SCHEME & SYLLABUS

Dean Academic
Global Academy of Technology,
Raja...hwarinagar, Beng...98

Head of Department
fo. Science Engineer
bal Academy of Techn
Bangalore - 98

Department of Information Science and Engineering

III -VIII Semester Scheme & Syllabus (2022-23)

Information Science & Engineering

NEP-2022

GLOBAL ACADEMY OF TECHNOLOGY

(Autonomous institution affiliated to VTU, Belagavi.
Accredited by NAAC with 'A' grade,
NBA Accredited CS, E&C, E&E, MECH and IS branches)
Ideal Homes Township,
Raja Rajeshwari Nagar, Bengaluru-560098.

II Year

Scheme & Syllabus

2022 Batch

Scheme & Syllabus of UG Autonomous Program – 2022 batch (3rd & 4th Semester)

III-SEMESTER:

Sl. No.	Course Code	Course Title	Teaching Hours/Week			Examination			CREDITS
			L	T	P	CIE	SEE	Total	
1	22MAT31X	Discrete Mathematics – I (Branch Specific)	2	2	0	50	50	100	3
2	22ISE32	Digital Logic Design and Computer Organization (Integrated)	3	0	2	50	50	100	4
3	22ISE33	Data Structure (Integrated)	3	0	2	50	50	100	4
4	22ISE34	Operating Systems	3	0	0	50	50	100	3
5	22ISE35	ESC/ETC/**PLC** Object Oriented Programming using Java	2	0	2	50	50	100	3
6	22ISE36	Web Technology and Its Applications (Integrated)	2	0	2	50	50	100	3
		Total				**300**	**300**	**600**	**20**

IV-SEMESTER:

Sl. No.	Course Code	Course Title	Teaching Hours/Week			Examination			CREDITS
			L	T	P	CIE	SEE	Total	
1	22MAT41X	Discrete Mathematics -II (Branch Specific)	2	2	0	50	50	100	3
2	22ISE42	Design and Analysis of Algorithms (Integrated)	3	0	2	50	50	100	4
3	22ISE43	Database Management Systems(Integrated)	3	0	2	50	50	100	4
4	22ISE44	Software Engineering	3	0	0	50	50	100	3
5	22ISE45	ESC/**ETC**/PLC Data Communications	2	0	2	50	50	100	3
6	22ISE46	Mobile Application Development (Integrated)	2	0	2	50	50	100	3
		Total				**300**	**300**	**600**	**20**

3rd Semester Syllabus

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:

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

SEMESTER- III

Course: Digital Logic Design and Computer Organization (Integrated)

Course Code	22ISE32	CIE Marks	50
Hours/Week (L: T: P)	3:0:2	SEE Marks	50
No. of Credits	4	Examination Hours	03

Prerequisites: Basic Electronics

Course Learning Objectives:

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	Design and Analyze working of sequential circuits and its applications
CLO4	Describe about the Input/output Organization and Machine Instructions
CLO5	Illustrate the working of various Memory System of computer

Content	No. of Hours/ RBT levels
Module 1 : Introduction **Digital Principles:** Definition of Digital Signals, Digital Waveforms, Digital Logic **Digital Logic:** The Basic Gates-: NOT, OR, AND, Universal Logic Gates: NOR, NAND, Positive and Negative Logic **Combinational Logic Circuits:** Sum-of-Products Method, Truth Table to Karnaugh Map, Pairs Quads, and Octets, Karnaugh Simplifications, Don't-care Conditions, Simplification by Quine-McCuskey Method, HDL Implementation Models. **Text Book 1: Chapter 1,2, & 3 (Specified Topics Only)**	**08 Hours** **L3**
Module 2: Data-Processing Circuits **Data-Processing Circuits:** Multiplexers, Demultiplexers, 1-of-16 Decoder, BCD-to-decimal Decoders, Encoders, Exclusive-or Gates, Parity Generators and Checkers, Magnitude Comparator, Programmable Array Logic, Programmable Logic Arrays, HDL Implementation of Data Processing Circuits **Text Book 1: Chapter 4 (Specified Topics Only)**	**08 Hours** **L3**
Module 3: Sequential Circuits **Flip-Flops:** Definition, Clocked RS Flip-Flops, Clocked D Flip-Flops, Edge-Triggered RS Flip-Flops, Edge-Triggered D- Flip-Flops, Edge-Triggered JK Flip-Flops JK Master-Slave. Flip-Flops, Various Representations of Flip-Flops, HDL Implementation of Flip-Flops **Registers**: Types of Registers, Serial In - Serial Out, Serial In - Parallel out, Parallel In - Serial Out, Parallel In - Parallel Out, Universal Shift Register, Register Implementation in HDL **Counters**: Definitions: Counter, Asynchronous Counter, Synchronous Counter, Counter Design as A Synthesis Problem, A Digital Clock, Counter Design using HDL **Text Book 1: Chapter 8,9 & 10 (Specified Topics Only)**	**08 Hours** **L4**

Module 4 **Machine Instructions and Programs:** Numbers, Arithmetic Operations and Characters, Memory Location and Addresses, Memory Operations, Instructions and Instruction Sequencing, Addressing Modes, Assembly Language **Input/output Organization:** Accessing I/O Devices, Interrupts: Interrupt Hardware, Enabling and Disabling Interrupts, Direct Memory Access, Buses **Text Book 2: Chapter 2 & 4 (Specified Topics Only)**	**08 Hours** **L3**
Module 5 **Memory System:** Basic Concepts, Semiconductor RAM Memories – Internal organization of memory chips, Static memories, Asynchronous and synchronous DRAM, Structure of larger memories, Cache Memories – Mapping Functions, Replacement Algorithms, Performance Considerations – Hit rate and miss penalty. **Text Book 2: Chapter 5 (Specified Topics Only)**	**08 Hours** **L3**

Lab. No	Experiments
1.	Introduction to Lab
2.	Design and Implementation of the following Using HDL: ➢ Basic Gates and Universal Gates
3.	Design and Implementation of the following Using HDL: ➢ Simplifying Given SOP and HDL Implementation for the simplified expression
4.	Design and Implementation of the following Using HDL: ➢ 8:1 Multiplexer ➢ Demultiplexer
5.	Design and Implementation of the following Using HDL: ➢ BCD-to-decimal Decoders ➢ Encoders
6.	Design and Implementation of the following Using HDL: ➢ Mod-n (n<8) synchronous up counter using J- K Flip-Flops.
7.	Design and Implementation of the following Using HDL: ➢ An asynchronous counter using decade counter count up from 0 to n (n<=9)
8.	Case study: Illustrate the various addressing modes of different processors with example.
9.	Case study: Study and Prepare a Report on Evolution of computer Memory Systems.
10.	Revision Lab and Report Submission for case Studies
11.	Lab Internal Assessment

COURSE OUTCOMES:

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

22ISE32.1	Experiment with Various logic gates and Problem Solving Techniques
22ISE32.2	Design various data processing circuits
22ISE32.3	Design, analyze and implement various sequential Circuits
22ISE32.4	Utilize the machine instructions and addressing modes, interrupts and DMA
22ISE32.5	Identify the Memory System for efficient data store

Textbooks:

1. DIGITAL PRINCIPLES A D APPLICATIONS , Seventh Edition (Indian Special Edition) by Donald P Leach, Albert Paul Malvino and Goutam Saha , Tata McGraw Hill, 2011
2. Computer Organization- Carl Hamacher, ZvonkoVranesic, SafwatZaky:, 5th Edition, Tata McGraw Hill,2018

Reference books:

1. R D Sudhakar Samuel, K.S. Nandini Prasad: Logic Design, 1st edition, Elsevier Publication, 2013.
2. M Morris Mano: Digital Logic and Computer Design, 14th Impression, Pearson, 2012. ISBN 978-81-7758-409-7.
3. Charles H. Roth: Fundamentals of Logic Design, Jr., 5th Edition, Thomson, 2004
4. Computer Organization & Architecture - William Stallings, 10th Edition, Pearson, 2016.

MOOCs

1. http://nptel.ac.in
2. https://www.khanacademy.org/
3. https://www.class-central.com
4. E-learning: www.vtu.ac.in

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 for the theory component are to be conducted for 40 marks each. Marks scored in each test is reduced to 30. Average of three test will be considered. The Lab CIE is conducted for 20 marks and is added to the theory component.

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 Test-1	**30**	**50**
	CIE Test-2	**30**	
	CIE Test- 3	**30**	
	Laboratory	**20**	
SEE	Semester End Examination	**100**	**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
22ISE32.1	3	3	3	2	2	-	-	-	-	-	-	2	2	-	-	-
22ISE32.2	3	3	3	2	2	-	-	-	-	-	-	2	2	-	-	-
22ISE32.3	3	3	3	2	2	-	-	-	-	-	-	2	2	-	-	-
22ISE32.4	3	3	3	2	2	-	-	-	-	-	-	2	2	-	-	-
22ISE32.5	3	3	3	2	2	-	-	-	-	-	-	2	2	-	-	-
Average	3	3	3	2	2	-	-	-	-	-	-	2	2	-	-	-

Low-1: Medium-2: High-3

SEMESTER – III

Course: Data Structure (Integrated)

Course Code	22ISE33	CIE Marks	50
Hours/Week (L: T: P)	3:0:2	SEE Marks	50
No. of Credits	4	Examination Hours	3

Prerequisites: C Programming

Course Learning Objectives:

CLO1	Explain fundamentals of data structures and their applications essential for Programming /problem solving.
CLO2	Find suitable data structure during application development/Problem Solving.
CLO3	Illustrate linear representation of data structures: Stack, Queues, Lists.
CLO4	Explain Non-Linear representation of data structures like Trees and Graphs and its memory Representation.
CLO5	Demonstrate sorting and searching algorithms.

Content	No.of Hours /RBT levels
Module 1 **Introduction:** Data Structures, Classifications (Primitive & Non Primitive), Data structure Operations, Structures, Self-Referential Structures, and Unions. Pointers and Dynamic Memory Allocation and its Functions, Representation of Linear Arrays in Memory. **Array Operations:** Review of Arrays, Traversing, inserting, deleting, searching, and sorting, Sparse Matrices. **Strings:** Basic Terminology, Storing, Operations and Pattern Matching algorithms. Programming Examples, Pattern matching algorithms-Brute force.	**10 Hours L2**
Module 2 **Stacks:** Definition, Stack Operations, Array Representation of Stacks, Stacks using Dynamic Arrays, Stack Applications: Polish notation, Infix to postfix conversion, evaluation of postfix expression. **Queues:** Definition, Array Representation, Queue Operations, Circular Queues, Circular queues using Dynamic arrays, Dequeues, Priority Queues, Programming Examples.	**10 Hours L3**
Module 3 **Linked Lists:** Definition, Representation of linked lists in Memory, Memory allocation. **Linked list operations:** Traversing, Searching, insertion, and Deletion, Doubly Linked lists, Circular linked lists, Linked Stacks and Queues, Applications of Linked lists, Programming Examples.	**10 Hours L3**

Module 4 **Trees:** Terminology, Binary Trees, Properties of Binary trees, Array and linked Representation of Binary Trees, Binary Tree Traversals - Inorder, Postorder, Preorder, **Binary Search Trees** – Definition, Insertion, Deletion, Traversal, Searching, Application of Trees- Evaluation of Expression, Programming Examples.	**10 Hours** **L3**
Module 5 **Advanced Trees:** AVL Trees, Definition, Height of an AVL Tree, Operations – Insertion, Deletion. **Sorting**: Insertion Sort and Radix sort. **Hashing**: Hash Table organizations, Hashing Functions, Static and Dynamic Hashing.	**10 Hours** **L3**

Program List	
1	Design, Develop and Implement a menu driven Program in C 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 in C for the following operations on Strings. a. Read a main String (STR), a Pattern String (PAT) and a Replace String(REP) b. Perform Pattern Matching Operation: Find and Replace all occurrences of PAT in STR with REP if PAT exists in STR. Report suitable messages in case PAT does not exist in STR Support the program with functions for each of the above operations. Don't use Built-in functions.
3	Design, Develop and Implement a menu driven Program in C for the following operations on STACK of Integers (Array Implementation of Stack with maximum size MAX) a. Push an Element on to Stack b. Pop an Element from Stack c. Demonstrate how Stack can be used to check Palindrome d. Demonstrate Overflow and Underflow situations on Stack e. Display the status of Stack f. Exit Support the program with appropriate functions for each of the above operations
4	Design, Develop and Implement a menu driven Program in C for the following operations on QUEUE of Integer (Array Implementation of QUEUE with maximum size MAX) a. Enqueue an Element on to Queue b. Dequeue an Element from Queue c. Demonstrate Overflow and Underflow situations on Queue d. Display the status of Queue e. Exit Support the program with appropriate functions for each of the above operations

5	a. Design, Develop and Implement a Program in C for converting an Infix Expression to Postfix Expression. Program should support for both parenthesized and free parenthesized expressions with the operators: +, -, *, /, % (Remainder), ^(Power) and alphanumeric operands. b. Design, Develop and Implement a Program in C for evaluation of Suffix expression with single digit operands and operators: +, -, *, /, %.
6	Design, Develop and Implement a menu driven Program in C for the following operations on Singly Linked List (SLL) of Student Data with the fields: USN, Name, Branch, College, 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. Perform Insertion / Deletion at Front of SLL. e. Exit.
7	Design, Develop and Implement a menu driven Program in C for the following operations on Doubly Linked List (DLL) of Employee Data with the fields: SSN, Name, Dept, Designation, Sal, Phone Number. a. Create a DLL of N Employees Data by using end insertion. b. Display the status of DLL and count the number of nodes in it c. Perform Insertion and Deletion at End of DLL d. Perform Insertion and Deletion at Front of DLL e. Demonstrate how this DLL can be used as Double Ended Queue. f. Exit
8	Design, Develop and Implement a menu driven Program in C for the following operations on Binary Search Tree (BST) of Integers. a. Create a BST of N Integers: 6, 9, 5, 2, 8, 15, 24, 14, 7, 8, 5,2 b. Traverse the BST in Inorder, Preorder and Post Order.
9	Design, Develop and Implement a menu driven Program in C for the following operations on a. Radix Sort b. Insertion Sort
10	Given a File of N employee records with a set K of Keys (4-digit) which uniquely determine the records in file F. Assume that file F is maintained in memory by a Hash Table (HT) of m memory locations with L as the set of memory addresses (2- digit) of locations in HT. Let the keys in K and addresses in L are Integers. Design (remainder method), and implement hashing technique to map a given key K to the address space L. Resolve the collision (if any) using probing

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

22ISE33.1	Understand the basic data structures and its representation in memory
22ISE33.2	Apply appropriate algorithm for problem solving using arrays, strings, stacks, queues.
22ISE33.3	Explain the representation of linked lists, trees in memory.
22ISE33.4	Solve programs using linked lists and tree for a given specification.
22ISE33.5	Utilize the concepts of Hashing and Sorting to resolve problems

Textbooks:

1. Fundamentals of Data Structures in C, Ellis Horowitz and SartajSahni,2nd Ed, Universities Press, 2019.
2. Data Structures using C, A. S. Tanenbaum, Y. Langsam, and M.J. Augenstein, PHI/Pearson Education.

Reference books:

1. Data Structures: A Pseudo-code approach with C, Gilberg & Forouzan, 2nd Ed, Cengage Learning,2014.
2. Data Structures using C, Reema Thareja, 3rd Ed, Oxford press, 2018.

MOOCs:

1. http://nptel.ac.in/courses.php?disciplineId=111
2. https://www.khanacademy.org/
3. https://www.class-central.com/subject (MOOCS)
4. E-learning: www.vtu.ac.in

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 for the theory component are to be conducted for 40 marks each. Marks scored in each test is reduced to 30. Average of three test will be considered. Two lab CIE are conducted for 20 marks each and the average is added to the theory component.

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	**30**	**50**
	CIE Test-2	**30**	
	CIE Test- 3	**30**	
	Laboratory	**20**	
SEE	Semester End Examination	**100**	**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**
22ISE33.1	3	3	2	-	2	-	-	-	-	-	-	3	3	-	-	-
22ISE33.2	3	3	2	-	2	-	-	-	-	-	-	3	3	-	-	-
22ISE33.3	3	3	2	-	2	-	-	-	-	-	-	3	3	-	-	-
22ISE33.4	3	3	2	-	2	-	-	-	-	-	-	3	3	-	-	-
22ISE33.5	3	3	2	-	2	-	-	-	-	-	-	3	3	-	-	-
Average	**3**	**3**	**2**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**-**	**-**	**-**

Low-1: Medium-2: High-3

SEMESTER – III

Course: Operating Systems

Course Code	22ISE34	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
No. of Credits	3	Examination Hours	3

Prerequisites: Basics of Computers

Course Learning Objectives

CLO1	Introduce concepts and terminology used in OS
CLO2	Illustrate process scheduling and synchronization with semaphores
CLO3	Illustrate the concept of deadlocks and memory management
CLO4	Explain Mass storage structure and file system interface and it implementation
CLO5	Discuss Protection and its Security

Contents	No. of Hours RBT Level
Module 1 **Introduction to operating systems:** what operating systems do, Computer System organization, Computer System architecture, Operating System structure, Operating System operations, Process management, Memory management, Storage management, Security and Protection. **operating system structures:** Operating System Services, User - Operating System interface, System calls, Types of system calls, System programs, Operating system design and implementation, Operating System structure **Process Management:** Process concept, Process scheduling, Operations on processes, inter process communication	**08 Hours L2**
Module 2 **Threads:** Overview, Multicore Programming, Multithreading Models, Threading Issues **Process Synchronization**: Background, The Critical section problem, Peterson's solution, Mutex Locks, Semaphores **CPU Scheduling:** Basic Concepts, Scheduling Criteria, Scheduling Algorithms.	**08 Hours L3**
Module 3 **Deadlocks:** Introduction to Deadlocks, System model, Deadlock characterization, Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection and recovery from deadlock **Memory Management:** Background, Swapping, Contiguous memory allocation, Segmentation, Paging, Structure of page table **Virtual Memory:** Background, Demand paging, Copy-on-write, Page replacement, Allocation of frames	**08 Hours L3**
Module 4 **Mass-Storage Structure:** Overview of Mass-Storage Structure, Disk Structure, Disk Attachment, Disk Scheduling, Disk Management.	**08 Hours L3**

File-System Interface: File Concept, Access Methods, Directory and Disk Structure File-System Mounting, File Sharing **File-System Implementation:** File- System Structure, File System Implementation, Directory Implementation, Allocation Method, Free-Space Management	
Module 5 **Protection:** Goals of protection, Principles of protection, Domain of protection, Access Matrix, Implementation of Access Matrix, Revocation of Access Rights, **Security:** The Security Problem, Program Threats, System and Network Threats, Cryptography as a Security Tool, User Authentication, Implementing Security Defenses	**08 Hours L2**

COURSE OUTCOMES

Upon completion of this course, student will be able to

22ISE34.1	Outline the fundamentals of operating system and its services
22ISE34.2	Apply Process Management and Synchronization concepts in real-time
22ISE34.3	Handle deadlock and Select appropriate Memory Management technique for a given problem
22ISE34.4	Utilize Storage Management and file system to solve real-time problem
22ISE34.5	Explain various Security and Protection concepts of operating System

Text Books

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Principles, 10th edition, Wiley-India, 2012.

Reference Books

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

MOOCs (Format is given below)

1. http://nptel.ac.in
2. https://www.khanacademy.org/
3. https://www.class-central.com (MOOCS)
4. E-learning: www.vtu.ac.in

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).
Two quizzes are to be conducted and each quiz is evaluated for 5 marks adding up to 10 marks or ATT can be given and is evaluated for 10 marks1 .
Quizzes can be conducted online. Faculty may adopt innovative methods for conducting quizzes effectively.
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 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**	
	Quiz 1/AAT	**05**	
	Quiz 2/AAT	**05**	
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
22ISE34.1	3	-	-	-	-	-	-	-	-	-	-	3	-	2	-	-
22ISE34.2	3	2	2	2	-	-	-	-	-	-	-	3	3	2	-	-
22ISE34.3	3	2	2	2	-	-	-	-	-	-	-	3	3	2	-	-
22ISE34.4	3	2	2	2	-	-	-	-	-	-	-	3	3	2	-	-
22ISE34.5	3	2	2	2	-	-	-	-	-	-	-	3	3	2	-	-
Average	3	2	2	2	-	-	-	-	-	-	-	3	3	2	-	-

Low-1: Medium-2: High-3

SEMESTER – III

Course: Object Oriented Programming using JAVA

Course Code	22ISE35	CIE Marks	50
Hours/Week (L: T: P)	2:0:2	SEE Marks	50
No. of Credits	3	Examination Hours	3

Prerequisites: Programming in C

Course Learning Objectives

CLO1	Understand the object-oriented concepts in JAVA.
CLO2	Implement the concepts of control structures
CLO3	Discuss the concepts of Inheritance, Exceptions, Packages and Interfaces
CLO4	Demonstrate the concept of Multithreading and Wrapper classes
CLO5	Interpret the need for advanced Java concepts like generics and collections in developing modular and efficient programs

Contents	No. of Hours RBT Level
Module 1 **Introduction to Java**: Java's magic: the Byte code; Java Development Kit (JDK); the Java Buzzwords, Object-oriented programming; Simple Java programs. Data types, variables and arrays, Operators, Control Statements. **Text book 1: Ch:1 Ch: 2 Ch:3 Ch:4 Ch:5**	**08 Hours L3**
Module 2 **Classes, Inheritance:** Classes: Classes fundamentals; Declaring objects; Constructors, this keyword, garbage collection. **Inheritance:** Inheritance basics, using super, creating multilevel hierarchy, method overriding and Abstract class. **Text book 1: Ch:6 Ch: 8**	**08 Hours L3**
Module 3 **Exceptions, Packages and Interfaces:** Exception handling in Java – try, catch, throw, throws, finally. Packages, Access Protection, Importing Packages, Interfaces. **Multi-Threaded Programming:** Multi-Threaded Programming: What are threads? How to make the classes threadable; Extending threads; Implementing runnable; Synchronization; Interthread Communication - producer consumer problem. **Text book 1: Ch:10 Ch:9 Ch:11**	**08 Hours L3**
Module 4 **Type Wrappers:** Character, Boolean, Numeric type wrappers. Autoboxing: Autoboxing and Methods, Autoboxing / Unboxing occur in expressions, Autoboxing/Unboxing Boolean and Character values, Autoboxing / Unboxing helps prevents errors **String Handling:** String Constructors**,** Special string operations, character extraction, Comparison, Searching and Modifying of strings, Data Conversion, Changing the case of characters, Additional String Methods, String Buffer, String Builder **Text book 1: Ch:12 Ch:17**	**08 Hours L3**

Module 5	
Generics: What are Generics, Simple Generics Example, A Generic Class with Two Parameters, General Form of Generic Class, Bounded Types, Wildcard Arguments, Generic Methods and Interfaces. **The Collections Framework:** Collections Overview, The Collection Interfaces – List, Set, The Collection Classes – ArrayList, LinkedList, HashSet **Text book 1: Ch:14 Ch:19**	**08 Hours** **L3**

COURSE OUTCOMES

Upon completion of this course, student will be able to

22ISE35.1	Illustrate the fundamentals of Java Programming.
22ISE35.2	Implement object-oriented concepts in Java.
22ISE35.3	Apply multithreading and interface concepts in Java application development.
22ISE35.4	Develop Java programs using wrapper classes and string handling methods.
22ISE35.5	Build applications using collection framework and generics to handle groups of objects effectively.

