What is an "Organisation"? Process of Organising, Principles of Organising, Span of Management, Departmentalisation or the Superstructure of an Organisation, Process Departmenatalisation **Staffing:** Importance and need for proper Staffing **Text Book: 2 Chapters: 1, 4, 7 and 11**	**08** **L2**
MODULE 3 **Direction and Supervision** - Requirements of Effective Direction, Giving Orders, Motivation, Job Satisfaction, Organisational Commitment, Morale, First-level or Front-line Supervision	**08** **L2**

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Leadership - Difference between a Lead and a Manager, Characteristics of Leadership, Functions of an Executive Leader, Traditional Approaches to Leadership, Leadership Effectiveness, New Approaches to Top Leadership, Leadership Assessment, Leadership Style in Indian Organisations, Worker Participation in Management in India **Communication -** Importance of Communication, Purposes of Communication, Formal Communication, Forms of Communication, Informal Communication, The Communication Process, Barriers to Communication, Principles of Effective Communication, Communication Channels and Networks, Checks on in-plant Communication, Communication in Indian Industries. **Coordination** - Need for Coordination, Managerial Control- Need for Control System, Benefits of Control. **Text Book: 2 Chapters: 15, 17, 16, 9 and 18**	
MODULE 4 **Entrepreneurship** - Introduction, Concept of Entrepreneurship, Evolution of the concept, Manager Vs Entrepreneur Functions of Entrepreneur, Characteristics of an Entrepreneur, Types of Entrepreneurs. Intrapreneurs-An emerging class, Stages in Entrepreneurial Process, Role of Entrepreneurs in Economic Development, Entrepreneurship in India Barriers to Entrepreneurship **Preparation of project** - Introduction, Meaning of Project, Project Identification, Project Selection, Report-Need and Significance, Contents of a Project Report Project Formulation, Guidelines by Planning Commission for Project Report, Errors in Project Report, Project Appraisal, Market Feasibility Study, Technical Feasibility Study, Financial Feasibility Study, Social Feasibility Study. **Text Book: 3 Chapters: 5 and 8**	**08** **L2**
MODULE 5 **Introduction to Financial Management**: Introduction, Evolution of Financial Management, Meaning, Importance Scope and Objectives, Conflicts in Principles of Profit vs. Value Maximization. **Case Studies:** 1. Cashless Aftermath: Effectiveness and Efficiency Worries 2. Faculty Procedure 3. Designing an Organisation Structure 4. Srijan 5. Ensuring Effective Communication 6. Getting Effective Leadership and Successful vs Effective Leadership **Text Book: 4 Chapter: 1 Text Book: 2 Chapter: 1, 4, 7, 9, 16, 17**	**08** **L2**

Course Outcomes:

Upon successful completion of this course, student will be able to

CO51.1	Explain the application of economic principles in management decision making
CO51.2	Discuss the functional areas of management and apply their principles in establishing an enterprise
CO51.3	Identify the business opportunities and analyze the management skills for the economic growth of the society
CO51.4	Analyze how the entrepreneur applies the principles of management to meet the personal and societal needs
CO51.5	Understand the basic financial management concepts

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Text Books:

1. Dwivedi D. N, "Managerial Economics", Vikas Publishing House 8th Edition, 2018.
2. P.C Tripathi, P.N Reddy, "Principles of Management", Tata McGraw Hill, 6th Edition, 2010.
3. K R Paneesh, "Management and Entrepreneurship", Sudha Publications, 4th Edition, 2010.
4. Nishikant Jha, Kuldeep Sharma, Nilesh Ekanath Koli, "Financial Management", Himalaya Publishing House Pvt. Ltd, 1st Edition, 2016.

Reference Books:

1. Geethika, Ghosh & Choudhury, "Managerial Economics", McGraw Hill Education 3rd Edition, 2021.
2. Robert Lussier, Thomson, "Management Fundamentals Concepts", Application, Skill Development - SAGE Publications, Inc, 9th Edition, 2020.

E-Books / Web References:

1. https://www.pdfdrive.com/financial-management-and-analysis-workbook-step-by-step-exercises-and-tests-tohelp-you-master-financial-management-and-analysis-e158595305.html
2. https://www.pdfdrive.com/fundamentals-of-financial-management-concise-sixth-edition-e20229517.html
3. https://www.youtube.com/watch?v=CCQwz_Gwo6o
4. https://www.digimat.in/nptel/courses/video/110107144/L01.html

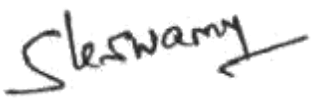
MOOCs:

1. Introduction to Managerial Economics
   https://www.iimbx.edu.in/courses/coursev1:IIMBx+ES101x+2019BL1/about

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO51.1	-	-	-	-	-	-	-	-	3	3	3	3	3	2
CO51.2	-	-	-	-	-	-	-	-	3	3	3	3	3	2
CO51.3	-	-	-	-	-	3	-	-	3	3	3	3	3	2
CO51.4	-	3	-	-	-	3	-	-	3	3	3	3	3	2
CO51.5	-	-	-	-	-	-	-	-	-	-	3	3	3	2
Average	**-**	**3**	**-**	**-**	**-**	**3**	**-**	**-**	**3**	**3**	**3**	**3**	**3**	**2**

Low-1: Medium-2: High-3



SUBJECT: DATABASE MANAGEMENT SYSTEMS (Integrated)

Subject Code	**22CSE52**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:2**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**3**
No. of Credits: 04			

Course Learning Objectives:
The course will enable students to

CLO1	Outline a strong foundation in database concepts, technology, and practice.
CLO2	Identify a strong foundation on normalization techniques to design a database
CLO3	Demonstrate the use of concurrency and transactions in database
CLO4	Design and build database applications for real world problems

CONTENTS	# of Hours / RBT Levels
MODULE 1 **Introduction:** Introduction, An example, Characteristics of Database approach, Advantages of using DBMS approach, Data models, schemas and instances, Three-schema architecture and data independence **Entity-Relationship Model:** An Example Database Application, Entity Types, Entity Sets, Attributes and Keys, Relationship types, Relationship Sets, Roles and Structural Constraints, Weak Entity Types, Sample ER Diagrams. **Text Book1: Chapters: 1.1-1.3, 1.6, 2.1, 2.2, 3.2-3.6**	**08** **L3**
MODULE 2 **Relational Model and Relational Algebra:** Relational Model Concepts, Unary Relational Operations: SELECT and PROJECT, Relational Algebra Operations from Set Theory, Binary Relational Operations: JOIN and DIVISION, Examples of Queries in Relational Algebra. **Mapping Conceptual Design into Logical Design:** Relational Database design using ER to Relational Mapping. **Text Book1: Chapters: 5.1, 8.1-8.3, 8.5, 9.1**	**08** **L3**
MODULE 3 **SQL:** SQL Data Definition and Data Types, Specifying basic constraints in SQL, Retrieval queries in SQL, Insert, Delete, Update statements in SQL. **SQL Advanced Queries:** More complex SQL Queries, Specifying Constraints as Assertions and Action Triggers, Views in SQL, Schema change statements in SQL. **Database Application Development:** PL/SQL, syntax, examples, create & drop procedure; If and Loops in Procedure; Introduction to Cursor, Cursor within *for* loops, Table within cursors. **Text Book1: Chapters: 6.1-6.4, 7.1-7.4**	**08** **L3**
MODULE 4 **Database Design:** Informal Design Guidelines for Relation Schemas, Functional Dependencies, Normal Forms Based on Primary Keys, Second, Third and Boyce Codd Normal Forms. Hashing in DBMS: Static and Dynamic Hashing Techniques. Indexing in DBMS: bitmap indexing **NoSQL Databases:** What is it and Why you need it?, Basics of Graph Databases, Document-Based NOSQL Systems and MongoDB. **Text Book1: Chapters: 14.1-14.5, 24.1, 24.3**	**08** **L3**

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MODULE 5	
Transactions Management: Introduction to Transaction Processing, Transaction states, Desirable properties of Transactions, Characterizing Schedules based on recoverability, Characterizing Schedules based on Serializability. **Concurrency Control and Recovery System:** Two-phase locking techniques for Concurrency control, Concurrency control based on Timestamp ordering, Shadow paging, ARIES recovery algorithm. **Text Book1: Chapters: 20.1, 20.2.1, 20.3-20.5, 21.1, 21.2, 22.4, 22.5**	**08** **L2**

Laboratory Component

- Design, develop, and implement the specified queries for the following problems using Oracle, MySQL, MS SQL Server, or any other DBMS under LINUX/Windows environment.
- Create Schema and insert at least 5 records for each table. Add appropriate database constraints.

List of Experiments

1. 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, Branch_id, No-of_Copies)
   BOOK_LENDING (Book_id, Branch_id, Card_No, Date_Out, Due_Date)
   LIBRARY_PROGRAMME (Branch_id, Branch_Name, Address)
   CARD (Card_No)
   Write SQL queries to
   a. Retrieve details of all books in the library – id, title, name of publisher, authors, number of copies in each Programme, etc.
   b. Get the particulars of borrowers who have borrowed more than 2 books, in the year 2020.
   c. Delete a book in BOOK table. Update the contents of other tables to reflect this data manipulation operation.
   d. Display the total number of books published by each Publisher.
   e. Create a view of all books and its number of copies that are currently available in the Library.

2. Consider the schema for Company Database:
   EMPLOYEE (SSN, FName, LName, Address, Gender, Salary, DNo)
   DEPARTMENT (DNo, DName, MgrSSN, MgrStartDate)
   DLOCATION (DNo,DLoc)
   PROJECT (PNo, PName, PLocation, DNo)
   WORKS_ON (SSN, PNo, Hours)
   Write SQL queries to
   a. Convert employee name into uppercase whenever an employee record is inserted or updated. Trigger to fire before the insert or update.
   b. Make a list of all project numbers for projects that involve an employee whose last name is 'Scott', either as a worker or as a manager of the department that controls the project.
   c. Show the resulting salaries if every employee working on the 'IoT' project is given a 10 percent raise.
   d. 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.
   e. Retrieve the name of each employee who works on all the projects controlled by department number 5.

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3. The commercial bank wants keep track of the customer's account information. Each customer may have any number of accounts and account can be shared by any number of customers. The system will keep track of the date of last transaction.
   We store the following details.
   a) Account: unique account-number, type and balance
   b) Customer: unique customer-id, name and several addresses composed of street, city and state
   Perform the following operations on the database:
   a. Create necessary tables and insert few tuples to all the relations.
   b. Add 5% interest to the customer who have less than 10000 balance.
   c. List joint accounts involving more than three customers.
   d. Find the total interest credited to each customer for a particular year.
   e. Find the customer who has not done any transaction.

4. A database is to be designed for a college to monitor students' progress throughout their course of study. The students are reading for a degree (such as B.E.) within the framework of the modular system. The college provides a number of Subjects (Modules), each being characterized by its code, title, credit value, module leader, teaching staff and the department they come from, prerequisite course. Department may be CSE, ISE etc. A Subject is co- ordinated by a module leader who shares teaching duties with one or more teachers. A Teacher may teach (and be a module leader for) more than one Subject. Students are free to choose any subject they wish. The database also contains some information about students including their Serial numbers, names, addresses, their past performance (i.e. subjects taken and Subject Examination Marks).
   For this case study,
   a. Analyze the data required, create the tables and insert the values.
   b. Retrieve the Teacher names who are not Module leaders.
   c. Display the department which offers the subject "Database Management System".
   d. Display the number of Subjects taught by each Teacher.
   e. Categorize students based on the following criterion: If Subject Examination Marks = 70 to 100 then CAT = 'Outstanding' If FinalIA = 40 to 69 then CAT = 'Average' If FinalIA< 39 then CAT = 'Weak'.

5. A college consists of number of employees working in different departments. In this context, create two tables' employee and department.
   Employee consists of columns Empno, Empname, Basic, HRA, DA, Deductions, Gross, Net, Date-of-birth. The calculation of HRA, DA are as per the rules of the college. Initially only Empno, Empname, Basic have valid values. Other values are to be computed and updated later. Department contains Deptno, Deptname, and Department Location columns. Deptno is the primary key in department table and referential integrity constraint exists between employee and department tables.
   Perform the following operations on the database:
   a. Create the tables employee and department with proper constraints.
   b. Add constraint that basic should not be less than 5000.
   c. Calculate HRA, DA, gross and net by using PL/SQL program.

BASIC	DA	HRA
15000	12%	8%
12000	10%	6%
9000	7%	4%
OTHERS	5%	200/-

   d. Write PL/SQL program that whenever salary is updated and its value becomes less than 5000 a trigger has to be raised preventing the operation.

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Course Outcomes:

Upon successful completion of this course, student will be able to

CO52.1	Construct ER models to represent simple database applications.
CO52.2	Develop Relational Algebraic expressions for complex Relational Algebra operations.
CO52.3	Develop SQL/PL/SQL programs for queries using Relational Model Concepts.
CO52.4	Design relational database model for an application by normalizing the database schema.
CO52.5	Demonstrate the use of concurrency control and transactions in database.

Text Books:

1. Elmasri, Ramez, and Sham Navathe, "Fundamentals of database systems", Vol. 7. Pearson, 2014.
2. Tiwari, Shashank, "Professional NOSQL", John Wiley & Sons, 2011.

Reference Books:

1. Raghurama Krishnan, Johannes Gehrke, "Database Management Systems", 3rd Edition, Tata McGraw Hill, New Delhi, India.
2. Silberschatz, Korth and Sudharshan, "Database System Concepts", 6th Edition, Mc-GrawHill, 2010.
3. C.J. Date, A. Kannan, S. Swamynatham, "An Introduction to Database Systems", 8th Edition, Pearson Education, 2006.
4. Coronel, Morris, and Rob, "Database Principles Fundamentals of Design, Implementation and Management", Cengage Learning 2012.

E-Books / Web References:

1. http://www.mim.ac.mw/books/Elmasri-Navathe-Fundamentals-of-Database-Systems-5th-Editi.pdf
2. https://www.edureka.co/blog/procedures-in-sql/
3. https://www.educba.com/hashing-in-dbms/
4. https://www.geeksforgeeks.org/bitmap-indexing-in-dbms/
5. https://www.mongodb.com/docs/manual/core/gridfs/

MOOCs:

1. https://archive.nptel.ac.in/courses/106/105/106105175

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO52.1	3	-	-	-	-	-	-	-	-	-	-	2	-	2
CO52.2	3	3	2	-	-	-	-	-	1	1	-	2	-	2
CO52.3	3	3	1	-	2	-	-	-	1	1	-	2	-	2
CO52.4	3	3	1	-	2	-	-	-	1	1	-	2	-	2
CO52.5	1	1	-	-	-	-	-	-	1	1	-	2	-	2
Average	**3**	**3**	**1**	**-**	**2**	**-**	**-**	**-**	**1**	**1**	**-**	**2**	**-**	**3**

Low-1: Medium-2: High-3

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SUBJECT: MACHINE LEARNING (Integrated)

Subject Code	**22CSE53**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:2**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**3**
No. of Credits: 04			

Course Learning Objectives:
The course will enable students to

CLO1	Define AI, machine learning and application of machine learning in real world
CLO2	Differentiate between supervised and unsupervised learning and their usage
CLO3	Apply neural networks, Bayesian classifier and k nearest neighbor for solving problems in machine learning
CLO4	Perform statistical analysis of machine learning techniques

CONTENTS	**# of Hours / RBT Levels**
MODULE 1 **Introduction**: What is artificial intelligence? A brief introduction to machine learning, Intersection of AI, ML and DL, Supervised vs Unsupervised Learning**,** Examples of Machine learning Applications **Dimensionality Reduction:** Subset Selection, Principal Components Analysis**,** Linear Discriminant Analysis, Isomap, Applications **Text Book: 1 Chapter: 1 Text Book: 3 Chapter: 6**	**08** **L3**
MODULE 2 **Regression**: Linear Models for Regression, Linear Basis Function Models, The Bias-Variance Decomposition **Classification**: Linear Models for Classification, Discriminant Functions-Two classes, Multiple classes, Least squares for classification Logistic Regression, Decision tree representation, Basic decision tree learning algorithm, Issues in decision tree learning, Random Forest, Bagging and Boosting **Text Book: 1 Chapter: 3 Text Book: 2 Chapter: 3, 4**	**08** **L3**
MODULE 3 **Sparse Kernel Machines**: Maximum Margin Classifiers, Overlapping class distributions, Multiclass SVMs, SVMs for regression **K-nearest neighbour**: Introduction, advantage, and applications **Artificial Neural Networks**: Introduction, Neural Network representation, Appropriate problems, Perceptron, Back propagation algorithm, Derivation of backpropagation algorithm, Convergence to local minima. **Text Book: 1 Chapters: 4 Text Book: 2 Chapter: 7**	**08** **L3**
MODULE 4 **Bayesian Learning**: Mathematical foundation, Conditional probability, Bayes theorem, ML for predicting probabilities, Naive Bayes classifier **Clustering**: Introduction, Mixture Densities, k-Means Clustering, Expectation-Maximization Algorithm**,** Hierarchical Clustering**,** Choosing the Number of Clusters **Text Book: 1 Chapter: 6 Text Book: 3 Chapter: 7**	**08** **L3**

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MODULE 5	
Evaluating Hypothesis: Estimating hypothesis accuracy, Basics of sampling theorem, General approach for deriving confidence intervals, Difference in error of two hypotheses, **Reinforcement Learning:** Introduction, Elements of Reinforcement Learning, Model-Based Learning, Temporal Difference Learning, Generalization **Text Book: 1 Chapter: 5 Text Book: 3 Chapter: 18**	**08** **L3**

Laboratory Component
List of Experiments

1. Implement different outlier detection algorithm considering a suitable dataset.
2. Develop a program to demonstrate linear and polynomial regression using appropriate dataset.
3. Develop a program to demonstrate logistic regression using appropriate dataset.
4. Develop a program to demonstrate the working of the decision tree algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
5. Develop a program to implement the random forest Classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
6. Develop a program to construct Support Vector Machine considering a Sample dataset.
7. Develop a program to implement K-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions.
8. Build an Artificial Neural Network using the Back-propagation algorithm and test the same using appropriate data sets.
9. Develop a program to implement the naïve Bayesian Classifier model. Calculate the accuracy, precision, and recall, ROC curve for your dataset.
10. Implement K Means algorithm and GMM using appropriate datasets.

Course Outcomes:
Upon successful completion of this course, student will be able to

CO53.1	Understand the fundamental of machine learning algorithm
CO53.2	Illustrate Regression Techniques and classification Algorithm
CO53.3	Apply SVM, ANN and KNN algorithm to solve appropriate problems
CO53.4	Apply Bayesian Techniques and derive effective learning rules
CO53.5	Illustrate performance of ML algorithms using evaluation techniques and understand reinforcement learning

Text Books:

1 Tom M. Mitchell, "Machine Learning", McGraw Hill Education, India Edition 2013.
2 Christopher M. Bishop, "Pattern Recognition and Machine Learning", Paperback, 2016.
3 Khan, Shahzad, "Introduction to Machine Learning" (Adaptive Computation and Machine Learning Series), The MIT Press, 2004, Natural Language Engineering 14, No. 1, 2008.

Reference Books:

1. Trevor Hastie, Robert Tibshirani, Jerome Friedman, "The Elements of Statistical Learning", Springer series in statistics, 2nd Edition.
2. Dipanjan Sarkar, Raghav Bali, Tushar Sharma, "Practical Machine Learning with Python-A Problem-Solver's Guide to Building Real-World Intelligent Systems", APress, 2018.
3. Kevin P. Murphy , Francis Bach , "Machine Learning: A Probabilistic Perspective (Adaptive Computation and Machine Learning) 1st Edition, Massachusets Institute of Technology, 2012.
4. Pang-Ning Tan, Michael Steinbach, Vipin Kumar, "Introduction to Data Mining", Pearson, First Impression, 2014.

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E-Books/Web References:

1. https://www.cs.huji.ac.il/~shais/UnderstandingMachineLearning/understanding-machine-learning-theory-algorithms.pdf
2. https://medium.com/@prithvilee22/ai-ml-case-study-55d34e308c92
3. https://d3.harvard.edu/platform-digit/submission/robo-banking-artificial-intelligence-at-jpmorgan-chase/
4. https://towardsdatascience.com/a-machine-learning-approach-building-a-hotel-recommendation-engine-6812bfd53f50
5. https://www.udemy.com/topic/artificial-intelligence
6. http://www.dkriesel.com/_media/science/neuronalenetze-en-zeta2-2col-dkrieselcom.pdf
7. http://gael-varoquaux.info/scikit-learn-tutorial/

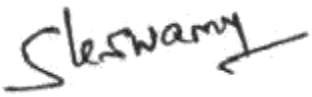
MOOCs:

1. https://onlinecourses.nptel.ac.in/noc20_cs29/preview
2. https://www.simplilearn.com/pgp-ai-machine-learning-certification-training-course
3. https://www.udemy.com/course/machinelearning/
4. https://www.coursera.org/learn/machine-learning

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO53.1	3	3	2	-	3	-	-	-	-	-	-	2	-	2
CO53.2	3	3	2	-	3	-	-	-	-	1	-	2	-	2
CO53.3	3	3	2	-	3	-	-	-	-	1	-	2	-	3
CO53.4	3	3	2	-	3	-	-	-	-	1	-	2	-	3
CO53.5	3	3	2	-	3	-	-	-	-	1	-	2	-	3
Average	**3**	**3**	**2**	**-**	**3**	**-**	**-**	**-**	**-**	**1**	**-**	**2**	**-**	**3**

Low-1: Medium-2: High-3



SUBJECT: THEORY OF COMPUTATION

Subject Code	**22CSE54**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**3**
No. of Credits: 03			

Course Learning Objectives:
The course will enable students to

CLO1	provide required theoretical foundation for a computational model
CLO2	understand various Computing models like Finite State Machine, Pushdown Automata
CLO3	understand different types of grammars
CLO4	understand Turing machines as an abstract computational model

CONTENTS	# of Hours / RBT Levels
MODULE 1 **Finite Automata:** Introduction, Basic Mathematical Notation and techniques, Finite State systems, Basic Definition, Regular Grammars, Finite Automaton, DFA & NDFA, Finite Automaton with ε-moves, Equivalence of NFA and DFA, Equivalence of NDFA's with and without ε-moves, Minimization of DFA Demonstration of DFA, NFA and conversion using JFlap Tool **Text Book 1: Chapters: 1, 2**	**10** **L3**
MODULE 2 **Regular Expressions:** Writing Regular Expressions, Regular Languages, Properties of Regular Languages, Pumping Lemma for Regular Languages, Equivalence of Finite Automaton and Regular Expressions Demonstration of Regular Expressions using JFlap Tool **Text Book 1: Chapters: 3, 4**	**06** **L3**
MODULE 3 **Grammars:** Introduction, Types of Grammar, Context Free Grammars and Languages, Derivations and Languages, Ambiguity, Relationship between derivation and derivation trees, Simplification of CFG, Elimination of Useless Symbols, Unit productions, Null productions, Chomsky Normal Form **Text Book 1: Chapters: 5, 7**	**10** **L3**
MODULE 4 **Pushdown Automata:** Definition, Moves, Instantaneous Descriptions, Deterministic Pushdown Automata, Equivalence of Pushdown Automata and CFL, Pumping Lemma for CFL, problems based on Pumping Lemma Demonstration of Pushdown Automata using JFlap Tool **Text Book 1: Chapters: 6, 7.2**	**06** **L3**
MODULE 5 **Turing Machine:** Introduction, Formal definition of Turing Machine, Instantaneous Descriptions, Turing Machine as Acceptors, Turing Machine as Transducers, Computable Languages and functions, Turing Machine constructions, Modifications of Turing Machines, Variants of Turing Machines Demonstration of Turing Machine using JFlap Tool **Text Book 1: Chapter: 8**	**08** **L3**

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Course Outcomes:

Upon successful completion of this course, student will be able to

CO54.1	Derive the proofs for the closure properties of Regular Languages and Context free Languages using Induction Method
CO54.2	Construct the abstract machines including Finite Automata, Pushdown Automata from their associated languages and grammar
CO54.3	Write Grammars for Regular and Context Free Languages
CO54.4	Write Context Free Grammar in their normalized forms
CO54.5	Explain the usage of Turing Machines in computability solution

Text Books:

1. John E Hopcroft, Rajeev Motwani, Jeffrey D Ullman, "Introduction to Automata Theory", Languages and Computation, 3rd Edition, Pearson Education, 2013.

Reference Books:

1. Elaine Rich, Automata, "Computability and Complexity", Pearson Education, 1st Edition, 2013.
2. Peter Linz, "An Introduction to Formal Languages and Automata", Jones & Bartlett Learning, 2001.

E-Books/Web References:

1. https://www.javatpoint.com/theory-of-automata
2. https://www.tutorialspoint.com/automata_theory/pushdown_automata_introduction.htm
3. https://www.jflap.org/

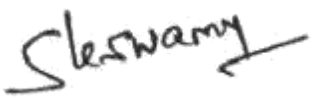
MOOCs:

1. https://www.udemy.com/course/formal-languages-and-automata-theory
2. https://www.classcentral.com/course/edx-automata-theory-376

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO54.1	3	2	2	-	1	-	-	-	-	-	-	1	2	-
CO54.2	3	2	2	-	1	-	-	-	-	-	-	1	2	-
CO54.3	3	2	2	-	1	-	-	-	-	-	-	1	2	-
CO54.4	3	2	2	-	-	-	-	-	-	-	-	1	2	-
CO54.5	3	2	2	-	1	-	-	-	-	-	-	1	2	-
Average	**3**	**2**	**2**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**2**	**-**

Low-1: Medium-2: High-3



SUBJECT: ROBOTIC PROCESS AUTOMATION

Subject Code	**22CSE551**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**3**
No. of Credits: 03			

Course Learning Objectives:
The course will enable students to

CLO1	Understand basic concepts of RPA
CLO2	Describe RPA, where it can be applied and how it implemented
CLO3	Describe the different types of variables, Control Flow and data manipulation techniques
CLO4	Understand Image, Text and data Tables Automation, Plugins and Extensions.
CLO5	Describe various Events, Exceptions, Managing and Maintaining the Code

CONTENTS	# of Hours / RBT Levels
MODULE 1 **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, APls, Al, Cognitive Automation, Agile, Scrum, Kanban and Waterfall Dev Ops, Flowcharts **Text Book 1: Chapters: 1, 2**	**07** **L2**
MODULE 2 **What is Robotic Process Automation**: Scope and techniques of automation, Robotic process automation, About UiPath, The future of automation Record and PIay: **UiPath stack**, Downloading and installing UiPath Studio, Learning UiPath Studio, Task recorder - Step-by-step examples using the recorder **Text Book 2: Chapters: 1, 2**	**07** **L2**
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) **Text Book 2: Chapters: 3, 4**	**08** **L2**
MODULE 4 **Taking Control of the Controls**: Finding and attaching windows, Finding the control, Techniques for waiting for a control, Act on controls, working with UiExplorer, Handling events, Revisit recorder, Screen Scraping, when to use OCR, Types of OCR available, how to use OCR, Avoiding typical failure points. **Tame that Application with Plugins and Extensions Terminal plugin:** SAP automation, Mail plugin, PDF	**09** **L2**

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plugin, Web integration, Excel and Word plugins, Credential management **Text Book 2: Chapters: 5, 6**	
MODULE 5 **Handling User Events and Assistant Bots:** What are assistant bots?, Monitoring system event triggers, Monitoring image and element triggers, Launching an assistant bot on a keyboard event. **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. **Managing and Maintaining the Code:** Project organization, nesting workflows, Reusability of workflows, commenting techniques, State Machine, when to use Flowcharts, State Machines, or Sequences, using config files and examples of a config file, Integrating a TFS server. **Text Book 2: Chapters: 7, 8, 9**	**09** **L2**

Course Outcomes:

Upon successful completion of this course, student will be able to

CO551.1	Understand the basic concepts of RPA
CO551.2	Describe various components and platforms of RPA
CO551.3	Describe the types of variables, control flow and data manipulation techniques
CO551.4	Understand Image, Text and data Tables Automation, Plugins and Extensions
CO551.5	Describe various Events, Exceptions, Managing and Maintaining the Code

Text Books:

1. Tom Taulli, "The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems", Publisher: A press, 2020.
2. Alok Mani Tripathi, "Learning Robotic Process Automation", Publisher: Packt Publishing Release Date: March 2018.

Reference Books:

1. Frank Casale, Rebecca Dilla, Heidi Jaynes, Lauren Livingston, "Introduction to Robotic Process Automation", A Primer, Institute of Robotic Process Automation, Amazon Asia-Pacific Holdings Private Limited, 2018
2. Richard Murdoch, "Robotic Process Automation: Guide to Building Software Robots", Automate Repetitive Tasks & Become an RPA Consultant, Amazon Asia-Pacific Holdings Private Limited, 2018
3. A Gerardus Blokdyk, "Robotic Process Automation RPA A Complete Guide ", 2020.

E-Books / Web References:

1. https://www.uipath.com/rpa/robotic-process-automation
2. https://www.academy.uipath.com
3. https://www.packtpub.com/product/learning-robotic-process-automation/9781788470940

MOOCs:

1. https://www.coursera.org/specializations/roboticprocessautomation
2. https://www.edx.org/learn/robotic-process-automation
3. https://www.uipath.com/rpa/academy
4. https://www.udemy.com/topic/robotic-process-automation/

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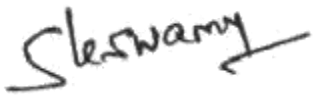
5. https://www.my-mooc.com/en/video/what-is-robotic-process-automation-rpa-rpa-tutorial-for-beginners-rpa-training-edureka/
6. https://www.careers360.com/courses-certifications/robotics-and-automation-courses-brpg

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO551.1	3	2	1	1	-	-	-	-	-	1	-	1	2	-
CO551.2	2	1	-	-	-	-	-	-	-	1	-	1	2	-
CO551.3	3	3	2	1	1	-	-	-	-	1	-	1	3	-
CO551.4	3	3	2	1	1	-	-	-	-	1	-	1	3	-
CO551.5	3	3	2	1	-	-	-	-	-	1	-	1	3	-
Average	**3**	**3**	**2**	**1**	**1**	**--**	**--**	**--**	**--**	**1**	**--**	**1**	**3**	-

Low-1: Medium-2: High-3



SUBJECT: R PROGRAMMING

Subject Code	**22CSE552**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**3**
No. of Credits: 03			

Course Learning Objectives:
The course will enable students to:

CLO1	Use R for statistical programming, computation, graphics, and modeling
CLO2	Write functions and use R in an efficient way
CLO3	Understand the basic types of statistical models
CLO4	Be able to expand their knowledge of R on their own

CONTENTS	# of Hours RBT Level
MODULE 1 **Introduction:** How to run R, R Sessions and Functions, Basic Math, Variables, Data Types, Vectors, Conclusion, Advanced Data Structures, Data Frames, Lists, Matrices, Arrays, Classes. **Text Book: 1 Chapters: 1**	**08** **L2**
MODULE 2 **R Programming Structures:** Control Statements, Loops, - Looping Over Nonvector Sets, If-Else, Arithmetic and Boolean Operators and values, Default Values for Argument, Return Values, Deciding Whether to explicitly call return-Returning Complex Objects, Functions are Objective, No Pointers in R, Recursion, A Quicksort Implementation-Extended Extended Example: A Binary Search Tree. **Text Book: 1 Chapter: 7**	**08** **L2**
MODULE 3 **Doing Math and Simulation in R:** Math Function, Extended Example Calculating Probability-Cumulative Sums and Products-Minima and Maxima-Calculus, Functions Fir Statistical Distribution, Sorting, Linear Algebra Operation on Vectors and Matrices, Extended Example: Vector cross Product-Extended Example: Finding Stationary Distribution of Markov Chains, Set Operation, Input /output, Accessing the Keyboard and Monitor, Reading and writer Files. **Text Book: 1 Chapter: 8**	**08** **L2**
MODULE 4 **Graphics:** Creating Graphs, The Workhorse of R Base Graphics, the plot () Function – Customizing Graphs, Saving Graphs to Files. **Text Book: 1 Chapter: 12**	**08** **L3**

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MODULE 5	
Probability Distributions: Normal Distribution-Binomial Distribution-Poisson Distributions Other Distribution, Basic Statistics, Correlation and Covariance, T-Tests, ANOVA **Linear Models:** Simple Linear Regression, Multiple Regression Generalized Linear Models, Logistic Regression, Poisson Regression, other Generalized Linear Models-Survival Analysis, Nonlinear Models, Splines-Decision-Random Forests **Text Book: 2 Chapters: 17, 18, 19**	**08** **L3**

Course Outcomes:

Upon successful completion of this course, student will be able to

CO552.1	Demonstrate basic R programming framework and data structures
CO552.2	Explain control structures and recursion in R programming language
CO552.3	Apply mathematical and statistical operations data structures in R
CO552.4	Examine datasets to create testable hypotheses and identify appropriate statistical tests
CO552.5	Make use of appropriate statistical tests using R and Create and edit visualizations with regression models

Text Books:

1. Norman Matloff, "The Art of R Programming, A Tour of Statistical Software Design", Cengage Learning, 2011.
2. Jared P. Lander, "R for Everyone: Advanced Analytics and Graphics", 2nd Edition, Addison- Wesley Professional, 2017.

Reference Books:

1. R Cookbook, D Long, Paul Teetor, "Proven Recipes for Data Analysis, Statistics, and Graphics", 2nd Edition, James, Oreilly Media, Inc, 2019.
2. Robert I. Kabacoff, "R in Action, Data Analysis and Graphics with R", Manning Shelter Island, 2015.

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO522.1	2	2	-	-	2	-	-	-	-	2	-	-	-	2
CO522.2	-	2	-	-	2	2	-	-	-	2	-	-	-	2
CO522.3	2	-	-	2	-	2	-	-	-	-	2	-	-	2
CO522.4	2	-	-	2	-	-	2	-	-	-	2	-	-	2
CO522.5	2	-	-	2	-	-	2	-	-	-	2	-	-	2
Average	**2**	**2**	**-**	**2**	**2**	**2**	**2**	**-**	**-**	**2**	**2**	**-**	**-**	**2**

Low-1: Medium-2: High-3

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SUBJECT: UNIX SYSTEM PROGRAMMING

Subject Code	**22CSE553**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**03**	**Examination Hours**	**03**
No. of Credits: 03			

Course Learning Objectives:
The course will enable students to

CLO1	Become familiar with UNIX standards and understand the functioning of API's
CLO2	Become familiar with functioning of process along with various system calls
CLO3	Understand Signals and how UNIX supports signals
CLO4	Understand various forms of Interprocess Communication.

CONTENTS	# of Hours / RBT Levels
MODULE 1 **UNIX System Overview and Standardization:** Introduction, UNIX architecture, Logging in, Files and Directories, Input and Output, Programs and Processes, Error Handling, User identification, UNIX standardization, UNIX systems implementation **UNIX and ANSI Standards:** ANSI C standard, ANSI /ISO C++ standard, Differences between ANSI C and C++, POSIX Standards. **Text Book: 1 Chapters: 1.1 to 1.8, 2.2, 2.3 Text Book: 2 Chapter: 1**	**08** **L3**
MODULE 2 **UNIX Files:** File types, UNIX and POSIX file systems, UNIX and POSIX file attributes, INDOES in UNIX System V, Application Program Interface to Files, UNIX Kernel Support for Files. **UNIX File APIs:** General file APIs, open, read, write, close, fcntl, lseek, link, unlink, stat, fstat, lstat, access, chmod, fchmod, chown, fchown, lchown, utime, file and record locking, directory file APIs, device file APIs, FIFO file APIs, symbolic link file APIs **Text Book: 2 Chapters: 6, 7**	**08** **L3**
MODULE 3 **Environment of a UNIX Process:** Introduction, main function, process termination, command line arguments, environment list, memory layout of a C program, shared libraries, memory allocation, environment variables, setjmp and longjmp functions, getrlimit and setrlimit functions. **Process Control:** Introduction, process identifiers, fork function, vfork function, exit functions, wait and waitpid functions, race conditions, exec functions, changing user IDs and group IDs, system function. **Text Book: T1 Chapters: 7.1 to 7.11, 8.1 to 8.7, 8.9 to 8.11, 8.13**	**08** **L3**
MODULE 4 **Process Relationships:** Introduction, terminal logins, network logins, process groups, sessions, controlling terminal, job control **Daemon Processes**: Introduction, daemon characteristics, coding rules, error logging, client-server model **Signals:** UNIX kernel support for signals, signal, signal mask, sigaction, sigsetjmp and siglongjmp APIs, kill, alarm, interval timers	**08** **L2**

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Text Book: T1 Chapters: 9.1 to 9.8, 13.1 to 13.4 Text book: T2 Chapter: 9	
MODULE 5 **Interprocess Communication:** Introduction, pipes, popen and pclose functions, Coprocesses, FIFOs, Message Queues, Semaphores, Shared Memory, Client server Properties **Text Book: T1 Chapters: 15.1 to 15.5, 15.7 to 15.9, 15.11**	**08** **L3**

Course Outcomes:

Upon successful completion of this course, student will be able to

CO553.1	Describe the ANSI and POSIX standards used in UNIX operating system
CO553.2	Explain the UNIX file types and demonstrate the use of UNIX file APIs in programming.
CO553.3	Explain the process management activities along with various system calls
CO553.4	Describe the use of signals in UNIX and illustrate the use of signals in programs
CO553.5	Explain the need of daemons in UNIX and identify the use of daemons in UNIX OS
CO553.6	Explain inter process communication mechanisms of UNIX

Text Books:

1. W Richard Stevens and Stephen A Rago, "Advanced Programming in the UNIX Environment", Pearson, 3rd Edition, First Impression 2016
2. Terrence Chan, "UNIX System Programming using C++", PEARSON, First Impression 2015

Reference Books:

1. Maurice J Bach, "The Design of the UNIX Operating System", PHI, Eastern Economy Edition
2. Kay A Robbins & Steven Robbins, "Unix Systems Programming: Communication, Concurrency, and Threads", Prentice Hall Publications

E-Books / Web References:

1. http://ndl.ethernet.edu.et/bitstream/123456789/88549/1/2018_Book_SystemsProgrammingInUnixLinux.pdf
2. https://igm.univ-mlv.fr/~yahya/progsys/linux.pdf

MOOCs:

1. https://unix.stackexchange.com/questions/75686/online-course-that-covers-unix-linux-systems-programming
2. https://ep.jhu.edu/courses/605614-system-development-in-the-unix-environment/

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO553.1	3	3	3	-	-	-	-	-	-	-	-	-	2	-
CO553.2	3	3	3	-	-	-	-	-	-	-	-	-	2	-
CO553.3	3	3	3	-	-	-	-	-	-	-	-	-	2	-
CO553.4	3	3	3	-	-	-	-	-	-	-	-	-	2	-
CO553.5	3	3	3	-	-	-	-	-	-	-	-	-	2	-
CO553.6	3	3	3	-	-	-	-	-	-	-	-	-	2	-
Average	**3**	**3**	**3**	-	-	-	-	-	-	-	-	-	2	-

Low-1: Medium-2: High-3

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SUBJECT: COMPUTER GRAPHICS

Subject Code	**22CSE554**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**03**
No. of Credits: 03			

Course Learning Objectives:

The course will enable students to

CLO1	Overview of Computer Graphics along with its applications.
CLO2	Exploring 2D graphics mathematics along with OpenGL API's.
CLO3	Exploring 3D graphics mathematics along with OpenGL API's
CLO4	Understand and analyze various interactive input methods and GUIs.
CLO5	Design different types of animations

CONTENTS	# of Hours / RBT Levels
MODULE 1 **Computer Graphics hardware and software and OpenGL:** Computer Graphics: Video DisplayDevices, Raster-Scan Systems Basics of computer graphics, Application of Computer Graphics. OpenGL: Introduction to OpenGL, coordinate reference frames, specifying two-dimensional world coordinate reference frames in OpenGL, OpenGL point functions, OpenGL line functions, point attributes, line attributes, curve attributes, OpenGL point attribute functions, OpenGL line attribute functions **Text Book: 1 Chapters: 1, 2, 3**	**08** **L2**
MODULE 2 **2D graphics with OpenGL:** 2D Geometric Transformations: Basic 2D Geometric Transformations, matrix representations and homogeneous coordinates, 2D Composite transformations, other 2D transformations, raster methods for geometric transformations, OpenGL raster transformations, OpenGL geometric transformations function **Text Book: 1 Chapters: 5, 6**	**08** **L2**
MODULE 3 **3D Geometric Transformations:** Translation, rotation, scaling, composite 3D transformations, other 3D transformations, OpenGL geometric transformations functions. **Text Book: 1 Chapter: 8**	**08** **L3**
MODULE 4 **Interactive Input Methods and Graphical User Interfaces:** Graphical Input Data, Logical Classification of Input Devices, Input Functions for Graphical Data, Interactive Picture-Construction Techniques, Virtual-Reality Environments, OpenGL Interactive Input-Device Functions, OpenGL Menu Functions, Designing a Graphical User Interface **Text Book: 1 Chapter: 18**	**08** **L3**
MODULE 5 **Computer Animation: Design** of Animation Sequences, Traditional Animation Techniques, General Computer-Animation Functions, Computer-Animation Languages, Character Animation, Periodic Motions, OpenGL Animation Procedures. **Text Book: 1 Chapter: 11**	**08** **L3**

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Course Outcomes:

Upon successful completion of this course, student will be able to

CO554.1	Design geometric objects using Computer Graphics principles and OpenGL APIs.
CO554.2	Use OpenGL APIs and related mathematics for 2D geometric Operations on the objects.
CO554.3	Use OpenGL APIs and related mathematics for 3D geometric Operations on the objects.
CO554.4	Understand and analyze various interactive input methods and GUIs.
CO554.5	Design different types of animations

Text Books:

1. Donald D Hearn, M Pauline Baker and WarrenCarithers, "Computer Graphics with OpenGL", 4th Edition, Pearson, 2014.

Reference Books:

1. Edward Angel, "Interactive Computer Graphics- A Top Down approach with OpenGL", 5th Edition. Pearson Education, 2008.
2. James D Foley, Andries Van Dam, Steven K Feiner, John F Huges, "Computer graphics with OpenGL", Pearson Education

E-Books / Web References:

1. https://medium.com/analytics-vidhya/introduction-to-computer-vision-opencv-in-python-fb722e805e8b

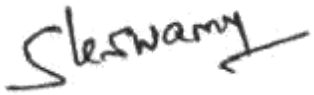
MOOCs:

1. https://nptel.ac.in/courses/106106090
2. https://nptel.ac.in/courses/106102063
3. https://nptel.ac.in/courses/106103224
4. https://nptel.ac.in/courses/106102065
5. OpenCV Tutorial (tutorialspoint.com) (Tutorial, Types of Images, Drawing Functions)

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO554.1	2	2	2	-	-	2	-	-	-	-	-	2	-	2
CO554.2	2	2	2	-	-	2	-	-	-	-	-	2	-	2
CO554.3	3	3	3	-	-	2	-	-	-	-	-	2	-	2
CO554.4	3	3	3	-	-	2	-	-	-	-	-	2	-	2
CO554.5	3	3	3	-	-	2	-	-	-	-	-	2	-	2
Average	**3**	**3**	**3**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**2**

Low-1: Medium-2: High-3



SUBJECT: ANDROID PROGRAMMING (Integrated)

Subject Code	**22CSE56**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**1:0:2**	**SEE Marks**	**50**
Total Hours	**15 Hours**	**Examination Hours**	**03**
No. of Credits: 02			

Course Learning Objectives:

The course will enable students to:

CLO1	Learn and acquire the art of Android programming and Configure Android Studio to run the applications.
CLO2	Understand and implement Android's User interface functions.
CLO3	Create, modify, and query on SQLite database.
CLO4	Inspect different methods of sharing data using services

CONTENTS	# of Hours / RBT Levels
MODULE 1 **Android:** History and features, Architecture, Life cycle, Activities, Views, and Layout	**03** **L2**
MODULE 2 Intent, and Fragments	**02** **L3**
MODULE 3 Menu, Services, Broadcast receivers, and Content providers	**04** **L3**
MODULE 4 Notification, Shared Preferences, SQLite database, and Triggering	**03** **L3**
MODULE 5 Multimedia, SMS, and Email	**03** **L3**

Laboratory Component
List of Experiments

1. Create an Android app to show an Activity Life Cycle using both Toast and LogInfo methods. [Module 1]
2. Create an Android app that takes input as Person Name with a hint to the user as "Enter Your Name" and a Button with the name "Click Me" When the user clicks the button a Toast message with "Welcome Given Name" should be displayed. [Module 1]
   Requirement: Layout, Text View, EditText as Number, Buttons, and Toast.
3. Create an Android app to take a
   a. "State of Birth" as input using autocompletetext feature,
   b. "City of birth" as input using a spinner feature
   c. the input "DOB" using the date picker.
   with a Button having the name "Submit" and when the button is clicked, calculate the current age of the person and display the Person age, Birth State and City of Birth using a Toast message. [Module 1]

   Requirement: AutoCompleteText with a hint to enter the State of birth in Textbox, Spinner with a hint to enter the city of birth in Textbox, Array Adapter, String Array Datepicker, EditText, Imageview, Button, and Toast.

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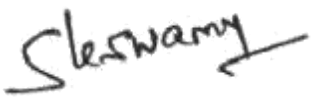
4. Create a SIGN-Up activity with Username and Password. Validation of password should happen based on the following rules:
    a) Password should contain uppercase and lowercase letters.
    b) Password should contain letters and numbers.
    c) Password should contain special characters.
    d) Minimum length of the password (the default value is 8).

    On successful SIGN UP proceed to the next Login activity. Here the user should SIGN IN using the Username and Password created during the signup activity. If the Username and Password are matched then navigate to the next activity which displays a message saying "Successful Login" or else display a toast message saying "Login Failed". The user is given only two attempts and after that displays a toast message saying "Failed Login Attempts" and disable the SIGN IN button.
    Requirement: Bundle and Intent to transfer information from one activity to another. [Module 2]
5. Create an Android application that uses Fragment with a list of buttons representing various colors, and on click of these buttons, the appropriate color is filled in the next fragment. [Module 2]
    Requirement: EditText, TextView, Button, Fragment (use: project->new->fragment->blankfragment)
6. Create an Android app for a restaurant with a "menu" to take the order and calculate the total amount of orders and use text to speech feature of Android to announce the total amount of the order along with a toast message. [Module 3]
    Requirement: Menu, onCreateOptionsMenu & onOptionsItemSelected methods, Android Speech, and Toast.
7. Create an activity like a phone dialer with CALL and SAVE buttons. On pressing the CALL button, it must call the phone number and on pressing the SAVE button it must save the number to the phone contacts. [Module 3]
    Requirement: Activity with buttons, layout, intent, and content provider
8. Create an Android application to demonstrate the Shared Preferences and Notification, using three buttons (Red, Yellow, and Green) with the layout background color setting features. Once the Color is set send a notification on which color is selected.
    Requirement: Buttons, Layout, Notifications, and Shared Preferences [Module 4]
9. Write a program to enter the Medicine Name, Date, and Time of the Day as input from the user and store it in the SQLite database. Input for the Time of the Day should be either Morning or Afternoon or Evening or Night. Trigger an alarm based on the Date and Time of the Day and display the Medicine Name. [Module 4]
    Requirement: EditText, Buttons, and alarm Manager
10. Create an Android application to demonstrate a basic media player that allows the user to Forward, Backward, Play, and Pause audio. Also, make use of the indicator in the seek bar to move the audio forward or backward as required. [Module 5]
    Requirement: Buttons, Audio Manager, and Media Player
11. Create an Android application to send the student performance report to the parents over an Sms and Mail facility in an activity. [Module 5]
    Requirement: EditText, Buttons, Sms sending, and Mail Manager.
12. Create an Android application to display information about telephony services. [Module 5]



Course Outcomes:

Upon successful completion of this course, students will be able to

CO56.1	Discuss the fundamentals of Android programming and its architecture.
CO56.2	Develop mobile applications with appropriate Android views, Layouts, Intents, and Fragments.
CO56.3	Produce the application with the use of Services, Broadcast receiver, Notifications, and Content provider.
CO56.4	Apply data persistence techniques or methods, to perform CRUD operations.

Text Books:

1. Google Developer Training, "Android Developer Fundamentals Course – Concept Reference", Google Developer Training Team, 2017. Link: https://www.gitbook.com/book/google-developer-training/android-developer- fundamentals-course-concepts/details

Reference Books:

1. Erik Hellman, "Android Programming – Pushing the Limits", 1st Edition, Wiley India Pvt Ltd, 2014..
2. Dawn Griffiths and David Griffiths, "Head First Android Development", 3rd Edition, O" Reilly SPD Publishers, 2015.
3. Bill Phillips, Chris Stewart, and Kristin Marsicano, "Android Programming: The Big Nerd Ranch Guide", 3rd Edition, Big Nerd Ranch Guides, 2017.
4. Barry Burd, "Android Application Development" All-in-one Dummies, Wiley, 3rd Edition, January 2021.
5. Anubhav Pradhan, Anil V Deshpande, "Composing Mobile Apps" using Android, Wiley 2014,

E-Books / Web References:

1. https://developer.android.com/reference/classes.html
2. https://medium.com/javarevisited/5-free-courses-to-become-an-android-developer-d4d207f53675

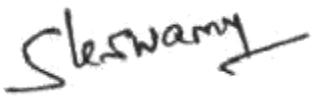
MOOCs:

1. https://www.coursera.org/specializations/android-app-development#courses

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO56.1	3	-	-	-	-	-	-	-	1	1	-	2	2	-
CO56.2	3	3	2	-	1	-	-	-	1	1	-	2	2	-
CO56.3	3	3	2	-	2	-	-	-	1	1	-	2	2	-
CO56.4	3	3	2	-	2	-	-	-	1	1	-	2	2	2
Average	**3**	**3**	**2**	**-**	**1**	**-**	**-**	**-**	**1**	**1**	**-**	**2**	**2**	**2**

Low-1: Medium-2: High-3



SUBJECT: ENVIRONMENTAL SCIENCES

Course Code	**22CIV57/66**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**1:0:0**	**SEE Marks**	**50**
No. of Credits	**1**	**Examination Hours**	**1 hour**

Course Learning Objectives:

CLO1	The fundamentals of environmental science.
CLO2	The types of natural resources
CLO3	The various global environmental concerns.
CLO4	The types of wastes generated and their handling at a basic level
CLO5	The area of environmental law and policies with a few important acts in the field

Content	No. of Hours/ RBT Levels
Module 1 **Environment:** • Definition, scope & importance • Components of Environment Ecosystem: Structure and function of various types of ecosystems • Human Activities – Food, Shelter, and Economic & Social Security. • Population - Growth, variation among nations – population explosion and impact on environment **Biodiversity:** Types, Value, Hot spots, Threats and Conservation of biodiversity, Forest Wealth, and Deforestation.	**04 Hours / L2**
Module 2 **Natural Resources**: Forest, Water, Mineral, Food, Energy, Land Environmental Pollution - Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards.	**04 Hours / L2**
Module 3 **Global Environmental Concerns** (Concept, policies and case-studies): Ground water depletion/recharging, Climate Change; Acid Rain; Ozone Depletion; Radon and Fluoride problem in drinking water; Resettlement and rehabilitation of people, Environmental Toxicology.	**04 Hours / L2**
Module 4 **Sources:** Sources of Solid waste, Types of solid waste, Physical and Chemical composition of municipal solid waste. Solid Waste Management Rules in India, Sources and management of E – Waste, Biomedical Waste, Hazardous waste, and construction waste at individual and community level. Socio-economic aspect of waste management Environmental Toxicology.	**04 Hours / L2**
Module 5 **Latest Developments in Environmental Pollution Mitigation Tools** (Concept and Applications): Environment Impact Assessment, Environmental Management Systems, ISO14001; Environmental Stewardship, NGOs.	**04 Hours / L2**

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COURSE OUTCOMES: Upon completion of this course, student will be able to:

22CIV57.1/66.1	Understand holistically the key concepts "Environment", and "Biodiversity".
22CIV57.2/66.2	Classify the types of natural resources available and the effects of anthropogenic interventions.
22CIV57.3/66.3	Express the gravity of various global environmental concerns.
22CIV57.4/66.4	Categorize the types of wastes generated and their handling at a basic level.
22CIV57.5/66.5	Understand the importance of environmental law and policies.