Text Books

1. **Java the Complete Reference**, Herbert Schildt, 11th Edition, Tata McGraw Hill, 2020.

Reference Books

1. **Starting Out with Java**: From Control Structures through Objects Tony Gaddis, Haywood Community College.—6th edition, Pearson Education.2017
2. **Big Java**: **Early Objects**, Cay S. Horstmann, 7th Edition, Wiley Publication.
3. **Advanced JAVA programming**, Uttam K Roy, Oxford University press, 2015.

MOOCs (Format is given below)

1. Programming in java:https://nptel.ac.in/courses/106/105/106105191/
2. Java Tutorial for Complete Beginners: https://www.udemy.com/course/java-tutorial/
3. Core Java Specialization:https://www.coursera.org/specializations/core-java

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.

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 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**	
	Quiz 1/AAT	**05**	
	Quiz 2/AAT	**05**	
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
22ISE35.1	3	3	3	-	2	-	-	-	-	-	-	1	1	-	3	3
22ISE35.2	3	3	3	-	2	-	-	-	-	-	-	1	2	-	3	3
22ISE35.3	3	3	3	-	2	-	-	-	-	-	-	1	2	-	3	3
22ISE35.4	3	3	3	-	2	-	-	-	-	-	-	1	2	-	3	3
22ISE35.5	3	3	3	-	2	-	-	-	-	-	-	1	2	-	3	3
Average	3	3	3	-	2	-	-	-	-	-	-	1	1.8	-	3	3

Low-1: Medium-2: High-3

SEMESTER – III

Course: Web Technology and Its Applications (Integrated)

Course Code	22ISE36	CIE Marks	50
Hours/Week (L: T: P)	2:0:2	SEE Marks	50
No. of Credits	3	Examination Hours	3

Prerequisites: Computer Networks, object-oriented programming

Course Learning Objectives

CLO1	Understand the basic tags, forms and tables using HTML and CSS
CLO2	Design Client-Side programs using JavaScript and Server-Side programs using PHP
CLO3	Interpret Object Oriented Programming capabilities of PHP
CLO4	Analyze different JavaScript frameworks

Contents	No. of Hours RBT Level
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.	**08 Hours L2**
Module 2 HTML Tables and Forms, Introducing Tables, Styling Tables, Introducing Forms, Form Control Elements, Table and Form Accessibility, Microformats, Advanced CSS: Layout, Normal Flow, Positioning Elements, Floating Elements, Constructing Multicolumn Layouts, Approaches to CSS Layout, Responsive Design, CSS Frameworks.	**08 Hours L3**
Module 3 JavaScript: Client-Side Scripting, What is JavaScript and What can it do?, JavaScript Design Principles, Where does JavaScript Go?, Syntax, JavaScript Objects, The Document Object Model (DOM), JavaScript Events, Forms, Introduction to Server-Side Development with PHP, What is Server-Side Development, A Web Server's Responsibilities, Quick Tour of PHP, Program Control, Functions	**08 Hours L3**
Module 4 PHP Arrays and Superglobals, Arrays, $_GET and $_POST Superglobal Arrays, $_SERVER Array, $_Files Array, Reading/Writing Files, PHP Classes and Objects, Object-Oriented Overview, Classes and Objects in PHP, Object Oriented Design	**08 Hours L3**
Module 5 Managing State, The Problem of State in Web Applications, Passing Information via Query Strings, Passing Information via the URL Path, Cookies, Serialization, Session State, HTML5 Web Storage, Caching, Advanced JavaScript and jQuery, JavaScript PseudoClasses, jQuery Foundations, AJAX, Asynchronous File Transmission, **Protection:** Goals of protection, Principles of protection, Protection Rings, Domain of protection, Access matrix, Implementation of access matrix, Revocation of Access Rights , Role-Based Access Control	**08 Hours L2**

Program List	
1	Develop and demonstrate a HTML document that illustrates a) Headings tags(H1,H2,H3,H4,H5,H6) b) Font Details (Font Size,Style, Type, Color) c) Unordered List(UL) d) Ordered List(OL) and Definition list (DL)
2	Develop and demonstrate a HTML document that illustrates a) Image as a background b) Hyperlink using an image c) Hyperlink to another web page
3	Write HTML code using Forms, Tables and Java Script to design a simple calculator to perform the following operations: sum, product, difference and quotient.
4	Write a JavaScript that calculates the squares and cubes of the numbers from 0 to 10 and outputs HTML text that displays the resulting values in an HTML table format.
5	Write a 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.
6	Develop and demonstrate a HTML5 file that includes JavaScript script that uses functions for the following problems: a. Parameter: A string b. Output: The position in the string of the left-most vowel c. Parameter: A number d. Output: The number with its digits in the reverse order
7	Write a PHP program a) to display a digital clock which displays the current time of the server. b) to keep track of the number of visitors visiting the web page and to display this count of visitors, with proper headings.
8	Write the PHP programs to do the following: a. Implement simple calculator operations. b. Find the transpose of a matrix. c. Multiplication of two matrices. d. Addition of two matrices.
9	Write a PHP program named states.py that declares variable states with value "Global Academy of Technology". write a PHP program that does the following: a. Search for a word in variable states that ends in emy. Store this word in element 0 of a list named statesList. b. Search for a word in states that begins with G and ends in l. Perform a case insensitive comparison. [Note: Passing re.Ias a second parameter to method compile performs a case-insensitive comparison.] Store this word in element1 of statesList. c. Search for a word in states that begins with T and ends in y. Store this word in element 2 of the list. d. Search for a word in states that ends in f. Store this word in element 3 of the list.
10	Demonstrate JQuery program using CSS.

COURSE OUTCOMES

Upon completion of this course, student will be able to

22ISE36.1	Design web pages using HTML tags and CSS
22ISE36.2	Construct tables and forms using HTML and CSS
22ISE36.3	Apply Javascript and PHP concepts for client side and server-side scripting
22ISE36.4	Demonstrate the object-oriented PHP concepts
22ISE36.5	Illustrate web services, applications, and JavaScript frameworks like jQuery to focus on core features

Text Books

1. Randy Connolly, Ricardo Hoar, "Fundamentals of Web Development", 1 stEdition, Pearson Education India. (ISBN:978-9332575271)

Reference Books

1. Robin Nixon, "Learning PHP, MySQL &JavaScript with jQuery, CSS and HTML5", 4 thEdition, O'Reilly Publications, 2015. (ISBN:978-9352130153)
2. Luke Welling, Laura Thomson, "PHP and MySQL Web Development", 5th Edition, Pearson Education, 2016. (ISBN:978-9332582736)
3. Nicholas C Zakas, "Professional JavaScript for Web Developers", 3rd Edition, Wrox/Wiley India, 2012. (ISBN:978-8126535088)
4. David Sawyer Mcfarland, "JavaScript & jQuery: The Missing Manual", 1st Edition, O'Reilly/Shroff Publishers & Distributors Pvt Ltd, 2014

MOOCs (Format is given below)

1. https://nptel.ac.in/courses/106105084
2. https://www.coursera.org/learn/django-database-web-apps
3. https://www.udemy.com/topic/javascript/

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 for theory component are to be conducted for 40 marks each. Marks scored in each test is reduced to 30. Two lab CIE is conducted for 20 marks each and average is added to theory component.

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	**30**	**50**
	CIE Test-2	**30**	
	CIE Test-3	**30**	
	Laboratory	**20**	
SEE	Semester End Examination	**100**	**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**
22ISE36.1	2	-	-	-	2	-	-	-	-	-	-	2	-	-	-	-
22ISE36.2	2	2	2	-	2	-	-	-	-	-	-	2	2	-	-	-
22ISE36.3	2	2	2	-	2	-	-	-	-	-	-	2	-	-	-	-
22ISE36.4	2	2	2	-	2	-	-	-	-	-	-	2	2	-	-	-
22ISE36.5	2	-	-	-	2	-	-	-	-	-	-	2	2	-	-	-
Average	2	2	2	-	2	-	-	-	-	-	-	2	2	-	-	-

Low-1: Medium-2: High-3

4th Semester Syllabus

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
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				
Average	3	2	1									3				

Low-1: Medium-2: High-3

SEMESTER –IV

Course: Design and Analysis of Algorithms (Integrated)

Course Code	**22ISE42**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:2**	**SEE Marks**	**50**
No. of Credits	**4**	**Examination Hours**	**3**

Prerequisites: C Programming and Data Structures

Course Learning Objectives:

CLO1	Apply different techniques used in algorithm analysis for solving computational problems.
CLO2	Design appropriate algorithm to solve problems on real world applications
CLO3	Understand different algorithm's design techniques and strategies.
CLO4	Analyze the efficiency of alternative algorithmic solutions for the same problem
CLO5	Apply appropriate data structures to enhance the performance of algorithms for problem solving

Content	No. of Hours/ RBT levels
Module 1 **Basics of Algorithms:** Definition, Fundamentals of Algorithm and Problem Solving — Important Problem Types — Fundamentals of Algorithm Analysis and Efficiency, Time and Space Complexity. **Analysis of Algorithm:** The efficient algorithm, Average, Best and worst-case analysis, Amortized analysis, Asymptotic Notations, Mathematical analysis of Non-Recursive and recursive Algorithms with Examples	**10 Hours L3**
Module 2 **Divide and Conquer Algorithm**: Introduction, Recurrence and different methods to solve recurrence. Problem Solving using divide and conquer algorithm - Binary Search, Max-Min problem, Sorting (Merge Sort, Quick Sort), Matrix Multiplication. **Exploring Graphs:** An introduction to graphs - Undirected Graph, Directed Graph, Traversing Graphs, Depth First Search, Breath First Search and Connected components**. Decrease and Conquer Approach:** Topological Sort.	**10Hours L3**
Module 3 Greedy Algorithm General Characteristics of greedy algorithms, Problem solving using Greedy Algorithm - Elements of Greedy strategy, The Knapsack Problem, Job Scheduling Problem, Coin Change Problem, Huffman code. **Minimum Spanning** trees - Kruskal's algorithm and Prim's algorithm, **Single source shortest paths:** Dijkstra's Algorithm.	**10 Hours L3**
Module 4 **Dynamic Programming:** Introduction, The Principle of Optimality, Problem Solving using Dynamic Programming - Calculating the Binomial Coefficient, Making Change Problem, Assembly Line-Scheduling, Knapsack problem, **Transitive Closure**-Warshall's Algorithm, All Points Shortest path, Floyd's Algorithm, Optimal Binary Search Trees, Bellman-Ford Algorithm, Travelling Sales Person problem.	**10Hours L3**

Module 5	
Backtracking and Branch and Bound: Introduction, The N Queens problem, Knapsack problem, Travelling Salesman problem, Minimax principle. **Introduction to NP-Completeness:** The class P and NP, Polynomial reduction, NP- Completeness Problem, NP-Hard Problems. Travelling Salesman problem, Hamiltonian problem, Approximation algorithms.	**10 Hours L3**

Program List	
1	Sort a given set of ***n*** integer elements using **Selection Sort** method and compute its time complexity. Run the program for varied values of *n*> 5000 and record the time taken to sort. Plot a graph of the time taken versus ***n***on graph sheet. The elements can be read from a file or can be generated using the random number generator. Demonstrate how brute force method works along with its time complexity analysis: worst case, average case and best case.
2	Sort a given set of ***n*** integer elements using **Merge Sort** method and compute its time complexity. Run the program for varied values of *n*> 5000, and record the time taken to sort. Plot a graph of the time taken versus ***n***on graph sheet. The elements can be read from a file or can be generated using the random number generator. Demonstrate using C how the divide-and-conquer method works along with its time complexity analysis: worst case, average case and best case.
3	Implement in C, the **0/1 Knapsack** problem using (a) Greedy method. (b) Dynamic Programming method
4	From a given vertex in a weighted connected graph, find shortest paths to other vertices using **Dijkstra's algorithm**. Write the program in C.
5	Find Minimum Cost Spanning Tree of a given connected undirected graph using **Kruskal's algorithm.**
6	Find Minimum Cost Spanning Tree of a given connected undirected graph using **Prim's algorithm**.
7	Write C programs to implement **All-Pairs Shortest Paths problem** using **Floyd's algorithm**.
8	Write C programs to Implement **Travelling Salesmen Problem** using Dynamic programming.
9	Design and implement in C to find a **subset** of a given set **S** = {SI, S2,.....,Sn} of ***n*** positive integers whose SUM is equal to a given positive integer ***d***. For example, if S ={1, 2, 5, 6, 8} and ***d***= 9, there are two solutions {1,2,6}and {1,8}. Display a suitable message, if the given problem instance doesn't have a solution.
10	Design and implement in C, **the Hamiltonian problem** and analyses for NP Completeness.

COURSE OUTCOMES:

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

22ISE42.1	Demonstrate the Computational Complexity of Algorithms in terms of time and space
22ISE42.2	Devise algorithms using divide and conquer, decrease and conquer strategies for a given problem
22ISE42.3	Demonstrate Graph algorithms using greedy method, transform and conquer approach to model engineering problems
22ISE42.4	Solve the given problem using Dynamic Programming strategy
22ISE42.5	Use Back Tracking, Branch and Bound algorithm design technique for solving computationally hard problems

Textbooks:

1. Introduction to the Design and Analysis of Algorithms, Anany Levitin, 2rd Edition, 2019. Pearson.
2. Computer Algorithms/C++, Ellis Horowitz, Satraj Sahni and Rajasekaran, 2nd Edition, 2014, Universities Press

Reference books:

1. Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, 2nd Edition, PHI, 2006.
2. Design and Analysis of Algorithms, S. Sridhar, Oxford (Higher Education)

MOOCs:

1. http://npteI.ac.in/courses.php?disciplineId=111
2. https://www.khanacademy.org/
3. https://www.class-central.com/subject (MOOCS)
4. E-learning: www.vtu.ac.in

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 for theory component are to be conducted for 40 marks each. Marks scored in each test is reduced to 30. Two lab CIE is conducted for 20 marks each and average is added to theory component.

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 2.

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

	Component	Marks	Total Marks
	CIE Test-1	**30**	**50**
	CIE Test-2	**30**	
	CIE Test- 3	**30**	
	Laboratory	**20**	
SEE	Semester End Examination	**100**	**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
22ISE42.1	3	3	3	1	-	-	-	-	-	-	-	1	3	-	-	-
22ISE42.2	3	3	3	-	-	-	-	-	-	-	-	1	3	-	-	-
22ISE42.3	3	3	3	-	-	-	-	-	-	-	-	1	3	-	-	-
22ISE42.4	3	3	3	-	-	-	-	-	-	-	-	1	3	-	-	-
22ISE42.5	3	3	3	-	-	-	-	-	-	-	-	1	3	-	-	-
Average	3	3	3	1	-	-	-	-	-	-	-	1	3	-	-	-

Low-1: Medium-2: High-3

SEMESTER IV

Course: Database Management Systems (Integrated)

Course Code	22ISE43	CIE Marks	50
Hours/Week (L: T: P)	3:0:2	SEE Marks	50
No. of Credits	4	Examination Hours	03

Course Learning Objectives: Basic knowledge of Computer Science and Database

CLO1	To understand the concept of DBMS and ER Modeling.
CLO2	To explain the relational algebra, queries and its features
CLO3	To understand the use of Advanced queries and Normalization of the database
CLO4	To become familiar with Transactions in database, Recovery and Security of database
CLO5	To understand the NOSQL database management system

Content	No.of Hours/ RBT levels
Module 1 **Fundamental Concepts and Architecture** Introduction to database system, Characteristics of the Database Approach, Actors on the Scene, Workers behind the Scene, Advantages of using the DBMS Approach, Data Models, Schemas, and Instances, Three-Schema Architecture and Data Independence. **Conceptual Database Design** High-Level Conceptual Data Models for Database Design, Entity Types, Entity Sets, Attributes, and Keys, Relationship Types, Relationship Sets, Roles, and Structural Constraints, Weak Entity Types, ER Diagrams, Naming Conventions, and Design Issues.	**10 Hours L3**
Module 2 **Relational Database Design** Relational Model Constraints, Update Operations, dealing with Constraint Violations, Relational Algebra, Unary Relational Operations: Operations from Set Theory, Binary Relational Operations, Additional Relational Operations, Database Design Using ER-to-Relational Mapping **SQL** SQL data definition and data types, specifying constraints in SQL, retrieval queries in SQL, INSERT, DELETE, and UPDATE statements in SQL, Additional features of SQL.	**10 Hours L3**

Module 3 **Advances Queries** More complex SQL retrieval queries, Specifying constraints as assertions and action triggers, Views in SQL, Schema change statements in SQL. Database Application Development: Accessing databases from applications, An introduction to JDBC, JDBC classes and interfaces, SQLJ, Stored procedures, **Normalization Theory** Informal Design Guidelines for Relation Schemas, Functional Dependencies, Inference Rules, Equivalence, and Minimal Cover, Properties of Relational Decompositions, Algorithms for Relational Database Schema Design, Normal Forms Based on Primary Keys, Boyce-Codd Normal Form	**12 Hours L3**
Module 4 **Transaction and Concurrency** Introduction to Transaction Processing, Desirable Properties of Transactions, Characterizing Schedules Based on Serializability, Concurrency, Two-Phase Locking Techniques for Concurrency Control, Concurrency Control Based on Timestamp Ordering. **Recovery and Security** Recovery Concepts, NO-UNDO/REDO Recovery Based on Deferred Update, Recovery Techniques Based on Immediate Update, Shadow Paging.	**10 Hours L3**
Module 5 **NoSQL Database Management** Introduction, Need of NoSQL, CAP Theorem, different NoSQL data models: Key-value stores, Column families, Document databases, Graph databases	**08 Hours L3**

Program List	
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_BRANCH(Branch_id, Branch_Name, Address) ***Write SQL queries to*** 1. Retrieve details of all books in the library – id, title, name of publisher, authors, number of copies in each branch, etc. 2. Get the particulars of borrowers who have borrowed more than 3 books, but from Jan 2017 to Jun 2017. 3. Delete a book in BOOK table. Update the contents of other tables to reflect this data manipulation operation. 4. Partition the BOOK table based on year of publication. Demonstrate its working with a simple query. 5. Create a view of all books and its number of copies that are currently available in the Library.

2	Consider the following schema for Order Database: SALESMAN(Salesman_id, Name, City, Commission) CUSTOMER(Customer_id, Cust_Name, City, Grade, Salesman_id) ORDERS(Ord_No, Purchase_Amt, Ord_Date, Customer_id, Salesman_id) ***Write SQL queries to*** 1. Count the customers with grades above Bangalore's average. 2. Find the name and numbers of all salesman who had more than one customer. 3. List all the salesman and indicate those who have and don't have customers in their cities 4. Create a view that finds the salesman who has the customer with the highest order of a day. 5. Demonstrate the DELETE operation by removing salesman with id 1000. All his orders must also be deleted.
3	Consider the schema for Movie Database: ACTOR(Act_id, Act_Name, Act_Gender) DIRECTOR(Dir_id, Dir_Name, Dir_Phone) MOVIES(Mov_id, Mov_Title, Mov_Year, Mov_Lang, Dir_id) MOVIE_CAST(Act_id, Mov_id, Role) RATING(Mov_id, Rev_Stars) ***Write SQL queries to*** 1. List the titles of all movies directed by 'Hitchcock'. 2. Find the movie names where one or more actors acted in two or more movies. 3. List all actors who acted in a movie before 2000 and also in a movie after 2015 (use JOIN operation). 4. Find the title of movies and number of stars for each movie that has at least one rating and find the highest number of stars that movie received. Sort the result by movie title. 5. Update rating of all movies directed by 'Steven Spielberg' to 5.
4	Consider the schema for College Database: STUDENT(USN, SName, Address, Phone, Gender) SEMSEC(SSID, Sem, Sec) CLASS(USN, SSID) SUBJECT(Subcode, Title, Sem, Credits) IAMARKS(USN, Subcode, SSID, Test1, Test2, Test3, FinalIA) ***Write SQL queries to*** 1. List all the student details studying in fourth semester 'C' section. 2. Compute the total number of male and female students in each semester and in each section. 3. Create a view of Test1 marks of student USN '1BI15CS101' in all subjects. 4. Calculate the FinalIA (average of best two test marks) and update the corresponding table for all students. 5. Categorize students based on the following criterion: If FinalIA = 17 to 20 then CAT = 'Outstanding' If FinalIA = 12 to 16 then CAT = 'Average' If FinalIA< 12 then CAT = 'Weak' Give these details only for 8th semester A, B, and C section students.
5	Consider the schema for Company Database: EMPLOYEE(SSN, Name, Address, Sex, Salary, SuperSSN, DNo)

	DEPARTMENT(DNo, DName, MgrSSN, MgrStartDate) DLOCATION(DNo,DLoc) PROJECT(PNo, PName, PLocation, DNo) WORKS_ON(SSN, PNo, Hours) ***Write SQL queries to*** 1. 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. 2. Show the resulting salaries if every employee working on the 'IoT' project is given a 10 percent raise. 3. Find the sum of the salaries of all employees of the 'Accounts' department, as well as the maximum salary, the minimum salary, and the average salary in this department 4. Retrieve the name of each employee who works on all the projects controlled by department number 5 (use NOT EXISTS operator). 5. For each department that has more than five employees, retrieve the department number and the number of its employees who are making more than Rs. 6,00,000.