Textbooks:

1. Environmental studies, Benny Joseph, Tata Mcgraw-Hill 2nd edition 2012
2. Environmental studies, S M Prakash, pristine publishing house, Mangalore 3rd edition-2018
3. Gilbert M.Masters, Introduction to Environmental Engineering and Science, 2nd edition, Pearson Education, 2004

Reference books:

1. Benny Joseph, Environmental studies, Tata Mcgraw-Hill 2nd edition 2009
2. M.Ayi Reddy Textbook of Environmental Science and Technology, BS publications 2007
3. Dr. B.S Chauhan, Environmental Studies, University of science press 1st edition

Web References:

https://www.hzu.edu.in/bed/E%20V%20S.pdf
https://onlinecourses.nptel.ac.in/noc23_hs155/preview
https://onlinecourses.swayam2.ac.in/cec19_bt03/preview

CO/PO Mapping															
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
22CIV57.1/66.1	2	-	-	-	-	-	3	-	-	-	-	-	1	-	-
22CIV57.2/66.2	2	1	-	-	-	-	3	-	-	-	-	1	1	-	1
22CIV57.3/66.3	2	-	2	-	-	2	3	1	-	-	-	1	1	-	1
22CIV57.4/66.4	2	2	-	-	-	2	3	-	-	-	-	-	-	-	1
22CIV57.5/66.5	2	-	-	-	-	2	3	-	-	-	-	-	-	1	1
Average	**2**	**1.5**	**2**	**-**	**-**	**2**	**3**	**1**	**-**	**-**	**-**	**1**	**1**	**1**	**1**

Low-1: Medium-2: High-3

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SUBJECT: UNIVERSAL HUMAN VALUES

Course Code	22UHV57/66	CIE Marks	50
Hours/Week (L: T: P)	1:0:0	SEE Marks	50
No. of Credits	1	Examination Hours	1 hour

Course Learning Objectives:

The course will enable students to:

CLO1	To create an awareness on Engineering Ethics and Human Values.
CLO2	To understand social responsibility of an engineer.
CLO3	To appreciate ethical dilemma while discharging duties in professional life.

Content	No. of Hours
Module 1 **Introduction to Value Education** • Value Education, Definition, Concept and Need for Value Education. • The Content and Process of Value Education. • Basic Guidelines for Value Education, • Self-exploration as a means of Value Education. • Happiness and Prosperity as parts of Value Education.	**05 Hours**
Module 2 **Harmony in the Human Being** • Human Being is more than just the Body. • Harmony of the Self ('I') with the Body. • Understanding Myself as Co-existence of the Self and the Body. • Understanding Needs of the Self and the needs of the Body. • Understanding the activities in the Self and the activities in the Body.	**05 Hours**
Module 3 **Harmony in the Family and Society and Harmony in the Nature** • Family as a basic unit of Human Interaction and Values in Relationships. • The Basics for Respect and today's Crisis: Affection, Guidance, Reverence, Glory, Gratitude and Love, • Comprehensive Human Goal: The Five Dimensions of Human Endeavour. • Harmony in Nature: The Four Orders in Nature. • The Holistic Perception of Harmony in Existence.	**05 Hours**
Module 4 **Social Ethics** • The Basics for Ethical Human Conduct, Defects in Ethical Human Conduct. • Holistic Alternative and Universal Order, • Universal Human Order and Ethical Conduct. • Human Rights violation and Social Disparities.	**05 Hours**
Module 5 **Professional Ethics** • Value based Life and Profession., Professional Ethics and Right Understanding. • Competence in Professional Ethics. • Issues in Professional Ethics – The Current Scenario. • Vision for Holistic Technologies • Production System and Management Models.	**05 Hours**

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Course Outcomes:

Upon successful completion of this course, student will be able to:

22UHV57.1/66.1	Understand the significance of value inputs in a classroom and start applying them intheir life and profession
22UHV57.2/66.2	Distinguish between values and skills, happiness and accumulation of physical facilities,the Self and the Body, Intention and Competence of an individual, etc.
22UHV57.3/66.3	Understand the role of a human being in ensuring harmony in society and nature.
22UHV57.4/66.4	Distinguish between ethical and unethical practices and start working out the strategy toactualize a harmonious environment wherever they work.

Textbooks:

1. A.N Tripathy, New Age International Publishers, 2003.
2. Bajpai. B. L, New Royal Book Co, Lucknow, Reprinted, 2004
3. Bertrand Russell Human Society in Ethics & Politics

Reference books:

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. Corliss Lamont, Philosophy of Humanism.
4. Gaur. R.R. , Sangal. R, Bagari G.P, A Foundation Course in Value Education, Excel Books, 2009.
5. Gaur. R.R. , Sangal R , Bagaria G.P, Teachers Manual, Excel Books, 2009.
6. I.C. Sharma, Ethical Philosophy of India, Nagin & co, Julundhar
7. William Lilly- Introduction to Ethics -Allied Publisher

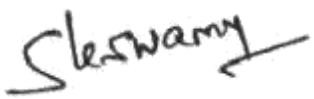
MOOCs:

1. https://nptel.ac.in/courses/109104068
2. https://www.udemy.com/course/value-education-and-professional-ethics/
3. https://www.coursera.org/lecture/ethical-frameworks-action/promotion-of-human-values-P7dwl

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
22UHV57.1/66.1	-	-	-	-	-	-	-	2	-	-	-	1	-	-	-	-
22UHV57.2/66.2	-	-	-	-	-	-	-	2	-	-	-	1	-	-	-	-
22UHV57.3/66.3	-	-	-	-	-	-	-	2	-	-	-	1	-	-	-	-
22UHV57.4/66.4	-	-	-	-	-	-	-	2	-	-	-	1	-	-	-	-
Average	-	-	-	-	-	-	-	**2**	-	-	-	**1**	-	-	-	-

Low-1: Medium-2: High-3



SEMESTER – VI

SUBJECT: CLOUD COMPUTING

Subject Code	**22CSE61**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**03**
No. of Credits: 03			

Course Learning Objectives:
The course will enable students to:

CLO1	Illustrate the core concepts of the cloud computing paradigm and reference models
CLO2	Discuss system virtualization and outline its role in enabling the cloud computing system model
CLO3	Understand the Cloud management and Cloud Security
CLO4	Analyze the different applications of Cloud Computing

CONTENTS	# of Hours / RBT Levels
MODULE 1 **Introduction:** Defining Cloud Computing, Cloud Types, Examining the Characteristics of Cloud Computing Historical Developments, Building Cloud Computing Environments Computing Platform and Technologies. Principles of Parallel and Distributed Computing: Eras of Computing, Parallel vs Distributed Computing, Elements of Parallel Computing, Elements of Distributed Computing, Technologies for Distributed Computing. **Text Book: 1 Chapter 1: 1.1-1.3, Chapter 2:2.1-2.4**	**08** **L2**
MODULE 2 **Virtualization:** Introduction, Characteristics of Virtualized Environments, Taxonomy of Virtualization Techniques, Pros and Cons of Virtualization, Technology Examples: VMware: Full Virtualization **Microservices, Dockers and Containers:** An introduction to Microservices, Modular Architecture, Advantages and Disadvantages of Microservices. Dockers Containers, Dockers architecture and Components, The Power of Docker: A Simple Example **Text Book: 1 Chapter 3: 3.1, 3.2, 3.3, 3.5, 3.6 Text Book: 2 Chapters: 1, 5**	**08** **L2**
MODULE 3 Cloud Computing Architecture: Introduction, Cloud Reference Model, Architecture, Infrastructure / Hardware as a Service, Platform as a Service, Software as a Service, Types of Clouds, Public Clouds, Private Clouds, Hybrid Clouds, Community Clouds, Economics of the Cloud, Open Challenges **Text Book: 1 Chapter 4: 4.1 - 4.5**	**08** **L2**
MODULE 4 Managing the Cloud: Administrating the Clouds, Cloud Management Products, Emerging Cloud Management Standards Understanding Cloud Security: Securing the Cloud, Securing Data, Establishing Identity and Presence **Text Book: 3 Chapters: 11, 12**	**08** **L2**

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MODULE 5 Case Study on Open Source & Commercial Clouds: Working with AWS cloud platform-EC2, S3, Understanding Amazon Database Services, Microsoft Azure, Azure Core Concepts, Microsoft Azure using Amazon Web Services, CRM and ERP **Text Book: 1 Chapter: 9**	**08** **L2**

Course Outcomes:

Upon successful completion of this course, students will be able to

CO61.1	Explain the concepts and terminologies of cloud computing
CO61.2	Understand the concepts of Virtualization
CO61.3	Identify and analyze the reference models for Cloud Computing
CO61.4	Examine the Cloud Environment & Cloud Security
CO61.5	Interpret the use of AWS, Azure and Google cloud platform to develop applications

Text Books:

1. Rajkumar Buyya, Christian Vecchiola, S Thamarai Selvi, "Mastering Cloud Computing", Tata McGraw Hill Education Private Limited, 2013.
2. Parminder Singh Kocher, "Microservices and Containers", Addison Wesley, 2018
3. Barrie Sosinsky, "Cloud Computing Bible", Wiley Publishing, Inc, 2011.

Reference Books:

1. Dinkar Sitaram, Geetha Manjunath, "Moving to the Cloud", Elsevier Publications, 2011.
2. Dr. Kumar Saurabh, "Cloud Computing", Wiley India, 2011.

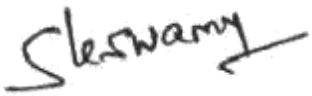
MOOCs:

1. NPTEL Course - Cloud Computing, By Prof. Soumya Kanti Ghosh, IIT Kharagpur https://onlinecourses.nptel.ac.in/noc23_cs89/preview

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO61.1	3	2	1	1	2	-	-	-	-	-	-	2	2	-
CO61.2	3	2	1	1	2	-	-	-	-	-	-	2	2	-
CO61.3	3	2	1	1	2	-	-	-	-	-	-	2	2	-
CO61.4	3	2	1	1	2	-	-	-	-	-	-	2	2	-
CO61.5	3	2	1	1	2	-	-	-	-	-	-	2	2	-
Average	**3**	**2**	**1**	**1**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**-**

Low-1: Medium-2: High-3



SUBJECT: ADVANCED JAVA (Integrated)

Subject Code	**22CSE62**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:2**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**03**
No. of Credits: 04			

Course Learning Objectives:
The course will enable students to:

CLO1	Identify the need for advanced Java concepts like Enumerations, Auto boxing/Unboxing and Annotations
CLO2	Understand hierarchy of Interfaces and Classes for managing groups of objects
CLO3	Adapt Servlets and JSP to build Server-Side Programs
CLO4	Learn front end design using Java Swing
CLO5	Discuss the use of JDBC and Spring boot to access database through Java Programs

CONTENTS	**# of Hours / RBT Levels**
MODULE 1 **Enumerations, Autoboxing:** Enumerations, Enumeration fundamentals, the values() and valueOf() Methods, Java Enumerations are class types, Enumerations Inherits Enum, example, Type Wrappers, Autoboxing, Autoboxing and Methods, Autoboxing/Unboxing occurs in Expressions, Autoboxing/Unboxing, Boolean and character values, Autoboxing/Unboxing helps prevent errors **Annotations:** Annotations, Annotation basics, specifying a Retention Policy, Obtaining Annotations at Run Time by use of Reflection, Annotated element Interface, Using Default values, Marker Annotations, Single Member Annotations, The Built-In annotations **Text Book: 1 Chapter: 12**	**08** **L3**
MODULE 2 **The Collections Framework:** Collections Overview, The Collection Interfaces, The Collection Interface, The List Interface, The Set Interface, The SortedSet Interface, The NavigableSet Interface, The Queue Interface, The Deque Interface; The Collection Classes, The ArrayList Class, The LinkedList Class, The HashSet Class, The LinkedHashSet Class, The TreeSet Class, The PriorityQueue Class, The ArrayDeque Class, The EnumSet Class, Accessing a Collection via an Iterator, Using an Iterator, The For-Each Alternative to Iterators **Text Book: 1 Chapter: 19**	**08** **L3**
MODULE 3 **Introducing Servlets:** Background, The Life Cycle of a Servlet, Using Tomcat, ASimple Servlet, The Servlet API, Reading Servlet Parameter; The Javax.servlet.http Package, The HttpServletRequest Interface, The HttpServletResponse Interface, The HttpSession Interface, The Cookie Interface, The HttpServlet Class, Handling HTTP Requests and Responses, Handling HTTP GET Requests, Handling HTTP POST Requests, Using Cookies, Session Tracking **Java Server Pages (JSP):** JSP Tags, Variables and Objects, Methods, Control statements, Loops, Tomcat, Request String, User Sessions, Cookies, Session Objects	**08** **L3**

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Text Book: 1 Chapter: 35 Text Book: 2 Part I Chapter: 11	
MODULE 4 **JDBC Objects:** The Concept of JDBC, JDBC Driver Types, JDBC Packages, A Brief Overview of the JDBC process, Database Connection, Associating the JDBC/ODBC Bridge with the Database, Statement Objects, ResultSet, Transaction Processing, Data types, Exceptions **Text Book: 2 Part II, Chapter: 6**	**08** **L3**
MODULE 5 **Introducing Spring Boot:** What is Spring Boot, Features, Architecture, Spring Initializr, Generating a Project, Creating a spring Boot Project, connecting Spring Boot with database. **Introducing Swing:** Two key Swing features, Swing components are lightweight, Swing supports a pluggable look and feel, Components and Containers, A simple Swing Application, Jlabel and ImageIcon, JTextField, The Swing Buttons, JComboBox, JTable. **URL: 3, 4 Text Book: 1, Chapters: 31, 32**	**08** **L3**

Laboratory Component
List of Experiments

Implement the following programs using Java in Eclipse IDE.

1. Implement a Java program to retrieve the probability of answer from a class and display the following Answer using the concept of Enumerations. The Probability can be retrieved using Random().

Probability	**Answer**
< 15 %	MAY BE
< 30 %	NO
< 60 %	YES
< 75 %	LATER
<98 %	SOON
Default	NEVER

2. Implement a Java program to illustrate Annotations by specifying Retention policy at Runtime.
3. Implement a Java program to demonstrate the methods of LinkedList class for objects of type Float.
4. Implement a program to demonstrate the use of Iterator with ArrayList created for objects of type String.
5. Implement a Java Servlet program to input username and password and check whether the password is correct or not.
6. Implement a JSP program to create a session attribute and read the session attribute.
7. Implement a JDBC program to execute the following. Display the records after each operation.
   - Select the records of employees whose salary is greater than 20000.
   - Update the records of employees by 30% who are above 25.

Table Name : Emp			
EmpID	**EmpName**	**Salary**	**Age**
14	Deepa	35000	31
10	Kishan	32000	28
200	Karan	23000	23
15	Nisha	31000	27
202	Madhu	24000	24

8. Implement a JDBC program to demonstrate the concept of CallableStatement.
9. Implement a Spring Boot program to display student records stored in the database.

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10. Implement a Java Swing program to create a table with column heading such as Book_ID, Book_Name, Author, ISBN. Insert atleast 5 records in the table and display them.

Course Outcomes:

Upon successful completion of this course, student will be able to

CO62.1	Use Enumerations, Auto-boxing/Unboxing and Annotations in developing modular and efficient Java programs
CO62.2	Illustrate the concepts of Collection framework for developing Java applications
CO62.3	Implement Servlets and JSP in Server-side Java Programming
CO62.4	Use JDBC API to connect Java Application with Database
CO62.5	Design simple GUI interfaces using Swing to interact with users

Text Books/URL:

1. Herbert Schildt, "Java the Complete Reference", 11th Edition, McGraw-Hill Education, 2019.
2. Jim Keogh, "J2EE: The Complete Reference", 1st Edition, McGraw Hill Education.
3. https://www.javatpoint.com/spring-boot-tutorial
4. https://www.springboottutorial.com/spring-boot-with-mysql-and-oracle

Reference Books:

1. Y Daniel Liang, "Introduction to Java Programming and Data Structures", Comprehensive Version, Addison Wesley; 12th Edition.
2. Stephanie Bodoff, Eric Armstrong, Jennifer Ball, Debbie Bode Carson, Ian Evans, Dale Green, Kim Haase, Eric Jendrock, "The J2EE Tutorial", 2nd Edition, Pearson Education.

E-Books / Web References:

1. http://java.sun.com/docs/books/tutorial/
2. http://www.onlinecomputerbooks.com/free-java-books.php

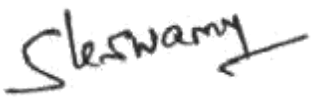
MOOCs:

1. https://www.udemy.com/course/complete-jdbc-programming-part-1/
2. https://www.coursera.org/learn/java-database-connectivity-introduction

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO62.1	3	3	3	-	3	-	-	-	2	-	-	2	-	2
CO62.2	3	3	3	-	3	-	-	-	2	-	-	2	-	2
CO62.3	3	3	3	-	3	-	-	-	2	-	-	2	-	2
CO62.4	3	3	3	-	3	-	-	-	2	-	-	2	-	2
CO62.5	3	3	3	-	3	-	-	-	2	-	-	2	-	2
Average	**3**	**3**	**3**	**-**	**3**	**-**	**-**	**-**	**2**	**-**	**-**	**2**	**-**	**2**

Low-1: Medium-2: High-3



SUBJECT: COMPUTER NETWORKS (Integrated)

Subject Code	**22CSE63**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:2**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**3**
No. of Credits: 04			

Course Learning Objectives:
The course will enable students to:

CLO1	Explain the functions of each layer in the OSI and TCP/IP reference model.
CLO2	Discuss data transmission in Physical layer and error control in Data link layer
CLO3	Explain routers, IP and Routing Algorithms in network layer
CLO4	Discuss transport layer services and understand UDP and TCP protocols
CLO5	Demonstration of application layer protocols

CONTENTS	**# of Hours / RBT Levels**
MODULE 1 **Network Models**: Protocol Layering, TCP/IP Protocol Suite, The OSI Model. **Physical Layer:** Data and Signals, Transmission Impairment, Data Rate Limits. Digital **Transmission:** Line Coding **Text Book 1: Chapters: 2.1, 2.2, 2.3, 3.1, 3.4, 3.5, 4.1.1**	**07** **L2**
MODULE 2 **Bandwidth Utilization:** Multiplexing and Spectrum Spreading: Multiplexing. **Error Detection and Correction:** Introduction, Block Coding, Cyclic Codes, Checksum-Concept. **Data Link Control (DLC):** Data-Link Layer Protocols, HDLC, Point-To-Point Protocol (PPP) (Services, Framing, Transition Phases) **Text Book 1: Chapters: 6.1, 10.1, 10.2, 10.3, 10.4.1, 11.2, 11.3, 11.4.1, 11.4.2, 11.4.3**	**08** **L2**
MODULE 3 **Introduction to Network Layer:** Network-Layer Services, Packet Switching, Ipv4 Addresses. **Network-Layer Protocols:** Internet Protocol (IP), Icmpv4. Unicast Routing: Distance-Vector Routing, Link-State Routing, Internet Structure, Routing Information Protocol (RIP), Open Shortest Path First (OSPF). **Next Generation IP:** Ipv6 Addressing, Transition from Ipv4 to Ipv6 **Text Book 1: Chapters: 18.1, 18.2, 18.4, 19.1, 19.2, 20.2.1, 20.2.2, 20.3.1, 20.3.2, 20.3.3, 22.2, 22.4**	**10** **L3**
MODULE 4 **Transport Layer:** Introduction, Transport-Layer Protocols. **Transport-Layer Protocols:** User Datagram Protocol, TCP Services, TCP Features, Segment, A TCP Connection. **Text Book 1: Chapters: 23.1, 23.2, 24.2, 24.3.1, 24.3.2, 24.3.3, 24.3.4**	**08** **L2**
MODULE 5 **Application Layer:** Introduction, Application Programming Interface. **Standard Client-Server Protocols:** World Wide Web and HTTP, FTP, Electronic Mail, Domain Name System (DNS)	**07** **L2**

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Text Book 1: Chapters: 25.1, 25.2.1, 26.1, 26.2, 26.3, 26.6	

Laboratory Component
List of Experiments

(Program can be written in C/C++/ Java/NS2 Simulator)

1. Write a program for error detecting code using CRC-CCITT (16-bits).
2. Write a program to demonstrate Link state routing algorithm.
3. Write a program to demonstrate Distance vector routing algorithm.
4. Write a Java program to Implement TCP/IP sockets, write a client – server program to make the client send the file name and to make the server send back the contents of the requested file if present.
5. Write a program on datagram socket for client/server to display the messages on client side, typed at the server side.
6. Implement Ring topology operation using NS2.
7. Implement Bus topology operation using NS2.
8. Implement three nodes point – to – point network with duplex links between them. Set the queue size, vary the bandwidth and find the number of packets dropped.
9. Write a NS2 script to implement the operation of Stop and Wait protocol.
10. Implement simple ESS with transmitting nodes in wire-less LAN by simulation and determine the performance with respect to transmission of packets.

Course Outcomes:
Upon successful completion of this course, student will be able to

CO63.1	Explain networking with reference to OSI, TCP/IP models
CO63.2	Discuss analog and digital conversion techniques in physical layer and error detection and correction in Data link layer
CO63.3	Summarize Internet Protocol and network layer routing algorithms
CO63.4	Explain transport layer UDP and TCP protocols services
CO63.5	Understand principles of application layer protocols

Text Books:

1. Behrouz A Forouzan, "Data and Communications and Networking", 5th Edition, McGraw Hill, Indian Edition.

Reference Books:

1. James F Kurose and Keith W Ross, "Computer Networking, A Top-Down Approach", 6th Edition, Pearson, 2017.
2. Larry L Peterson and Brusce S Davie, "Computer Networks", 5th Edition, ELSEVIER
3. Andrew S Tanenbaum, "Computer Networks", 5th Edition, Pearson
4. Mayank Dave, "Computer Networks", 2nd Edition, Cengage Learning

E-Books / Web References:

1. http://eti2506.elimu.net/Introduction/Books/Data%20Communications%20and%20Networking%20By%20Behrouz%20A.Forouzan.pdf
2. https://eclass.teicrete.gr/modules/document/file.php/TP326/%CE%98%CE%B5%CF%89%CF%81%CE%AF%CE%B1%20(Lectures)/Computer_Networking_A_Top-Down_Approach.pdf

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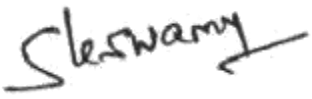
MOOCs:

1. https://www.my-mooc.com/en/mooc/computer-networking--ud436/
2. https://www.udacity.com/course/computer-networking--ud436
3. https://onlinecourses.swayam2.ac.in/cec19_cs07/preview

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO63.1	3	2	-	-	1	-	-	-	-	-	-	2	-	1
CO63.2	3	2	-	-	2	-	-	-	-	-	-	2	-	1
CO63.3	3	2	3	-	2	-	-	-	-	-	-	2	-	1
CO63.4	3	2	3	-	2	-	-	-	-	-	-	2	-	1
CO63.5	3	2	3	-	2	-	-	-	-	-	-	2	-	1
Average	**3**	**2**	**3**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**1**

Low-1: Medium-2: High-3



SUBJECT: SYSTEM SOFTWARE AND COMPILER DESIGN

Subject Code	**22CSE641**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**3**
No. of Credits: 03			

Course Learning Objectives:
The course will enable students to:

CLO1	Study the features and design aspects of assemblers, Macro, loaders and linkers.
CLO2	Learn the design principles of a Compiler.
CLO3	Learn the various parsing techniques and different levels of translation.
CLO4	Learn how to optimize and effectively generate machine codes.