COURSE OUTCOMES:

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

22ISE43.1	Design entity relationship diagrams to represent simple database application scenarios.
22ISE43.2	Illustrate the design principles for database design, SQL.
21ISE43.3	Retrieve data using advanced queries, also can normalize the database using Normalization Techniques.
22ISE43.4	Demonstrate Transaction processing and can apply Concurrency control on database also can use recovery mechanisms for the desirable database problem.
22ISE43.5	Review the fundamental view on unstructured data and its management.

Textbooks:

1. Fundamentals of Database Systems**,** Ramez Elmasri and Shamkant B.Navathe, Pearson Education,7th edition, 2013

Reference books:

1. Database Management Systems, Raghu Rama Krishnan, Tata Mcgraw Hill,6th edition,2010.
2. Database System Concepts, Abraham Silberschatz, Henry F.Korth and S.Sudarshan, Tata Mc Graw Hill, 6th edition, 2011.

MOOCs

1. http://nptel.ac.in
2. https://www.khanacademy.org/
3. https://www.class-central.com
4. E-learning: www.vtu.ac.in

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 for the theory component are to be conducted for 40 marks each. Marks scored in each test is reduced to 30. Two lab CIE are conducted for 20 marks each and the average is added to the theory component.

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 2.

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

	Component	Marks	Total Marks
	CIE Test-1	**30**	**50**
	CIE Test-2	**30**	
	CIE Test- 3	**30**	
	Laboratory	**20**	
SEE	Semester End Examination	**100**	**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**
22ISE43.1	3	3	3	-	-	-	-	-	-	-	-	2	2	-	-	-
22ISE43.2	3	3	3	-	-	-	-	-	-	-	-	2	2	-	-	-
22ISE43.3	3	3	3	-	-	-	-	-	-	-	-	2	2	-	-	-
22ISE43.4	3	3	3	-	-	-	-	-	-	-	-	2	2	-	-	-
22ISE43.5	3	3	3	-	-	-	-	-	-	-	-	2	2	-	-	-
Average	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**-**	**-**	**-**

Low-1: Medium-2: High-3

SEMESTER – IV

Course: Software Engineering

Course Code	22ISE44	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
No. of Credits	3	Examination Hours	03

Prerequisites: General awareness of the software/project development.

Course Learning Objectives:

CLO1	Outline software engineering principles and processes involved in building software by following professional and ethical laws.
CLO2	To gain knowledge of the development of software projects by applying phases of SDLC.
CLO3	Outline the various levels of software evaluation and software evolution to meet the changes.
CLO4	Identify software quality parameters, schedule of project activities.
CLO5	Recognize the need for agile practices in software development.

Content	No.of Hours/ RBT levels
Module 1 **Introduction**: Software Crisis, Need for Software Engineering, Professional Software Development, Software Engineering Ethics, Case Studies. **Software Processes**: Models: Waterfall Model, Incremental Model and Spiral Model. Process activities. **Requirements Engineering:** Requirements Engineering Processes, Requirements Elicitation and Analysis, Functional and non-functional requirements, The software Requirements Document, Requirements Specification, Requirements validation and management.	**08 Hours L2**
Module 2 **System Models:** Context models, Interaction models, Structural models, Behavioural models. **Design and Implementation**: Introduction to RUP, Design Principles, Object-oriented design using the UML, Implementation issues.	**08 Hours L2**

Module 3 **Software Testing**: Development testing, Test-driven development, Release testing, User testing. **Software Evolution:** Evolution processes, Program evolution dynamics, Software maintenance, Legacy system management	**08 Hours L2**
Module 4 **Project Planning**: Software pricing, Plan-driven development, Project scheduling Estimation techniques (Introduction to COCOMO model) **Quality management**: Software quality, Reviews and inspections, Software standards	**08 Hours L2**
Module 5 **Agile Software Development**: Coping with Change, The Agile Manifesto: Values and Principles. Agile methods: SCRUM (Ref "The SCRUM Primer, Ver2.0") and Extreme Programming, Plan-driven and agile development , Agile project management, Scaling agile methods	**08 Hours L2**

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

22ISE44.1	Understand the principles of software engineering process and its phases.
22ISE44.2	Outline the nature of software systems based on process and system models.
22ISE44.3	Explain the software testing and evolution processes.
22ISE44.4	Demonstrate project planning process and quality management.
22ISE44.5	Discuss software practices in agile methodology.

Textbooks:

1. **Software Engineering**, Ian Sommerville, 9th Edition, Pearson Education, 2017. (Listed topics only from Chapters 1,2,3,4, 5, 7, 8, 9, 23, and 24)

2. The SCRUM Primer, Ver 2.0, http://www.goodagile.com/scrumprimer/scrumprimer20.pdf

Reference books:

1. Software Engineering-A Practitioners Approach, Roger S. Pressman, 7th Edition, Tata McGraw Hill.
2. An Integrated Approach to Software Engineering, Pankaj Jalote:, Wiley India

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.

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 2.

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

	Component	Marks	Total Marks
	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	CIE Test- 3	**40**	
	Quiz 1/AAT	**05**	
	Quiz 2/AAT	**05**	
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**
22ISE44.1	3	3	3	-	-	2	2	3	1	1	-	2	3	2	-	-
22ISE44.2	3	3	3	-	1	2	2	3	1	1	-	2	3	2	-	-
22ISE44.3	3	3	2	-	1	2	2	2	1	1	-	2	3	2	-	-
22ISE44.4	3	3	2	-	-	1	1	1	1	1	2	2	3	2	-	-
22ISE44.5	3	3	3	-	2	1	1	1	1	1	1	2	3	2	-	-
Average	3	3	2.6	-	1.3	1.6	1.6	2	1	1	1.5	2	3	2	-	-

Low-1: Medium-2: High-3

SEMESTER –IV

Course: Data Communications

Course Code	22ISE45	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
No. of Credits	3	Examination Hours	3

Course Learning Objectives:

CLO1	Understand the basic concepts of data communication, layered model, protocols and interworking between computer networks
CLO2	Discuss the fundamentals of analog and digital signal and performance parameters.
CLO3	Discuss Digital and Analog conversion and various Error Detection and Correction techniques in data link layer.
CLO4	Demonstrate Link Layer services and Medium Access Control protocols for reliable and noisy channels.
CLO5	Comprehend the working of wireless and wired LANs.

Content	No.of Hours/ RBT levels
Module 1 **Introduction-** Data communications: Components, Data Representation, Data Flow; Networks: Network Criteria, Physical Structures; Network types: Local Area Network, Wide Area Network, Switching, The Internet, Accessing the Internet; Internet history: Early History, Birth of the Internet, Internet Today; standards and administration: Internet Standards, Internet Administration; **Network Models-** Protocol layering: Scenarios, Principles of Protocol Layering, Logical Connections; TCP/IP Protocol suite: Layered Architecture, Layers in the TCP/IP Protocol Suite, Description of Each Layer; The OSI model: OSI versus TCP/IP, Lack of OSI Model's Success;	**08 Hours** **L2**
Module 2 **Introduction to physical layer-** Data and signals: Analog and Digital Data, Analog and Digital Signals , Periodic and Nonperiodic; Digital signals: Bit Rate, Bit Length; Transmission Impairment: Attenuation , Distortion, Noise ; Data rate limits : Nyquist Bit Rate, Shannon Capacity; Performance: Bandwidth, Throughput , Latency (Delay) , Bandwidth-Delay Product, Jitter;	**08 Hours** **L3**
Module 3 **Digital Transmission-** Digital-to-Digital conversion: Line coding, Line coding schemes; Analog-to-Digital conversion: PCM. **Analog Transmission-**Digital to Analog conversion: Amplitude shift keying, Frequency shift keying, Phase shift keying, quadrature amplitude modulation; **Error detection & correction-** Introduction: Types of Errors, Redundancy, Detection versus Correction, Coding; Block coding: Error Detection; Cyclic codes: CRC, Polynomials; Checksum: Concept, Other Approaches to the Checksum;	**08 Hours** **L3**

Module 4 **Data link control**-DLC services: Framing, Flow and Error Control, Connectionless and Connection-Oriented; DLL protocols: Simple Protocol, Stop-and-Wait Protocol, Piggybacking; Point-to-Point Protocol: Framing, transition phases; **Media Access Control (MAC)**-Random Access: ALOHA, CSMA, CSMA/CD, CSMA/CA:Controlled Access: Reservation, Polling, Token Passing; Channelization: FDMA,TDMA, CDMA;	**08 Hours** **L2**
Module 5 **Wired LANs-**Ethernet protocol: IEEE Project 802, Ethernet Evolution; Standard Ethernet: Characteristics, Addressing; **Wireless LANs-** IEEE 802.11 PROJECT: Architecture, MAC sub layer, addressing mechanism; Bluetooth: Architecture, Bluetooth Layers; **Other Wireless Networks-** Cellular Telephony: Operation, First Generation (1G), Second Generation (2G) , Third Generation (3G), Fourth Generation (4G):	**08 Hours** **L2**

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

22ISE45.1	Explain the fundamentals of data communication
22ISE45.2	Differentiate between analog and digital signals and understand the performance parameter.
22ISE45.3	Apply analog and digital conversion techniques for data transmission in data link layer..
22ISE45.4	Describe the fundamentals of Data Link Control and Medium Access Control layers.
22ISE45.5	Outline the basics of Wired and Wireless LANs.

Textbooks:

1. Data Communications and Networking, Behrouz A. Forouzan, , Fifth Edition, Tata McGraw-Hill, 2017.

Reference books:

1. Communication Networks –Fundamental Concepts and Key architectures, Alberto Leon Garcia and Indra Widjaja, , Second Edition, Tata McGraw-Hill, 2004.
2.Data Communications and Networking, Wayne Tomasi, Introduction to, Pearson Education, 2005

MOOCs:

1. http://nptel.ac.in/courses.php?disciplineId=111
2. https://www.khanacademy.org/
3. https://www.class-central.com/subject (MOOCS)
4. E-learning: www.vtu.ac.in

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.

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 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**	
	Quiz 1/AAT	**05**	
	Quiz 2/AAT	**05**	
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
22ISE45.1	3	-	-	-	-	1	-	1	-	-	-	1	-	3	-	-
22ISE45.2	3	3	3	3	-	1	-	1	-	-	-	1	1	3	-	-
22ISE45.3	3	3	3	3	-	1	-	1	-	-	-	1	1		-	3
22ISE45.4	3	3	3	3	-	1	-	1	-	-	-	1	-	3	-	-
22ISE45.5	3	-	-	-	-	1	-	1	-	-	-	1	-	3	-	1
Average	**3**	**3**	**3**	**3**	**-**	**1**	**-**	**1**	**-**	**-**	**-**	**1**	**1**	**3**	**-**	**2**

Low-1: Medium-2: High-3

SEMESTER – IV

Course: Mobile Applications Development (Integrated)

Course Code	22ISE46	CIE Marks	50
Hours/Week (L: T:P)	2:0:2	SEE Marks	50
No. of Credits	3	Examination Hours	03

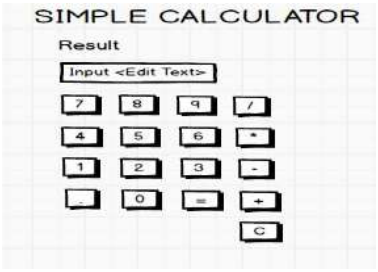
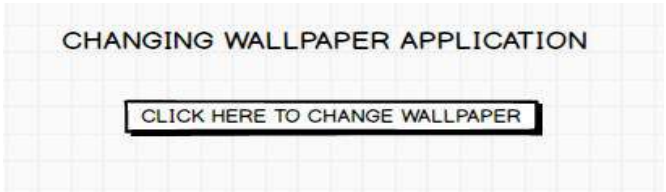
Prerequisites: Java Programming

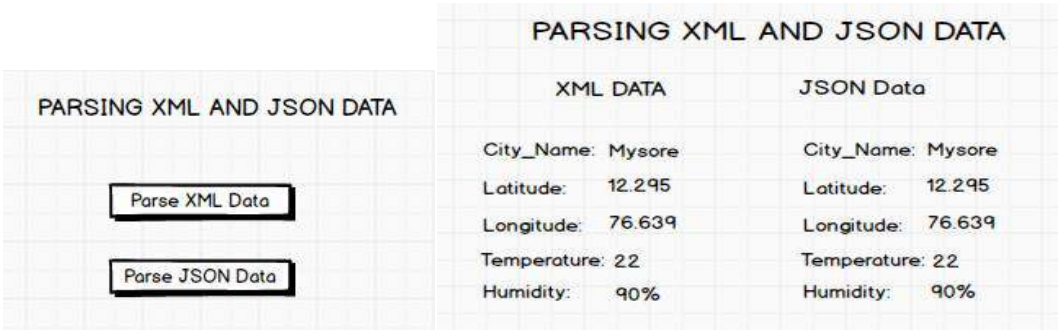
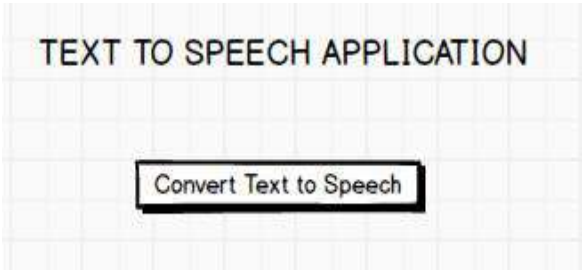
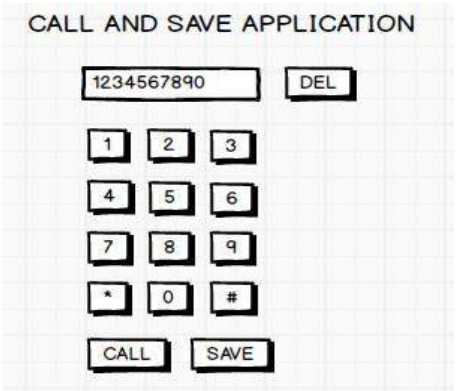
Course Learning Objectives:

CLO1	Learn to setup Android application development environment.
CLO2	Understand and illustrate user interfaces for interacting with apps.
CLO3	Implement views with pictures and menus for enhanced UI development.
CLO4	Identify options to save persistent application data.
CLO5	Publish robust android applications to cater to queries.

Content	No. of Hours/ RBT levels
Module1 Getting Started with Android Programming, Using Android Studio for Android Development, Activities, Fragments and Intents	**08 Hours L3**
Module2 Android User Interface, User Interface design with Views, User Interface Design with Layouts, Utilizing the Action Bar	**08 Hours L3**
Module3 Displaying pictures and menus with views, Using menus with views	**08 Hours L3**
Module4 Data Persistence: Saving and loading user preferences, Modifying and retrieving preference values, Persisting data to files	**08 Hours L3**
Module5 Creating and using data bases, content providers, predefined query string constants	**08 Hours L3**

Programs List	
1.	Create an application to design a Visiting Card. The Visiting card should have a company logo at the top right corner. The company name should be displayed in Capital letters, aligned to the center. Information like the name of the employee, job title, phone number, address, email, fax and the website address is to be displayed. Insert a horizontal line between the job title and the phone number. 

2	Develop an Android application using controls like Button, Text View, Edit Text for designing a calculator having basic functionality like Addition, Subtraction, Multiplication, and Division. 
3	Create a SIGN Up activity with Username and Password. Validation of password should happen based on the following rules: • Password should contain uppercase and lowercase letters. • Password should contain letters and numbers. • Password should contain special characters. • 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 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 display a toast message saying "Failed Login Attempts" and disable the SIGN IN button. Use Bundle to transfer information from one activity to another.  
4	Develop an application to set an image as wallpaper. On click of a button, the wallpaper image should start to change randomly every 30 seconds. 
5	Write a program to create an activity with two buttons START and STOP. On pressing of the START button, the activity must start the counter by displaying the numbers from One and the counter must keep on counting until the STOP button is pressed. Display the counter value in a Text View control. 

6	Create two files of XML and JSON type with values for City Name, Latitude, Longitude, Temperature, and Humidity. Develop an application to create an activity with two buttons to parse the XML and JSON files which when clicked should display the data in their respective layouts side by side. 
7	Develop a simple application with one Edit Text so that the user can write some text in it. Create a button called “Convert Text to Speech” that converts the user input text into voice. 
8	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. 

Course out comes:

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

22ISE46.1	Develop Android application by setting up Android development environment
22ISE46.2	Implement adaptive, responsive user interfaces that work across a wide range of devices.
22ISE46.3	Demonstrate enriched user interface design for Android applications
22ISE46.4	Integrate different data storage and retrieval preferences.
22ISE46.5	Apply query strings for robust applications.

Textbooks:

1. JFD iMarzio,"Beginning Android Programming withAndroidStudio",4th Edition, Wiley India Pvt Ltd, 2016. ISBN-13:978-812656558
2. Google Developer Training, "Android Developer Fundamentals Course – Concept Reference", Google Developer Training Team, 2017. https://www.gitbook.com/book/google-developer-training/android-developerfundamentals- course-concepts/details

Reference books:

1. Erik Hellman, "Android Programming – PushingtheLimits",1stEdition,WileyIndiaPvtLtd,2014.
2. Dawn Griffiths and David Griffiths, "Head First Android Development", 1st Edition, 'Reilly SPD Publishers, 2015.
3. Anubhav Pradhan, Anil V Deshpande, "Composing Mobile Apps" using Android, Wiley2014, ISBN:978-81- 265-4660-2
4. Google Developer Training, "Android Developer Fundamentals Course – Concept Reference", Google Developer Training Team, 2017. https://www.gitbook.com/book/google-developer-training/android-developer fundamentals course-concepts/details (Download pdf file from the above link)

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 40marks each. Marks scored in each test is reduced to 30 One lab CIE is conducted for 20 marks each and average is added to theory component.

Some possible AATs: seminar/ assignments/term paper/ open ended experiments/ miniprojects/ 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 Table2.