CONTENTS	**# of Hours / RBT Levels**
MODULE 1 **Introduction:** Introduction to System Software, Machine Architecture of SIC and SIC/XE **Assemblers**: Basic assembler functions, machine dependent assembler features, machine independent assembler features, assembler design options. **Text Book 1: Chapter 1: 1.1,1.2,1.3.1,1.3.2, Chapter 2: 2.1 to 2.4**	**08** **L2**
MODULE 2 **Introduction:** Language Processors, The structure of a compiler. **Lexical Analysis**: The role of lexical analyzer, Input buffering, Specifications of token, recognition of tokens. **Text Book 2:Chapter 1 1.1-1.5 Chapter 3: 3.1 – 3.4**	**06** **L2**
MODULE 3 **Syntax Analysis**: Introduction, Context Free Grammars, Writing a grammar, Top Down Parsers, Bottom-Up Parsers **Text Book 2: Chapter 4 4.1, 4.2 4.3 4.4 4.5**	**10** **L2**
MODULE 4 **Lex and YACC:** The Simplest Lex Program, Grammars, Parser-Lexer Communication, A YACC Parser, The Rules Section, Running LEX and YACC, A Word Counting Program, Using YACC – Grammars, A YACC Parser - The Definition Section, The Rules Section, The LEXER, Compiling and Running a Simple Parser. **Text Book 3: Chapter 1, 2, 3**	**06** **L2**
MODULE 5 **SDT:** Syntax Directed Translation, Intermediate code generation, Code generation **Text Book 2: Chapters: 5.1, 5.2, 5.3, 6.1, 6.2, 8.1, 8.2**	**10** **L2**

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Course Outcomes:

Upon successful completion of this course, student will be able to

CO641.1	Discuss the features of assemblers and loaders.
CO641.2	Describe the functionality of Lexical Analysis using Lex Tool.
CO641.3	Explain Top –Down, Bottom- Up Parsers using YACC tool.
CO641.4	Utilize Lex and YACC tools for implementing different concepts of system software
CO641.5	Describe the importance of Syntax Directed Translation, Intermediate code generation, Code generation.

Text Books:

1. Leland. L. Beck, D Manjula, "System Software", 3rd Edition, 2012.
2. Alfred V Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, "Compilers-Principles, Techniques and Tools", Pearson, 2nd Edition, 2007
3. Doug Brown, John Levine, Tony Mason, "Lex & YACC", O'Reilly Media, October 2012.

Reference Books:

1. Srimanta Pal, "Systems programming", Oxford university press, 2016
2. K C Louden, "System programming and Compiler Design", Cengage Learning
3. K Muneeswaran, "Compiler Design", Oxford University Press 2013.

E-Books / Web References:

1. https://www.freebookcentre.net/CompuScience/Free-Compiler-Design-Books-Download.html
2. https://learnengineering.in/pdf-compilers-principles-techniques-tools-by-aho-free-download/

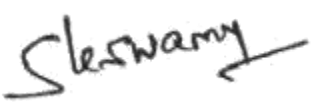
MOOCs:

1. https://online.stanford.edu/courses/soe-ycscs1-compilers
2. https://www.udacity.com/course/compilers-theory-and-practice--ud168

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO641.1	3	2	-	-	-	-	-	-	-	1	-	1	3	-
CO641.2	3	2	-	-	2	-	-	-	-	1	-	1	3	-
CO641.3	3	3	2	1	2	-	-	-	-	1	-	1	3	-
CO641.4	3	3	-	-	-	-	-	-	-	1	-	1	3	-
CO641.5	3	3	1	1	1	-	-	-	-	1	-	1	3	-
Average	**3**	**3**	**2**	**1**	**2**	**-**	**-**	**-**	**-**	**1**	**-**	**1**	**3**	**-**

Low-1: Medium-2: High-3



SUBJECT: BIG DATA ANALYTICS

Subject Code	**22CSE642**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**3**
No. of Credits: 03			

Course Learning Objectives:
The course will enable students to:

CLO1	Understand the fundamentals of Big Data Analytics
CLO2	Explore the Hadoop framework and Hadoop Distributed File system
CLO3	Illustrate the concepts of NoSQL using MongoDB and Cassandra for Big Data
CLO4	Employ MapReduce programming model to process the big data

CONTENTS	**# of Hours / RBT Levels**
MODULE 1 **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.	**08** **L2**
MODULE 2 **Introduction to Hadoop:** Hadoop Distributed File System Basics, Running Example Programs, and Benchmarks, Hadoop MapReduce Framework, MapReduce Programming, Essential Hadoop Tools, Hadoop YARN Applications, Managing Hadoop with Apache Ambari, Basic Hadoop Administration Procedures	**08** **L2**
MODULE 3 **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.	**08** **L2**
MODULE 4 **MapReduce, Hive and Pig:** Introduction, MapReduce Map Tasks, Reduce Tasks and MapReduce Execution, Composing MapReduce for Calculations and Algorithms, Hive, HiveQL, Pig.	**08** **L2**
MODULE 5 **Text, Web Content, Link, and Social Network Analytics:** Introduction, Text mining, Web Mining, Web Content and Web Usage Analytics, Page Rank, Structure of Web and analyzing a Web Graph, Social Network as Graphs and Social Network Analytics	**08** **L2**

Course Outcomes:
Upon successful completion of this course, students will be able to

CO642.1	Understand the fundamentals of Big Data analytics
CO642.2	Discuss the Hadoop framework and Hadoop Distributed File system
CO642.3	Illustrate the concepts of NoSQL using MongoDB and Cassandra for Big Data
CO642.4	Describe the MapReduce programming model to process the big data along with Hadoop tools

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CO642.5	Explain web content and Social Networks to provide analytics with relevant visualization tools

Text Books:

1. Raj Kamal and Preeti Saxena, “Big Data Analytics Introduction to Hadoop, Spark, and Machine-Learning”, McGraw Hill Education, 2018.
2. Douglas Eadline,"Hadoop 2 Quick-Start Guide: Learn the Essentials of Big Data Computing in the Apache Hadoop 2 Ecosystem", 1st Edition, Pearson Education, 2016.

Reference Books:

1. Tom White, “Hadoop: The Definitive Guide”, 4th Edition, O“Reilly Media, 2015.
2. Boris Lublinsky, Kevin T Smith, Alexey Yakubovich, "Professional Hadoop Solutions", 1st Edition, Wrox Press, 2014
3. Eric Sammer, "Hadoop Operations: A Guide for Developers and Administrators",1st Edition, O'Reilly Media, 2012.

E-Books / Web References:

1. Seema Acharya, Subhashini Chellappan, “Big Data and Analytics”, Wiley Publication, 2015.
2. Judith Hurwitz, Alan Nugent, Dr. Fern Halper, Marcia Kaufman, “Big Data for Dummies”, Publisher: Wiley, 2013.

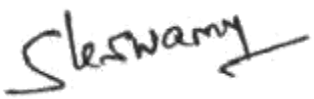
MOOCs:

1. https://www.coursera.org/courses?query=big%20data

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO642.1	3	3	3	-	-	-	-	-	-	-	-	2	2	-
CO642.2	3	3	3	-	-	-	-	-	-	-	-	2	2	-
CO642.3	3	3	3	-	-	-	-	-	-	-	-	2	2	-
CO642.4	3	-	3	-	1	-	-	-	-	-	-	2	2	-
CO642.5	-	-	3	-	1	-	-	-	-	-	-	2	2	-
Average	**3**	**3**	**3**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**-**

Low-1: Medium-2: High-3



SUBJECT: DOT NET FRAMEWORKS

Subject Code	**22CSE643**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**03**
No. of Credits: 03			

Course Learning Objectives:
The course will enable students to:

CLO1	Inspect Visual Studio programming environment and tool-set designed to build applications for Microsoft Windows
CLO2	Understand Object Oriented Programming concepts in C# Programming
CLO3	Interpret Interfaces and define custom interfaces for application
CLO4	Build Custom collections in C#
CLO5	Understand data query using LINQ

CONTENTS	**# of Hours / RBT Levels**
MODULE 1 Welcome to C#, Working with variables, operators and expressions, Writing methods and applying scope **Text Book: 1 Chapters: 1, 2, 3**	**08** **L3**
MODULE 2 Using decision statements, Using compound assignment and iteration statements, Managing errors and exceptions **Text Book: 1 Chapters: 4, 5, 6**	**08** **L3**
MODULE 3 Creating and Managing classes and objects, Understanding values and references, Using arrays, Understanding parameter arrays **Text Book: 1 Chapters: 7, 8, 10, 11**	**08** **L3**
MODULE 4 Working with Inheritance, Creating Interfaces and defining Abstract classes, Implementing properties to access fields **Text Book: 1 Chapters: 12, 13, 15**	**08** **L3**
MODULE 5 Using Collections, Querying in-memory data by using query expressions **Text Book: 1 Chapters: 18, 21**	**08** **L3**

Course Outcomes:
Upon successful completion of this course, student will be able to

CO643.1	Design applications on Visual Studio .NET platform by understanding the syntax and semantics of C#
CO643.2	Demonstrate Object Oriented Programming concepts in C# programming
CO643.3	Design custom interfaces and abstract classes for applications
CO643.4	Illustrate the use of Collections in C#

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CO643.5	Implement LINQ queries to query in-memory data

Text Books:

1. John Sharp, "Microsoft Visual C# Step by Step", 8th Edition, PHI Learning Pvt. Ltd.

Reference Books:

1. E Balagurusamy, "Programming in C#", 4th Edition, McGraw Hill Education.
2. Christian Nagel, "Professional C# 6 and .NET Core 1.0", 1st Edition, Wiley India Pvt Ltd.
3. Mark Michaelis, "Essential C# 6.0", 5th Edition, Pearson Education India.

E-Books / Web References:

1. https://www.c-sharpcorner.com/
2. https://freecomputerbooks.com/C-Sharp-11-Programming-Essentials.html

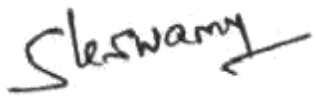
MOOCs:

1. https://www.udemy.com/course/complete-csharp-masterclass/
2. https://dotnet.microsoft.com/en-us/learn/csharp

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO643.1	3	3	3	-	3	-	-	-	2	-	-	2	-	2
CO643.2	3	3	3	-	3	-	-	-	2	-	-	2	-	2
CO643.3	3	3	3	-	3	-	-	-	2	-	-	2	-	2
CO643.4	3	3	3	-	3	-	-	-	2	-	-	2	-	2
CO643.5	3	3	3	-	3	-	-	-	2	-	-	2	-	2
Average	**3**	**3**	**3**	**-**	**3**	**-**	**-**	**-**	**2**	**-**	**-**	**2**	**-**	**2**

Low-1: Medium-2: High-3



SUBJECT: AUGMENTED REALITY AND VIRTUAL REALITY

Subject Code	**22CSE644**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**3**
No. of Credits: 03			

Course Learning Objectives:
The course will enable students to:

CLO1	Discuss historical and modern overviews and perspectives on Virtual Reality.
CLO2	Describe the fundamentals of sensation, perception, technical and engineering aspects of virtual reality systems
CLO3	Explain the knowledge on the field of Augmented Reality
CLO4	Understand various AR tracking methods

CONTENTS	# of Hours / RBT Levels
MODULE 1 Introduction to Virtual Reality, Bird's Eye View -Hardware, software, Human physiology and perception, Geometry of Virtual Worlds- Geometric models, changing Position and orientation, viewing transformations, chaining transformations. **Text Book: 1 Chapters: 1, 2, 3**	**08** **L2**
MODULE 2 Visual Perception - Perception of Depth, Perception of Motion, Perception of Color, Combining Sources of Information Visual Rendering -Ray Tracing and Shading Models, Rasterization, Correcting Optical Distortions, Improving Latency and Frame Rates. **Text Book: 1 Chapters: 6, 7**	**08** **L2**
MODULE 3 Interaction -Motor Programs and Remapping, Locomotion, manipulation, social interaction. Evaluating VR systems and Experiences – Perceptual Training, Developer recommendations, comfort and VR sickness and Experiments on Human subjects. **Text Book: 1 Chapters: 9, 10**	**08** **L2**
MODULE 4 Introduction to Augmented Reality-Definition and scope, History, Examples. Displays-Multimodal displays, visual perception, requirements and characteristics, Spatial display models, visual displays **Text Book: 2 Chapters: 1, 2**	**08** **L2**
MODULE 5 Tracking, Calibration, and registration, Coordinate systems, Characteristics of tracking technology, stationary tracking systems, Mobile sensors, Optical tracking, sensor fusion, Computer vision for augmented reality-marker tracking, Multiple-Camera Infrared Tracking, Natural Feature Tracking by Detection, Incremental Tracking, Simultaneous Localization and Mapping, Outdoor Tracking **Text Book: 2 Chapters: 3, 4**	**08** **L2**

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Course Outcomes:
Upon successful completion of this course, student will be able to

CO644.1	Describe working and applications of Virtual reality systems
CO644.2	Understand the system of human vision and its implication on perception and rendering
CO644.3	Explain the importance of interaction in VR systems and VR experiences evaluation
CO644.4	Describe the working, applications and different display models used in Augmented Reality systems
CO644.5	Discuss Tracking techniques used in Augmented reality systems

Text Books:

1. Steven M. LaValle, "Virtual Reality", Cambridge University Press, 2016
2. Schmalstieg and Hollerer, "Augmented Reality: Principles & Practice", Pearson Education India, 2016.

Reference Books:

1. Burdea, Grigore C, Philippe Coiffet, "Virtual Reality Technology ", Wiley-IEEE Press, 2nd Edition, 2003.
2. Allan Fowler, "AR Game Development", 1st Edition, A press Publications, 2018.

E-Books / Web References:

1. http://lavalle.pl/vr/book.html
2. https://www.vttresearch.com/sites/default/files/pdf/science/2012/S3.pdf

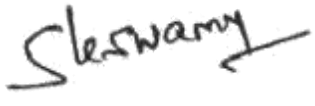
MOOCs:

1. https://www.coursera.org/learn/ar
2. https://nptel.ac.in/courses/106/106/106106138/

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO644.1	2	2	-	-	2	1	-	1	-	-	-	1	1	-
CO644.2	2	2	-	-	2	1	-	1	-	-	-	1	1	-
CO644.3	2	2	-	-	2	1	-	1	-	-	-	1	1	-
CO644.4	2	2	-	-	2	1	-	1	-	-	-	1	1	-
CO644.5	2	2	-	-	2	1	-	1	-	-	-	1	1	-
Average	**2**	**2**	**-**	**-**	**2**	**1**	**-**	**1**	**-**	**-**	**-**	**1**	**1**	**-**

Low-1: Medium-2: High-3



SUBJECT: ADVANCED PYTHON

Subject Code	**22CSE651**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**3**
No. of Credits: 03			

Course Learning Objectives:
The course will enable students to:

CLO1	Acquire programming skills in core python.
CLO2	Able to perform store and clean data with pandas
CLO3	Outline the process HTML and JSON
CLO4	Develop the ability to write database applications Data frames in Python

CONTENTS	No of Hours / RBT Levels
MODULE 1 **NumPy Basics: Arrays and vectorized Computation:** The NumPy ndarrray: A Multidimensional Array Object, Creating ndarrays, Data Types for ndarrays, Arithmetic with NumPy Arrays, Basic lndexing and Slicing , Boolean lndexing, Fancy lndexing, Transposing Arrays and Swapping Axes, Universal Functions: Fast Element-Wise Array Functions, Array-Oriented Programming with Arrays , Expressing Conditional Logic as Array Operations, Mathematical and Statistical Methods, Methods for Boolean Arrays, Sorting, Unique and Other Set Logic, File Input and Output with Arrays, Linear Algebra, Pseudorandom Number **Text Book: 1 Chapter: 4**	**08** **L3**
MODULE 2 **Getting Started with Pandas:** Introduction to Pandas Data Structures, Series, DataFrame, Index Objects, Essential Functionality, Reindexing, Dropping Entries from an Axis , Indexing, Selection, and Filtering, Integer Indexes, Arithmetic and Data Alignment, Function Application and Mapping, Sorting and Ranking, Axis lndexes with Duplicate Labels, Summarizing and Computing Descriptive Statistics, Correlation and Covariance, Unique Values, Value Counts, and Membership **Text Book: 1 Chapter: 5**	**08** **L3**
MODULE 3 **Data Loading, Storage, and File Formats:** Reading and Writing Data in Text Format, Reading Text Files in Pieces, Writing Data to Text Format, Working with Delimited Formats, JSON Data, XML and HTML: Web Scraping, Binary Data Formats, Using HDF5 Format, Reading Microsoft Excel Files, Interacting with Web APIs, Interacting with Databases **Text Book: 1 Chapter: 6**	**08** **L3**
MODULE 4 **Data Cleaning and Preparation:** Handling Missing Data, Filtering Out Missing Data, Filling In Missing Data, Data Transformation, Removing Duplicates, Transforming Data Using a Function or Mapping, Repracing Values, Renaming Axis lndexes, Discretization and Binning, Detecting and Filtering outliers, Permutation and Random sampling, computing lndicator/Dummy Variables, string Manipulation, string object	**08** **L3**

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Methods, Regular Expressions, Vectorized String Functions in pandas **Text Book: 1 Chapter: 7**	
MODULE 5 **Data Wrangling: Join, Combine and Reshape:** Hierarchical Indexing, Reordering and sorting Levels, Summary Statistics by Level, Indexing with a DataFrame's columns, Combining and Merging Datasets, Database-style DataFrame Joins, Merging on Index, Concatenating Along an Axis, Combining Data with overlap Reshaping and Pivoting, Reshaping with Hierarchical Indexing, Pivoting "Long" to "Wide" Format, Pivoting "Wide" to "Long" Format. **Text Book: 1 Chapter: 7**	**08** **L3**

Course Outcomes:

Upon successful completion of this course, student will be able to:

CO651.1	Implement Arrays and Vectorized Computation Using NumPy
CO651.2	Apply the Pandas Data Structure
CO651.3	Illustrate Read and Write Operation on JSON and XML data
CO651.4	Demonstrate Store and Clean Data Operation with Pandas Data Frames
CO651.5	Demonstrate Data Wrangling using Join, Combine and Reshape Methods

Text Books:

1. Wes McKinney, "Python for Data Analysis" 2nd Edition O'Reilly, 2017.

Reference Books:

1. Dr. Bharti Motwani, "Data Analytics using Python", Wiley, 2020, ISBN: 978-8126502950
2. Phuong Vo.T.H, Martin Czygan, Ashish Kumar, Kirthi Raman, "Python: Data Analytics and Visualization", Packt Publishing Limited,2017, ISBN :9781788290098

E-Books / Web References:

1. https://www.tutorialspoint.com/python/index.htm
2. https://www.pythontutorial.net/advanced-python/
3. https://www.learnpython.org/

MOOCs:

1. https://nptel.ac.in/courses/106106145
2. https://onlinecourses.nptel.ac.in/noc19_cs41/preview

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO651.1	2	2	2	-	1	-	-	-	-	-	-	2	-	-
CO651.2	2	2	2	-	1	-	-	-	-	-	-	2	-	-
CO651.3	2	2	2	-	1	-	-	-	-	-	-	2	-	-
CO651.4	2	2	2	-	1	-	-	-	-	-	-	2	-	-
CO651.5	2	2	2	-	1	-	-	-	-	-	-	2	-	-
Average	**2**	**2**	**2**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**

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Low-1: Medium-2: High-3

SUBJECT: SOFTWARE TESTING

Subject Code	**22CSE652**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**3**
No. of Credits: 03			

Course Learning Objectives:
The course will enable students to:

CLO1	Understand the Basics of Software Testing
CLO2	Understand the different testing techniques
CLO3	Understand the different types of testing models
CLO4	Understand the appropriate technique for the design of flow graph and document for the software artefact

CONTENTS	# of Hours / RBT Levels
MODULE 1 **Basics of Software Testing:** Basic definitions, Software Quality, Requirements, Behaviour 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 **Text Book 3: Chapters: 1:1.2 - 1.5, 3**	**08** **L2**
MODULE 2 **Problem Statements:** Generalized pseudo code, the triangle problem, the Next Date function, the commission problem, the SATM (Simple Automatic Teller Machine) problem, the currency converter, Saturn windshield wiper **Functional Testing:** Boundary value analysis, Robustness testing, Worst-case testing, Robust Worst testing for triangle problem, Next Date problem and commission problem, Equivalence classes, Equivalence test cases for the triangle problem, Next Date function, and the commission problem, Guidelines and observations, Decision tables, Test cases for the triangle problem, Next Date function, and the commission problem, Guidelines and observations **Text Book 1: Chapters: 2, 5, 6, 7 Text Book 2: Chapter: 3**	**08** **L2**
MODULE 3 **Fault Based Testing:** Overview, Assumptions in fault based testing, Mutation analysis, Fault-based adequacy criteria, Variations on mutation analysis. **Structural Testing:** Overview, Statement testing, Branch 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 **Text Book 2: Chapters: 16, 12 Text Book 1: Chapters: 9, 10**	**08** **L2**
MODULE 4 **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 **Process Framework**: Basic principles: Sensitivity, redundancy, restriction, partition,	**08** **L2**

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visibility, Feedback, the quality process, Planning and monitoring, Quality goals, Dependability properties, Analysis Testing, Improving the process, Organizational factors **Planning and Monitoring the Process**: Quality and process, Test and analysis strategies and plans, Risk planning, monitoring the process, Improving the process, the quality team. **Text Book 2**: **Chapters: 17, 20**	
MODULE 5 **Integration and Component-Based Software Testing**: Overview, Integration testing strategies, Testing components and assemblies. System, Acceptance and Regression Testing: Overview, System testing, Acceptance testing, Usability, Regression testing, Regression test selection techniques, Test case prioritization and selective execution. **Levels of Testing, Integration Testing**: Traditional view of testing levels, Alternative life-cycle models, The SATM system, Separating integration and system testing, A closer look at the SATM system, Decomposition-based, call graph-based, Path-based integrations. **Text Book 2: Chapters: 21, 22 Text Book 1 : Chapters: 12, 13**	**08** **L2**

Course Outcomes:

Upon successful completion of this course, student will be able to

CO652.1	Discuss test cases for any given problem
CO652.2	Compare the different testing techniques
CO652.3	Classify the problems according to a suitable testing model
CO652.4	Understand the appropriate technique for the design of flow graph
CO652.5	Illustrate appropriate document for the software artefact

Text Books:

1. Paul C. Jorgensen, "Software Testing, A Craftsman's Approach", 3rd Edition, Auerbach Publications, 2008.
2. Mauro Pezze, Michal Young, "Software Testing and Analysis – Process, Principles and Techniques", Wiley India, 2009.
3. Aditya P Mathur, "Foundations of Software Testing", Pearson Education, 2008.

Reference Books:

1. Gopalaswamy Ramesh, Srinivasan Desikan, "Software testing Principles and Practices", 2nd Edition, Pearson, 2007.
2. Ron Patton, "Software Testing", 2nd Edition, Pearson Education, 2004.

E-Books / Web References:

1. https://www.softwaretestinghelp.com/practical-software-testing-new-free-ebook-download/
2. https://www.cs.purdue.edu/homes/apm/FoundationsBookSecondEdition/Slides/ConsolidatedSlides.pdf

MOOCs:

1. https://onlinecourses.nptel.ac.in/noc19_cs71/preview
2. https://www.coursera.org/learn/introduction-software-testing
3. https://www.udacity.com/course/software-testing--cs258

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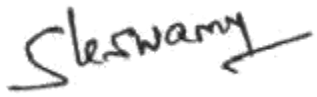
Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO652.1	2	-	-	-	-	1	-	-	1	1	-	1	2	2
CO652.2	2	-	-	1	-	1	-	-	1	1	-	1	2	2
CO652.3	2	1	-	1	-	1	-	-	1	1	-	1	2	2
CO652.4	2	1	1	1	1	1	1	1	1	1	1	1	2	2
CO652.5	2	1	1	1	1	1	1	1	1	1	1	1	2	2
Average	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**2**

Low-1: Medium-2: High-3



SUBJECT: INTRODUCTION TO CYBER SECURITY

Subject Code	**22CSE653**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**03**
No. of Credits: 03			

Course Learning Objectives:
The course will enable students to:

CLO1	Outline the basic knowledge on Computer Forensics.
CLO2	Distinguish between cybercrime and the laws governing cybercrime.
CLO3	Comprehend the contextual need of cybercrime investigations.
CLO4	Demonstrate the use of tools used in cyber forensics.

CONTENTS	# of Hours / RBT Levels
MODULE 1 **Understanding Cyber Crime:** Cyber Security–the need of the hour, history of internet, impact of internet , internet in India, CIA triad, Reasons for cyber crime, Classification of cyber crimes , Cyber crimes –Legal Perspective **Text Book 1: Chapter: 1**	**08** **L2**
MODULE 2 **Cyber Offenses:** Attacks Plan, Social Engineering, Cyber Stalking, Cybercafé and Cybercrimes ,Botnets, Cloud computing and cyber crime **Text Book 1: Chapter: 2**	**06** **L2**
MODULE 3 **Cyber Crime in Devices:** Introduction, Proliferation of mobile and wireless devices, Credit card fraud in the mobility era, Challenges posed by mobile devices, Registry settings, Attacks on mobile/cell phones, Security implications and Measures for organizations in handling mobile devices, Organizational security policies and measures in mobile computing era, Laptops **Text Book: 2 Chapter: 3**	**10** **L2**
MODULE 4 **Tools and Methods:** Introduction, proxy servers and Anonymizers, Phishing, Password cracking, Keyloggers and spywares, virus and worms, Trojan Horses and back doors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer overflow, Identity Theft **Text Book: 2 Chapter: 4, 5**	**10** **L2**
MODULE 5 **Cyber Crimes and Cyber Security, The Legal Perspective:** The Indian IT Act 2000, challenges , Digital Signatures, Amendments in the Indian IT Act, Punishments, Cyber law **Text Book:2 Chapter: 6**	**06** **L2**

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Course Outcomes:
Upon successful completion of this course, student will be able to

CO653.1	Discuss the need of cyber security
CO653.2	Distinguish different methods of cyber-crimes
CO653.3	Describe the organizational methods and policies for cyber-crime handling in mobile and wireless devices
CO653.4	Describe the computer forensic tools and their usage
CO653.5	Understand the Legal Perspective of cyber crimes in India

Text Books:

1. SunithBelapure and Nina Godbole, "Cyber Security: Understanding Cyber crime, computer forensics and legal perspectives", Wiley India, 2013.
2. Anand Shinde, "Introduction to Cyber Security: Guide to the world of cyber security", Notion Press, 2021.