Table2: Distribution of weightage for CIE & SEE of Regular courses

	Component	Marks	Total Marks
CIE	CIETest-1	**30**	**50**
	CIETest-2	**30**	
	CIETest-3	**30**	
	Lab	**20**	
SEE	Semester End Examination	**100**	**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**
22ISE46.1	3	3	3	-	2	-	-	1	1	1	-	3	2	2	2	2
22ISE46.2	3	3	3	-	2	-	-	1	1	1	-	3	2	2	2	2
22ISE46.3	3	3	3	-	2	-	-	1	1	1	-	3	2	2	2	2
22ISE46.4	3	3	3	-	2	-	-	1	1	1	-	3	2	2	2	2
22ISE46.5	3	3	3	-	2	-	-	1	1	1	-	3	2	2	2	2
Average	3	3	3	-	2	-	-	1	1	1	-	3	2	2	2	2

Low-1: Medium-2: High-3

III Year

Scheme & Syllabus

2022 Batch

Scheme & Syllabus of UG Autonomous Program – 2022 batch
(5th & 6th Semester)

V-SEMESTER:

Sl. No	Course Code	Course Title	Course Type	Teaching Dept.	Teaching Hours/Week			Examination			CREDITS
					L	T	P	CIE	SEE	Total	
1	22ISE51	Software Project Management and Economics	PC	Respective Department	3	0	0	50	50	100	3
2	22ISE52	Computer Networks (Integrated)	IPC		3	0	2	50	50	100	4
3	22ISE53	Machine learning and its Applications (Integrated)	IPC		3	0	2	50	50	100	4
4	22ISE54	Theory of Computation	PC		3	0	0	50	50	100	3
5	22ISE55X	Program Elective 1	PEC		3	0	0	50	50	100	3
	22ISE56	Data Analytics using R	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	Respective Department	1	0	0	50	50	100	
TOTAL								**350**	**350**	**700**	**20**

Program Elective 1*		Program Elective 1*	
22ISE551	System Software	22ISE553	Object Oriented Modelling and Design
22ISE552	Optimization Techniques	22ISE554	Cloud Computing

***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.

VI-SEMESTER:

Sl. No.	Course Code	Course Title	Course Type	Teaching Dept.	Teaching Hours/Week			Examination			CREDITS
					L	T	P	CIE	SEE	Total	
1	22ISE61	Cryptography and Network Security	PC	Respective Department	3	0	0	50	50	100	3
2	22ISE62	Full Stack Development (Integrated)	IPC		3	0	2	50	50	100	4
3	22ISE63	Deep Learning (Integrated)	IPC		3	0	2	50	50	100	4
4	22ISE64X	Program Elective 2	PEC		3	0	0	50	50	100	3
5	22ISE65X	Open Elective 1	OEC	Offering Department	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	Respective Department							
7	22ISEMP67	Mini Project	MP	Respective Department	Two Contact hours per week			50	50	100	2
Total								**350**	**350**	**700**	**20**

Program Elective 2*		**Program Elective 2***	
22ISE641	Business Intelligence	22ISE643	Software Testing
22ISE642	Computer Graphics	22IES644	Wireless Sensor Networks
Open Elective 1 (Offered to other branch students)			
22ISE651	Data Structures using C	22ISE653	Introduction to DBMS
22ISE652	Internet and Network Security	22ISE654	Introduction to Web Technologies

***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.

5th Semester Syllabus

SEMESTER – V

Course: Software Project Management and Economics

Course Code	22ISE51	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
No. of Credits	03	Examination Hours	3

Prerequisites:

Course Learning Objectives

CLO1	Gain an overview on project management framework, knowledge areas, financial management
CLO2	Examine the knowledge areas of software project management for various stakeholders' requirements.
CLO3	Prepare a cost estimate and budget for software projects along with various risk assessment.
CLO4	Envisage HR principles, quality management for model of entrepreneurship management in varied environments, and managing startups

Contents	No. of Hours RBT Level
Module 1 **INTRODUCTION,** Purpose of the *PMBOK,* What is a Project? The Relationships Among Portfolios, Programs, and Projects, What is Project, Management?, Relationships Among Portfolio Management, Program Management, Project, Management, and Organizational Project ,Management, Program Management, Portfolio Management ,Projects and Strategic Planning, Project Management Office. **ORGANIZATIONAL INFLUENCES AND PROJECT LIFE CYCLE** Organizational Influences on Project Management, Organizational Cultures and Styles, Organizational Communications., Organizational Structures, Organizational Process Assets, Enterprise Environmental Factors, Project Stakeholders and Governance, Project Stakeholders, Project Governance, Project Success, Project Team, Composition of Project Teams, Project Life Cycle, Characteristics of the Project Life Cycle, Project Phases	**08 Hours L2**
Module 2 **PROJECT MANAGEMENT PROCESSES** Common Project Management Process Interactions, Project Management Process Groups, Initiating Process Group, Planning Process Group., Executing Process Group, Monitoring and Controlling Process Group, Closing Process Group, Project Information, Role of the Knowledge Areas **PROJECT INTEGRATION MANAGEMENT-**Develop Project Charter, Develop Project Charter: Inputs, Develop Project Charter: Tools and Techniques, Develop Project Charter: Outputs, Develop Project Management Plan, Develop Project Management Plan: Inputs, Develop Project Management Plan: Tools and Techniques, Develop Project Management Plan: Outputs	**08 Hours L3**

Module 3 **DIRECT AND MANAGE PROJECT WORK-**Direct and Manage Project Work: Inputs, Direct and Manage Project Work: Tools and Techniques, Direct and Manage Project Work: Outputs, Monitor and Control Project Work, Monitor and Control Project Work: Inputs, Monitor and Control Project Work: Tools and Techniques., Monitor and Control Project Work: Outputs, Perform Integrated Change Control, Perform Integrated Change Control: Inputs, Perform Integrated Change Control: Tools and Techniques, Perform Integrated Change Control: Outputs **PROJECT TIME MANAGEMENT-** Plan Schedule Management, Plan Schedule Management: Inputs, Plan Schedule Management: Tools and Techniques, Plan Schedule Management: Outputs, Define Activities, Define Activities: Inputs, Define Activities: Tools and Techniques, Define Activities: Outputs, Sequence Activities, Sequence Activities: Inputs, Sequence Activities: Tools and Techniques, Sequence Activities: Outputs, Estimate Activity Resources, Estimate Activity Resources: Inputs, Estimate Activity Resources: Tools and Techniques, Estimate Activity Resources: Outputs	**08 Hours** **L3**
Module 4 **PROJECT HUMAN RESOURCE MANAGEMENT-** Plan Human Resource Management, Plan Human Resource Management: Inputs, Plan Human Resource Management: Tools and Techniques, Plan Human Resource Management: Outputs, Acquire Project Team, Acquire Project Team: Inputs, Acquire Project Team: Tools and Techniques, Acquire Project Team: Outputs, Develop Project Team, Develop Project Team: Inputs, Develop Project Team: Tools and Techniques, Develop Project Team: Outputs Manage Project Team- Manage Project Team: Inputs, Manage Project Team: Tools and Techniques, Manage Project Team: Outputs **PROJECT RISK MANAGEMENT-** Plan Risk Management, Plan Risk Management: Inputs, Plan Risk Management: Tools and Techniques, Plan Risk Management: Outputs, Identify Risks, Identify Risks: Inputs, Identify Risks: Tools and Techniques, Identify Risks: Outputs, Perform Qualitative Risk Analysis, Perform Qualitative Risk Analysis: Inputs, Perform Qualitative Risk Analysis: Tools and Techniques, Perform Qualitative Risk Analysis: Outputs, **Plan Risk Responses-** Plan Risk Responses: Inputs, Plan Risk, Responses: Tools and Techniques, Plan Risk Responses: Outputs, Control Risks, Control Risks: Inputs, Control Risks: Tools and Techniques, Control Risks: Outputs	**08 Hours** **L3**
Module 5 **PROJECT COST MANAGEMENT-** Plan Cost Management, Plan Cost Management: Inputs, Plan Cost Management: Tools and Techniques, Plan Cost Management: Outputs, Estimate Costs, Estimate Costs: Inputs, Estimate Costs: Tools and Techniques, Estimate Costs: Outputs, Determine Budget, Determine Budget: Inputs, Determine Budget: Tools and Techniques, Determine Budget: Outputs, Control Costs, Control Costs: Inputs, Control Costs: Tools and Techniques, Control Costs: Outputs **PROJECT QUALITY MANAGEMENT-** Plan Quality Management, Plan Quality Management: Inputs, Plan Quality Management: Tools and Techniques, Plan Quality Management: Outputs, Perform Quality Assurance, Perform Quality Assurance: Inputs, Perform Quality Assurance: Tools and Techniques., Perform Quality Assurance: Outputs, Control Quality, Control Quality: Inputs, Control Quality: Tools and Techniques, Control Quality: Output	**08 Hours** **L2**

COURSE OUTCOMES

Upon completion of this course, student will be able to

22ISE51.1	Gain an overview on project management framework, knowledge areas, financial management
22ISE51.2	Examine the knowledge areas of software project management, monitor, and integrate change control.
22ISE51.3	Describe the need of direct and manage project work and time management of project work.
22ISE51.4	Envisage HR principles, model of entrepreneurship and risk management.
22ISE51.5	Prepare a cost estimate and budget for software projects along with quality assessment.

Text Books:

1. A Guide to the Project Management Body of Knowledge (PMBOK Guide)-5th edition

Reference Book:

1. Project Management by Vasant Desai, Himalaya Publishing House

E-Books / Web References:

http://www.opentextbooks.org.hk/system/files/export/15/15694/pdf/Project_Management_15694.pdf

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. Marks scored in each test is reduced to 20 and added to test component.

CIE is executed by way of two quizzes / Alternate Assessment Tools (AATs), and three tests.

Quizzes can to be conducted and each quiz can be evaluated for 5 marks adding up to 10 marks.

All quizzes are conducted online. Faculty may adopt innovative methods for conducting quizzes effectively.

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 2.

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**	
	Quiz 1/AAT	**05**	
	Quiz 2/AAT	**05**	
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
22ISE51.1	2	2	2	-	-	-	-	-	-	-	2	-	1	-	-	-
22ISE51.2	2	2	2	-	1	-	-	3	2	-	2	-	1	-	-	-
22ISE51.3	2	2	2	-	1	-	-	-	-	-	2	-	1	-	-	-
22ISE51.4	2	2	-	-	1	-	-	3	2	-	2	2	-	-	-	-
22ISE51.5	2	2	-	-	-	-	-	3	-	-	2	2	-	-	-	-
Average	**2**	**2**	**2**	**-**	**1**	**-**	**-**	**3**	**2**	**-**	**2**	**2**	**1**	**-**	**-**	**-**

Low-1: Medium-2: High-3

Semester- V

Course Name: Computer Networks (Integrated)

Course Code	22ISE52	CIE Marks	50
Hours/Week (L: T: P)	3:0:2	SEE Marks	50
No. of Credits	4	Examination Hours	03

Prerequisites: Data Communications

Course Learning Objectives:

CLO1	Demonstration of application layer protocols
CLO2	Discuss transport layer services and understand UDP and TCP protocols
CLO3	Explain routers, IP and Routing Algorithms in network layer
CLO4	Understand the different Network Security Concepts
CLO5	Discuss Wireless networks and Mobile Networks concepts

Content	No. ofHours /RBT Level
Module 1 **Application Layer:** Principles of Network Applications: Network Application Architectures, Transport Services Available to Applications, Transport Services Provided by the Internet, Application-Layer Protocols. The Web and HTTP: Overview of HTTP, Non-persistent and Persistent Connections, HTTP Message Format, User-Server Interaction: Cookies, Web Caching, The Conditional GET, File Transfer: FTP Commands & Replies, Electronic Mail in the Internet: SMTP, Comparison with HTTP, Mail Message Format, Mail Access Protocols, DNS; The Internet's Directory Service: Services Provided by DNS, Overview of How DNS Works, DNS Records and Messages	**10 Hours L1, L2, L3**
Module 2 **Transport Layer:** Introduction and Transport-Layer Services: Overview of the Transport Layer in the Internet,: Connectionless Transport: UDP, UDP Segment Structure, UDP Checksum, Principles of Reliable Data Transfer: Building a Reliable Data Transfer Protocol, Pipelined Reliable Data Transfer Protocols, Go-Back-N, Selective repeat, Connection-Oriented Transport TCP: The TCP Connection, TCP Segment Structure, Reliable Data Transfer, Flow Control, TCP Connection Management, Principles of Congestion Control: The Causes and the Costs of Congestion, Approaches to Congestion Control, TCP Congestion Control: Fairness.	**10 Hours L1, L2, L3**
Module 3 **The Network layer:** What's Inside a Router? Input Processing, Switching, Output Processing. The Internet Protocol: datagram format, IPv4 addressing, ICMP, IPv6, Routing Algorithms: The Link-State (LS) Routing Algorithm, The Distance-Vector (DV) Routing Algorithm.	**10 HoursL1, L2, L3**

Module 4 **Network Security:** Overview of Network Security: Elements of Network Security, Classification of Network Attacks, Security Methods, Symmetric-Key Cryptography: Data Encryption Standard (DES), Advanced Encryption Standard (AES), Public-Key Cryptography: RSA Algorithm, Diffie-Hellman Key-Exchange Protocol, Authentication: Hash Function, Secure Hash Algorithm (SHA), Digital Signatures, Firewalls and Packet Filtering, Packet Filtering, Proxy Server.	**10 Hours** **L1, L2, L3**
Module 5 **Wireless and Mobile Networks:** Cellular Internet Access: An Overview of Cellular Network Architecture, 3G Cellular Data Networks: Extending the Internet to Cellular subscribers, On to 4G: LTE, Mobility management: Principles, Addressing, Routing to amobile node, Mobile IP, Managing mobility in cellular Networks, Routing calls to a Mobile user, Handoffs in GSM	**10 Hours** **L1, L2, L3**

COURSE OUTCOMES (CO)

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

22ISE52.1	Understand principles of application layer protocols
22ISE52.2	Explain transport layer UDP and TCP protocols services
22ISE52.3	Summarize Internet Protocol and network layer routing algorithms
22ISE52.4	Understand different network security algorithms.
22ISE52.5	Discuss the wireless and mobile network covering IEEE 802.11 standard

Text Books:

1. **James F Kurose and Keith W Ross,** Computer Networking, A Top-Down Approach, Sixth edition,Pearson,2017.

Reference books:

1. Behrouz A Forouzan, Data and Communications and Networking, Fifth Edition, McGraw Hill,Indian Edition
2. Larry L Peterson and Brusce S Davie, Computer Networks, fifth edition, ELSEVIER
3. Andrew S Tanenbaum, Computer Networks, fifth edition, Pearson
4. Mayank Dave, Computer Networks, Second edition, Cengage Learning

E-Books / Web References:

1. 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
2. http://eti2506.elimu.net/Introduction/Books/Data%20Communications%20and%20Networking %20By%20Behrouz%20A.Forouzan.pdf

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 for the theory component are to be conducted for 40 marks each. Marks scored in each test is reduced to 30. Average of three test will be considered. The Lab CIE is conducted for 20 marks and is added to the theory component.

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	**30**	**50**
	CIE Test-2	**30**	
	CIE Test-3	**30**	
	Laboratory Test	**20**	
SEE	Semester End Examination	**100**	**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
22ISE52.1	1	-	-	-	-	1	-	-	-	-	-	3	-	2	-	-
22ISE52.2	1	-	-	-	-	1	-	-	-	-	-	3	-	2	-	-
22ISE52.3	2	2	1	1	-	1	-	-	-	-	-	3	-	2	-	-
22ISE52.4	1	-	-	-	-	1	-	-	-	-	-	3	-	2	-	2
22ISE52.5	1	-	-	-	-	1	-	-	-	-	-	3	-	2	-	-
Average	**1**	**2**	**1**	**1**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**2**	**-**	**2**

High-3: Medium-2: Low-1

Sl No	Programs List	No. of Hours/ RBT levels
	PART A	
1	Implement Ring topology and Bus topology operation using NS2.	**L3**
2	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 in NS2.	**L3**
3	Implement an Ethernet LAN using n nodes and set multiple traffic nodes and plot congestion window for different source / destination using NS2 Simulator.	**L3**
4	Write a NS2 script to Implement the operation of Stop and Wait Protocol.	**L3**
5	Implement simple ESS and with transmitting nodes in wire-less LAN by simulation and determine the performance with respect to transmission of packets using NS2 Simulator.	**L3**
	PART B	
6	Write a Java program for error detecting code using CRC-CCITT (16- bits).	**L3**
7	Write a java program to find the shortest path between vertices using bellman-ford algorithm.	**L3**
8	Write a java program for congestion control using leaky bucket algorithm	**L3**
9	Write a java program to implement RSA algorithm, to encrypt the data while sending it and decrypt while receiving	**L3**
10	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	**L3**

SEMESTER -V

Course: Machine Learning and its Applications (Integrated)

Course Code	22ISE53	CIE Marks	50
Hours/Week (L: T: P)	3:0:2	SEE Marks	50
No. of Credits	4	Examination Hours	03

Course Learning Objectives: Python programming

CLO1	To Understand the need of statistical analysis of machine learning techniques.
CLO2	Familiarize the concepts machine learning and problems relevant to machine learning.
CLO3	Understand supervised, unsupervised & Reinforcement learning algorithms
CLO4	Familiarize neural networks, Bayesian classifier and k nearest neighbor for solving problems in machine learning.

Content	No.of Hours/ RBT levels
Module 1 **Exploratory Data Analysis :** Estimates of Location, Estimates of Variability, Exploring the Data Distribution, Exploring Binary and Categorical Data, Exploring Two or More Variables. **Random Variables and Probability Distributions:** Conditional Probability and Independence, Random Variables, Distributions of Random Variables, Discrete Distributions, Continuous Distributions, Sampling Distribution of a Statistic, Normal Distribution, Binomial Distribution, Chi-Square Distribution, F-Distribution, Poisson and Related Distributions.	**10 Hours L3**
Module 2 **Concept Learning:** Concept learning task, Concept learning as search, Find-S algorithm, Candidate Elimination Algorithm, Inductive bias of Candidate Elimination Algorithm. **Decision Tree Learning :**Introduction, Decision tree representation, Appropriate problems, ID3 algorithm, Ensembles of Decision Trees.	**10 Hours L3**
Module 3 **Bayesian Learning:** Introduction, Bayes theorem, Bayes theorem and concept learning, ML and LS error hypothesis, ML for predicting, MDL principle, Bates optimal classifier, Gibbs algorithm, Naive Bayes classifier, BBN, EM Algorithm.	**10 Hours L3**
Module 4 **Regression:** Linear Regression, Multi Linear Regression, Locally weighted regression **Unsupervised Learning** : k-Means Clustering, Agglomerative Clustering **Instance-Base Learning:** Introduction, k-Nearest Neighbour Learning Kernelized Support Vector Machines , Dimensionality Reduction, Feature Extraction	**10 Hours L3**

Module 5	
Artificial Neural Network : Introduction, NN representation, Appropriate problems, Perceptron, Backpropagation algorithm. **Reinforcement Learning:** Introduction, The learning task, Q-Learning.	**10 Hours L3**

Program List	
1	Write a python program to import and export data using Pandas library functions. Demonstrate various data pre-processing techniques for a given dataset
2	For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
3	Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
4	a) Implement Random forest ensemble method on a given dataset. b) Implement Boosting ensemble method on a given dataset.
5	a) Write a program to implement the Linear Regression for a sample training data set stored as a .CSV file. Compute Mean Square Error by considering few test data sets. b) Write a program to implement the Logistic Regression for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier.
6	Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
7	Write a program to implement Support Vector Machine algorithm to classify the iris data set. Print both correct and wrong predictions.
8	Write a program to calculate the accuracy, precision, and recall for your data set. Assume a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task.
9	Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.
10	a) Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. b) Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same dataset for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.

COURSE OUTCOMES:

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

22ISE53.1	Apply Statistical methods and probability for Machine Learning
22ISE53.2	Solve machine learning problems using Concept learning and Decision Tree Learning Algorithm
22ISE53.3	Apply Bayesian Techniques and derive effective learning rules techniques
22ISE53.4	Apply Regression, SVM and unsupervised learning models to solve appropriate problems
22ISE53.5	Apply Artificial Neural Networks algorithms for classification problems and Reinforcement Learning Algorithms.

Textbooks:

1. Practical Statistics for Data Scientists: 50+ Essential Concepts Using R and Python, Peter Bruce,Andrew Bruce, Peter Gedeck,2nd edition, O'Reilly Media, Inc., 1005 Gravenstein Highway North, Sebastopol, CA 95472.
2. Probability and Statistics:The Science of Uncertainty,Second Edition, Michael J. Evans and Jeffrey S.,Rosenthal University of Toronto.
3. Tom M. Mitchell, Machine Learning, McGraw Hill Education, India Edition 2013.
4. Introduction to Machine Learning with Python, Andreas C. Muller and Sarah Guido, O'Reilly Media

Reference books:

1. Ethem Alpaydın, Introduction to machine learning, MIT press, Third edition.
2. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning, Springer series in statistics, 2nd edition.
3. Dipanjan Sarkar,Raghav Bali ,Tushar Sharma, "Practical Machine Learning with Python-A Problem Solver's Guide to Building Real-World Intelligent Systems",APress,2018.
4. Andreas C. Müller, Sarah Guido, "Introduction to Machine Learning with Python", 1st edition, Oreilly Publications, 2016
5. Kevin P. Murphy , Francis Bach , "Machine Learning: A Probabilistic Perspective (Adaptive Computation and Machine Learning) 1st Edition, Massachusets Institute of Technology, 2012
6. Anil Maheswari, Data Analytics, McGraw Hill, India, 2017
7. Elaine Rich, Kevin K and S B Nair, Artificial Intelligence, 3rd Edition,McGraw Hill Education, 2017.
8. Saroj Kaushik, Artificial Intelligence, 2nd Edition, Cengage Publications, 2022

MOOCs

1. http://nptel.ac.in
2. https://www.khanacademy.org/
3. https://www.class-central.com
4. E-learning: www.vtu.ac.in

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 for the theory component are to be conducted for 40 marks each. Marks scored in each test is reduced to 30. Average of three test will be considered. Two lab CIE are conducted for 20 marks each and the average is added to the theory component.

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 Test-1	**30**	**50**
	CIE Test-2	**30**	
	CIE Test- 3	**30**	
	Laboratory	**20**	
SEE	Semester End Examination	**100**	**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
22ISE53.1	3	3	3	-	2	-	-	-	-	-	-	2	2	-	-	-
22ISE53.2	3	3	3	-	2	-	-	-	-	-	-	2	2	-	-	-
22ISE53.3	3	3	3	-	2	-	-	-	-	-	-	2	2	-	-	-
22ISE53.4	3	3	3	-	2	-	-	-	-	-	-	2	2	-	-	-
22ISE53.5	3	3	3	-	2	-	-	-	-	-	-	2	2	-	-	-
Average	**3**	**3**	**3**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**-**	**-**	**-**

Low-1: Medium-2: High-3

SEMESTER – V

Course: Theory of Computation

Course Code	22ISE54	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
No. of Credits	3	Examination Hours	03

Prerequisites: Set theory, mathematical induction, functions relations, elements of mathematical reasoning, and proof techniques.