Reference Books:

1. Marjie T Britz, "Computer Forensics and Cyber Crime - An Introduction", Pearson Education, 2nd Edition, 2012.
2. Harish Cahnder, "Cyber Laws and IT Protection", PHI, 2012.
3. Thomas J Moubray, "Cyber Security: Managing Systems, Conducting Testing and Investigating Inrusions", John Wiley, 2014.

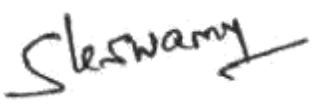
MOOCs:

1. https://www.cyberdegrees.org/
2. https://www.udemy.com/course/the-complete-internet-security-privacy-course-volume-1/

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO653.1	1	2	-	-	-	-	-	1	-	1	-	1	-	-
CO653.2	2	2	1	1	-	-	-	1	-	1	-	1	-	1
CO653.3	2	2	1	1	-	-	-	1	-	1	-	1	-	1
CO653.4	2	2	1	1	-	-	-	1	-	1	-	1	-	1
CO653.5	2	2	1	1	-	-	-	1	-	1	-	1	-	1
Average	**2**	**2**	**2**	**1**	-	-	-	**1**	-	**1**	-	**1**	-	**1**

Low-1: Medium-2: High-3



SUBJECT: INTRODUCTION TO JAVA

Subject Code	**22CSE654**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**3hrs/week**	**Examination Hours**	**3 hours**
No. of Credits: 03			

Course Learning Objectives:
The course will enable students to:

CLO1	Learn fundamentals of Java programming and use the Java SDK environment to create, debug and run simple Java programs.
CLO2	Understand the basic object-oriented concepts with Java programming.
CLO3	Learn Arrays and string handling methods using programming examples
CLO4	Understand how to extend Java classes with packages, inheritance and dynamic binding.
CLO5	Learn how to use exception handling in Java applications.

CONTENTS	**# of Hours / RBT Levels**
MODULE 1 **Basic Concepts of Programming and Java:** History and Overview of Java**,** Problem-Solving, Installation, and Demonstration of compiling, and running the sample program, Command Line Arguments, Scanner class, Data types, Identifiers, Variables, Literals, Operators, Type Conversion and Casting, Assignments and Expression, The Predefined Streams: Basic Input/ Output functions, Control Statements: Decision Making, Branching and Looping, Lexical Issues **Text Book: 1 Chapters: 1, 2, 3, 4, 5, 13, 20**	**10** **L2**
MODULE 2 **Classes, Objects, and Methods:** Introduction to Object-Oriented Principles, defining a class, adding data members and methods to the class, instantiating objects, and accessing class members and methods **Compile-time Polymorphism:** Method overloading, constructors, constructor overloading, this keyword, static keyword, and Inner classes **Text Book: 1 Chapters: 2, 6, 7**	**08** **L2**
MODULE 3 **Arrays:** Defining an Array, Initializing & Accessing an Array, Multi–Dimensional Array, Array of objects **String:** Creation & Operation. **String buffer:** Creation & Operation **Text Book: 1 Chapters: 3, 7, 17**	**08** **L2**
MODULE 4 **Inheritance**: Defining a subclass, Types of Inheritance, super keyword. **Run-time Polymorphism:** Method overriding, dynamic method dispatch. **Final and Abstract Keywords:** with data members, with methods, and with class. **Text Book: 1 Chapter: 8**	**08** **L2**
MODULE 5 **Packages:** Defining a Package, Member Access protection, and Importing the Packages. **Interface**: Defining and implementing interfaces,	**06** **L2**

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Exceptions: Definition, Types of Exceptions, Exception Handlers, Built-In Exceptions, User-defined Exception. **Text Book: 1; Chapters: 9, 10**	

Course Outcomes:

Upon successful completion of this course, students will be able to

CO654.1	Describe the basic programming concepts
CO654.2	Discuss the concept of classes, objects, and methods for specific scenarios
CO654.3	Illustrate the concept of arrays and strings
CO654.4	Outline the use of inheritance and polymorphism for applications
CO654.5	Demonstrate the concepts of packages, interface, and error-handling mechanisms

Textbooks:

1. Herbert Schildt, "Java The Complete Reference", Comprehensive coverage of the Java Language, 11th Edition, Mc Graw Hill Education, 2019.

Reference Books:

1. H. M.Dietel and P. J. Dietel ,"Java How to Program", 10th Edition, Pearson Education/PHI, 2016.
2. Y. Daniel Liang, "Introduction to Java programming", 7th Edition, Pearson Publication, 2009.
3. Cay S Horstmann and Cary Gornell, "Java, Volume I Fundamentals", 11th Edition, Pearson publication, 2016.

E-Books / Web References:

1. http://elib.vku.udn.vn/bitstream/123456789/1282/1/Core%20Java-Volume%20I%20-%20Fundamentals.pdf
2. https://www.w3schools.com/java/java_intro.asp
3. https://www.geeksforgeeks.org/java/

MOOCs:

1. https://onlinecourses.nptel.ac.in/noc23_cs74/preview

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO654.1	3	-	-	-	-	-	-	-	1	1	-	2	2	-
CO654.2	3	3	2	-	1	-	-	-	1	1	-	2	2	-
CO654.3	3	3	2	-	2	-	-	-	1	1	-	2	2	-
CO654.4	3	3	2	-	2	-	-	-	1	1	-	2	2	-
CO654.5	3	3	2	-	2	-	-	-	1	1	-	2	2	-
Average	**3**	**3**	**2**	**-**	**1**	**-**	**-**	**-**	**1**	**1**	**-**	**2**	**2**	**-**

Low-1: Medium-2: High-3

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SEMESTER – VI

Course: Universal Human Values

Course Code	22UHV66	CIE Marks	50
Hours/Week (L: T: P)	1:0:0	SEE Marks	50
No. of Credits	1	Examination Hours	1

Course Learning Objectives:

CLO1	To create an awareness on Engineering Ethics and Human Values.
CLO2	To understand social responsibility of an engineer.
CLO3	To appreciate ethical dilemma while discharging duties in professional life.

Content	No. of Hours
Module 1 **Introduction to Value Education** • Value Education, Definition, Concept and Need for Value Education. • The Content and Process of Value Education. • Basic Guidelines for Value Education. • Self-exploration as a means of Value Education. • Happiness and Prosperity as parts of Value Education.	**05 Hours**
Module 2 **Harmony in the Human Being** • Human Being is more than just the Body. • Harmony of the Self ('I') with the Body. • Understanding Myself as Co-existence of the Self and the Body. • Understanding Needs of the Self and the needs of the Body. • Understanding the activities in the Self and the activities in the Body.	**05 Hours**
Module 3 **Harmony in the Family and Society and Harmony in the Nature** • Family as a basic unit of Human Interaction and Values in Relationships. • The Basics for Respect and today's Crisis: Affection, e, Guidance, Reverence, Glory, Gratitude and Love. • Comprehensive Human Goal: The Five Dimensions of Human Endeavour. • Harmony in Nature: The Four Orders in Nature. • The Holistic Perception of Harmony in Existence.	**05 Hours**
Module 4 **Social Ethics** • The Basics for Ethical Human Conduct. • Defects in Ethical Human Conduct. • Holistic Alternative and Universal Order. • Universal Human Order and Ethical Conduct. • Human Rights violation and Social Disparities.	**05 Hours**

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Module 5	
Professional Ethics • Value based Life and Profession. • Professional Ethics and Right Understanding. • Competence in Professional Ethics. • Issues in Professional Ethics – The Current Scenario. • Vision for Holistic Technologies, Production System and Management Models.	**05 Hours**

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

22UHV66.1	Understand the significance of value inputs in a classroom and start applying them in their life and profession
22UHV66.2	Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc.
22UHV66.3	Understand the role of a human being in ensuring harmony in society and nature.
22UHV66.4	Distinguish between ethical and unethical practices and start working out the strategy to actualize a harmonious environment wherever they work.

Textbooks:

1.A.N Tripathy, New Age International Publishers, 2003.
2. Bajpai. B. L, New Royal Book Co, Lucknow, Reprinted,
2004 3.Bertrand Russell Human Society in Ethics & Politics

Reference books:

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. Corliss Lamont, Philosophy of Humanism.
4. Gaur. R.R. , Sangal. R, Bagari G.P, A Foundation Course in Value Education, Excel Books, 2009.
5. Gaur. R.R. , Sangal R , Bagaria G.P, Teachers Manual, Excel Books, 2009.
6. I.C. Sharma, Ethical Philosophy of India, Nagin & co, Julundhar
7. William Lilly- Introduction to Ethics -Allied Publisher

Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of four sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question from each module.**

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. Average Marks scored is added to test component. CIE is executed by way of two quizzes / Alternate Assessment Tools (AATs), and two tests. Two quizzes are to be conducted and each quiz is evaluated for 5 marks adding up to 10 marks. All quizzes are conducted online. Faculty may adopt innovative methods for conducting quizzes effectively.

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Some possible AATs: seminar/ assignments/term paper/ open ended experiments/ mini-projects/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic toolbox for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other. Typical evaluation pattern for regular courses is shown in Table 1:

Table 1: Distribution of weightage for CIE

	Component	Marks	Total Marks
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	CIE Test-3	**40**	
	AAT	**10**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

CO/PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
22UHV66.1	-	-	-	-	-	-	-	2	-	-	-	1	-	-	-	-
22UHV66.2	-	-	-	-	-	-	-	2	-	-	-	1	-	-	-	-
22UHV66.3	-	-	-	-	-	-	-	2	-	-	-	1	-	-	-	-
22UHV66.4	-	-	-	-	-	-	-	2	-	-	-	1	-	-	-	-
Average	-	-	-	-	-	-	-	2	-	-	-	1	-	-	-	-

Low-1: Medium-2: High-3

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SUBJECT: MINI PROJECT

Subject Code	**22CSEMP67**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**2 Contact hours/week**	**SEE Marks**	**50**
Examination Hours :3 Hours			
No. of Credits: 2			

Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary Mini- project can be assigned to an individual student or to a group having not more than 2 students.

CIE procedure for Mini-Project:

(i) **Single discipline**: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide. The CIE marks awarded for the Mini-project work, shall be based on the evaluation of project report, project presentation skill and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

(ii) **Interdisciplinary**: Continuous lnternal Evaluation shall be group wise at the college level with the participation of all the guides of the college. The CIE marks awarded for the Mini Project, shall be based on the evaluation of project report, project presentation skill and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

SEE for Mini-Project:

(i) **Single discipline**: Contribution to the Mini-project and the performance of each group member shall be assessed individually in the semester end examination (SEE) conducted at the department.

(ii) lnter disciplinary: Contribution to the Mini-project and the performance of each group member shall be assessed individually in semester end examination (SEE) conducted separately at the departments to which the student/s belong to.

Typical Evaluation pattern for the Course is shown in Table 1.

Table 1: CIE and SEE Evaluation

Components	**Marks**	**Total**	
CIE			
Review 1	-	50	**100**
Review 2	50		
SEE			
Semester End Examination	50	50	

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SCHEME AND SYLLABUS

Department of
Computer Science and Engineering

22 SCHEME

Computer Science and Engineering

VII – VIII Semester

GLOBAL ACADEMY OF TECHNOLOGY
(Autonomous Institution Affiliated to VTU, Belagavi.)
Accredited by NAAC with 'A' Grade,
NBA Accredited - CSE, ISE, ECE, EEE, ME, CV
Ideal Homes Township,
Raja Rajeshwari Nagar, Bengaluru-560098

VII SEMESTER

Sl. No.	Course Code	Course Title	Course Type	Teaching Dept.	Teaching Hours/Week			Examination			CREDITS
					L	T	P	CIE	SEE	Total	
1	22CSE71	Internet of Things	PC	CSE	4	0	0	50	50	100	4
2	22CSE72	Cryptography and Network Security (Integrated)	IPC		3	0	2	50	50	100	4
3	22CSE73	Deep Learning (Integrated)	IPC		3	0	2	50	50	100	4
4	22CSE74X	Program Elective 3	PEC		3	0	0	50	50	100	3
5	22CSE75X	Open Elective 2	OEC	CSE	3	0	0	50	50	100	3
6	22CSEP76	Project Phase 1	MP	Two Contact hours per week				100	-	100	2
Total								**350**	**250**	**600**	**20**

Program Elective 3*			
22CSE741	Blockchain and its Applications	22CSE743	Introduction to DevOps
22CSE742	NoSQL	22CSE744	Natural Language Processing
Open Elective 2 (Offered to other branch students)			
22CSE751	Introduction to Full Stack Development	22CSE753	Mobile Application Development
22CSE752	Cloud Computing	22CSE754	R Programming

*__NPTEL for Credit transfer__: Students can take 12 weeks NPTEL course as an equivalent to Program elective. The NPTEL courses of duration less than 12 weeks will not be considered for credit transfer. The courses (only technical) taken are as per the recommendation of BOS of respective department. The similarity of the contents as offered by NPTEL should not exceed a maximum of 40% of the courses being registered by the student. The NPTEL course need to be completed before the registration of the elective. Any certificate obtained after the registration of elective would not be considered. The validity of NPTEL certificate is for two years and it cannot be used more than once to avail the benefit. The student is eligible to transfer a maximum of nine credits in the entire duration of the program. The grades will be awarded as equivalent to the grades obtained in the NPTEL course.

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VIII SEMESTER

Sl. No.	Course Code	Course Title	Course Type	Teaching Dept.	Teaching Hours/Week			Examination			CREDITS
					L	T	P	CIE	SEE	Total	
1	22CSE81	Green Computing	PC	CSE	3	0	0	50	50	100	3
2	22CSE82X	Program Elective 4	PEC		3	0	0	50	50	100	3
3	22CSE83X	Program Elective 5	PEC		3	0	0	50	50	100	3
4	22CSE84	Project work phase - II	MP	Two Contact hours per week				100	100	200	8
5	22CSES85	Technical Seminar	MP	One Contact hour per week				100	-	100	1
6	22INT86	Internship	INT	Completed during the intervening period of VI and VII Semester				100	-	100	2
Total								**450**	**250**	**700**	**20**

Program Elective 4*			
22CSE821	Quantum Computing	22CSE823	Software Architecture and Design Patterns
22CSE822	Cyber Security and Digital Forensics	22CSE824	Advanced Computer Architecture
Program Elective 5*			
22CSE831	Storage Area Networks	22CSE833	Soft Computing
22CSE832	Social Network Analysis	22CSE834	Digital Image Processing

*__NPTEL for Credit transfer__: Students can take 12 weeks NPTEL course as an equivalent to Program elective. The NPTEL courses of duration less than 12 weeks will not be considered for credit transfer. The courses (only technical) taken are as per the recommendation of BOS of respective department. The similarity of the contents as offered by NPTEL should not exceed a maximum of 40% of the courses being registered by the student. The NPTEL course need to be completed before the registration of the elective. Any certificate obtained after the registration of elective would not be considered. The validity of NPTEL certificate is for two years and it cannot be used more than once to avail the benefit. The student is eligible to transfer a maximum of nine credits in the entire duration of the program. The grades will be awarded as equivalent to the grades obtained in the NPTEL course.

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SEMESTER - VII

SUBJECT: INTERNET OF THINGS

Subject Code	**22CSE71**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**4:0:0**	**SEE Marks**	**50**
Total Hours	**50**	**Examination Hours**	**3**
No. of Credits: 04			

Course Learning Objectives:
The course will enable students to:

CLO1	Understand the fundamental basic concepts of IoT
CLO2	Learn the working of Sensors, Transducers, Actuators and their connectivity to the network.
CLO3	Relate different Application protocols for IoT.
CLO4	Familiarize on different Systems on Chips like Arduino, Raspberry Pi and Intel

CONTENTS	# of Hours / RBT Levels
MODULE 1 **Introduction to loT:** Introduction to loT: What is IoT?, IoT terms and Basic Definitions, Disambiguation of IoT vs IoE vs M2M vs others, Characteristics of IoT ,IoT Ecosystem: What is an IoT Ecosystem? , Enabling Technologies in IoT, Applications of IoT ,IoT Reference model: Level 1 Physical Devices and Controllers, Level 2 Connectivity, Level 3 Edge(Fog) Computing, Level 4 Data Accumulation, Level 5 Data Abstraction, Level 7 Collaboration and Processes, Security in the IoT **Text Book: 1 Chapter: 1.1-1.3**	**08** **L2**
MODULE 2 **Transducers, Sensors and Actuators:** Defining Transducers, Sensors and Actuators, Introduction to Transducers, Introduction to sensors, Introduction to Actuators, Interfacing concepts to Embedded systems, Wireless sensor networks and its technologies, Network topologies in wireless sensor networks, Issues and challenges of a wireless sensor network, security in wireless sensor networks, participating wireless sensing technologies, RFID, LoRa **Text Book: 1 Chapter: 2.1-2.6.8**	**08** **L2**
MODULE 3 **IoT Protocols:** Protocol Classification, MQTT, XMPP, DDS, AMQP, COAP, REST, and comparison of the Protocols **Text Book: 1 Chapter: 3.1-3.8**	**08** **L2**
MODULE 4 **IoT Physical Devices and Endpoints Arduino UNO:** Introduction to Arduino, Exploring Arduino Uno Learning Board, Installing the Software (Arduino IDE), Fundamentals of Arduino Programming, Introduction to Communications, Example Modules on Arduino-Case studies **Text Book: 1 Chapter: 7.1-7.6**	**08** **L3**
MODULE 5 **IoT Physical Devices and Endpoints RaspberryPi:** Introduction to RaspberryPi, Exploring the Raspberry Learning Board, RaspberryPi Operating Systems, Operating system setup on Raspberrypi, RaspberryPi Commands, Programming RaspberryPi with Python, Case studies **Textbook: 1 Chapter: 8.1-8.6**	**08** **L3**

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Course Outcomes:

Upon successful completion of this course, students will be able to

CO71.1	Discuss the functional blocks of an IoT system, IoT communication models by enabling different technologies of IoT
CO71.2	Explain the deployment of Sensors, Transducers, Actuators to connect them to the network
CO71.3	Discuss the role of IoT protocols for efficient network communication
CO71.4	Develop programs that run on Arduino UNO board
CO71.5	Illustrate different sensor technologies for sensing real-world entities and identify the applications of IoT in the Industry using Raspberry Pi

Text Books:

1. Srinivasa K G, Siddesh G. M, Hanumantha Raju R, "Internet of Things", Cengage Leaning India, 017.

Reference Books:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", 1st Edition, Pearson Education (Cisco Press Indian Reprint)
2. Vijay Madisetti and Arshdeep Bahga, "Internet of Things - A Hands on Approach", Orient Blackswan Private Limited, 1st Edition, 2015.
3. Raj Kamal, "Internet of Things: Architecture and Design Principles", 1st Edition, McGraw Hill Education, 2017.

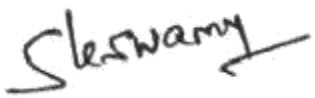
MOOCs:

1. NPTEL Course – Introduction to Internet of Things, By Prof. Sudip Misra, IIT Kharagpur, https://onlinecourses.nptel.ac.in/noc23_cs83/preview

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO71.1	3	-	-	-	-	1	1	1	1	-	-	1	-	3
CO71.2	3	-	-	-	1	1	2	1	1	-	-	1	-	3
CO71.3	3	-	1	-	1	1	2	1	1	-	-	1	-	3
CO71.4	3	3	3	3	3	3	3	3	3	1	3	1	-	3
CO71.5	3	3	3	3	3	3	3	3	3	1	3	1	-	3
Average	**3**	**3**	**3**	**3**	**2**	**2**	**3**	**2**	**2**	**1**	**3**	**1**	**-**	**3**

Low-1: Medium-2: High-3



SUBJECT: CRYPTOGRAPHY AND NETWORK SECURITY (Integrated)

Subject Code	**22CSE72**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:2**	**SEE Marks**	**50**
Total Hours	**50**	**Examination Hours**	**3**
No. of Credits: 04			

Course Learning Objectives:
The course will enable students to:

CLO1	Apply different Classical Encryption Techniques
CLO2	Analyse different Block Ciphers and the Data Encryption Standard
CLO3	Illustrate Public-Key Cryptography algorithms
CLO4	Understand different types of malicious software
CLO5	Understand the concepts of Payload-System and Firewalls

CONTENTS	# of Hours / RBT Levels
MODULE 1 **Overview Computer Security Concepts:** The OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms **Classical Encryption Techniques**: Symmetric Cipher Model, Substitution Techniques, Transposition techniques **Text Book 1: Chapters: 1.1, 1.2, 1.3, 1.4, 1.5, 2.1, 2.2, 2.3**	**08** **L3**
MODULE 2 **Block Ciphers and the Data Encryption Standard:** Traditional block Cipher structure, The data encryption standard, A DES example, The strength of DES, Block cipher design principles **Text Book 1: Chapter: 3.1, 3.2, 3.3, 3.4, 3.5**	**08** **L3**
MODULE 3 **Public-Key Cryptography and RSA:** Principles of public-key cryptosystems, The RSA algorithm, **Other Public-Key Cryptosystems:** Diffie-Hellman key exchange, Elgamal Cryptographic systems **Text Book 1: Chapters: 9.1, 9.2, 10.1, 10.2**	**08** **L3**
MODULE 4 **Malicious Software:** Malicious Software: Types of malicious software (malware), Advanced persistent threats, Propagation - Infected Content-Viruses, Propagation-Vulnerability Exploit-Worms, Propagation - Social Engineering, Spam e-mail, Trojans **Text Book 2: Chapter :10.1 to 10.5**	**08** **L2**
MODULE 5 **Malicious Software:** Payload-System corruption, Payload - Attack agent - Zombie, bots, Payload-Information Theft - Key loggers, phishing, spyware, Payload – Steal thing - Backdoors, Rootkits, Countermeasures, Distributed Denial of Service attacks **Firewalls:** The Need for Firewalls, Firewall Characteristics and access policy, Firewall types **Text Book 2: Chapters :10.6 to 10.11, 12.1, 12.3**	**08** **L2**

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Laboratory Component
List of Experiments

Programs can be written in C/ Java

1. Implement Caesar Cipher encryption & Decryption technique.
2. Implement data encryption and decryption using Hill Cipher method.
3. Demonstrate the working of Play fair Substitution technique.
4. Demonstrate the working of Vigenere Cipher substitution technique.
5. Write a program to implement Rail fence - Row and column transposition technique.
6. Demonstrate the Data Encryption Standard algorithm using substitution and transposition attributes of cryptography.
7. Execute the program for simple RSA algorithm to encrypt and decrypt the data.
8. Implement Diffie-Hellman Key Exchange algorithm.

Course Outcomes:
Upon successful completion of this course, student will be able to

CO72.1	Implement different Classical Encryption Techniques
CO72.2	Implement Block Ciphers and the Data Encryption Standard algorithm
CO72.3	Implement Public-Key Cryptography algorithms
CO72.4	Explain different types of malicious software
CO72.5	Explain the concepts of Payload and Firewalls

Text Books:

1. William, Stallings. Cryptography and network security: For VTU. Pearson Education India, 2006.
2. William, Stallings. Network Security Essentials: Applications and Standards (For VTU). Pearson Education India, 2011.

Reference Books:

1. V. K Pachghare: Cryptography and Information Security, PHI 2nd Edition
2. BehrouzA.Foruzan, Cryptography and Network Security, Tata McGraw Hill 2007.