Course Learning Objectives:

CLO1	Explain the core concepts in Automata and Theory of Computation
CLO2	Identify different Formal language Classes and their Relationships
CLO3	Design Grammars and Recognizers for different formal languages
CLO4	Identify theorems in automata theory using their properties
CLO5	Determine the decidability and intractability of Computational problems

Content	No. of Hours/ RBT levels
Module 1 **Why study the Theory of Computation, Languages and Strings:** Strings, Languages. A Language Hierarchy, Computation. **Finite State Machines (FSM):** Deterministic FSM, Regular languages, Designing FSM, Nondeterministic FSMs, Minimizing FSM, Finite State Transducers.	**08 Hours** **L3**
Module 2 **Regular Expressions**: what is a Regular Expression? Kleene's theorem, Applications of Regular Expressions, Manipulating and Simplifying RE's . **Regular Grammars:** Definition, Regular Grammars and Regular languages. **Regular Languages, Properties of Regular Languages:** Regular Languages (RL) and Non-regular Languages: How many RL's, To show that a language is regular, Closure properties of RLs, to show some languages are not RL's.	**08 Hours** **L3**
Module 3 **Context-Free Grammars(CFG):** Introduction to Rewrite Systems and Grammars, CFG's and languages, designing CFG's, simplifying CFGs, proving that a Grammar is correct, Derivation and Parse trees, Ambiguity, Normal Forms. **Pushdown Automata (PDA):** Definition of (non-deterministic) PDA, Deterministic and Non-deterministic PDAs, Equivalence of Context-Free Grammars and PDA's: Building a PDA from a Grammar.	**08 Hours** **L3**
Module 4 **Context-Free Languages:** The Pumping Theorem for Context-Free Languages, Closure properties of Context-Free Languages. **Turing Machines:** Turing machine model, Representation, Language acceptability by TM,design of TM, Techniques for TM construction.	**08 Hours** **L3**

Module 5	
Types of Turing machine: Variants of Turing Machines (TM), The model of Linear Bounded automata. **Decidability:** Definition of an algorithm, decidability, decidable languages, Undecidable languages, halting problem of TM, Post correspondence problem. Complexity: Growth rate of functions, the classes of P and NP, Quantum Computation: quantum computers, Church Turing thesis.	**08 Hours** **L3**

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

22ISE54.1	Choose different combinatorial methods to design computational models.
22ISE54.2	Apply formal mathematical methods to prove properties of languages, grammars, and automata.
22ISE54.3	Interpret various algorithms used for restricted machine models of computation.
22ISE54.4	Identify limitations of computational models and suggest possible methods of improving the same.
22ISE54.5	Distinguish between decidability and undecidability languages of Turing machine

Textbooks:

1.Elaine Rich, Automata, Computability and Complexity, 1st Edition, Pearson education, 2012/2013. (Chapters: 1,2,3.3.4,5.1 to 5.4,5.7,5.9,6.1 to 6.4 ,7.1,7.2,8.1 to 8.4,11.1 to 11.8.12.1,12.2,12.3.1,13.3,13.4)
2.K L P Mishra, N Chandrasekaran, 3rd Edition, Theory of Computer Science, PHI, 2012. (Chapters 9.1 to 9.8, 10.1 to 10.7, 12.1, 12.2, 12.8, 12.8.1, 12.8).

Reference books:

1. Introduction to Languages and the Theory of Computation, John C Martin, TMH.
2. Introduction to Formal languages Automata Theory and Computation Kamala Krithivasan, Rama R, Pearson.
3. John E Hopcroft, Rajeev Motwani, Jeffery D Ullman, Introduction to Automata Theory, Languages, and Computation, 3rd Edition, Pearson Education, 2013

MOOCs (Format is given below)

1. http://nptel.iitm.ac.in/
2. https://www.khanacademy.org/
3. https://www.class-central.com (MOOCS)
4. E-learning: www.vtu.ac.in

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.

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 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**	
	Quiz 1/AAT	**05**	
	Quiz 2/AAT	**05**	
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
22ISE54.1	3	3	3	3	-	-	-	-	-	-	-	2	2	2	-	-
22ISE54.2	3	3	3	3	-	-	-	-	-	-	-	2	2	2	-	-
22ISE54.3	3	3	3	3	-	-	-	-	-	-	-	2	2	2	-	-
22ISE54.4	3	3	3	3	-	-	-	-	-	-	-	2	2	2	-	-
22ISE54.5	3	3	3	3	-	-	-	-	-	-	-	2	2	2	-	-
Average	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**2**	**-**	**-**

Low-1: Medium-2: High-3

SEMESTER – V

Course: System Software

Course Code	22ISE551	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
No. of Credits	3	Examination Hours	3

Prerequisites: Basics of Computers

Course Learning Objectives

CLO1	Explain SIC and SIC/XE Machine Architecture.
CLO2	Discuss Assembler and loader functions features with design options
CLO3	Understand Basic Macro processors
CLO4	Explain programming features of Lex and Yacc

Contents	No. of Hours RBT Level
Module 1 Introduction, System Software and Machine Architecture, Simplified Instructional Computer (SIC) - SIC Machine Architecture, SIC/XE Machine Architecture, SIC Programming Examples. Assemblers -1: Basic Assembler Function - A Simple SIC Assembler, Assembler Algorithm and Data Structures	**08 Hours L2**
Module 2 Machine Dependent Assembler Features - Instruction Formats & Addressing Modes, Program Relocation. Machine Independent Assembler Features – Literals, Symbol-Definition Statements, Expression, Program Blocks, Control Sections and Programming Linking, Assembler Design Operations - OnePass Assembler, Multi-Pass Assembler, Implementation Examples - MASM Assembler.	**08 Hours L3**
Module 3 Loaders and Linkers: Basic Loader Functions - Design of an Absolute Loader, A Simple Bootstrap Loader, Machine-Dependent Loader Features – Relocation, Program Linking, Algorithm and Data Structures for a Linking Loader; Machine-Independent Loader Features - Automatic Library Search, Loader Options, Loader Design Options - Linkage Editor, Dynamic Linkage, Bootstrap Loaders, Implementation Examples - MS-DOS Linker.	**08 Hours L3**
Module 4 Macro Processor: Basic Macro Processor Functions - Macro Definitions and Expansion, Macro Processor Algorithm and Data Structures, MachineIndependent Macro Processor Features - Concatenation of Macro Parameters, Generation of Unique Labels, Conditional Macro Expansion, Keyword Macro Parameters, Macro Processor Design Options - Recursive Macro Expansion, General-Purpose Macro Processors, Macro Processing Within Language Translators, Implementation Examples - MASM Macro Processor, ANSI C Macro Processor.	**08 Hours L3**

Module 5	
Lex and Yacc – 1: Lex and Yacc - The Simplest Lex Program, Recognizing Words With LEX, Symbol Tables, Grammars, Parser-Lexer Communication, The Parts of Speech Lexer, A YACC Parser, The Rules Section, Running LEX and YACC, LEX and Hand- Written Lexers, Using LEX - Regular Expression, Examples of Regular Expressions, A Word Counting Program, Parsing a Command Line. Using YACC – Grammars, Recursive Rules, Shift/Reduce Parsing, What YACC Cannot Parse, A YACC Parser - The Definition Section, The Rules Section, Symbol Values and Actions	**08 Hours L3**

COURSE OUTCOMES

Upon completion of this course, student will be able to

22ISE551.1	Outline the fundamentals of SIC and SIC/XE Machine Architecture.
22ISE551.2	Illustrate machine dependent and machine independent assembler features.
22ISE551.3	Discuss machine dependent and machine independent loader features.
22ISE551.4	Explain Macro Processor functions, features and design options
22ISE551.5	Illustrate Lex and Yacc using programs.

Text Books

1. Leland.L.Beck, D. Manjula : System Software, 3rd Edition, Pearson Education, 1997.
2. John.R.Levine, Tony Mason and Doug Brown: Lex and Yacc, O'Reilly, SPD, 1998.

Reference Books

1. D.M.Dhamdhere: System Programming and Operating Systems, 2nd Edition, Tata McGraw - Hill, 1999.

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.
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 2.

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	Component	Marks	Total Marks
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	CIE Test-3	**40**	
	Quiz 1/AAT	**05**	
	Quiz 2/AAT	**05**	
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
22ISE551.1	2	2	2	-	-	-	-	-	-	-	-	-	-	-	2	-
22ISE551.2	2	2	2	-	-	-	-	-	-	-	-	-	-	-	2	-
22ISE551.3	2	2	2	-	-	-	-	-	-	-	-	-	-	-	2	-
22ISE551.4	2	2	2	-	-	-	-	-	-	-	-	-	-	-	2	-
22ISE551.5	2	2	2	-	1	-	-	-	-	-	-	1	-	-	2	-
Average	2	2	2	-	1	-	-	-	-	-	-	1	-	-	2	-

Low-1: Medium-2: High-3

SEMESTER – V

Course: Optimization Techniques

Course Code	22ISE552	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
No. of Credits	03	Examination Hours	03

Prerequisite: Probability, statics and Linear Algebra

Course Learning Objectives:

CLO1	Formulate optimization problem as a linear programming problem.
CLO2	Solve optimization problems using simplex method.
CLO3	Formulate and solve transportation and assignment problems.
CLO4	Apply game theory for decision making problems.

Content	No. of Hours/ RBT levels
Module 1 **Introduction, Linear Programming:** Introduction: The origin, nature and impact of OR; Defining the problem and gathering data; Formulating a mathematical model; Deriving solutions from the model; Testing the model; Preparing to apply the model; Implementation. **Introduction to Linear Programming Problem (LPP):** Prototype example, Assumptions of LPP, Formulation of LPP and Graphical method various examples.	**08 Hours L2**
Module 2 **Simplex Method – 1:** The essence of the simplex method; Setting up the simplex method; Types of variables, Algebra of the simplex method; the simplex method in tabular form; Tie breaking in the simplex method, Big M method, Two phase method.	**08Hours L3**
Module 3 **Simplex Method – 2: Duality Theory -**The essence of duality theory, Primal dual relationship, conversion of primal to dual problem and vice versa. The dual simplex method.	**08 Hours L3**
Module 4 **Transportation and Assignment Problems:** **The Transportation problem:** Initial Basic Feasible Solution (IBFS) by North West Corner Rule method, Matrix Minima Method, Vogel's Approximation Method. Optimal solution by Modified Distribution Method (MODI). **The Assignment problem:** A Hungarian algorithm for the assignment problem. Minimization and Maximization varieties in transportation and assignment problems.	**08 Hours L3**

Module 5	
Game Theory: The formulation of two persons, zero sum games; saddle point, maximin and minimax principle, Solving simple games- a prototype example; Games with mixed strategies; Graphical solution procedure. **Metaheuristics:** The nature of Metaheuristics, Tabu Search, Simulated Annealing, Genetic Algorithms.	**08 Hours L3**

COURSE OUTCOMES:

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

22ISE552.1	Understand the verbal description of the problem to formulate Linear programming model.
22ISE552.2	Apply Graphical, Simplex, Two Phase, and Big-M, to solve Linear Programming Problem.
22ISE552.3	Apply Duality Theory and Dual Simplex Method to solve Linear Programming Problem.
22ISE552.4	Apply optimization techniques to solve transportation and assignment problems.
22ISE552.5	Apply game strategies to solve simple games and optimization of metaheuristic techniques.

Textbooks:

1. D.S. Hira and P.K. Gupta, Operations Research, (Revised Edition), Published by S. Chand & Company Ltd, 2014.

Reference books:

1. S Kalavathy, Operation Research, Vikas Publishing House Pvt Limited.
2. S D Sharma, Operation Research, Kedar Nath Ram Nath Publishers.

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.

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.

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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**	
	Quiz 1/AAT	**05**	
	Quiz 2/AAT	**05**	
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**
22ISE552.1	3	3	3	2	-	-	-	-	-	-	-	2	-	2	-	-
22ISE552.2	3	3	3	2	-	-	-	-	-	-	-	2	-	2	-	-
22ISE552.3	3	3	3	2	-	-	-	-	-	-	-	2	-	2	-	-
22ISE552.4	3	3	3	2	-	-	-	-	-	-	-	2	-	2	-	-
22ISE552.5	3	3	3	2	2	-	-	-	-	-	-	2	-	2	-	-
Average	**3**	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**2**	**-**	**-**

Low-1: Medium-2: High-3

SEMESTER – V

Course: Object Oriented Modelling and Design

Course Code	22ISE553	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
No. of Credits	3	Examination Hours	3

Prerequisites: Software Engineering, Object Oriented Concepts

Course Learning Objectives

CLO1	Become familiar with all phases of Object-Oriented Modeling and Design
CLO2	Master the main features of the Unified Modeling Language (UML) and its usage.
CLO3	Master the main concepts of object technologies and how to apply them at work
CLO4	Develop the ability to analyze and solve challenging problem domains using UML models
CLO5	Understand and design the reusable design pattern principles and apply them towards the implementation of software solutions.

Contents	No. of Hours RBT Level
Module 1 **Introduction:** What is Object Orientation? What is OO development? Object Oriented themes; Evidence for usefulness of OO Development; **Modeling as Design Technique**: Modeling, The object modeling technique; **Class Modeling:** Object and class concepts, Link and associations concepts, Generalization and inheritance; A sample class model, **Advanced Class Modeling**: Advanced object and class concepts; Association ends; N-ary associations; Aggregation, Abstract classes; Multiple inheritance; Metadata; Reification Constraints;	**08 Hours L2**
Module 2 **State Modeling**: Events, States, Transitions and Conditions, State diagrams; State diagram behavior, Practical tips, **Advanced State Modeling**: Nested state diagrams , Nested states, Signal generalization; Concurrency ,A sample state model; Relation of class and state models; Practical tips, **Interaction Modeling**: Use case models; Sequence models, Activity models, Advanced Interaction Modeling, Use case relationships; Procedural sequence models Special constructs for activity models, Process Overview: Development stages; Development life cycle.	**08 Hours L3**
Module 3 **Domain Analysis**: Overview of analysis, Domain class model; Domain state model, Domain interaction model; Iterating the analysis, **Application Analysis**: Application interaction model; Application class model, Application state model; Adding operations **System Design** :Overview of system design; Estimating performance; Making a reuse plan; Breaking a system in to subsystems, Identifying concurrency; Allocation of sub-systems; Management of data storage; Handling global resources, Choosing a software control strategy; Handling boundary conditions, Setting the trade-off priorities	**08 Hours L3**

Module 4 **Class Design**: Overview of class design; Bridging the gap; Realizing use cases, Designing algorithms; Recurring downwards, Refactoring; Design optimization, Reification of behavior; Adjustment of inheritance, Organizing a class design; ATM example **Implementation Modeling**: Overview of implementation; Fine-tuning classes, Fine-tuning generalizations; Realizing associations; Testing, Legacy Systems: Reverse engineering; Building the class models; Building the interaction model	**08 Hours L3**
Module 5 **Design Patterns**: What is a pattern and what makes a pattern? Pattern categories; Relationships between patterns, Pattern description; Communication Patterns , Forwarder-Receiver , Design Patterns: Client-Dispatcher-Server, Publisher-Subscriber ,Management Patterns: Command processor, View Handler Communication : Forwader – Receiver, Client-Dispatcher-Server	**08 Hours L2**

COURSE OUTCOMES

Upon completion of this course, student will be able to

22ISE553.1	Design simple UML models and structure programs using object-oriented methodologies.
22ISE553.2	Implement object-oriented methods which includes principles abstraction, inheritance and polymorphism in the basic UML diagrams.
22ISE553.3	Design and develop different models to navigate to the solution of programming problems in UML convention.
22ISE553.4	Apply standard ethics and effective communication for developing UML models.
22ISE553.5	Design and develop real time interactive systems in UML convention using various design patterns on a builder tool.

Text Books

1. Michael Blaha, James Rumbaugh: Object-Oriented Modeling and Design with UML, 2nd Edition, Pearson Education, 2005.(Chapters 1 to 17, 23)

2. Frank Buschmann, RegineMeunier, Michael StalPattern-Oriented Software Architecture, A System of Patterns, Volume 1, John Wiley and Sons, 2006. (Chapters 1, 3.5, 3.6, 4).

Reference Books

1. Grady Booch Object-Oriented Analysis and Design with Applications, 3rd Edition, Pearson, 2007.

2. Mark Priestley Practical Object-Oriented Design with UML, 2nd Edition, Tata McGraw-Hill, 2003.

3. Booch, and Jacobson.The Unified Modeling Language User Guide, 2nd Edition, Pearson, 2005.

MOOCs (Format is given below)

1. http://nptel.ac.in
2. https://www.khanacademy.org/
3. https://www.class-central.com (MOOCS)
4. E-learning: www.vtu.ac.in

Scheme of Examination:

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Continuous Internal Evaluation (CIE):

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Two quizzes are to be conducted and each quiz is evaluated for 5 marks adding up to 10 marks.

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CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	CIE Test-3	**40**	
	Quiz 1/AAT	**05**	
	Quiz 2/AAT	**05**	
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
22ISE553.1	3	3	3	-	-	-	-	-	-	-	1	-	3	3	-	-
22ISE553.2	3	3	3	-	-	-	-	-	-	-	1	-	3	3	-	-
22ISE553.3	3	3	3	-	-	-	-	-	-	-	1	-	3	3	-	-
22ISE553.4	3	3	3	-	-	-	-	-	-	-	1	-	3	3	-	-
22ISE553.5	3	3	3	-	-	-	-	-	-	-	1	-	3	3	-	-
Average	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**3**	**3**	**-**	**-**

Low-1: Medium-2: High-3

SEMESTER – V

Course: Cloud Computing

Course Code	22ISE554	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
No. of Credits	3	Examination Hours	3

Course Learning Objectives

CLO1	Understand 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	Learn the key and enabling technologies that help in the development of cloud.
CLO4	Be able to install and use current cloud technologies

Contents	No. of Hours RBT Level
Module 1 **Introduction:** Defining Cloud Computing, Cloud Types, Examining the Characteristics of Cloud Computing Historical Developments, Virtualization, Introduction, Characteristics of Virtualized Environments, Taxonomy of Virtualization Techniques, Execution Virtualization, Other Types of Virtualization, Virtualization and Cloud Computing, Pros and Cons of Virtualization, Technology Examples: VMware: Full Virtualization.	**08 Hours L2**
Module 2 **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, Cloud Definition, Cloud Interoperability and Standards Scalability and Fault Tolerance Security, Trust, and Privacy Organizational Aspects, Aneka application framework overview	**08 Hours L3**
Module 3 **Cloud Computing and Big Data:** Introduction to Bigdata, Characteristics, Cloud computing role for Bigdata, Data Intensive Computing, Map-Reduce Programming, Characterizing Data-Intensive Computations, Challenges Ahead, Technologies for Data-Intensive Computing, Storage Systems, Introducing the MapReduce Programming Model.	**08 Hours L3**
Module 4 **Cloud Computing Software Security Fundamentals:** Cloud Information Security Objectives, Cloud Security Services, Relevant Cloud Security Design Principles, Secure Cloud Software Requirements, Approaches to Cloud Software Requirements Engineering, Cloud Security Policy Implementation, Secure Cloud Software Testing, Cloud Computing Security Challenges, Virtualization Security Management, VM Security Recommendations, VM-Specific Security Techniques.	**08 Hours L3**

Module 5	
Case Study on Open Source & Commercial Clouds: Amazon AWS, Google Cloud, Microsoft Azure Using Amazon Web Services, Amazon Web Service Components and Services, working with the Elastic Compute Cloud (EC2), Working with Amazon Storage Systems, Understanding Amazon Database Services, Google AppEngine, Architecture and Core Concepts, Application Life-Cycle, Cost Model, Observations, Microsoft Azure, Azure Core Concepts, SQL Azure, Windows Azure Platform Appliance, CRM and ERP.	**08 Hours L2**

COURSE OUTCOMES

Upon completion of this course, student will be able to

22ISE554.1	Explain the concepts and terminologies of cloud computing
22ISE554.2	Identify the architecture and infrastructure of cloud computing depending on application
22ISE554.3	Outline data intensive computing and its technologies.
22ISE554.4	Classify the core issues of cloud computing such as security, privacy, and interoperability
22ISE554.5	Describe the use of AWS, Azure and Google cloud platform to develop applications

Text Books

1.Cloud Computing Principles and Paradigms, Rajkumar Buyya, James Broberg, Andrzej Goscinski, Wiley Publishers,2011

2.Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Ronald L. Krutz, Russell Dean Vines, Wiley-India, 2010

Reference Books

1. Thomas Erl, Cloud Computing: Concepts, Technology & Architecture, Pearson.
2. John Rhoton, Cloud Computing Explained: Handbook for Enterprise Implementation.
3. Cloud Computing (Wind) by Dr. Kumar Saurabh, 2nd Edison, Wiley India
4. Cloud Computing Bible, Barrie Sosinsky, Wiley-India, 2010
5. Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi Mastering Cloud. Computing McGraw Hill Education

MOOCs

1. https://onlinecourses.nptel.ac.in/noc21_cs14
2. https://www.udemy.com/topic/cloud-computing/
3. https://ramslaw.files.wordpress.com/2016/07/0124114547cloud.pdf
4. http://www.asecib.ase.ro/cc/carti/Cloud%20Computing%20Security%20[2010].pdf

Scheme of Examination:

Semester End Examination (SEE):

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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.
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 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**	
	Quiz 1/AAT	**05**	
	Quiz 2/AAT	**05**	
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
22ISE554.1	3	2	1	1	2	-	-	-	-	-	-	2	2	-	-	-
22ISE554.2	3	2	1	1	2	-	-	-	-	-	-	2	2	-	-	-
22ISE554.3	3	2	1	1	2	-	-	-	-	-	-	2	2	-	-	-
22ISE554.4	3	2	1	1	2	-	-	-	-	-	-	2	2	-	-	-
22ISE554.5	3	2	1	1	2	-	-	-	-	-	-	2	2	-	-	-
Average	**3**	**2**	**1**	**1**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**-**	**-**	**-**

Low-1: Medium-2: High-3

SEMESTER – V

Course: Data Analytics using R

Course Code	22ISE56	CIE Marks	50
Hours/Week (L: T: P)	1:0:2	SEE Marks	50
No. of Credits	2	Examination Hours	3

Prerequisites: Basics of C Programming and Python

Course Learning Objectives

CLO1	Understand basics of R Programming and vectors
CLO2	Describe various operations of matrices, arrays and lists
CLO3	Understand the concepts of data frames, factors and tables
CLO4	Apply the concepts of control statements and functions using R
CLO5	Illustrate string manipulations and simulations using R

Contents	No. of Hours RBT Level
Module 1 **Getting Started:** How to Run R, A First R Session, Introduction to Functions, Preview of Some Important R Data Structures, Extended Example: Regression Analysis of Exam Grades, Getting Help. **Vectors:** Scalars, Vectors, Arrays, and Matrices, Declarations, Common Vector Operations, Using all() and any(),Vectorized Operations, NA and NULL Values, Filtering, A Vectorized if-then-else: The ifelse() Function.	**06 Hours L3**
Module 2 **Matrices and Arrays:** Creating Matrices, General Matrix Operations, Applying Functions to Matrix Rows and Columns, Adding and Deleting Matrix Rows and Columns, Avoiding Unintended Dimension Reduction, Naming Matrix Rows and Columns. **Lists:** Creating Lists, General List Operations, Accessing List Components and Values, Applying Functions to Lists, Recursive Lists.	**06 Hours L3**
Module 3 **Data Frames:** Creating Data Frames, Other Matrix-Like Operations, Merging Data Frames, Applying Functions to Data Frames. **Factors and Tables:** Factors and Levels, Common Functions Used with Factors, Working with Tables, Other Factor- and Table-Related Functions	**05 Hours L3**
Module 4 **R Programming Structures:** Control Statements, Arithmetic and Boolean Operators and Values, Default Values for Arguments, Return Values, Functions Are Objects, Environment and Scope Issues, No Pointers in R, Writing Upstairs, Recursion, Replacement Functions	**05 Hours L3**

Module 5	
String Manipulation: An Overview of String-Manipulation Functions, Regular Expressions, Use of String Utilities in the edtdbg Debugging Tool. **Math and Simulations in R:** Math Functions, Functions for Statistical Distributions, Sorting, Linear Algebra Operations on Vectors and Matrices, Set Operations, Simulation Programming in R	**05 Hours L3**

COURSE OUTCOMES

Upon completion of this course, student will be able to

22ISE56.1	Illustrate R data structures and vectors
22ISE56.2	Interpret matrix and list operations in R
22ISE56.3	Illustrate concepts of Data frames and factors and tables
22ISE56.4	Demonstrate the concepts of control statements and functions using R
22ISE56.5	Interpret string manipulation and mathematical simulations using R

Text Books

1. Norman Matloff, The Art of R Programming - A Tour of Statistical Software Design, 1st Edition, No Starch Press 2011.

Reference Books

1. Seema Acharya, Data Analytics Using R, 1st Edition, McGrawHill – Education, 2018
2. Dr. Dhaval Maheta, Data Analysis Using R, A Priemer for Data Scientist, 1st Edition, Notion Press, 2021.

MOOCs (Format is given below)

1. https://www.udemy.com/course/data-analytics-with-r-from-scratch/
2. https:// www.coursera.org/learn/data-analysis-r
3. https://www.udacity.com/course/data-analysis-with-r--ud651

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.

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 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**	
	Quiz 1/AAT	**05**	
	Quiz 2/AAT	**05**	
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
22ISE56.1	3	3	3	-	2	-	-	-	-	-	-	2	3	-	-	-
22ISE56.2	3	3	3	-	2	-	-	-	-	-	-	2	3	-	-	-
22ISE56.3	3	3	3	-	2	-	-	-	-	-	-	2	3	-	-	-
22ISE56.4	3	3	3	-	2	-	-	-	-	-	-	2	3	-	-	-
22ISE56.5	3	3	3	-	2	-	-	-	-	-	-	2	3	-	-	-
Average	3	3	3	-	2	-	-	-	-	-	-	2	3	-	-	-

Low-1: Medium-2: High-3

SEMESTER – V

Course: Environmental Science

Course Code	22CIV57	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**

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

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

Scheme of Examination:

Semester End Examination (SEE): SEE Question paper is to be set for 50 marks with multiple choice questions of 1 mark each covering all aspects of the syllabus.

Continuous Internal Evaluation (CIE): Three Tests are to be conducted for 50 marks each. The average of the three tests are taken for computation of CIE. Question paper for each of the CIE is to be of the multiple-choice type with 50 question each.

Typical Evaluation pattern for regular courses is shown in Table.

Table 1: Distribution of weightage for CIE & SEE for 1 credit course

	Component	Marks	Total Marks
CIE	CIE Test-1	**50**	**50**
	CIE Test-2	**50**	
	CIE Test-2	**50**	
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
22CIV57.1	2	-	-	-	-	-	3	-	-	-	-	-	1	-	-
22CIV57.2	2	1	-	-	-	-	3	-	-	-	-	1	1	-	1
22CIV57.3	2	-	2	-	-	2	3	1	-	-	-	1	1	-	1
22CIV57.4	2	2	-	-	-	2	3	-	-	-	-	-	-	-	1
22CIV57.5	2	-	-	-	-	2	3	-	-	-	-	-	-	1	1
Average	**2**	**1.5**	**2**	**-**	**-**	**2**	**3**	**1**	**-**	**-**	**-**	**1**	**1**	**1**	**1**

Low-1: Medium-2: High-3

SEMESTER – V

Course: Universal Human Values

Course Code	22UHV57	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	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**

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

22UHV57.1	Understand the significance of value inputs in a classroom and start applying them intheir life and profession
22UHV57.2	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	Understand the role of a human being in ensuring harmony in society and nature.
22UHV57.4	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

Scheme of Examination:

Semester End Examination (SEE): SEE Question paper is to be set for 50 marks with multiple choice questions of 1 mark each covering all aspects of the syllabus.

Continuous Internal Evaluation (CIE): Three Tests are to be conducted for 50 marks each. The average of the three tests are taken for computation of CIE. Question paper for each of the CIE is to be of the multiple-choice type with 50 question each.

Typical Evaluation pattern for regular courses is shown in Table.

Table 1: Distribution of weightage for CIE & SEE for 1 credit course

	Component	Marks	Total Marks
CIE	CIE Test-1	**50**	**50**
	CIE Test-2	**50**	
	CIE Test-2	**50**	
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
22UHV57.1	-	-	-	-	-	-	-	2	-	-	-	1	-	-	-	-
22UHV57.2	-	-	-	-	-	-	-	2	-	-	-	1	-	-	-	-
22UHV57.3	-	-	-	-	-	-	-	2	-	-	-	1	-	-	-	-
22UHV57.4	-	-	-	-	-	-	-	2	-	-	-	1	-	-	-	-
Average	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**-**

Low-1: Medium-2: High-3

6th Semester Syllabus

SEMESTER – VI

Course: Cryptography and Network Security

Course Code	22ISE61	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
No. of Credits	3	Examination Hours	03

Prerequisites: Computer Networks

Course learning Objectives: This Course will enable the students to:

CLO1	To understand the basic concepts underlying classical and modern cryptography, and the fundamentals.
CLO2	To Understand how security is defined and proven at the cryptographic level.
CLO3	To Understand common attacks and how to prevent them.
CLO4	To Gain the ability to apply appropriate cryptographic techniques to a security engineering (and management) problem at hand.

Content	No. of Hours/RBT levels
Module 1 History of cryptography, some background in probability and algorithms, classical cryptography-shift cipher, monoalphabetic substitution cipher, polyalphabetic substitution cipher, encryption with perfect secrecy, Caesar Cipher, Playfair Cipher, Hill Cipher, Varnum, Vignar One Time Pad.	**08 Hours L2**
Module 2 Introduction: Information security and cryptography, Basic terminology and concepts, Symmetric key encryption, Public-key cryptography, Hash functions, Protocols and mechanisms, Key establishment, management, and certification, Pseudorandom numbers and sequences, Classes of attacks and security models.	**08 Hours L2**
Module 3 Mathematical Background -Probability theory , Information theory, Complexity theory, Number theory, The RSA problem, The Diffie-Hellman problem, Ford Fulkerson problem, Composite module**.**	**08 Hours L3**
Module 4 Symmetric encryption: Block ciphers (DES, Triple-DES, and AES), substitution/permutation networks, Feistel networks, RSA algorithm. Digital Signatures, hashing and signing, Hashed RSA, El Gamal and DSA signature schemes, public-key infrastructures, certificates, cryptography in TLS, IPSec and virtual private networks, NSA Suite B.	**08 Hours L3**

Module 5	
Key Establishment Protocols Introduction, Key transport based on symmetric encryption, Key agreement based on symmetric techniques, Key transport based on public-key encryption, Key agreement based on asymmetric techniques, Secret sharing, Key Management Techniques, Techniques for distributing public keys, Techniques for controlling key usage, Key management involving multiple domains	**08 Hours L3**

COURSE OUTCOMES:

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

22ISE61.1	Understand the history of cryptography and various cipher techniques.
22ISE61.2	Understand the concepts of cryptography, encryption techniques and key management.
22ISE61.3	Apply the mathematical techniques on cryptographic algorithms.
22ISE61.4	Implement the different cryptographic algorithms, Digital Signature and hashing techniques.
22ISE61.5	Discuss the various key establishment and key sharing protocols.

TextBooks:

1. Alfred J. Menezes, Paul C. Van Oorschot and Scott A. Vanstone, “Handbook of Applied Cryptography” CRC Press.
2. William Stallings, Cryptography and Network Security: Principles and Practice (ISBN 0131873164), 4/e.

Reference Books:

1. Matt Bishop, Computer Security: Art and Science, Addison-Wesley, 2002.
2. MihirBellare and Phillip Rogaway, “Introduction to Modern Cryptography”.

E-Books / Web References:

1. Katz and Y. Lindell, Introduction to Modern Cryptography: Principles and Protocol s, Chapman & Hall/CRC Press, 2nd edition http://www.cs.umd.edu/~jkatz/imc.html
2. A.Menezes, P. Van Oorschot, S. Vanstone, Handbook of Applied Cryptography, CRC Press, August 2001 http://www.cacr.math.uwaterloo.ca/hac/.
3. http://www.freetechbooks.com/information-security-f52.html.

MOOCs

1. https://crypto.stanford.edu/~dabo/courses/OnlineCrypto/
2. https://www.my-mooc.com/en/mooc/basic-cryptography-and-programming-with-crypto-api/

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 Three 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.

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 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**	
	Quiz 1/AAT	**05**	
	Quiz 2/AAT	**05**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

CO/PO Mapping														
CO/ PO	**PO 1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**P09**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**
22ISE61.1	3		3	-	-	-	-	3	-	-	-	-	-	3
22ISE61.2	3	2	3	-	-	-	-	2	-	-	-	-	-	3
22ISE61.3	3	2	3	-	-	-	-	3	-	-	-	-	-	3
22ISE61.4	3	3	3	-	-	-	-	3	-	-	-	-	-	3
22ISE61.5	3		3	-	-	-	-	3	-	-	-	-	-	3
Average	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**3**

High-3: Medium-2: Low-1

SEMESTER- VI

Course: Full Stack Development (Integrated)

Course Code	22ISE62	CIE Marks	50
Hours/Week (L: T: P)	3:0:2	SEE Marks	50
No. of Credits	04	Examination Hours	03

Course Learning Objectives: Knowledge of Database, Web Programming and Java Programming

CLO1	Explain the use of learning full stack web development.
CLO2	Make use of rapid application development in the design of responsive web pages.
CLO3	Illustrate Models, Views and Templates with their connectivity in Django for full stack web development
CLO4	Demonstrate the use of state management and admin interfaces automation in Django.
CLO5	Design and implement Django apps containing dynamic pages with SQL database

Content	No. of Hours/ RBT levels
Module-1 **MVC based Web Designing** Web framework, MVC Design Pattern, Django Evolution, Views, Mapping URL to Views, Working of Django URL Confs and Loose Coupling, Errors in Django, Wild Card patterns in URLS. **Textbook 1: Chapter 1 and Chapter 3**	**10 hours L3**
Module-2 **Django Templates and Models** Template System Basics, Using Django Template System, Basic Template Tags and Filters, MVT Development Pattern, Template Loading, Template Inheritance, MVT Development Pattern. Configuring Databases, Defining and Implementing Models, Basic Data Access, Adding Model String Representations, Inserting/Updating data, Selecting and deleting objects, Schema Evolution **Textbook 1: Chapter 4 and Chapter 5**	**10 hours L3**
Module-3 **Django Admin Interfaces and Model Forms** Activating Admin Interfaces, Using Admin Interfaces, Customizing Admin Interfaces, Reasons to use Admin Interfaces. Form Processing, Creating Feedback forms, Form submissions, custom validation, creating Model Forms, URLConf Ticks, Including Other URLConfs. **Textbook 1: Chapters 6, 7 and 8**	**10 hours L3**
Module-4 **Generic Views and Django State Persistence** Using Generic Views, Generic Views of Objects, Extending Generic Views of objects, Extending Generic Views. MIME Types, Generating Non-HTML contents like CSV and PDF, Syndication Feed Framework, Sitemap framework, Cookies, Sessions, Users and Authentication. **Textbook 1: Chapters 9, 11 and 12**	**10 hours L3**

Module-5 **jQuery and AJAX Integration in Django** Ajax Solution, Java Script, XHTMLHttpRequest and Response, HTML, CSS, JSON, iFrames, Settings of Java Script in Django, jQuery and Basic AJAX, jQuery AJAX Facilities, Using jQuery UI Autocomplete in Django **Textbook 2: Chapters 1, 2 and 7**	**10 Hours** **L3**

Program List	
1.	Develop a Django app that displays current date and time in server.
2.	Develop a Django app that displays date and time four hours ahead and four hours before as an offset of current date and time in server.
3.	Develop a layout.html with a suitable header (containing navigation menu) and footer with copyright and developer information. Inherit this layout.html and create 3 additional pages: contact us, About Us and Home page of any website.
4.	Develop a Django app that performs student registration to a course. It should also display list of students registered for any selected course. Create students and course as models with enrolment as ManyToMany field.
5.	For student and course models created in Lab experiment 4, register admin interfaces, perform migrations and illustrate data entry through admin forms.
6.	Develop a Model form for student that contains his topic chosen for project, languages used and duration with a model called project.
7.	For students enrolment developed in experiment 4, create a generic class view which displays list of students and detail view that displays student details for any selected student in the list.
8.	Develop example Django app that performs CSV and PDF generation for any models created in previous laboratory component.
9.	Develop a registration page for student enrolment as done in Module 2 but without page refresh using AJAX.
10.	Develop a search application in Django using AJAX that displays courses enrolled by a student being searched.

COURSE OUTCOMES:

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

22ISE62.1	Understand the working of MVT based full stack web development with Django.
22ISE62.2	Designing of Models and Forms for rapid development of web pages
22ISE62.3	Analyze the role of Template Inheritance and Generic views for developing full stack web applications.
22ISE62.4	Apply the Django framework libraries to render nonHTML contents like CSV and PDF
22ISE62.5	Perform jQuery based AJAX integration to Django Apps to build responsive full stack web applications

Textbooks:

1. Adrian Holovaty, Jacob Kaplan Moss, The Definitive Guide to Django: Web Development Done Right, Second Edition, Springer-Verlag Berlin and Heidelberg GmbH & Co. KG Publishers, 2009.
2. Jonathan Hayward, Django Java Script Integration: AJAX and jQuery, First Edition, Pack Publishing, 2011

Reference books:

1. Aidas Bendroraitis, Jake Kronika, Django 3 Web Development Cookbook, Fourth Edition, Packt Publishing, 2020

2. William Vincent, Django for Beginners: Build websites with Python and Django, First Edition, Amazon Digital Services, 2018
3. Antonio Mele, Django3 by Example, 3rd Edition, Pack Publishers, 2020
4. Arun Ravindran, Django Design Patterns and Best Practices, 2nd Edition, Pack Publishers, 2020.
5. Julia Elman, Mark Lavin, Light weight Django, David A. Bell, 1st Edition, Oreily Publications, 2014

MOOCs

1. MVT architecture with Django: https://freevideolectures.com/course/3700/django-tutorials
2. Using Python in Django: https://www.youtube.com/watch?v=2BqoLiMT3Ao
3. Model Forms with Django: https://www.youtube.com/watch?v=gMM1rtTwKxE
4. Real time Interactions in Django: https://www.youtube.com/watch?v=3gHmfoeZ45k
5. AJAX with Django for beginners: https://www.youtube.com/watch?v=3VaKNyjlxAU

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 for theory component are to be conducted for 40 marks each. Marks scored in each test is reduced to 30. Two lab CIE is conducted for 20 marks each and average is added to theory component.

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 Test-1	**30**	**50**
	CIE Test-2	**30**	
	CIE Test- 3	**30**	
	Laboratory	**20**	
SEE	Semester End Examination	**100**	**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**
22ISE62.1	3	3	3	-	3	-	-	-	-	-	-	2	2	-	-	-
22ISE62.2	3	3	3	-	3	-	-	-	-	-	-	2	2	-	-	-
22ISE62.3	3	3	3	-	3	-	-	-	-	-	-	2	2	-	-	-
22ISE62.4	3	3	3	-	3	-	-	-	-	-	-	2	2	-	-	-
22ISE62.5	3	3	3	-	3	-	-	-	-	-	-	2	2	-	-	-
Average	**3**	**3**	**3**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**-**	**-**	**-**

Low-1: Medium-2: High-3

SEMESTER – VI

Course: Deep Learning (Integrated)

Course Code	22ISE63	CIE Marks	50
Hours/Week (L: T: P)	3:0:2	SEE Marks	50
No. of Credits	4	Examination Hours	3

Prerequisites: Machine Learning Basics

Course Learning Objectives:

CLO1	Understand the fundamentals of deep learning.
CLO2	Know the theory behind Convolutional Neural Networks, Autoencoders, RNN.
CLO3	Illustrate the strength and weaknesses of many popular deep learning approaches.
CLO4	Introduce major deep learning algorithms, the problem settings, and their applications to solve real world problems.

Content	No.of Hours/ RBT levels
Module 1 **Introduction to Deep Learning:** Introduction, Deep learning Model, Historical Trends in Deep Learning, **Machine Learning Basics:** Learning Algorithms, Supervised Learning Algorithms, Unsupervised Learning Algorithms. **Textbook 1: Chapter1 – 1.1, 1.2, 5.1,5.7-5.8.**	**10 Hours L2**
Module 2 **Feedforward Networks**: Introduction to feed forward neural networks, Gradient-Based Learning, Back Propagation and Other Differentiation Algorithms. Regularization for Deep Learning, **Textbook 1: Chapter 6, 7**	**10 Hours L3**
Module 3 **Optimization for Training Deep Models:** Empirical Risk Minimization, Challenges in Neural Network Optimization, **Basic Algorithms:** Stochastic Gradient Descent, Parameter Initialization Strategies, Algorithms with Adaptive Learning Rates: The AdaGrad algorithm, The RMSProp algorithm, Choosing the Right Optimization Algorithm. **Textbook 1: Chapter: 8.1-8.5**	**10 Hours L3**
Module 4 **Convolutional Networks:** The Convolution Operation, Pooling, Convolution and Pooling as an Infinitely Strong Prior, Variants of the Basic Convolution Function, Structured Outputs, Data Types, Efficient Convolution Algorithms, Random or Unsupervised Features- LeNet, AlexNet. **Textbook 1: Chapter: 9.1-9.9.**	**10 Hours L3**

Module 5	
Recurrent and Recursive Neural Networks: Unfolding Computational Graphs, Recurrent Neural Network, Bidirectional RNNs, Deep Recurrent Networks, Recursive Neural Networks, The Long Short Term Memory and Other Gated RNNs. **Applications:** Large-Scale Deep Learning, Computer, Speech Recognition, Natural Language Processing and Other Applications. **Textbook 1: Chapter: 10.1-10.3, 10.5, 10.6, 10.10, 12.**	**10 Hours** **L3**

Program List	
1	Build a deep neural network model start with linear regression using a single variable.
2	Build a deep neural network model start with linear regression using multiple variables.
3	Build a feed forward neural network for prediction of logic gates.
4	Write a program for character recognition using CNN.
5	Write a program for character recognition using RNN and compare it with CNN.
6	Write a program to convert speech into text.
7	Write a program to convert text into speech.
8	Write a program for Time-Series Forecasting with the LSTM Model.
9	Write a program to predict a caption for a sample image using LSTM.
10	Write a program to develop a GAN for Generating MNIST Handwritten Digits.

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

22ISE63.1	Understand the fundamental issues and challenges of deep learning data, model selection, model complexity etc.,
22ISE63.2	Describe various knowledge on deep learning and algorithms
22ISE63.3	Apply CNN and RNN model for real time applications
22ISE63.4	Identify various challenges involved in designing and implementing deep learning algorithms.
22ISE63.5	Relate the deep learning algorithms for the given types of learning tasks in varied domain

Textbooks:

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, “Deep Learning”, MIT Press, 2016.

Reference books:

1. Bengio, Yoshua. "Learning deep architectures for AI." Foundations and trends in Machine Learning, 2009.

2. N.D.Lewis, “Deep Learning Made Easy with R: A Gentle Introduction for Data Science”, January 2016.

3.Nikhil Buduma, “Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms”, O’Reilly publications.

4. Navin Kumar Manaswi ,Deep Learning with Applications Using Python Chatbots and Face, Object, and Speech Recognition With TensorFlow and Keras ,Apress,2018.

MOOCs:

1. https://nptel.ac.in/courses/106106184
2. https://faculty.iitmandi.ac.in/~aditya/cs671/index.html

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 for theory component are to be conducted for 40 marks each. Marks scored in each test is reduced to 30. Two lab CIE is conducted for 20 marks each and average is added to theory component.

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	**30**	**50**
	CIE Test-2	**30**	
	CIE Test- 3	**30**	
	Laboratory	**20**	
SEE	Semester End Examination	**100**	**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
22ISE63.1	3	3	3	2	2	-	-	-	-	-	2	-	2	-	-	-
22ISE63.2	3	3	3	2	2	-	-	-	-	-	2	-	2	-	-	-
22ISE63.3	3	3	3	2	2	-	-	-	-	-	2	-	2	-	-	-
22ISE63.4	3	3	3	2	2	-	-	-	-	-	2	-	2	-	-	-
22ISE63.5	3	3	3	2	2	-	-	-	-	-	2	-	2	-	-	-
Average	3	3	3	2	2	-	-	-	-	-	2	-	2	-	-	-

Low-1: Medium-2: High-3

SEMESTER – VI

Course: Business Intelligence

Course Code	22ISE641	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
No. of Credits	3	Examination Hours	3

Prerequisites: Fundamentals of Software Engineering and Machine Learning Concepts

Course Learning Objectives

CLO1	Understand the Concepts of Business Intelligence, Decision Support System and Data Warehousing.
CLO2	Understand the Concepts of Data Mining, Data Preparation and Exploration.
CLO3	Understand the Classification and Clustering Model on the given Dataset.
CLO4	Understand the Basic Implementation of Business Intelligence using Tableau.
CLO5	Understand Business Intelligence for Different Applications using Marketing Models.