E-Books / Web References:

1. https://www.sanfoundry.com
2. https://www.oreilly.com/library/view/cryptography-and-network/9789332579125/

MOOCs:

1. https://www.coursera.org/learn/cryptography
2. https://onlinecourses.nptel.ac.in/

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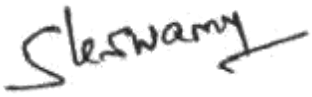
Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO72.1	3	3	3	-	3	1	-	-	-	-	-	2	-	2
CO72.2	3	3	3	-	3	1	-	-	-	-	-	2	-	2
CO72.3	3	3	3	-	3	1	-	-	-	-	-	2	-	2
CO72.4	3	3	1	-	-	1	-	-	-	-	-	2	-	2
CO72.5	3	3	1	-	-	1	-	-	-	-	-	2	-	2
Average	**3**	**3**	**2**	**-**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**2**

Low-1: Medium-2: High-3



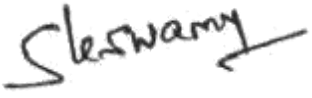
SUBJECT: DEEP LEARNING (Integrated)

Subject Code	**22CSE73**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:2**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**3**
No. of Credits: 04			

Course Learning Objectives:
The course will enable students to:

CLO1	Discuss the idea of artificial neural networks and their architecture
CLO2	Explain techniques used for training artificial neural networks
CLO3	Design of an artificial neural network for classification
CLO4	Design and deployment of deep learning models for machine learning problems

CONTENTS	**# of Hours / RBT Levels**
MODULE 1 **Introduction:** What is a Neural Network, The Human Brain, Models of a Neuron, Neural Networks Viewed as Directed Graphs, Feedback, Network Architectures, Rosenblatt's Perceptron: Introduction, Perceptron, The Perceptron Convergence Theorem, Relation Between the Perceptron and Bayes Classifier for a Gaussian Environment **Text Book: 1 Chapter: 1**	**08** **L2**
MODULE 2 **Multilayer Perceptrons:** Introduction, Batch Learning and On-Line Learning, The Back-Propagation Algorithm, XOR Problem, Heuristics for Making the Back Propagation Algorithm Perform Better, Back Propagation and Differentiation **Text Book: 1 Chapter: 4**	**08** **L3**
MODULE 3 **Regularization for Deep Learning:** Parameter Norm Penalties - L2 Parameter Regularization, Dataset Augmentation, Semi-Supervised Learning, Multi-Task Learning, Early Stopping, Parameter Tuning and Parameter Sharing, Sparse Representations, Dropout, Adversarial Training. Optimization for Training Deep Models: Challenges in Neural Network Optimization –Ill Conditioning, Local Minima, Plateaus, Saddle Points and Other Flat Regions. Cliffs and Exploding Gradients, Learning Rate Adaptation, Basic Algorithms, Algorithms with Adaptive Learning Rates **Text Book: 2 Chapters: 7, 6**	**08** **L3**
MODULE 4 **Convolution neural networks:** The Convolution Operation, Motivation, Pooling, Convolution and Pooling as an Infinitely Strong Prior, Variants of the Basic Convolution Function, Structured Outputs, Data Types, Efficient Convolution Algorithms **Text Book: 2 Chapter: 9**	**08** **L2**
MODULE 5 **Sequence Modeling:** Recurrent and Recursive Nets: Unfolding Computational Graphs, Recurrent Neural Networks, Bidirectional RNNs, Encoder-Decoder Sequence-to-Sequence Architectures, Auto encoders, Deep Recurrent Networks, Recursive Neural Networks, The Long Short-Term Memory and Vanishing Gradients **Text Book: 2 Chapters: 10, 11**	**08** **L2**



Laboratory Component
List of Experiments

1. Understand and use ANN.
2. Build a Convolution Neural Network for Image Recognition.
3. Design a CNN for Image Recognition which includes hyper parameter tuning.
4. Implement a Recurrence Neural Network for Predicting Sequential Data.
5. Implement Multi-Layer Perceptron algorithm for Image denoising hyper parameter tuning.
6. Implement Object Detection Using YOLO.
7. Design a Deep learning Network for Robust Bi-Tempered Logistic Loss.
8. Build AlexNet using Advanced CNN
9. Demonstration of Application of Autoencoders.
10. Implementation of Generative adversarial networks and data augmentation.

Course Outcomes:
Upon successful completion of this course, student will be able to

CO73.1	Illustrate the concepts and applications of neural networks and deep learning.
CO73.2	Illustrate various types of learning work and its applications.
CO73.3	Illustrate the Regularization and Optimization for Deep learning.
CO73.4	Discuss deep feed forward networks and convolutional to solve practical problems.
CO73.5	Demonstrate recurrent, recursive nets function and practical problems can be mapped to these functions.

Text Books:

1. Haykin, Simon. Neural networks and learning machines, 3/E. Pearson Education India, 2016
2. Goodfellow, Ian, Yoshua Bengio, and Aaron Courville. Deep learning. MIT press, 2016.

Reference Books:

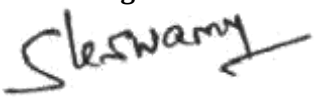
1. Hands-On Machine Learning with Scikit- Learn and Tensor Flow, Aurélien Géron, Concepts, Tools, and Techniques to Build Intelligent Systems, Third Edition, O'Reilly, 2017.
2. Nikhil Ketkar, "Deep Learning with Python: A Hands-on Introduction", 1st Edition, A press publisher, 2017.
3. Nikhil Buduma, "Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithm", 1st Edition, O'Reilly Media, 2017.

E-Books / Web References:
1. http://neuralnetworksanddeeplearning.com/

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO73.1	2	2	2	2	2	-	-	-	2	2	-	2	2	-
CO73.2	2	2	2	2	2	-	-	-	2	2	-	2	2	-
CO73.3	2	2	2	2	2	-	-	-	2	2	-	2	2	-
CO73.4	2	2	2	2	2	-	-	-	2	2	-	2	2	-
CO73.5	2	2	2	2	2	-	-	-	2	2	-	2	2	-
Average	**2**	**2**	**2**	**2**	**2**	**-**	**-**	**-**	**2**	**2**	**-**	**2**	**2**	**-**

Low-1: Medium-2: High-3



SUBJECT: BLOCKCHAIN AND ITS APPLICATIONS

Subject Code	**22CSE741**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**3**
No. of Credits: 03			

Course Learning Objectives:

The course will enable students to:

CLO1	Understand the basic terminologies of cryptography
CLO2	Understand how Block chain systems (mainly Bitcoin and Ethereum) work.
CLO3	Explain alternative blockchains and Decentralized applications.
CLO4	Understand various applications of Block chain.

CONTENTS	**# of Hours / RBT Levels**
MODULE-1 **Blockchain**: Introduction to Blockchain, Generic Elements of a Blockchain, How Blockchain works, Benefits and limitations of Blockchain, Types of Blockchain, CAP theorem and Blockchain, Decentralization using Blockchain, Methods of decentralization, Blockchain and full ecosystem decentralization **Decentralized Applications (DApps):** Requirements of a Decentralized Application, DApp examples, Platforms for Decentralization **Text Book 1: Chapters: 1, 2**	**08** **L2**
MODULE-2 **Cryptography and Technical Foundations:** Cryptographic primitives, Asymmetric cryptography, Basics of Hash Functions, Design of SHA-256, Merkle trees, Digital signatures: RSA Digital Signature Algorithm, Elliptic Curve Digital Signature Algorithm **Text Book 1: Chapters: 3, 4**	**08** **L2**
MODULE-3 **Bitcoin and Alternative Coins**: Bitcoin, Digital keys and addresses, Private and Public keys in Bitcoin, Vanity & Multi signature addresses, Transactions: Coin base Transactions, Blockchain: Structure of Block, Mining: Tasks of Miners, Mining Algorithm, Different Mining Methods, Bitcoin Network, Bitcoin Wallets, Bitcoin Installation & Programming, Bitcoin limitations, Namecoin, Litecoin, Primecoin, Zcash **Text Book 1: Chapters: 5, 8**	**08** **L2**
MODULE-4 **Ethreum** : Introduction, Ethereum network, Components of Ethreum ecosystem, Ether cryptocurrency, EVM. Development tools and Frameworks: Remix, Truffle, Ganache, Solidity language **Text Book 1: Chapter: 10**	**08** **L3**
MODULE-5 **Alternative Blockchains:** Kadena, Ripple, Storj, BigchainDB, Eris **Blockchain-Outside of Currencies:** Internet of Things, IoT Blockchain experiment, Government, Health, Finance **Notable Blockchain Projects:** Zcash on Ethereum, Bitcoin-NG, Falcon, Bletchley **Text Book 1: Chapters: 16, 17, 19**	**08** **L2**

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Course Outcomes:

Upon successful completion of this course, student will be able to

CO741.1	Summarize the terminologies and types of BlockChain
CO741.2	Integrate various cryptographic algorithms in to BlockChain
CO741.3	Enumerate the Bitcoin features and its alternative options
CO741.4	Implement Ethereum BlockChain using various tools and frameworks learnt
CO741.5	Discuss about alternative block chains available and various applications of BlockChain

Text Books:

1. Bashir, Imran. Mastering Blockchain. Packt Publishing Ltd, 2017.

Reference Books:

1. Andrew Miller, Arvind Narayanan, Edward Felten, Joseph Bonneau, Steven Goldfeder. "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction", Princeton University Press, 2016.
2. Wood, Gavin. "Ethereum: a secure decentralized transaction ledger (2014)." URL http://gavwood. com/paper. pdf (2017).
3. Bahga, Arshdeep, and Vijay Madisetti. Blockchain applications: a hands-on approach. Vpt, 2017.

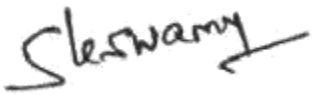
E-Books / Web References:

1. Mastering Bitcoin: Programming the Open Blockchain-oreilly-2nd-edition-2017(PDF) (pdfroom.com)
2. Understanding Cryptography's role in Blockchains, Comparitech

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO741.1	3	2	1	-	-	-	-	-	-	-	-	-	1	-
CO741.2	3	2	1	-	-	-	-	2	-	-	-	-	1	-
CO741.3	3	2	1	-	-	-	-	3	-	-	-	-	1	-
CO741.4	3	3	1	2	-	-	-	3	-	-	-	-	1	-
CO741.5	3	-	1	-	-	-	-	3	-	-	-	-	1	-
Average	**3**	**3**	**1**	**2**	**-**	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**1**	**-**

Low-1: Medium-2: High-3



SUBJECT: NOSQL

Subject Code	**22CSE742**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**3**
No. of Credits: 03			

Course Learning Objectives:

CLO1	Explore the emergence, requirements and benefits of a NoSQL database
CLO2	Site principles behind the NoSQL databases, such as chapters from modern distributed database theory, P2P indexing or the Map Reduce programming model
CLO3	Understand the basic architecture and data models of a NoSQL database (key-value stores, document databases, column-family stores, graph databases)
CLO4	Understand Mongodb, Cassandra NOSQL Databases

The course will enable students to:

CONTENTS	**# of Hours / RBT Levels**
MODULE 1 Why NoSQL? The Value of Relational Databases, Getting at Persistent Data, Concurrency, Integration, A (Mostly) Standard Model, Impedance Mismatch, Application and Integration Databases, Attack of the Clusters, The Emergence of NoSQL Aggregate Data Models; Aggregates, Example of Relations and Aggregates, Consequences of Aggregate Orientation, Key-Value and Document Data Models, Column-Family Stores, Summarizing Aggregate-Oriented Databases **Text Book:1 Chapters:1, 2**	**08** **L3**
MODULE 2 Distribution Models; Single Server, Sharding, Master-Slave Replication, Peer-to-Peer Replication, Combining Sharding and Replication. Consistency, Update Consistency, Read Consistency, Relaxing Consistency, The CAP Theorem, Relaxing Durability, Quorums. Version Stamps, Business and System Transactions, Version Stamps on Multiple Nodes **Text Book:1 Chapters: 4, 5, 6**	**08** **L3**
MODULE 3 Map-Reduce, Basic Map-Reduce, Partitioning and Combining, Composing Map-Reduce Calculations, A Two Stage Map-Reduce Example, Incremental Map-Reduce. Key-Value Databases, What Is a Key-Value Store, Key-Value Store Features, Consistency, Transactions, Query Features, Structure of Data, Scaling, Suitable Use Cases, Storing Session Information, User Profiles, Preference, Shopping Cart Data, When Not to Use, Relationships among Data, Multioperation Transactions, Query by Data, Operations by Sets **Text Book:1 Chapters: 7, 8**	**08** **L3**
MODULE 4 Document Databases, What Is a Document Database?, Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Web Analytics or Real-Time Analytics, Ecommerce Applications **Text Book:1 Chapter: 9**	**08** **L3**

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MODULE 5 Hello NoSQL: Getting Initial Hands-on Experience, Starting MongoDB and Storing Data Creating the Preferences Database Starting Cassandra and Connecting to It Storing and Accessing Data with Cassandra WORKING WITH LANGUAGE BINDINGS **Text Book:2 Chapter: 2**	**08** **L3**

Course Outcomes:

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

CO742.1	Discuss the emergence of NOSQL
CO742.2	Explain the data distribution models
CO742.3	Define, compare and use the Key value database
CO742.4	Define, compare and use the Document database
CO742.5	Demonstrate the essentials on MongoDB and Cassandra

Text Books:

1. Pramod J. Sadalage, Martin Fowler. NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Pearson Addision Wesley, 2012
2. Shashank Tiwari. Professional NoSQL. John Wiley and Sons.

Reference Books:

1. Dan Sullivan, "NoSQL For Mere Mortals", 1st Edition, Pearson Education India, 2015.
2. Dan McCreary and Ann Kelly, "Making Sense of NoSQL: A guide for Managers and the Rest of us", 1st Edition, Manning Publication/Dreamtech Press, 2013.
3. Kristina Chodorow, "Mongodb: The Definitive Guide- Powerful and Scalable Data Storage", 2nd Edition, O'Reilly Publications, 2013.

E-Books / Web References:

1. https://sd.blackball.lv/library/Professional_NoSQL_(2011).pdf
2. https://pragprog.com/titles/pwrdata/seven-databases-in-seven-weeks-second-edition/

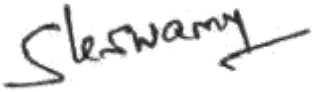
MOOCs:

1. https://www.coursera.org/learn/nosql-databases

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO742.1	3	3	3	-	-	-	-	-	-	-	-	-	-	2
CO742.2	3	3	3	-	-	-	-	-	-	-	-	-	-	2
CO742.3	3	3	3	-	2	-	-	-	-	-	-	-	-	3
CO742.4	3	3	3	-	2	-	-	-	-	-	-	-	-	3
CO742.5	3	3	3	-	3	-	-	-	-	-	-	-	-	3
Average	**3**	**3**	**3**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**

Low-1: Medium-2: High-3



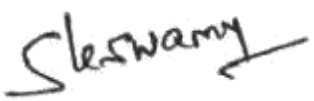
SUBJECT: INTRODUCTION TO DEVOPS

Subject Code	**22CSE743**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**3**
No. of Credits: 03			

Course Learning Objectives:
The course will enable students to:

CLO1	Define and discuss the key concepts and principles of DevOps
CLO2	Describe the Service Delivery process using Cloud
CLO3	Explain the concepts of test automation, infrastructure automation, and build and deployment automation
CLO4	Apply agile principles to a range of decision possibilities
CLO5	Explain the concepts of Docker Containerization

CONTENTS	**# of Hours / RBT Levels**
MODULE 1 **Introduction to DevOps:** What Is Devops, History of Devops, Devops definition, DevOps Main Objectives, DevOps and Software Development Life Cycle-Waterfall Model, Agile Model, DevOps Technical Challenges, DevOps Tools	**08** **L3**
MODULE 2 **DevOps On Cloud:** Essentials on Cloud Computing. Cloud and Virtualization architecture, Cloud deployment architecture, Cloud Providers-An Overview, Why we need DevOps on Cloud? Introduction to Amazon Web Services	**08** **L3**
MODULE 3 **GIT:** A Version controlling tool: Introduction, Essentials of GIT in industry. How to setup GET, Working with various commands in GIT, Recording Changes to the Repository, Viewing the Commit History, Undoing Things, Working with Remotes, Branching and Merging in Git, Git workflows	**08** **L3**
MODULE 4 **Jenkins:** Essentials of Continuous Integration, Know about Jenkins and its architecture in detail, Jenkins tool Management in detail, Know about User management in Jenkins. Authentication, Authorization, Adding a slave node to Jenkins, Building Delivery Pipeline, Notification settings in Jenkins, Plugin management in Jenkins	**08** **L3**
MODULE 5 **Docker:** Introduction-Real-world Shipping Transportation Challenges, Introducing Docker and its technology, Understanding of Docker images and containers, Working with container-How to Share and copy a container, Container Life Cycle, How to use Base Image and customize o Creation of Docker File, How to Publish Image on Docker Hub, Introduction to Docker Networking, Docker Swarm-An introduction	**08** **L3**



Course Outcomes:

Upon successful completion of this course, student will be able to

CO743.1	Interpret the principles of DevOps
CO743.2	Understand the usage of Cloud on DevOps
CO743.3	Use GIT tool for workflows
CO743.4	Use Jenkins tool for Continuous Integration and Continuous Delivery
CO743.5	Implement DevOps principles using Docker

Textbooks:

1. Mikael Krief, "Learning DevOps: The complete guide to accelerate collaboration with Jenkins, Kubernetes, Terraform and Azure DevOps", Packt Publishing Limited, 2019.

Reference Books:

1. DevOps: Continuous Delivery, Integration, and Deployment with DevOps: Dive-Sricharan Vadapalli, Packt, 2018.
2. DevOps: Puppet, Docker, and Kubemetes -Thomas Uphill, John Arundel, Neependra Khare, Hideto Saito, Hui-Chuan Chloe Lee, Ke-Jou Carol Hsu, Packt, 2017.

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO743.1	2	2	2	1	3	-	-	-	-	-	-	2	2	-
CO743.2	3	3	2	1	3	-	-	-	-	-	-	2	2	-
CO743.3	3	1	2	1	3	-	-	-	-	-	-	2	2	-
CO743.4	3	1	3	3	3	-	-	-	-	-	-	2	2	-
CO743.5	3	2	3	3	3	-	-	-	-	-	-	2	2	-
Average	**3**	**2**	**3**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**-**

Low-1: Medium-2: High-3

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SUBJECT: NATURAL LANGUAGE PROCESSING

Subject Code	**22CSE744**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**03**
No. of Credits: 03			

Course Learning Objectives:
The course will enable students to:

CLO1	To understand natural language processing models
CLO2	To apprehend the concepts of word level analysis
CLO3	To interpret the concepts of extracting relations from text and mining diagnostic text reports
CLO4	To understand evaluating self-explanations in iSTART and contextual signatures
CLO5	To apprehend the concepts behind information retrieval models and lexical resources

CONTENTS	**# of Hours / RBT Levels**
MODULE 1 **Introduction:** Natural language processing (NLP), origins of NLP, language and knowledge, challenges of NLP, language and grammar, processing of Indian languages, applications, examples of early NLP systems, information retrieval, language modelling, grammar-based language models, statistical language model **Text Book: 1 Chapters: 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7, 1.8, 1.9, 2.1, 2.2, 2.3**	**08** **L2**
MODULE 2 **Word level Analysis:** Introduction, 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, parsing, probabilistic parsing **Text Book: 1 Chapters: 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 4.1, 4.2, 4.3, 4.4, 4.4, 4.5**	**08** **L2**
MODULE 3 **Extracting relations from text:** Introduction, subsequence kernels for relation extraction, a dependency path kernel for relation extraction, experimental evaluation, mining diagnostic text reports by learning to annotate knowledge roles, frame semantics and semantic role labelling, learning to annotate cases with knowledge roles, Evaluations **Text Book: 2 Chapters: 3.1, 3.2, 3.3, 3.4, 4.1, 4.3, 4.5**	**08** **L2**
MODULE 4 **Evaluating Self-Explanations in iSTART:** Introduction, iSTART -feedback systems, iSTART-evaluations of feedback systems **Textual signatures:** Introduction, Cohesion, Coh- Metrix, approaches to analysing texts, latent Symantec analysis, predictions **Automatic document separation:** Introduction, related work, data preparation, document separation as a sequence mapping problem **Text Book: 2 Chapters: 6.1, 6.2, 6.3, 7.1, 7.2, 7.3, 7.4, 7.5, 7.6, 8.1, 8.2, 8.3, 8.4**	**08** **L2**
MODULE 5 **Information Retrieval:** Introduction, design features of information retrieval systems, Information retrieval models, classical, nonclassical, alternative models of information retrieval, Evaluation of the information retrieval systems **Lexical Resources:** Introduction, WordNet, FrameNet, Stemmers, Part of speech Tagger, research corpora **Text Book: 1 Chapters: 9.1, 9.2, 9.3, 9.4, 9.5, 9.6, 9.7, 12.1, 12.2, 12.3, 12.4, 12.5, 12.6**	**08** **L2**

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Course Outcomes:

Upon successful completion of this course, student will be able to

CO744.1	Understand natural language processing models
CO744.2	Apprehend the concepts of word level analysis
CO744.3	Interpret the concepts of extracting relations from text and mining diagnostic text reports
CO744.4	Understand evaluating self-explanations in iSTART and contextual signatures
CO744.5	Apprehend the concepts behind information retrieval models and lexical resources

Text Books:

1. Tanveer Siddiqui, U. S. Tiwary, "Natural Language Processing and Information Retrieval", Oxford University Press, Sixth Impression, 2018.
2. Anne Kao, Stephen R Poteet, "Natural Language Processing and Text Mining", Springer-Verlag London Limited 2007.

Reference Books:

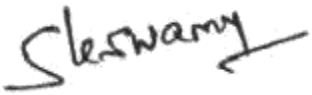
1. James Allen, "Natural Language Understanding", 2nd Edition, Pearson Publisher, 1995.
2. Charniack, Eugene, Statistical Language Learning, MIT Press, 1996.
3. Jurafsky, Daniel and Martin, James, "Speech and Language Processing: An introduction to Computational Linguistics and Speech Recognition" Second Impression, Pearson Education, 2009.
4. Manning, Christopher and Heinrich, Schutze, Foundations of Statistical Natural Language Processing, MIT Press, 1999.
5. Charu C. Aggarwal, "Machine Learning for Text", Springer, 2018.

E-Books / Web References:

1. https://www.coursera.org/learn/language-processing
2. https://towardsdatascience.com/a-practitioners-guide-to-naturallanguage-processing-part-i-processing-understanding-text-9f4abfd13e72
3. https://www.tutorialspoint.com/natural_language_processing/index.htm
4. https://www.kaggle.com/learn/natural-language-processing

MOOCs:

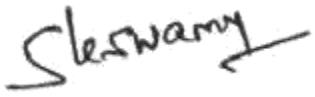
1. https://nptel.ac.in/courses/106/105/106105158/
2. https://onlinecourses.nptel.ac.in/noc19_cs56/preview
3. https://nptel.ac.in/courses/106/106/106106211/
4. https://nptel.ac.in/courses/106/101/106101007/
5. https://www.coursera.org/specializations/natural-language-processing
6. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-864-advanced-natural-language-processing-fall-2005/



Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO744.1	3	2	2	1	-	-	-	-	-	-	-	2	-	2
CO744.2	3	2	2	1	-	-	-	-	-	-	-	2	-	2
CO744.3	3	2	2	1	-	-	-	-	-	-	-	2	-	2
CO744.4	3	2	2	1	-	-	-	-	-	-	-	2	-	2
CO744.5	3	2	2	1	-	-	-	-	-	-	-	2	-	2
Average	**3**	**2**	**2**	**1**	-	-	-	-	-	-	-	**2**	-	**2**

Low-1: Medium-2: High-3



SUBJECT: INTRODUCTION TO FULL STACK DEVELOPMENT

Subject Code	**22CSE751**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**03**
No. of Credits: 03			

Course Learning Objectives:
The course will enable students to:

CLO1	Illustrate the Semantic Structure of HTML and CSS
CLO2	Compose forms and tables using HTML and CSS
CLO3	Understand different approaches to creating page layout
CLO4	Design Client-Side programs using JavaScript
CLO5	Design Server-Side programs using PHP

CONTENTS	**# of Hours / RBT Levels**
MODULE 1 **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 **Introduction to CSS:** What is CSS, CSS Syntax, Location of Styles, Selectors, The Cascade: How Styles Interact, The Box Model, CSS Text Styling **Text Book: 1 Chapters: 2, 3**	**08** **L3**
MODULE 2 **HTML Tables and Forms:** Introducing Tables, Styling Tables, Introducing Forms, Form Control Elements, Table and Form Accessibility **Text Book: 1 Chapter: 4**	**08** **L3**
MODULE 3 **Advanced CSS:** Layout, Normal Flow, Positioning Elements, Floating Elements, Constructing Multicolumn Layouts, Approaches to CSS Layout, Responsive Design **Text Book: 1 Chapter: 5**	**08** **L2**
MODULE 4 **JavaScript:** Client-Side Scripting, Where does JavaScript Go?, Syntax, JavaScript Objects, The Document Object Model (DOM), JavaScript Events, Forms **Text Book: 1 Chapter: 6**	**08** **L3**
MODULE 5 **PHP:** Quick Tour of PHP, Program Control, Functions, PHP Arrays and Superglobals, Arrays, $_GET and $_POST Superglobal Arrays, $_SERVER Array, $_Files Array, Reading/Writing Files, Classes and Objects in PHP, Object Oriented Design, Error Handling and Validation, What are Errors and Exceptions ?, PHP Error Reporting, PHP Error and Exception Handling. **Text Book: 1 Chapters: 8, 9, 10, 12 (Selected Topics)**	**08** **L3**

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Course Outcomes:

Upon successful completion of this course, student will be able to

CO751.1	Design web pages using HTML and CSS syntax and semantics
CO751.2	Construct and visually format tables and forms using HTML and CSS
CO751.3	Construct complex layouts to build web pages
CO751.4	Write Client-Side Scripts using JavaScript to display the contents dynamically
CO751.5	Write Server-Side Scripts using PHP to generate and display the contents dynamically

Text Books:

1. Fundamentals of Web Development, Randy Connolly, Ricardo Hoar, Pearson Education India, 1st Edition.

Reference Books:

1. Robin Nixon, "Learning PHP, MySQL &JavaScript with jQuery, CSS and HTML5", O'Reilly Publications, 4th Edition, 2015.
2. Luke Welling, Laura Thomson, "PHP and MySQL Web Development", Pearson Education, 5th Edition, 2016.
3. Nicholas C Zakas, "Professional JavaScript for Web Developers", Wiley India, 3rd Edition, 2012.

E-Books / Web References:

1. http://www.pearsonglobaleditions.com/connolly
2. https://www.w3schools.com/html/html5_intro.asp
3. https://www.w3schools.com/css/
4. https://www.w3schools.com/jS/default.asp
5. https://www.w3schools.com/pHP/default.asp
6. https://www.apachefriends.org/index.html
7. https://www.w3schools.com/xml/
8. https://www.w3schools.com/xml/ajax_intro.asp
9. https://jquery.com/

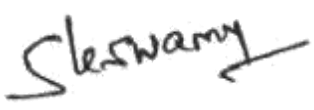
MOOCs:

1. https://nptel.ac.in/courses/106105084
2. https://www.udemy.com/topic/web-app-development/

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO751.1	2	2	3	-	-	-	-	-	-	-	-	2	2	-
CO751.2	2	2	2	-	-	-	-	-	-	-	-	3	2	-
CO751.3	2	1	2	-	-	-	-	-	-	-	-	3	2	-
CO751.4	2	2	2	-	-	-	-	-	-	-	-	3	2	-
CO751.5	2	2	2	-	-	-	-	-	-	-	-	3	2	-
Average	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**2**	**-**

Low-1: Medium-2: High-3



SUBJECT: CLOUD COMPUTING

Subject Code	**22CSE752**	**CIE Marks**	**40**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**60**
Total Hours	**3**	**Examination Hours**	**3**
No. of Credits: 03			

Course Learning Objectives:
The course will enable students to:

CLO1	Learn the fundamentals and essentials of Cloud Computing.
CLO2	Understand the web services of Cloud Computing
CLO3	Understand the privacy policies in cloud
CLO4	Learn the end user access to mobile-based cloud storage technologies

CONTENTS	**# of Hours / RBT Levels**
MODULE 1 **The Evolution of Cloud Computing:** What Is the Cloud? Emergence of Cloud Computing, Global Nature of the Cloud, Cloud-Based Service Offerings, Grid Computing or Cloud Computing? Is the Cloud Model Reliable? Benefits of Using a Cloud Model, What About Legal Issues When Using Cloud Models? What Are the Key Characteristics of Cloud Computing? Challenges for the Cloud **Text Book:1 Chapter: 1**	**08** **L2**
MODULE 2 **Web Services Delivered from the Cloud:** Communication-as-a-Service(CaaS), Infrastructure-as-a-Service (IaaS) , Monitoring-as-a-Service (MaaS) Platform-as-a-Service (PaaS) Software-as-a-Service (SaaS) **Text Book:1 Chapter: 2**	**08** **L2**
MODULE 3 **Federation, Presence, Identity, and Privacy in the Cloud:** Federation in the Cloud, Presence in the Cloud, Privacy and its Relation to Cloud-Based Information Systems **Text Book:1 Chapters: 5**	**08** **L2**
MODULE 4 **End-User Access to Cloud Computing:** YouTube, YouTube API Overview, Zimbra, Facebook, Zoho **Text Book:1 Chapter: 8**	**08** **L2**
MODULE 5 **Mobile Internet Devices and the Cloud:** What Is a Smartphone? Mobile Operating Systems for Smartphones, Mobile Platform Virtualization Collaboration, Applications for Mobile Platforms **Text Book:1 Chapter:9**	**08** **L2**

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Course Outcomes:

Upon successful completion of this course, student will be able to

CO752.1	Describe the features of Cloud Computing
CO752.2	Learn and classify the different services of cloud
CO752.3	Identify, Learn and discuss the privacy issues in the Cloud
CO752.4	Discuss the end user access to the Cloud enabled platforms
CO752.5	Learn and identify the role of the cloud in hand held devices

Text Books:

1. Rittinghouse, JohnW., and James F. Ransome, "Cloud Computing: Implementation, Management and Security", CRC Press, 2017.

Reference Books:

1. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, "Mastering Cloud Computing", Tata Mcgraw Hill, 2013.
2. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing -A Practical Approach", Tata Mcgraw Hill, 2009.

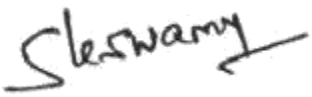
MOOCs:

1. https://www.udemy.com/course/cloud-computing-for-beginners-infrastructure-as-a-service/

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO752.1	3	2	1	1	-	-	-	-	-	-	-	1	2	-
CO752.2	3	2	1	1	-	-	-	-	-	-	-	1	2	-
CO752.3	3	2	1	1	-	-	-	-	-	-	-	1	2	-
CO752.4	3	2	1	1	-	-	-	-	-	-	-	1	2	-
CO752.5	3	2	1	1	-	-	-	-	-	-	-	1	2	-
Average	**3**	**2**	**1**	**1**	-	-	-	-	-	-	-	**1**	**2**	-

Low-1: Medium-2: High-3



SUBJECT: MOBILE APPLICATION DEVELOPMENT

Subject Code	**22CSE753**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**3**
No. of Credits: 03			

Course Learning Objectives:
The course will enable students to:

CLO1	Learn to setup Android application development environment
CLO2	Illustrate user interfaces for interacting with apps and triggering actions
CLO3	Interpret tasks used in handling multiple activities
CLO4	Identify options to save persistent application data
CLO5	Appraise the role of security and performance in Android applications

CONTENTS	**# of Hours / RBT Levels**
MODULE 1 Get started, Build your first app, Activities, Testing, debugging and using support libraries	**08** **L3**
MODULE 2 Get started, Build your first app, Activities, Testing, debugging and using support libraries	**08** **L3**
MODULE 3 Background Tasks, Triggering, scheduling and optimizing background tasks	**08** **L3**
MODULE 4 All about data, Preferences and Settings, Storing data using SQLite, Sharing data with content providers, Loading data using Loaders	**08** **L3**
MODULE 5 Permissions, Performance and Security, Firebase and AdMob, Publish	**08** **L2**

Course Outcomes:
Upon successful completion of this course, student will be able to

CO753.1	Create, test and debug Android application by setting up Android development environment
CO753.2	Implement adaptive, responsive user interfaces that work across a wide range of devices.
CO753.3	Infer long running tasks and background work in Android applications
CO753.4	Demonstrate methods in storing, sharing and retrieving data in Android applications
CO753.5	Understand the role of permissions, security and describe the steps involved in publishing Android application to share with the world

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Text Books:

1. Erik Hellman, "Android Programming – Pushing the Limits", 1st Edition, Wiley India Pvt Ltd, 2014.
2. Dawn Griffiths and David Griffiths, "Head First Android Development", 1st Edition, O'Reilly SPD Publishers, 2015.
3. J F DiMarzio, "Beginning Android Programming with Android Studio", 4th Edition, Wiley India Pvt Ltd, 2016.

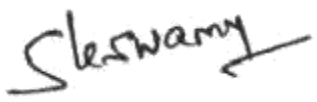
E-Books / Web References

1. https://www.udemy.com/course/a-beginners-guide-to-android-app-development/
2. https://www.udemy.com/course/complete-android-n-developer-course/
3. https://www.udemy.com/course/the-complete-android-oreo-developer-course/
4. https://www.coursera.org/learn/introduction-to-android-mobile-application-development

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO753.1	3	2	2	-	-	-	-	-	-	1	-	1	-	2
CO753.2	3	2	2	-	-	-	-	-	-	1	-	1	-	2
CO753.3	3	2	2	-	-	-	-	-	-	1	-	1	-	2
CO753.4	3	2	2	-	-	-	-	-	-	1	-	1	-	2
CO753.5	3	2	2	-	-	-	-	-	-	1	-	1	-	2
Average	**3**	**2**	**2**	-	-	-	-	-	-	**1**	-	**1**	-	**2**

Low-1: Medium-2: High-3



SUBJECT: R PROGRAMMING

Subject Code	**22CSE754**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**3**
No. of Credits: 03			

Course Learning Objectives:
The course will enable students to:

CLO1	Use R for statistical programming, computation, graphics, and modeling
CLO2	Write functions and use R in an efficient way
CLO3	Fit some basic types of statistical models
CLO4	expand their knowledge of R on their own

CONTENTS	# of Hours RBT Levels
MODULE 1 **Introduction:** How to run R, R Sessions and Functions, Basic Math, Variables, Data Types, Vectors, Conclusion, Advanced Data Structures, Data Frames, Lists, Matrices, Arrays, Classes	**08** **L2**
MODULE 2 **R Programming Structures:** Control Statements, Loops, -Looping Over Nonvector Sets, -If-Else, Arithmetic and Boolean Operators and values, Default Values for Argument, Return Values, Deciding Whether to explicitly call return-Returning Complex Objects, Functions are Objective, No Pointers in R, Recursion, A Quicksort Implementation-Extended Extended Example: A Binary Search Tree	**08** **L2**
MODULE 3 **Doing Math and Simulation in R**: Math Function, Extended Example Calculating Probability-Cumulative Sums and Products-Minima and Maxima-Calculus, Functions Fir Statistical Distribution, Sorting, Linear Algebra Operation on Vectors and Matrices, Extended Example: Vector cross Product-Extended Example: Finding Stationary Distribution of Markov Chains, Set Operation, Input /output, Accessing the Keyboard and Monitor, Reading and writer Files	**08** **L2**
MODULE 4 **Graphics:** Creating Graphs, The Workhorse of R Base Graphics, the plot () Function – Customizing Graphs, Saving Graphs to Files	**08** **L3**
MODULE 5 **Probability Distributions:** Normal Distribution-Binomial Distribution-Poisson Distributions Other Distribution, Basic Statistics, Correlation and Covariance, T-Tests, ANOVA. **Linear Models:** Simple Linear Regression, Multiple Regression Generalized Linear Models, Logistic Regression, Poisson Regression, other Generalized Linear Models, Survival Analysis, Nonlinear Models, Splines, Decision-Random Forests	**08** **L3**

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Course Outcomes:

Upon successful completion of this course, student will be able to

CO754.1	Explain of basic R programming framework and data structures
CO754.2	Explain critical R programming language concepts such as control structures and recursion
CO754.3	Discuss mathematical and statistical operations data structures in R
CO754.4	Use datasets to create testable hypotheses and identify appropriate statistical tests
CO754.5	Make use of appropriate statistical tests using R and Create and edit visualizations with regression models

Text Books:

1. Norman Matloff, The Art of R Programming: A Tour of Statistical Software Design, No Starch Press, US publisher, 1st Edition, 2011.
2. Lander, R for Everyone: Advanced Analytics and Graphics, R for Everyone, Pearson Education Publisher, 1st Edition, 2014.

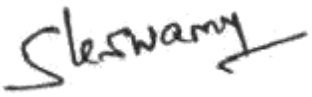
Reference Books:

1. JD Long, Paul Teetor, R Cookbook, PaulTeetor, Oreilly, 2nd Edition, 2019.
2. Rob Kabacoff, R in Action Data analysis and Graphics with R, Manning Publications Co.

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO754.1	2	2	-	-	-	-	-	-	-	-	-	-	2	-
CO754.2	2	2	-	-	-	-	-	-	-	-	-	-	2	-
CO754.3	2	2	-	-	-	-	-	-	-	-	-	-	2	-
CO754.4	2	2	-	-	-	-	-	-	-	-	-	-	2	-
CO754.5	2	2	-	-	-	-	-	-	-	-	-	-	2	-
Average	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**

Low-1: Medium-2: High-3



SUBJECT: PROJECT PHASE 1

Subject Code	**22CSEP76**	**CIE Marks**	**100**
Hours/Week (L: T: P) : 2 Contact hours/week			
No. of Credits: 2			

Project Phase-l:

Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary project can be assigned to an individual student or to a group having not more than 3 students. ln extraordinary cases, like the funded projects requiring students from different disciplines, the project student strength can be 5 or 6.

1. Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide. The CIE marks awarded for the project work phase -I, shall be based on the evaluation of the project work phase -1- Report (covering Literature Survey, Problem identification, Objectives and Methodology), project presentation skill and question and answer session in the ratio 50:25:25. The marks awarded for the Project report shall be the same for all the batch mates.

2. Inter disciplinary: Continuous internal Evaluation shall be group wise at the college level with the participation of all guides bf the college. Participation of external guide/s, if any, is desirable. The CIE marks awarded for the project work phase -I, shall be based on the evaluation of project work phase -1 Report (covering Literature Survey, Problem identification, Objectives and Methodology), project presentation skill and question and answer session in the ratio 50:25:25.

The marks awarded for the project report shall be the same for all the batch mates as per rubrics covering all Program Outcomes.

Typical Evaluation pattern for the Course is shown in Table 1.

Table 1: CIE and SEE Evaluation

Components	**Marks**	**Total**	
CIE			
Review 1	25	100	**100**
Review 2	25		
Report	50		

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SEMESTER - VIII

SUBJECT: GREEN COMPUTING

Subject Code	**22CSE81**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**3**
No. of Credits: 03			

Course Learning Objectives:
The course will enable students to:

CLO1	learn the fundamentals of Green Computing
CLO2	analyze the Green Computing Grid Framework.
CLO3	understand the issues related to Green compliance.
CLO4	study and develop various case studies.

CONTENTS	**# of Hours / RBT Levels**
MODULE 1 **Fundamentals:** Green IT Fundamentals: Business, IT and the Environment **Green computing:** carbon footprint, scoop on power – Green IT Strategies: Drivers, Dimensions, and Goals, Environmentally Responsible Business: Policies, Practices, and Metrics **Text Books: T1, T2 Chapters: T1:1, 2, 3 T2: 2, 3**	**08** **L2**
MODULE 2 **Green Assets and Modeling:** Green Assets: Buildings, Data Centers, Networks, and Devices – Green Business Process Management: Modeling, Optimization, and Collaboration – Green Enterprise Architecture – Environmental Intelligence – Green Supply Chains – Green Information Systems: Design and Development Models **Text Book: T1 Chapters: 4, 5, 6, 7**	**08** **L2**
MODULE 3 **Grid Framework:** Virtualization of IT systems – Role of electric utilities, Telecommuting, teleconferencing and teleporting – Materials recycling – Best ways for Green PC – Green Data center – Green Grid framework **Text Book: T2 Chapters: 13, 14, 15, 16**	**08** **L2**
MODULE 4 **Socio-cultural aspects of Green IT:** Green Enterprise Transformation Roadmap, Green Compliance: Protocols, Standards, and Audits, Emergent Carbon Issues: Technologies and Future **Textbook: T1 Chapters:8, 9, 10, 11**	**08** **L2**
MODULE 5 **Case Study:** The Environmentally Responsible Business Strategies (ERBS) – Case Study Scenarios for Trial Runs – Case Studies – Applying Green IT Strategies and Applications to a Home, Hospital, Packaging Industry and Telecom Sector **Textbook: T1 Chapters: 12**	**08** **L2**

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Course Outcomes:

Upon successful completion of this course, students will be able to

CO81.1	Understand green computing practices to minimize environmental negative impacts
CO81.2	Explain the skill in energy-saving practices in their use of hardware
CO81.3	Discuss technology tools that can reduce the stakeholders' paper waste and carbon footprint
CO81.4	Understand the ways to minimize equipment disposal requirements

Text Books:

1. Bhuvan Unhelkar, "Green IT Strategies and Applications-Using Environmental Intelligence", CRC Press, June 2011.
2. Woody Leonhard, Katherrine Murray, "Green Home computing for dummies", August 2009.

Reference Books:

1. Alin Gales, Michael Schaefer, Mike Ebbers, "Green Data Center: Steps for the Journey", Shoff/IBM Rebook, 2011.
2. John Lamb, "The Greening of IT", Pearson Education, 2009.
3. Jason Harris, "Green Computing and Green IT- Best Practices on regulations & industry", Lulu.com, 2008.
4. Carl Speshocky, "Empowering Green Initiatives with IT", John Wiley & Sons, 2010.
5. Wu Chun Feng (editor), "Green computing: Large Scale energy efficiency", CRC Press, 2012.

E-Books / Web References:

1. https://books.google.co.in/books?hl=en&lr=&id=h7jxve7_7WMC&oi=fnd&pg=PR2&dq=green+it+strategies+and+applications:+using+environmental+intelligence+pdf+download+by+bhuvan&ots=_Q1915zVpe&sig=QfcnDS_i_ricopA7Hjl6TY18IA8#v=onepage&q&f=false
2. https://books.google.co.in/books?hl=en&lr=&id=sGkPDKDMGVYC&oi=fnd&pg=PA1&dq=green+home+computing+for+dummies+by+woody&ots=h5JtqFjcCN&sig=HQkyGLoU7z40cxdSo2M-jHMGEZc#v=onepage&q&f=false

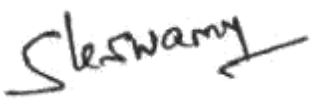
MOOCs :

1. https://www.udemy.com/course/how-to-start-green-home-computing/
2. https://www.coursera.org/learn/sustainable-business

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO81.1	3	-	-	-	-	-	-	-	-	-	-	1	-	1
CO81.2	3	-	-	-	-	-	-	-	-	-	-	1	-	1
CO81.3	3	-	-	-	-	-	-	-	-	-	-	1	-	1
CO81.4	3	-	-	-	-	-	-	-	-	-	-	1	-	1
Average	**3**	-	-	-	-	-	-	-	-	-	-	**1**	-	**1**

Low-1: Medium-2: High-3



SUBJECT: QUANTUM COMPUTING

Subject Code	**22CSE821**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**03**
No. of Credits: 03			

Course Learning Objectives:
The course will enable students to:

CLO1	Understand the fundamental principles of quantum computing
CLO2	Understand the building blocks of a quantum computer
CLO3	Describe the principles, quantum information and limitation of quantum operations formalizing
CLO4	Understand implementations of quantum computers
CLO5	Explain distance measures for processing quantum information

CONTENTS	# of Hours / RBT Levels
MODULE 1 **Fundamental concepts:** Global Perspectives, Quantum Bits, Quantum Computation, Quantum Algorithms, Quantum Information **Text Book: 1 Chapter: 1.1, 1.2, 1.3, 1.4, 1.6**	**08** **L2**
MODULE 2 **Quantum computation:** Quantum Circuits – Quantum algorithms, Single qubit operations, Control Operations, Measurement, Universal Quantum Gates **Text Book: 1 Chapter: 4.1, 4.2, 4.3, 4.4, 4.5**	**08** **L2**
MODULE 3 **Quantum search algorithms:** The quantum search algorithm, quantum search as a quantum simulation, Quantum counting, Speeding up the solution of NP-complete problems **Text Book: 1 Chapter: 6.1, 6.2, 6.3, 6.4**	**08** **L2**
MODULE 4 Quantum computers: Guiding principles, Conditions for quantum computation, Harmonic oscillator quantum computer, Optical photon quantum computer **Text Book: 1 Chapter: 7.1, 7.2, 7.3, 7.4**	**08** **L2**
MODULE 5 **Distance Measures for quantum information**: Distance measures for classical information, how close are two quantum states, how well does a quantum channel preserve information **Text Book: 1 Chapter: 9.1, 9.2, 9.3**	**08** **L2**

Course Outcomes:
Upon successful completion of this course, students will be able to

CO821.1	Understand the basics of quantum principles
CO821.2	Explain quantum circuits and their implementation
CO821.3	Understand quantum search algorithms and its simulation
CO821.4	Explain the realizations of quantum computers
CO821.5	Understand distance measures used in quantum information processing

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Text Books:

1. Micheal A. Nielsen. & Issac L. Chuang, Quantum Computation and Quantum Information, Cambridge University Press, First south Asia Edition, 2013.

Reference Books:

2. Parag K Lala, Quantum Computing, A Beginners Introduction, McGraw Hill Education (India), 1st Edition.
3. Chris Bernhardt, Quantum Computing for Everyone, The MIT Press, Reprint Edition

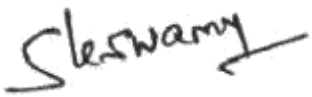
MOOCs:

1. https://nptel.ac.in/courses/106106232
2. https://elearn.nptel.ac.in/shop/iit-workshops/completed/quantum-computing/
3. https://onlinecourses.nptel.ac.in/noc21_cs103/preview
4. https://nptel.ac.in/courses/106106241
5. https://www.udemy.com/course/quantum-computing-introduction/

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO821.1	3	3	2	2	-	-	-	-	-	-	-	-	-	2
CO821.2	3	3	2	2	-	-	-	-	-	-	-	-	-	2
CO821.3	3	3	2	2	-	-	-	-	-	-	-	-	-	2
CO821.4	3	3	2	2	-	-	-	-	-	-	-	-	-	2
CO821.5	3	3	2	2	-	-	-	-	-	-	-	-	-	2
Average	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**

Low-1: Medium-2: High-3



SUBJECT: CYBER SECURITY AND DIGITAL FORENSICS

Subject Code	**22CSE822**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**4**	**Examination Hours**	**3**
No. of Credits: 03			

Course Learning Objectives:
The course will enable students to:

CLO1	Understand the concept of cyber crime for mobile and wireless devices.
CLO2	Illustrate various tools and methods used in Cybercrime
CLO3	Analyze and describe the challenges of computer forensics
CLO4	Understand the legal challenges of handling cyber forensics and its implications on organisation

CONTENTS	**# of Hours / RBT Levels**
MODULE 1 **Cyber Crime Mobile and Wireless devices:** Trend mobility, authentication service security, attacks on mobile phones, mobile phone security, implications for organizations, organizational measurement for handling mobile, security policies and measures in the mobile computing era **Text Book:1 Chapter: 3**	**08** **L2**
MODULE 2 **Tools and methods used in cyber crime:** Proxy servers and Anonymizers, Phishing Password cracking, Key loggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, SQL Injection-Buffer overflow, Attacks on wireless networks **Text Book: 1 Chapter: 4**	**08** **L3**
MODULE 3 **Understanding computer forensic:** Historical background of cyber forensic, forensic analysis of e-mail, Digital forensic life cycle, network forensics, setting up a computer forensic Laboratory, relevance of the OSI 7 Layer model to computer forensics, computer forensic from a compliance perspective **Text Book: 1 Chapter: 7**	**08** **L3**
MODULE 4 **Forensic of Hand Held Devices:** Understanding cell phone working characteristics, hand-held devices and digital forensics, tool kits for hand held device forensics, forensics of iPod's and digital music devices, techno legal challenges with evidence from hand-held devices **Text Book: 1 Chapter: 8**	**08** **L2**
MODULE 5 **Cyber Security: Organizational implications:** Cost of cyber crimes and IPR issues, web threats for organizations, social media marketing, security and privacy implications, protecting people's privacy in organizations, forensic best practices for organizations **Text Book: 1 Chapter: 9**	**08** **L2**

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Course Outcomes:

Upon successful completion of this course, student will be able to

CO822.1	Describe and learn the security challenges in mobile and wireless devices
CO822.2	Identify and classify the tools and techniques used to perform cyber crime
CO822.3	Describe and learn the challenges of computer forensics
CO822.4	Explain the legal challenges for handling forensics of Hand Held devices
CO822.5	Learn about the organisational implications of cyber security

Textbooks:

1. Sunit Belapure and Nina Godbole, "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley India Pvt Ltd, 2013.

Reference Books:

1. Dr. Surya Prakash Tripathi, Ritendra Goyal, Praveen Kumar Shukla, KLSI. "Introduction to Information Security and Cyber Laws". Dreamtech Press., 2015.
2. Thomas J. Mowbray, "Cybersecurity: Managing Systems, Conducting Testing, and Investigating Intrusions", by John Wiley & Sons, Inc, 2014.
3. James Graham, Ryan Olson, Rick Howard, "Cyber Security Essentials", CRC Press, 15-Dec-2010.

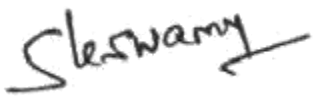
MOOCs:

1. https://www.udemy.com/course/network-security-course/

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	P09	PO10	PO11	PO12	PSO1	PSO2
CO822.1	3	-	-	-	-	-	-	-	-	-	-	2	-	2
CO822.2	3	3	1	-	3	-	-	-	1	1	-	2	-	2
CO822.3	3	3	1	-	2	-	-	-	1	1	-	2	-	3
CO822.4	3	3	1	-	-	-	-	-	1	1	-	2	-	3
CO822.5	1	1	-	-	-	-	-	-	-	-	-	2	-	2
Average	**3**	**3**	**1**	**-**	**3**	**-**	**-**	**-**	**1**	**1**	**-**	**2**	**-**	**2**

Low-1: Medium-2: High-3



SUBJECT: SOFTWARE ARCHITECTURE AND DESIGN PATTERNS

Subject Code	**22CSE823**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**3**
No. of Credits: 03			

Course Learning Objectives:
The course will enable students to:

CLO1	Discuss how to add functionality to designs while minimizing complexity
CLO2	Discuss code qualities are required to maintain to keep code flexible
CLO3	Summarize the common design patterns
CLO4	Describe the appropriate patterns for design problems

CONTENTS	# of Hours/ RBT Level
MODULE 1 **Introduction**: what is a design pattern? describing design patterns, the catalog of design pattern, organizing the catalog, how design patterns solve design problems, how to select a design pattern, how to use a design pattern. What is object-oriented development? key concepts of object oriented design other related concepts, benefits and drawbacks of the paradigm	**08** **L2**
MODULE 2 **Analysis a System**: overview of the analysis phase, stage 1: gathering the requirements functional requirements specification, defining conceptual classes and relationships, using the knowledge of the domain. Design and Implementation, discussions and further reading	**08** **L2**
MODULE 3 **Design Pattern Catalog**: Structural patterns, Adapter, bridge, composite, decorator, facade, flyweight, proxy	**08** **L2**
MODULE 4 **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, MVVC	**08** **L2**
MODULE 5 **Designing with Distributed Objects:** Client server system, java remote method invocation, implementing an object oriented system on the web (discussions and further reading) a note on input and output, selection statements, loops arrays	**08** **L2**

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Course Outcomes:
Upon successful completion of this course, student will be able to

CO823.1	Describe catalog, usage, selection of design patterns
CO823.2	Explain the functional requirements specification with classes and relationships
CO823.3	Discuss Structural patterns, Adapter, bridge, composite, decorator, facade, flyweight, proxy design patterns
CO823.4	Explain MVC architecture pattern and its implementation
CO823.5	Discuss Distributed Objects - client server system, RMI

Textbooks:

1. Dathan, Brahma, and Sarnath Ramnath, Object-Oriented Analysis, Design and Implementation, 2nd Edition, Springer, 2015.
2. Gamma, Erich, Ralph Johnson, Richard Helm, Ralph E. Johnson, and John Vlissides, Design patterns: elements of reusable object-oriented software, 1st Edition, Pearson Publications, 2008.