Contents	No. of Hours RBT Level
Module 1 **Business intelligence:** Effective and timely decisions, Data, information and knowledge, the role of mathematical models, Business intelligence architectures, Ethics and business intelligence. **Decision support systems:** Definition of system, Representation of the decision-making process **Data warehousing:** Definition of data warehouse, Data warehouse architecture.	**08 Hours L2**
Module 2 **Data mining:** Definition of data mining, Representation of input data, Data mining process. **Data preparation:** Data validation, Data transformation, Data reduction. **Data exploration:** Univariate analysis, Bivariate analysis.	**08 Hours L2**
Module 3 **Classification:** Classification problems, Evaluation of classification models, Bayesian methods, Logistic regression, Neural networks, Support vector machines. **Clustering:** Clustering methods, Partition methods, Hierarchical methods.	**08 Hours L3**
Module 4 **Tableau Foundations:** Cycle of Analytics. Connecting to Data. **Working with Data in Tableau:** The Tableau paradigm, Connecting to data, Managing data source metadata Working with extracts instead of live connections, Tableau file types Joins and blends, Filtering data.	**08 Hours L3**

Module 5	
Business intelligence applications: Marketing models: Relational marketing, Sales force management. **Logistic and production models:** Supply chain optimization, Optimization models for logistics planning, Revenue management systems. **Data envelopment analysis:** Efficiency measures, The CCR model, Identification of good operating practices.	**08 Hours** **L3**

COURSE OUTCOMES

Upon completion of this course, student will be able to

22ISE641.1	Understand the fundamentals of business intelligence, decision support system and Data warehousing.
22ISE641.2	Discuss various data mining techniques for decision making with business intelligence.
22ISE641.3	Apply classification and clustering models on the given dataset.
22ISE641.4	Implement various models using Tableau to solve real time business cases.
22ISE641.5	Apply business intelligence for various applications using marketing models.

Text Books

1. Carlo Vercellis, Business Intelligence: Data Mining and Optimization for Decision Making, A John Wiley & Sons, Ltd., Publication, 2009.
2. Joshua N Milligan, Learning Tableau 2019: Tools for Business Intelligence, data prep and visual analytics, 3rd Edition, Packt Publishing, 2019.

Reference Books

1. Efraim Turban, Ramesh Sharda, DursunDelen, Decision Support and Business Intelligence Systems, 9th Edition, Pearson 2013.
2. Henning Baars and Hans-Georg Kemper, Business Intelligence and Analytics, Grundlagen und praktische Anwendungen: Ansätze der IT-basierten Entscheidungsunterstützung, Springer Vieweg, 2021.
3. David Loshin Morgan, Kaufman, Business Intelligence: The Savvy Manager's Guide, Second Edition, 2012.
4. Larissa T. Moss, S. Atre, Business Intelligence Roadmap: The Complete Project Lifecycle of Decision Making", Addison Wesley, 2003.

MOOCs (Format is given below)

1. http://www.pentaho.com/
2. https://www.edx.org/course/introduction-data-analysis-using-excel-microsoftdat205x-2
3. https://www.ibm.com/developerworks/library/os-weka2/
4. http://www.saedsayad.com
5. http://www.cs.ccsu.edu/~markov/ccsu_courses/datamining-3.html
6. https://cognitiveclass.ai/
7. https://onlinecourses.nptel.ac.in/noc19_ge20/preview

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.
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 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**	
	Quiz 1/AAT	**05**	
	Quiz 2/AAT	**05**	
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
22ISE641.1	3	2	-	2	-	1	-	1	-	-	-	2	2	-	-	-
22ISE641.2	3	2	-	2	-	1	-	1	-	-	-	2	2	-	-	-
22ISE641.3	3	2	-	2	-	1	-	1	-	-	-	2	2	-	-	-
22ISE641.4	3	2	-	2	-	1	-	1	-	-	-	2	2	-	-	-
22ISE641.5	3	2	-	2	-	1	-	1	-	-	-	2	2	-	-	-
Average	**3**	**2**	**-**	**2**	**-**	**1**	**-**	**1**	**-**	**-**	**-**	**2**	**2**	**-**	**-**	**-**

Low-1: Medium-2: High-3

SEMESTER – VI

Course: Computer Graphics

Course Code	22ISE642	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
No. of Credits	3	Examination Hours	3

Prerequisites: Basics of Computers, Programming Language- C

Course Learning Objectives

CLO1	To understand computer graphics fundamentals
CLO2	To become familiar with raster technology for enabling users to interact with popular I/O devices.
CLO3	To represent 2D/3D geometric objects and apply transformations, viewing techniques, lighting, and shading effects.
CLO4	Familiarity with standard rasterization algorithms.

Contents	No. of Hours RBT Level
Module 1 **Computer Graphics**: Basics of computer graphics, Application of Computer Graphics, Video Display Devices: Random Scan and Raster Scan displays, color CRT monitors, Flat panel displays. Raster-scan systems: video controller, raster scan Display processor, graphics workstations and viewing systems, Input devices, graphics networks, graphics on the internet, graphics software. **Line Drawing Algorithms:** DDA, Bresenham's Circle Drawing – Bresenham's	**08 Hours L3**
Module 2 **Fill area Primitives:** Polygon fill-areas, fill area attributes, general scan line polygon fill algorithm. **2D Geometric Transformations:** Basic 2D Geometric Transformations, matrix representations and homogeneous coordinates. Inverse transformations, 2D Composite transformations, other 2D transformations, raster methods for geometric transformations,	**08 Hours L3**
Module 3 **3D Geometric Transformations:** 3D translation, rotation, scaling, composite 3D transformations, other 3D transformations, affine transformations. **Colour Models:** Properties of light, colour models, RGB and CMY colour models. **Illumination Models:** Light sources, basic illumination models-Ambient light, diffuse reflection, specular and Phong model.	**08 Hours L3**
Module 4 **Clipping:** window, normalization and viewport transformations, clipping algorithms, 2D point clipping, 2D line clipping algorithms: Cohen-Sutherland line clipping only -polygon fill area clipping: Sutherland-Hodgeman polygon clipping algorithm.	**08 Hours L3**
Module 5 **3D Viewing:** 3D viewing concepts, 3D viewing pipeline, 3D viewing coordinate parameters, Transformation from world to viewing coordinates, Projection transformation, orthogonal projections, perspective projections, The viewport transformation and 3D screen coordinates. **Curved surfaces:** Quadric surfaces and Cubic-Surface, Bezier Spline Curves, Bezier surfaces.	**08 Hours L3**

COURSE OUTCOMES

Upon completion of this course, student will be able to

22ISE642.1	Understand the fundamentals of computer graphics
22ISE642.2	Demonstrate the concepts of Fill area Primitives and 2D Geometric Transformations
22ISE642.3	Demonstrate the 3D Geometric Transformations and Color/Illumination models
22ISE642.4	Apply the concepts of clipping on window and viewport transformations
22ISE642.5	Understand the concepts of 3D Viewing, Projection transformation and Curved Surfaces

Text Books

1. Donald Hearn & Pauline Baker: Computer Graphics with OpenGL Version,3rd/ 4thEdition, Pearson Education,2011

Reference Books

1. James D Foley, Andries Van Dam, Steven K Feiner, John F Huges Computer graphics with OpenGL: pearson education
2. Xiang, Plastock : Computer Graphics , Sham's outline series, 2nd edition, TMG.
3. Kelvin Sung, Peter Shirley, Steven Baer : Interactive Computer Graphics, concepts and applications, Cengage Learning

MOOCs (Format is given below)

1. https://www.udemy.com/course/computer-graphics/
2. https://www.courses.com/indian-institute-of-technology-madras/computer-graphics
3. E-learning: www.vtu.ac.in

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.
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.

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	Component	Marks	Total Marks
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	CIE Test-3	**40**	
	Quiz 1/AAT	**05**	
	Quiz 2/AAT	**05**	
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
22ISE642.1	3	3	3	-	-	-	-	-	-	-	-	-	**3**	-	-	-
22ISE642.2	3	3	3	-	-	-	-	-	-	-	-	-	**3**	-	-	-
22ISE642.3	3	3	3	-	-	-	-	-	-	-	-	-	**3**	-	-	-
22ISE642.4	3	3	3	-	-	-	-	-	-	-	-	-	**3**	-	-	-
22ISE642.5	3	3	3	-	-	-	-	-	-	-	-	-	**3**	-	-	-
Average	3	3	3	-	-	-	-	-	-	-	-	-	**3**	-	-	-

Low-1: Medium-2: High-3

SEMESTER – VI
Course: Software Testing

Course Code	22ISE643	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
No. of Credits	3	Examination Hours	03

Prerequisites: Software Engineering

Course Learning Objectives:

CLO1	Understanding the basic fundamentals of testing, verification and validation methods and techniques.
CLO2	Apply software testing concepts and methodologies to a variety of testing scenarios.
CLO3	Perform software inspection and program analysis
CLO4	Develop and apply continuous verification and validation methods

Content	No. of Hours/ RBT levels
Module 1 **Software Testing:** Software Quality, Role of Testing, Verification and Validation, Failure, Error, Fault, and Defect, Notion of Software Reliability, Objectives of Testing, What Is a Test Case?, Expected Outcome, Concept of Complete Testing, Central Issue in Testing , Testing Activities, Test Levels, Sources of Information for Test Case Selection, White-Box, Black-Box and Gray-Box Testing, Test Planning and Design, Monitoring and Measuring Test Execution, Test Tools and Automation, Test Team Organization and Management Basic Definitions, Test Cases, Insights from a Venn Diagram, Identifying Test Cases, Specification-Based Testing, Code-Based Testing, Specification Based versus Code-Based Debate, Fault Taxonomies. Example Triangle Problem.	**08 Hours L2**
Module 2 **Unit Testing:** Concept of Unit Testing, Static Unit Testing, Defect Prevention, Dynamic Unit Testing, Mutation Testing, Debugging, Unit Testing in extreme Programming. Boundary Value Testing- Normal Boundary Value Testing, Robust Boundary Value Testing, Worst-Case Boundary Value Testing, Test Cases for the Triangle Problem, Random Testing. Equivalence Class Testing- Equivalence Classes, Traditional Equivalence Class Testing, Improved Equivalence Class Testing, Equivalence Class Test Cases for the Triangle Problem.	**08 Hours L3**
Module 3 **Data Flow Testing:** General Idea, Data Flow Anomaly, Overview of Dynamic Data Flow Testing, Data Flow Graph, Data Flow Terms, Data Flow Testing Criteria, Comparison of Data Flow Test Selection Criteria **Object-Oriented Testing**: Object-Oriented Unit Testing, Object-Oriented Integration Testing, Object-Oriented System Testing.	**08 Hours L3**

Module 4 **Software Quality:** Five Views of Software Quality, McCall's Quality Factors and Criteria, ISO 9126 Quality Characteristics, ISO 9000:2000 Software Quality Standard **Software Verification:** Inspection process, Applying the Inspection Process: Attributes of a Good Process, Requirements Inspections, Design Inspection, Code Inspection, Test Script Inspection, Software quality Metric: Strategy, Framework, Metrics Configuration Management: Basics, Identification, Baseline Management, Auditing and Reporting.	**08 Hours L3**
Module 5 **Software Validation:** Testing: Validation Testing Model, Test Planning Validation Metrics: Time Measures, Test Coverage Metrics, Quality Metrics, Software reliability growth: Test Analyze Fix Process, Reliability Growth Modeling. **Acceptance Testing:** What Is User Acceptance Testing? When Is It Performed? Who Performs UAT? Need for User Acceptance Testing, User Acceptance Testing Process, UAT Test Planning, User Acceptance Testing Design, Test Execution. Case Study: JUnit Tools/Selenium	**08 Hours L3**

COURSE OUTCOMES:
On completion of the Course, student will be able to

22ISE643.1	Understand the significance of the basics testing, verification and validation techniques.
22ISE643.2	Apply the concepts related to software verification and validation
22ISE643.3	Identify different testing Technique and design test plans, develop test suits and evaluate test suit coverage.
22ISE643.4	Use testing Frame work and Testing tools

Text Books:

1. Software Testing And Quality Assurance Theory And Practice – 2nd Edition, Kshirasagar Naik And Priyadarshi Tripathy, 2008.
2. Software Testing, A Craftsman's Approach, C Paul C. Jorgensen, Auerbach Publications, 4th Edition, 2014
3. Software Verification and Validation for Practitioners and Managers, Rakitin R. S., Artech House (2001), 2nd ed.
4. https://www.softwaretestinghelp.com/what-is-user-acceptance-testing-uat/

Reference Books:

1. Foundations of Software Testing, Aditya P Mathur, Pearson, 2008.
2. Software Testing and Analysis – Process, Principles and Techniques, Mauro Pezze, Michal Young, John Wiley & Sons, 2008

MOOCS

1. https://nptel.ac.in/courses/106/105/106105150/
2. https://nptel.ac.in/courses/106/101/106101163/

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 Three 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.

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.

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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**	
	Quiz 1/AAT	**05**	
	Quiz 2/AAT	**05**	
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
22ISE643.1	3	3	3	3	-	-	-	-	-	-	-	3	3	-	-	-
22ISE643.2	3	3	3	3	-	-	-		-	-	-	3	3	-	-	-
22ISE643.3	3	3	3	3	-	-	-	2	-	-	-	3	3	-	-	-
22ISE643.4	3	3	3	3	3	-	-	2	-	-	-	3	3	-	-	-
Average	3	3	3	3	3	-	-	2	-	-	-	3	3	-	-	-

Low-1: Medium-2: High-3

SEMESTER- VI

Course: Wireless Sensor Networks

Course Code	22ISE644	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
No. of Credits	3	Examination Hours	03

Course Learning Objectives:

CLO1	Describe the network architecture and OSI Model for IoT/M2M Systems.
CLO2	Understand the architecture and design principles for device supporting IoT
CLO3	Develop competence in programming for IoT Applications
CLO4	Identify the uplink and downlink communication protocols which best suits the specific application of IoT/WSNs.

Content	No.of Hours/ RBT levels
Module 1 **Overview of Wireless Sensor Networks:** Challenges for Wireless Sensor Networks, Enabling Technologies for Wireless Sensor Networks. **Architecture:** Single Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes, Operating Systems and Execution Environments, Network Architecture - Sensor Network Scenarios, Design Principles of WSN's.	**08 Hours** **L3**
Module 2 **Communication Protocols:** Physical Layer and Transceiver Design Considerations. **MAC Protocols:** Fundamentals of MAC Protocols, Low Duty Cycle Protocols And Wakeup Concepts, Contention-based protocols, Schedule-based protocols, IEEE 802.15.4 MAC Protocol.	**08 Hours** **L3**
Module 3 **Overview of Internet of Things:** IoT Conceptual Framework, IoT Architectural View, Technology Behind IoT, Sources of IoT, M2M communication, Examples of IoT. **Design Principles for Connected Devices**: IoT/M2M Systems layers and design standardization, Data enrichment, Data consolidation and device management at Gateway.	**08 Hours** **L2**
Module 4 **Internet Connectivity Principles**: Internet connectivity, Internet-based communication, IP Addressing in the IoT, Application layer protocols: HTTP, HTTPS, FTP, TELNET and others. **Data Collection, Storage and Computing using a Cloud Platform:** Introduction, Cloud computing paradigm for data collection, storage and computing. Cloud service models, IoT Cloud- based services using xively, Nimbits and other platforms.	**08 Hours** **L2**

Module 5	
Prototyping and designing software for IoT Applications: Introduction, Prototyping Embedded device software, Devices, gateways, Internet and web/ cloud services software development, Prototyping online component API's & Web API's.	**08 Hours L2**

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

22ISE644.1	Understand the basic architecture and communication protocols of WSNs
22ISE644.2	Illustrate the communication protocols associated with physical layer and MAC Layer.
22ISE644.3	Interpret the basic concepts of IoT and applications of M2M communication protocols.
22ISE644.4	Describe cloud computing and design principles of IoT.
22ISE644.5	Outline the concept of prototyping and designing software for IoT applications.

Textbooks:

1. Protocols And Architectures for Wireless Sensor Networks, Holger Karl & Andreas Willig, John Wiley, 2005.
2. Internet of Things - Architecture and design principles, Raj Kamal, McGraw Hill Education.

Reference books:

1. Wireless Sensor Networks - An Information Processing Approach, Feng Zhao & Leonidas J Guibas , Elsevier 2007.
2. Internet of Things, Srinivasa K G , CENCAGE Learning India,2017.

MOOCs

1. http://nptel.ac.in/courses.php?disciplineId=111
2. https://www.khanacademy.org/
3. https://www.class-central.com/subject
4. E-learning: www.vtu.ac.in

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. Marks scored in each test is reduced to 20 and added to test component.
CIE is executed by way of two quizzes / Alternate Assessment Tools (AATs), and three tests.
Quizzes are to be conducted and each quiz can be evaluated for 5 marks adding up to 10 marks.
All quizzes are conducted online. Faculty may adopt innovative methods for conducting quizzes effectively.

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-athon/ 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

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

	Component	Marks	Total Marks
	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	CIE Test- 3	**40**	
	Quiz 1/AAT	**05**	
	Quiz 2/AAT	**05**	
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
22ISE644.1	3	2	--	--	2	2	--	2	--	--	--	3	--	3	--	--
22ISE644.2	3	2	--	--	2	2	--	2	--	--	--	3	--	3	--	--
22ISE644.3	3	2	--	--	2	2	--	2	--	--	--	3	--	3	--	--
22ISE644.4	3	2	--	--	2	2	--	2	--	--	--	3	--	3	--	--
22ISE644.5	3	2	--	--	2	2	--	2	--	--	--	3	--	3	--	--
Avg	**3**	**2**	--	--	**2**	**2**	--	**2**	--	--	--	**3**	--	**3**	**--**	**--**

Low-1: Medium-2: High-3

SEMESTER – VI

Course: Data Structures Using C

Course Code	22ISE651	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
No. of Credits	3	Examination Hours	3

Prerequisites: C Language

Course Learning Objectives

CLO1	Explain fundamentals of data structures and their applications essential for programming/problem solving.
CLO2	Find suitable data structure during application development/Problem Solving.
CLO3	Illustrate linear representation of data structures: Stack, Queues and Lists in memory
CLO4	Illustrate linear representation of data structures: Trees and Graphs in memory.

Contents	No. of Hours RBT Level
Module 1 **Introduction:** Data Structures, Classifications (Primitive & Non Primitive), Data structure Operations, Review of Arrays, Array Operations: Traversing, inserting, deleting, searching, and sorting. Strings: Basic Terminology, Storing, Operations. Programming Examples.	**08 Hours L3**
Module 2 **Stacks:** Definition, Stack Operations, Array Representation of Stacks, Stacks using Dynamic Arrays, Stack Applications: Polish notation, Infix to postfix conversion, evaluation of postfix expression. **Queues:** Definition, Array Representation, Queue Operations, Circular Queues, Priority Queues.	**08 Hours L3**
Module 3 **Review of Structures**, Pointers and Dynamic Memory Allocation Functions. **Linked Lists**: Definition, Representation of linked lists in Memory and its allocation; Linked list operations: Traversing, Searching, Insertion, and Deletion. Doubly Linked lists, Circular linked lists.	**08 Hours L3**
Module 4 **Trees:** Terminology, Binary Trees, Properties of Binary trees, Array and linked Representation of Binary Trees, Binary Tree Traversals – In-order, post-order, pre-order, Additional Binary tree operations. Threaded binary trees, Binary Search Trees – Definition, Insertion, Deletion, Traversal, Searching, Application of Trees-Evaluation of Expression, Programming Examples	**08 Hours L3**
Module 5 **Exploring Graphs:** An introduction to graphs – Graph terminologies, Un-directed Graph, Directed Graph, Graph representation in memory. Traversing Graphs, Depth First Search, Breath First Search and Connected components.	**08 Hours L3**

COURSE OUTCOMES

Upon completion of this course, student will be able to

22ISE651.1	Understand the basic data structures and its representation in memory
22ISE651.2	Apply appropriate algorithm for problem solving using arrays, strings, stacks, queues.
22ISE651.3	Understand the representation of linked lists, trees and graphs in memory.
22ISE651.4	Write programs using linked lists and tree for a given specification.
22ISE651.5	Write programs to perform operations on graphs and its traversals.

Text Books

1. Ellis Horowitz and Sartaj Sahni, Fundamentals of Data Structures in C, 2nd Ed, Universities Press, 2019.
2. Data Structures using C – A. S. Tanenbaum, Y. Langsam, and M.J. Augenstein, PHI/Pearson Education 2019

Reference Books

1. Gilberg & Forouzan, Data Structures: A Pseudo-code approach with C, 2nd Ed, Cengage Learning,2014.
2. Reema Thareja, Data Structures using C, 3rd Ed, Oxford press, 2012.
3. Jean-Paul Tremblay & Paul G. Sorenson, An Introduction to Data Structures with Applications,2nd Ed, McGraw Hill, 2013
4. Robert Kruse, Data Structures and Program Design in C, 2nd Ed, PHI, 1996
5. Data Structures and Algorithms, 2008, G. A. V. Pai, TMH
6. Classic Data Structures, 2/e, Debasis , Sarnanta,PHI,2009

MOOCs (Format is given below)

1. Data Structures: https://www.coursera.org/learn/data-structures
2. Programming and Data Structures: https://nptel.ac.in/courses/106/106/106106130/

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.
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 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**	
	Quiz 1/AAT	**05**	
	Quiz 2/AAT	**05**	
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**
22ISE651.1	3	3	2	-	2	-	-	-	-	-	-	3	3	-	-	-
22ISE651.2	3	3	2	-	2	-	-	-	-	-	-	3	3	-	-	-
22ISE651.3	3	3	2	-	2	-	-	-	-	-	-	3	3	-	-	-
22ISE651.4	3	3	2	-	2	-	-	-	-	-	-	3	3	-	-	-
22ISE651.5	3	3	2	-	2	-	-	-	-	-	-	3	3	-	-	-
Average	3	3	2	-	2	-	-	-	-	-	-	3	3	-	-	-

Low-1: Medium-2: High-3

SEMESTER – VI

Course: Internet and Network Security

Course Code	22ISE652	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
No. of Credits	3	Examination Hours	3

Prerequisites: Data communication, Computer Networks

Course Learning Objectives

CLO1	Explain the Concept of Internet and its importance.
CLO2	Explain Cryptographic foundations and Secret Key Cryptography.
CLO3	Describe public key cryptography and Discrete Logarithm.
CLO4	Illustrate key management issues and solutions.
CLO5	Illustrate different protocols at transport layer and wireless security.