Reference Books:

1. Frank Bachmann, Regine Meunier, Hans Rohnert, Pattern Oriented Software Architecture – Volume 1, 1996.
2. Buschmann, Frank, Kevlin Henney, and Douglas C. Schmidt. Pattern-oriented software architecture, on patterns and pattern languages. Vol. 5. John Wiley & sons, 2007.
3. William J Brown et al., Anti-Patterns: Refactoring Software, Architectures and Projects in Crisis, John Wiley, 1998
4. Mark Richards, Software Architecture Patterns, O'Reilly, February 2015.
5. Len Bass, Paul Clements, and Rick Kazman, Software Architecture in Practice (3rd edition), by Addison-Wesley, 2012.

E-Books / Web References:

1. https://riptutorial.com/ebook/design-patterns
2. http://www.uml.org.cn/c%2B%2B/pdf/DesignPatterns.pdf

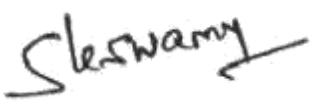
MOOCs:

1. https://www.coursera.org/specializations/software-design-architecture
2. https://www.classcentral.com/course/udacity-software-architecture-design-3418
3. https://www.udacity.com/course/software-architecture-design--ud821

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO823.1	2	2	2	-	-	-	-	-	-	-	-	-	1	-
CO823.2	2	2	2	-	-	-	-	-	-	-	-	-	1	-
CO823.3	2	2	2	-	-	-	-	-	-	-	-	-	1	-
CO823.4	2	2	2	-	-	-	-	-	-	-	-	-	1	-
CO823.5	2	2	2	-	-	-	-	-	-	-	-	-	1	-
Average	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**

Low-1: Medium-2: High-3



SUBJECT: ADVANCED COMPUTER ARCHITECTURE

Subject Code	**22CSE824**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**3**
No. of Credits: 03			

Course Learning Objectives:
The course will enable students to:

CLO1	Understand the fundamentals of computer design
CLO2	Illustrate the concepts of Instruction-level parallelism
CLO3	Understand concepts of Thread-level parallelism
CLO4	Learn the Cache and Virtual memory with its performance
CLO5	Understand the optimization in Memory hierarchy

CONTENTS	**# of Hours / RBT Levels**
MODULE 1 **Fundamentals of Computer Design**: Introduction, Classes of computers, defining computer architecture, Trends in Technology, power in Integrated Circuits and cost, Dependability, Measuring, reporting and summarizing Performance; Quantitative Principles of computer design **Instruction Level Parallelism - 1: ILP:** Concepts and challenges, Basic Compiler Techniques for exposing ILP **Text Book 1: Chapters: 1.1 to 1.9, 3.1, 3.2**	**08** **L2**
MODULE 2 **Instruction Level Parallelism – 2**: Reducing Branch costs with prediction; Overcoming Data hazards with Dynamic scheduling; Hardware-based speculation, Exploiting ILP using multiple issue and static scheduling, Exploiting ILP using dynamic scheduling, multiple issue and speculation **Text Book 1: Chapters: 3.3 to 3.8**	**08** **L2**
MODULE 3 **Thread Level Parallelism:** Introduction, Centralized Shared-Memory Architectures, Performance of symmetric shared–memory multiprocessors, Distributed shared memory and directory-based coherence, Basics of synchronization, Models of Memory Consistency. Crosscutting issues **Text Book 1: Chapter: 5.1 to 5.7**	**08** **L2**
MODULE 4 **Review Of Memory Hierarchy:** Introduction, Cache performance, Cache Optimizations, Virtual memory **Text Book 1: Appendix B.1 to B.4**	**08** **L2**
MODULE 5 **Memory Hierarchy Design:** Introduction, Memory technology and optimizations, Advanced optimizations of Cache performance, Virtual memory and virtual machines **Text Book 1: Chapter: 2.1 to 2.4**	**08** **L2**

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Course Outcomes:

Upon successful completion of this course, student will be able to

CO824.1	Understand the fundamental concepts of computer design and architecture
CO824.2	Understand the concepts of Dynamic scheduling and hardware-based speculation in Instruction Level Parallelism
CO824.3	Understand Symmetric and distributed shared memory techniques
CO824.4	Describe the performance of Cache and Virtual memory
CO824.5	Discuss the Memory technology and its optimization concepts

Text Books:

1. John L. Hennessey and David A. Patterso, "Computer Architecture, A Quantitative Approach", 6th Edition, Elsevier, 2007.

Reference Books:

1. Kai Hwang:,Advanced Computer Architecture Parallelism, Scalability ,Programmability, Tata Mc Grawhill, 2003.
2. David E. Culler, Jaswinder Pal Singh, Anoop Gupta:, Morgan Kaufman Parallel Computer Architecture, A Hardware / Software Approach, 1999.

E-Books / Web References:

1. http://acs.pub.ro/~cpop/SMPA/Computer%20Architecture,%20Sixth%20Edition_%20A%20Quantitative%20Approach%20(%20PDFDrive%20).pdf

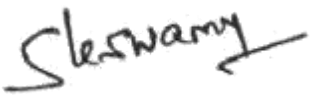
MOOCs:

1. https://onlinecourses.nptel.ac.in/noc22_cs10/preview
2. https://www.coursera.org/learn/comparch
3. https://www.my-mooc.com/en/mooc/comparch/
4. https://www.udemy.com/topic/computer-architecture/

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO824.1	3	1	-	-	-	-	-	-	-	-	-	1	-	1
CO824.2	3	1	1	-	-	-	-	-	-	-	-	1	-	1
CO824.3	3	2	1	-	-	-	-	-	-	-	-	1	-	2
CO824.4	3	2	1	-	-	-	-	-	-	-	-	1	-	2
CO824.5	3	2	1	-	-	-	-	-	-	-	-	1	-	2
Average	**3**	**2**	**1**	**-**	**-**	**--**	**--**	**--**	**--**	**-**	**--**	**1**	**-**	**2**

Low-1: Medium-2: High-3



SUBJECT: STORAGE AREA NETWORKS

Subject Code	**22CSE831**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**3**
No. of Credits: 03			

Course Learning Objectives:
The course will enable students to:

CLO1	Understand the way of managing the information in storage device and its challenges
CLO2	Understand the use of RAID level and Intelligent Storage systems
CLO3	Explore IP SAN and NAS
CLO4	Discuss business continuity techniques in terms of backup and archive
CLO5	Explore the Replication techniques on storage infrastructure and security in storage system

CONTENTS	**# of Hours / RBT Levels**
MODULE 1 **Storage System**: Introduction to Information Storage: Information Storage, Evolution of Storage Architecture, Data Center Infrastructure, Virtualization and Cloud Computing. 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	**08** **L2**
MODULE 2 **Data Protection RAID:** RAID Implementation Methods, RAID Array Components, RAID Techniques, RAID Levels, RAID Impact on Disk Performance, RAID Comparison. **Intelligent Storage Systems** : Components of an Intelligent Storage System, Types of Intelligent Storage Systems. Fibre Channel Storage Area Networks - Fibre Channel: Overview, The SAN and Its Evolution, Components of FC SAN.	**08** **L2**
MODULE 3 **IP SAN and FCoE:** iSCSI, FCIP, **Network-Attached Storage:** 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	**08** **L2**
MODULE 4 **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	**08** **L2**
MODULE 5 **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. **Remote Replication:** Modes of Remote Replication, Remote Replication Technologies. **Securing the Storage Infrastructure:** Information Security Framework, Risk Triad, Storage Security Domains. Security Implementations in Storage Networking	**08** **L2**

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Course Outcomes:

Upon successful completion of this course, student will be able to

CO831.1	Understand the challenges in managing information
CO831.2	Explain data protection methods in storage area networks
CO831.3	Classify different storage networking technologies
CO831.4	Describe business continuity techniques in terms of backup and archive
CO831.5	Illustrate the storage infrastructure and management activities

Text Books:

1. EMC Education Services, "Information Storage and Management: Storing, Managing, and Protecting Digital Information in Classic, Virtualized, and Cloud Environments" , 2nd Edition, Wiley, 2012.

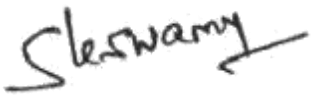
Reference Books:

1. Paul Massiglia, Richard Barker, "Storage Area Network Essentials: A Complete Guide to Understanding and Implementating SANs Paperback", 1st Edition, Wiley India Publications, 2008

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO831.1	2	1	1	-	-	1	1	-	-	-	-	-	-	2
CO831.2	2	1	1	-	-	1	1	-	-	-	-	-	-	2
CO831.3	2	1	1	-	-	1	1	-	-	-	-	-	-	2
CO831.4	2	1	1	-	-	1	1	-	-	-	-	-	-	2
CO831.5	2	1	1	-	-	1	1	-	-	-	-	-	-	2
Average	**2**	**1**	**1**	**-**	**-**	**1**	**1**	**--**	**--**	**-**	**-**	**-**	**-**	**2**

Low-1: Medium-2: High-3



SUBJECT: SOCIAL NETWORK ANALYSIS

Subject Code	**22CSE832**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**03**	**Examination Hours**	**03**
No. of Credits: 03			

Course Learning Objectives:
The course will enable students to

CLO1	Understand the components of the social network
CLO2	Model and visualize the social network
CLO3	Analyze the users in the social network
CLO4	Comprehend the evolution of the social network

CONTENTS	**# of Hours / RBT Levels**
MODULE 1 **Graph Theory and Social Networks:** Graphs, Basic Definitions, Paths and Connectivity, Distance and Breadth-First Search, Network Datasets: An Overview **Strong and Weak Ties:** Triadic Closure, The Strength of Weak Ties, Tie Strength and Network Structure in Large-Scale Data, Tie Strength, Social Media, and Passive Engagement, Closure, Structural Holes, and Social Capital **Text Book: T1 Chapters: 2, 3**	**08** **L2**
MODULE 2 **Social Network Data:** Introduction, Boundary Specification and Sampling, Types of Networks, Network Data, Measurement and Collection, Data Sets Found in These Pages Krackhardt's High-tech Managers, Padgett's Florentine Families, Freeman's EIES Network, Countries Trade Data, Galaskiewicz's CEOs and Clubs Network, Other Data **Text Book: T2 Chapter: 2**	**08** **L2**
MODULE 3 **Notation for Social Network Data:** Graph Theoretic Notation, Sociometric Notation, Algebraic Notation, Two Sets of Actors **Graphs and Matrices:** Why Graphs?, Graphs, Directed Graphs, Signed Graphs and Signed Directed Graphs, Valued Graphs and Valued Directed Graphs, Multigraphs, Hypergraphs, Relations, Matrices, Properties **Text Book: T2 Chapters: 3, 4**	**10** **L2**
MODULE 4 **Centrality and Prestige:** Prominence: Centrality and Prestige, Nondirectional Relations, Directional Relations, Comparisons and Extensions **Text Book: T2 Chapter: 5**	**06** **L3**
MODULE 5 **The Structure of the Web:** The World Wide Web, Information Networks, Hypertext, and Associative Memory, The Web as a Directed Graph, The Bow-Tie Structure of the Web, The Emergence of Web 2.0 **Link Analysis and Web Search:** Searching the Web: The Problem of Ranking, Link Analysis using Hubs and Authorities, PageRank, Applying Link Analysis in Modern Web Search, Applications beyond the Web, Advanced Material: Spectral Analysis, Random Walks, and Web Search **Text Book: T1 Chapters: 13, 14**	**08** **L2**

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Course Outcomes:
Upon successful completion of this course, student will be able to:

CO832.1	Explain concepts related to social network.
CO832.2	Discuss characteristics of social network data, with an emphasis on how to collect such data sets.
CO832.3	Explain notational system flexible enough to handle the wide range of network data sets that are encountered in practice.
CO832.4	Describe the concepts of graph theory and basic matrix operations that are used in social network analysis
CO832.5	Apply the concept of "central" and "prestigious" to find out various centrality measures.
CO832.6	Explain structure of Web along with its analysis

Text Books:

1. David Easley and Jon Kleinberg, "Networks, Crowds, and Markets: Reasoning about a Highly Connected World", Cambridge University Press 2010.
2. Stanley Wasserman and Katherine Faust, "Social Network Analysis – Methods and Applications Networks, Crowds, and Markets: Reasoning about a Highly Connected World", Cambridge University Press 2010.

Reference Books:

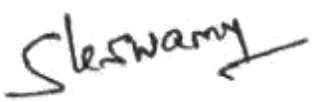
1. Ajith Abraham, Aboul Ella Hassanien, Vaclav Snasel," Computational Social Network Analysis: Trends, Tools and Research Advances", Springer, 2012
2. Borko Furht, "Handbook of Social Network Technologies and Applications", Springer, 1st Edition, 2011
3. Charu C. Aggarwal, "Social Network Data Analytics", Springer; 2014
4. Giles, Mark Smith, John Yen, "Advances in Social Network Mining and Analysis", Springer, 2010.
5. Guandong Xu, Yanchun Zhang and Lin Li, "Web Mining and Social Networking – Techniques and applications", Springer, 1st Edition, 2012
6. Peter Mika, "Social Networks and the Semantic Web", Springer, 1st Edition, 2007.
7. Przemyslaw Kazienko, Nitesh Chawla,"Applications of Social Media and Social Network Analysis", Springer, 2015

E-Books / Web References:

1. https://faculty.ucr.edu/~hanneman/nettext/Introduction_to_Social_Network_Methods.pdf
2. https://www.yumpu.com/en/document/view/63650187/download-pdf-social-network-analysis-a-handbook-full-books/3
3. https://www.perlego.com/book/1431705/social-network-analysis-pdf

MOOCs:

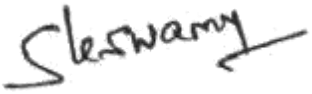
1. https://www.coursera.org/learn/social-network-analysis
2. https://www.classcentral.com/course/coursera-social-network-analysis-338
3. https://onlinecourses.nptel.ac.in/noc19_cs66/preview



Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO832.1	3	3	2	2	-	-	-	-	-	-	-	-	-	1
CO832.2	3	3	2	2	-	-	-	-	-	-	-	-	-	1
CO832.3	3	3	2	2	-	-	-	-	-	-	-	-	-	1
CO832.4	3	3	2	2	-	-	-	-	-	-	-	-	-	1
CO832.5	3	3	2	2	-	-	-	-	-	-	-	-	-	1
CO832.6	3	3	2	2	-	-	-	-	-	-	-	-	-	1
Average	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**

Low-1: Medium-2: High-3



SUBJECT: SOFT COMPUTING

Subject Code	**22CSE833**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**3 Hours**
No. of Credits: 03			

Course Learning Objectives:
The course will enable students to:

CLO1	Learn about soft computing techniques and their applications
CLO2	Analyze various neural network architectures and understand perceptrons and counter propagation networks
CLO3	Understanding the fuzzy systems
CLO4	Analyze the genetic algorithms and their applications

CONTENTS	**# of Hours/ RBT Levels**
MODULE 1 Introduction to soft computing, soft computing vs. hard computing, various types of soft computing techniques, applications of soft computing Introduction: Neural networks, Fuzzy logic, Genetic algorithms, Hybrid systems, Artificial Neural Networks: Fundamental concept, Evolution, Basic model of ANN, Important terminologies of ANN, MP neuron, Hebb Network	**08** **L2**
MODULE 2 Supervised Learning Network: Perceptron Networks, Adaptive linear neuron, multiple adaptive linear neurons, Back propagation Network	**08** **L2**
MODULE 3 Introduction to Fuzzy logic, classical sets, and fuzzy sets: Classical sets, Fuzzy sets. Classical relations and fuzzy relations: Cartesian product of relation, Classical relation, Fuzzy relations, Tolerance, and equivalence relations. Membership functions: Features, Fuzzification, methods of membership value assignments	**08** **L2**
MODULE 4 Defuzzification: Lambda-cuts for fuzzy sets, Lambda-cuts for fuzzy relations, Defuzzification methods. Fuzzy decision making: Individual, multi person, multi objective, multi attribute, and fuzzy Bayesian decision making	**08** **L2**
MODULE 5 Genetic algorithms: Introduction, Basic operations, Traditional algorithms, Simple GA, General genetic algorithms, the schema theorem, Genetic programming, applications	**08** **L2**

Course Outcomes:
Upon successful completion of this course, student will be able to

CO833.1	Describe various problems on artificial neural networks and familiarize all concepts on various networks and applications in them.
CO833.2	Identify the compositions of neural networks, perceptrons and other networks.
CO833.3	Examine various fuzzification techniques and practice them.
CO833.4	Design problems and obtain crisp values from fuzzy data using defuzzification.
CO833.5	Summarize various compositions and complexities of genetic algorithms.

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Text Books:

1. S N Sivanandam, Deepa S. N, "Principles of Soft computing", Wiley, India.
2. J.S.R. Jang, C T Sun, E Mizutani, "Neuro-fuzzy and soft computing", Pearson, 1996.

References:

1. N.K.Bose, Ping Liang, Neural Network fundamental with Graph, Algorithms & Applications, TMH, 1st Edition, 1998.
2. Bart Kosko, Neural Network & Fuzzy System, PHI Publication, 1st Edition, 2009. Rich E, Knight K, Artificial Intelligence, TMH, 3rd Edition, 2012.
3. George J Klir, Bo Yuan, Fuzzy sets & Fuzzy Logic, Theory & Applications, PHI Publication, 1st Edition, 2009.
4. Martin T Hagen, Neural Network Design, Nelson Candad, 2nd Edition, 2008.

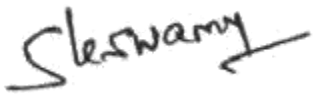
Web references:

1. www.myreaders.info/html/soft_computing.html

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO833.1	2	2	-	-	-	-	-	-	-	-	-	-	-	2
CO833.2	-	-	-	2	-	-	-	-	-	-	-	-	-	2
CO833.3	2	2	-	2	-	-	-	-	-	-	-	-	-	2
CO833.4	2	2	-	2	-	-	-	-	-	-	-	-	-	2
CO833.5	-	2	-	-	-	-	-	-	-	-	-	-	-	2
Average	**2**	**2**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**

Low-1: Medium-2: High-3



SUBJECT: DIGITAL IMAGE PROCESSING

Subject Code	**22CSE834**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**03**
No. of Credits: 03			

Course Learning Objectives:
The course will enable students to:

CLO1	Provide the basic knowledge and fundamentals of digital image processing concepts
CLO2	Develop the ability to understand the properties and representation of digital images
CLO3	Understand the concepts of spatial image processing algorithms
CLO4	Understand the histogram-based techniques applied on digital images
CLO5	Understand smoothing and sharpening of images using various operations

CONTENTS	# of Hours / RBT Levels
MODULE 1 **Introduction and Fundamentals:** What is digital image processing, example fields that use digital image processing, fundamental steps in digital image processing, components of an image processing system Elements of visual perception, light and electromagnetic spectrum, image sensing and acquisition **Text Book: 1 Chapters: 1.1, 1.3, 1.4, 1.5, 2.1, 2.2, 2.3**	**08** **L2**
MODULE 2 **Image representation and properties:** Image sampling and quantization, representing digital images, spatial and intensity resolution, image interpolation Pixel Relationships: Neighborhood, adjacency, connectivity, regions and boundary of pixels, Distance measures, set and logical operations **Text Book: 1 Chapter: 2.4, 2.5, 2.6**	**08** **L2**
MODULE 3 **Spatial Processing of an image:** Spatial operations, geometric spatial transformations and image registration, intensity transformations and spatial filtering, Image negatives, log-transformations. Contract stretching, intensity level slicing, bit-plane slicing, examples **Text Book: 1 Chapter: 3.1, 3.2**	**08** **L2**
MODULE 4 **Histogram processing and spatial filtering:** Histogram equalization, histogram matching (Specification) histogram statistics for image enhancement, Spatial filtering: spatial correlation and convolution **Text Book: 1 Chapter: 3.3, 3.4**	**08** **L2**
MODULE 5 Smoothing spatial filters, smoothing linear filters, order statistic (nonlinear) filters, sharpening spatial filters, Laplacian based image sharpening, gradient based image sharpening **Text Book: 1 Chapter: 3.5, 3.6**	**08** **L2**

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Course Outcomes:

Upon successful completion of this course, student will be able to

CO834.1	Understand the fundamentals of digital image processing
CO834.2	Understand the representation and properties of digital images
CO834.3	Interpret the properties of a digital image using spatial processing
CO834.4	Describe the images using histogram processing techniques
CO834.5	Interpret digital images using various smoothing and sharpening techniques

Text Books:

1. Digital Image Processing, Rafael C. Gonzalez and Richard E. Woods, Pearson education, 4th Edition, 2018.

Reference Books:

1. Computer Vision and Image Processing, Scott.E. Umbaugh, Prentice Hall, 1997.
2. Fundamentals of Digital Image Processing, Anil K. Jain, PHI, 2008.
3. Digital Image Processing, William K. Pratt, John Wiley, 4th Edition, 2007.
4. Digital Image Processing and Analysis, Chanda D,Datta Majumdar,2nd Edition, PHI, 2011

E-Books / Web References:

1. https://sisu.ut.ee/imageprocessing/book/1
2. https://engineering.purdue.edu/~bouman/ece637/

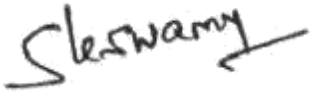
MOOCs:

1. https://onlinecourses.nptel.ac.in/noc19_ee55
2. https://www.classcentral.com/course/swayam-digital-image-processing-14005

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO834.1	3	3	1	1	-	-	-	-	-	-	-	1	2	-
CO834.2	3	3	1	1	-	-	-	-	-	-	-	1	2	-
CO834.3	3	3	1	1	-	-	-	-	-	-	-	1	2	-
CO834.4	3	3	1	1	-	-	-	-	-	-	-	1	2	-
CO834.5	3	3	1	1	-	-	-	-	-	-	-	1	2	-
Average	**3**	**3**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**2**	**-**

Low-1: Medium-2: High-3



SUBJECT: PROJECT WORK PHASE II

Subject Code	**22CSE84**	**CIE Marks**	**100**
Hours/Week (L: T: P)	**2 Contact hours/week**	**SEE Marks**	**100**
Examination hours :3			
No. of Credits: 8			

CIE for Project Phase - ll:

1. Single discipline: The CIE marks awarded for the project work phase -2, shall be based on the evaluation of project work phase -2 Report, project presentation skill and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates using Rubrics.
2. Interdisciplinary: Continuous internal Evaluation shall be group wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable. The CIE marks awarded for the project work phase -2, shall be based on the evaluation of project work phase -2 Report, project presentation skill and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates as per Rubrics covering all Program Outcomes.

SEE for Project Phase – ll:

1. Single discipline: Contribution to the project and-the performance of each group member shall be assessed individually in semester end examination (SEE) conducted at the department.

2. lnter disciplinary: Contribution to the project and the performance of each group member shall be assessed individually in semester end examination (SEE) conducted separately at the departments to which the student/s belong to.

Typical Evaluation pattern for the Course is shown in Table 1.

Table 1: CIE and SEE Evaluation

Components	Marks	Total	
CIE			
Review 1	25	100	200
Review 2	25		
Demonstration + Report	50		
SEE			
Semester End Viva	100	100	

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SUBJECT: TECHNICAL SEMINAR

Subject Code	**22CSES85**	**CIE Marks**	**100**
Hours/Week (L: T: P) : 1 Contact hours/week			
No. of Credits: 1			

Technical Seminar:
All the students admitted to IVth year of BE/B. Tech shall have to do power point presentation on any topic related to Computer Science and Engineering during Vlll semester and make a report of the presented topic referring to journals in that area. The prescribed credit shall be included in Vlll semester and shall be considered for the award of bachelor's degree. Those who do not present the Technical seminar shall be declared fail and shall have to complete during subsequent University examination after satisfying the Technical Seminar requirements. CIE procedure for Seminar: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide. The CIE marks awarded for the Seminar shall be based on the evaluation of seminar report, presentation skill and question and answer session in the ratio 50:25:25.

Typical Evaluation pattern for the Course is shown in Table 1.

Table 1: CIE and SEE Evaluation		
Components	**Marks**	**Total**
CIE		
Technical Seminar Presentation + Report	100	**100**

SUBJECT: INTERNSHIP

Subject Code	22INT86	CIE Marks	100
Hours/Week (L: T: P) : Completed during the intervening period of VI and VII Semester			
No. of Credits: 2			

Internship:

All the students admitted to IIIrd year of BE/B. Tech shall have to undergo mandatory internship of 4 weeks during the vacation of VI and VII semesters and /or VII and VIII semesters. Internship examination shall be conducted during VIII semester and the prescribed credit shall be included in VIII semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take-up/complete the internship shall be declared fail and shall have to complete during subsequent university examination after satisfying the internship requirements.

CIE procedure for Internship:

The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide. The CIE marks awarded for the Internship shall be based on the evaluation of Internship report, presentation skill and question and answer session in the ratio 50:25: 25.

Typical Evaluation pattern for the Course is shown in Table 1.

Table 1: CIE Evaluation

Components	Marks	Total
CIE		
Review Presentation + Report	100	100

Head of Department
Computer Science Engineering
Global Academy of Technology
Bangalore-98

Dean Academic
Global Academy of Technology,
Rajarajeshwarinagar, Bengaluru-98