Contents	No. of Hours RBT Level
Module 1 **Internet Connection concepts**-What is Internet, Internet services, Types of Accounts, Telephone, cable and satellite connections, Choosing an ISP, **Connecting to Dial-up Internet Accounts**-elements of windows 98 Dial-up networking , setting up a connection with windows 98,**High speed connection: ISDN, ADSL and Cable modems**-the contenders, choosing a high speed connection, connecting via ISDN, connecting via ADSL, connecting via Cable modems.	**08 Hours L2**
Module 2 **Introduction** - Cyber Attacks, Defence Strategies and Techniques, Guiding Principles, **Mathematical Background for Cryptography** - Modulo Arithmetic's, The Greatest Comma Divisor, Useful Algebraic Structures, Chinese Remainder Theorem, **Basics of Cryptography** - Preliminaries, Elementary Substitution Ciphers, Elementary Transport Ciphers, Other Cipher Properties, **Secret Key Cryptography** – Product Ciphers, DES Construction	**08 Hours L2**
Module 3 **Public Key Cryptography and RSA** – RSA Operations, Why Does RSA Work?, Performance, Applications, Practical Issues, Public Key Cryptography Standard (PKCS), **Cryptographic Hash** - Introduction, Properties, Construction, Applications and Performance, The Birthday Attack, **Discrete Logarithm and its Applications** - Introduction, Diffie-Hellman Key Exchange, Other Applications.	**08 Hours L3**
Module 4 **Key Management** - Introduction, Digital Certificates, Public Key Infrastructure, Identity–based Encryption, **Authentication–I** - One way Authentication, Mutual Authentication, Dictionary Attacks, **Authentication – II** – Centalised Authentication, The Needham-Schroeder Protocol, Kerberos, Biometrics, **IPSecSecurity at the Network Layer** – Security at Different layers: Pros and Cons, IPSec in Action, Internet Key Exchange (IKE) Protocol, Security Policy and IPSEC, Virtual Private Networks	**08 Hours L3**

Module 5	
Security at the Transport Layer - Introduction, SSL Handshake Protocol, SSL Record Layer Protocol, OpenSSL. **IEEE 802.11 Wireless LAN Security** - Background, Authentication, Confidentiality and Integrity, **Viruses, Worms, and Other Malware-** Virus and Worm Features, Internet scanning Worms, Topological worms, Web malware, Mobile malware**, Firewalls** – Basics, Practical Issues.	**08 Hours L3**

COURSE OUTCOMES

Upon completion of this course, student will be able to

22ISE5652.1	Understand internet concepts and design various internet connections.
22ISE5652.2	Understand Cryptographic foundations and Secret Key Cryptography.
22ISE5652.3	Design and develop simple cryptography algorithms.
22ISE5652.4	Discuss various key management techniques in security.
22ISE5652.5	Discuss different protocols at transport layer and wireless security.

Text Books

1. Margaret Levine Young –The Complete Reference-Internet Millennium Edition. (Chapters 1 to 4)
2. Cryptography, Network Security and Cyber Laws – Bernard Menezes, Cengage Learning, 2010 edition.

Reference Books

1. Cryptography and Network Security- Behrouz A Forouzan, Debdeep Mukhopadhyay, Mc-GrawHill, 3rd Edition, 2015
2. Cryptography and Network Security- William Stallings, Pearson Education, 7th Edition

MOOCs (Format is given below)

1. http://nptel.ac.in
2. https://www.khanacademy.org/
3. https://www.class-central.com (MOOCS)
4. E-learning: www.vtu.ac.in

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.
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 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**	
	Quiz 1/AAT	**05**	
	Quiz 2/AAT	**05**	
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
22ISE5652.1	2	2	2	-	-	-	-	-	-	-	2	-	-	1	-	-
22ISE5652.2	2	2	2	-	-	-	-	3	-	-	2	-	-	1	-	-
22ISE5652.3	2	2	2	-	-	-	-	-	-	-	2	-	-	2	-	2
22ISE5652.4	2	2	-	-	-	-	-	3	-	-	2	-	-	-	-	2
22ISE5652.5	2	2	-	-	-	-	-	3	-	-	2	-	-	-	-	2
Average	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**3**	**-**	**-**	**2**	**-**	**-**	**2**	**-**	**2**

Low-1: Medium-2: High-3

SEMESTER- VI

Course: Introduction to DBMS

Course Code	22ISE653	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
No. of Credits	3	Examination Hours	03

Prerequisites: Basics of Database

Course Learning Objectives:

CLO1	To understand the fundamental concepts and architecture of DBMS.
CLO2	Explain the basic concepts of Conceptual Data Modeling, Database Design and Relational Database Constraints.
CLO3	Practice Relational Algebra and SQL queries through a variety of database problems.
CLO3	To develop and evaluate a real database application using a database management system.
CLO3	To explain the Normalization and Transaction Processing Concepts.

Content	No.of Hours/ RBT levels
Module 1 **Databases and Database Users -** Introduction, Characteristics of the Database Approach, Actors on the Scene,Workers behind the Scene, Advantages of using the DBMS Approach, A Brief History of Database Applications. **Database System Concepts and Architecture -** Data Models, Schemas and Instances, Three-Schema Architecture and Data Independence, Database Languages and Interfaces.	**08 Hours L2**
Module 2 **Conceptual Data Modeling and Database Design-** High-Level Conceptual Data Models for Database Design, Entity Types, Entity Sets, Attributes and Keys, Relationship Types, Relationship Sets, Roles, and Structural Constraints, Weak Entity Types, ER Diagrams. **The Relational Data Model and Relational Database Constraints -**Relational Model Concepts, Relational Model Constraints and Relational Database Schemas, Update Operations, Transactions, Dealing with Constraint Violations.	**08 Hours L3**
Module 3 **Relational Algebra-** Unary Relational Operations: SELECT and PROJECT, Relational Algebra Operations from Set Theory, Binary Relational Operations: JOIN and DIVISION, Additional Relational Operations **SQL-** SQL Data Definition and Data Types, Specifying Constraints in SQL, Basic Retrieval Queries in SQL, INSERT DELETE, and UPDATE Statements in SQL, Additional Features of SQL.	**08 Hours L3**

Module 4 **More SQL: Complex Queries, Triggers, Views, and Schema Modification-** More complex SQL retrieval queries, Specifying constraints as assertions and action triggers, Views in SQL, Schema change statements in SQL. **Database Application Development:** Accessing databases from applications, An introduction to JDBC, JDBC classes and interfaces, SQLJ, Stored procedures.	**08 Hours** **L3**
Module 5 **Basics of Functional Dependencies and Normalization for Relational Databases -** Informal Design Guidelines for Relation Schemas, Functional Dependencies, Normal Forms Based on Primary Keys, General Definitions of Second and Third Normal Forms , Boyce-Codd Normal Form, Multivalued Dependency and Fourth Normal Form , Join Dependencies and Fifth Normal Form. **Introduction to Transaction Processing Concepts and Theory** -Introduction to Transaction Processing, Transaction and System Concepts, Desirable Properties of Transactions, Characterizing Schedules Based on Recoverability, Characterizing Schedules Based on Serializability.	**08 Hours** **L3**

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

22ISE653.1	Explain the fundamental concepts and architecture of DBMS.
22ISE653.2	Design entity relationship diagrams to represent simple database application scenarios.
22ISE653.3	Use Relational algebra operation and Structured Query Language (SQL) for database manipulation.
22ISE653.4	Apply advanced queries for database design and develop application.
22ISE653.5	Implement normalization algorithms using database design theory for different applications and transaction processing in databases.

Textbooks:

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

Reference books:

1. **Database Management Systems**, Raghu Rama Krishnan, Tata Mcgraw Hill,6th edition,2010.
2. Database System Concepts, Abraham Silberschatz, Henry F.Korth and S.Sudarshan, Tata Mc Graw Hill, 6th edition, 2011.

MOOCs (Format is given below)

1. http://nptel.ac.in
2. https://www.khanacademy.org/
3. https://www.class-central.com(MOOCS)
4. E-learning: www.vtu.ac.in

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 questionfrom each module.**

Continuous Internal Evaluation (CIE):
Three Tests are to be conducted for 40 marks each. Marks scored in each test is reduced to 20 and added to test component.
CIE is executed by way of two quizzes / Alternate Assessment Tools (AATs), and three tests.
Quizzes are to be conducted and each quiz can be evaluated for 5 marks adding up to 10 marks.
All quizzes are conducted online. Faculty may adopt innovative methods for conducting quizzes effectively.

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 2.

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

	Component	Marks	Total Marks
	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	CIE Test- 3	**40**	
	Quiz 1/AAT	**05**	
	Quiz 2/AAT	**05**	
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**
22ISE653.1	3	2	3	-	-	-	-	-	-	-	-	2	2	1	1
22ISE653.2	3	2	3	-	-	-	-	-	-	-	-	2	2	1	1
22ISE653.3	3	2	3	-	-	-	-	-	-	-	-	2	2	1	1
22ISE653.4	3	2	3	-	-	-	-	-	-	-	-	2	2	1	1
22ISE653.5	3	2	3	-	-	-	-	-	-	-	-	2	2	1	1
Average	3	2	3	-	-	-	-	-	-	-	-	2	2	1	1

Low-1: Medium-2: High-3

SEMESTER – VI

Course: Introduction to Web technologies

Course Code	22ISE654	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
No. of Credits	3	Examination Hours	3

Prerequisites: Basics of Computer Networks

Course Learning Objectives

CLO1	Understand the basic tags, forms and tables using HTML and CSS
CLO2	Design Client-Side programs using JavaScript and Server-Side programs using PHP
CLO3	Interpret Object Oriented Programming capabilities of PHP
CLO4	Understand query strings, cookies and sessions in web applications.

Contents	No. of Hours RBT Level
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.	**08 Hours L2**
Module 2 HTML Tables and Forms, Introducing Tables, Styling Tables, Introducing Forms, Form Control Elements, Table and Form Accessibility, Microformats, Advanced CSS: Layout, Normal Flow, Positioning Elements, Floating Elements, Constructing Multicolumn Layouts.	**08 Hours L3**
Module 3 JavaScript: Client-Side Scripting, What is JavaScript and What can it do?, JavaScript Design Principles, Where does JavaScript Go?, Syntax, JavaScript Objects, Introduction to Server-Side Development with PHP, What is Server-Side Development, A Web Server's Responsibilities, Quick Tour of PHP, Program Control, Functions	**08 Hours L3**
Module 4 PHP Arrays and Superglobals, Arrays, $_GET and $_POST Superglobal Arrays, $_SERVER Array, $_Files Array, Reading/Writing Files, PHP Classes and Objects, Object-Oriented Overview, Classes and Objects in PHP, Object Oriented Design	**08 Hours L3**
Module 5 Managing State, The Problem of State in Web Applications, Passing Information via Query Strings, Passing Information via the URL Path, Cookies, Serialization, Session State, HTML5 Web Storage, Caching.	**08 Hours L2**

COURSE OUTCOMES

Upon completion of this course, student will be able to

22ISE654.1	Discuss HTML tags and CSS to create web pages
22ISE654.2	Construct tables and forms using HTML and CSS
22ISE654.3	Apply JavaScript and PHP concepts for client side and server-side scripting
22ISE654.4	Illustrate the object-oriented PHP concepts
22ISE654.5	Discuss web services and its applications

Text Books

1. Randy Connolly, Ricardo Hoar, "Fundamentals of Web Development", 1 stEdition, Pearson Education India. (ISBN:978-9332575271)

Reference Books

1. Robin Nixon, "Learning PHP, MySQL &JavaScript with jQuery, CSS and HTML5", 4 thEdition, O'Reilly Publications, 2015. (ISBN:978-9352130153)
2. Luke Welling, Laura Thomson, "PHP and MySQL Web Development", 5th Edition, Pearson Education, 2016. (ISBN:978-9332582736)
3. Nicholas C Zakas, "Professional JavaScript for Web Developers", 3rd Edition, Wrox/Wiley India, 2012. (ISBN:978-8126535088)
4. David Sawyer Mcfarland, "JavaScript & jQuery: The Missing Manual", 1st Edition, O'Reilly/Shroff Publishers & Distributors Pvt Ltd, 2014

MOOCs (Format is given below)

1. https://nptel.ac.in/courses/106105084
2. https://www.coursera.org/learn/django-database-web-apps
3. https://www.udemy.com/topic/javascript/

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.

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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**	
	Quiz 1/AAT	**05**	
	Quiz 2/AAT	**05**	
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
22ISE654.1	2	-	-	-	2	-	-	-	-	-	-	2	-	-	-	-
22ISE654.2	2	2	2	-	2	-	-	-	-	-	-	2	2	-	-	-
22ISE654.3	2	2	2	-	2	-	-	-	-	-	-	2	-	-	-	-
22ISE654.4	2	2	2	-	2	-	-	-	-	-	-	2	2	-	-	-
22ISE654.5	2	-	-	-	2	-	-	-	-	-	-	2	2	-	-	-
Average	2	2	2	-	2	-	-	-	-	-	-	2	2	-	-	-

Low-1: Medium-2: High-3

SEMESTER – VI

Course: Environmental Science

Course Code	22CIV66	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**

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

22CIV66.1	Understand holistically the key concepts "Environment", and "Biodiversity".
22CIV66.2	Classify the types of natural resources available and the effects of anthropogenic interventions.
22CIV66.3	Express the gravity of various global environmental concerns.
22CIV66.4	Categorize the types of wastes generated and their handling at a basic level.
22CIV66.5	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

Scheme of Examination:

Semester End Examination (SEE): SEE Question paper is to be set for 50 marks with multiple choice questions of 1 mark each covering all aspects of the syllabus.

Continuous Internal Evaluation (CIE): Three Tests are to be conducted for 50 marks each. The average of the three tests are taken for computation of CIE. Question paper for each of the CIE is to be of the multiple-choice type with 50 question each.

Typical Evaluation pattern for regular courses is shown in Table.

Table 1: Distribution of weightage for CIE & SEE for 1 credit course

	Component	Marks	Total Marks
CIE	CIE Test-1	**50**	**50**
	CIE Test-2	**50**	
	CIE Test-2	**50**	
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
22CIV66.1	2	-	-	-	-	-	3	-	-	-	-	-	1	-	-
22CIV66.2	2	1	-	-	-	-	3	-	-	-	-	1	1	-	1
22CIV66.3	2	-	2	-	-	2	3	1	-	-	-	1	1	-	1
22CIV66.4	2	2	-	-	-	2	3	-	-	-	-	-	-	-	1
22CIV66.5	2	-	-	-	-	2	3	-	-	-	-	-	-	1	1
Average	**2**	**1.5**	**2**	**-**	**-**	**2**	**3**	**1**	**-**	**-**	**-**	**1**	**1**	**1**	**1**

Low-1: Medium-2: High-3

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 hour

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, 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**

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 intheir 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 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

Scheme of Examination:

Semester End Examination (SEE): SEE Question paper is to be set for 50 marks with multiple choice questions of 1 mark each covering all aspects of the syllabus.

Continuous Internal Evaluation (CIE): Three Tests are to be conducted for 50 marks each. The average of the three tests are taken for computation of CIE. Question paper for each of the CIE is to be of the multiple-choice type with 50 question each.

Typical Evaluation pattern for regular courses is shown in Table.

Table 1: Distribution of weightage for CIE & SEE for 1 credit course

	Component	Marks	Total Marks
CIE	CIE Test-1	**50**	**50**
	CIE Test-2	**50**	
	CIE Test-2	**50**	
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

IV Year

Scheme & Syllabus

2022 Batch

Scheme & Syllabus of UG Autonomous Program – 2022 batch
(7th & 8th Semester)

VII-SEMESTER:

Sl. No.	Course Code	Course Title	Course Type	Teaching Dept.	Teaching Hours/Week			Examination			CREDITS
					L	T	P	CIE	SEE	Total	
1	22ISE71	Storage Area Network	PC	Respective Department	3	0	0	50	50	100	3
2	22ISE72	Big data Analytics (Integrated)	IPC		3	0	2	50	50	100	4
3	22ISE73	IOT and Its Applications	IPC		3	0	2	50	50	100	4
4	22ISE74X	Program Elective 3	PEC		3	0	0	50	50	100	3
5	22ISE75X	Open Elective 2	OEC	Offering Department	3	0	0	50	50	100	3
6	22ISEP76	Project Phase 1	MP	Two Contact hours per week				100	-	100	2
Total								**350**	**250**	**600**	**19**

Program Elective 3*		**Program Elective 3***	
22ISE741	Natural Language Processing	22ISE743	.NET Framework for Applications
22ISE742	AI and Its Application	22ISE744	Blockchain Technologies
Open Elective 2 (Offered to other branch students)			
22ISE751	Introduction to JAVA	22ISE753	Introduction to Software Engineering
22ISE752	IT law and Ethics	22ISE754	Introduction to Data Science

***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.

VIII-SEMESTER:

Sl. No.	Course Code	Course Title	Course Type	Teaching Dept.	Teaching Hours/Week			Examination			CREDITS
					L	T	P	CIE	SEE	Total	
1	22ISE81	Software Architecture and Design Pattern	PC	Respective Department	4	0	0	50	50	100	4
2	22ISE82X	Program Elective 4	PEC		3	0	0	50	50	100	3
3	22ISE83X	Program Elective 5	PEC		3	0	0	50	50	100	3
4	22ISE84	Project work phase – II	MP	Two Contact hours per week				100	100	200	8
5	22ISE85	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**	**21**

Program Elective 4*		**Program Elective 4***	
22ISE821	Software Defined Network	22ISE823	Social Network Analysis
22ISE822	Green Computing	22ISE824	Digital Image Processing
Program Elective 5*			
22ISE831	System modeling and Simulation	22ISE833	Introduction to DevOps
22ISE832	Augmented Reality and VirtualReality	22ISE834	Robotics process Automation and Development

***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.

7th Semester Syllabus

SEMESTER – VII

Course: Storage Area Networks

Course Code	22ISE71	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
No. of Credits	03	Examination Hours	03

Prerequisites: Computer Networks, Operating System, Computer Organization

Course Learning Objectives:

CLO1	Understand meaning and need of storage area network
CLO2	Explore various data protection techniques
CLO3	Examine emerging technologies in storage area including IP-SAN
CLO4	Understand backup, recovery, disaster recovery, business continuity, and replication in storage area.

Content	No. 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. **Textbook1 : Ch.1.1 to 1.4, Ch.2.1 to 2.10**	**08 Hours 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. **Textbook1 : Ch.3.1 to 3.6, Ch. 4.1, 4.3, Ch. 5.1 to 5.3**	**08Hours L3**
Module 3 **IP SAN and FCoE:** iSCSI, FCIP **Network-Attached Storage:** General-Purpose Servers versus NAS Devices,Benefi ts 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 Textbook1 : Ch.6.1, 6.2, Ch. 7.1 to 7.8**	**08 Hours L3**
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. **Textbook1 : Ch.9.1 to 9.6, Ch. 10.1 to 10.9**	**08 Hours 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. **Textbook1 : Ch.11.1 to 11.7, Ch. 12.1, 12.2, Ch. 14.1 to 14.4**	**08 Hours** **L2**

COURSE OUTCOMES:

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

22ISE71.1	Understand basic concepts of Information Storage and Data Center Environment.
22ISE71.2	Outline the various data protection techniques to safeguard the storage system
22ISE71.3	Illustrate IP SAN and FCoE in Network Attached Storage Systems
22ISE71.4	Outline the various concepts of business continuity using backup and archive
22ISE71.5	Illustrate the various local and remote replication techniques to secure the storage infrastructure.

Textbooks:

1. EMC Education Services, "Information Storage and Management", Wiley India Publications, 2016. ISBN: 978-81-265-3750-1

Reference books:

1. **"Storage Area Network Essentials-** A Complete Guide to Understanding and Implementing SANs" by Richard Barker, Paul Massiglia , Wiley Computer Publishing,
2. **"Introduction to Storage Area Networks"** by Jon Tate, Pall Beck, Hector Hugo Ibarra, Shanmuganathan Kumaravel, Libor Miklas 9thEdition (December 2017), REDBOOK, IBM

MOOCs:

1. Storage Area Networking Fundamentals by IBM- https://www.ibm.com/training/course/SN71G
2. Storage Area Network with OpenfilerLinuxBuild - Udemy - https://www.udemy.com/course/build-your-own-san-storage/
3. Storage Area Network with Oracle ZFS on Centos Linux : L2- Udemy- https://www.udemy.com/course/storage-area-network-with-oracle-zfs-on-centos-linux-l2/

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.

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 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**	
	Quiz 1/AAT	**05**	
	Quiz 2/AAT	**05**	
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
22ISE71.1	3	3	-	-	-	-	-	-	-	-	-	2	-	2	-	-
22ISE71.2	3	3	2	-	-	-	-	-	-	-	-	2	-	2	-	-
22ISE71.3	3	3	2	-	-	-	-	-	-	-	-	2	-	2	-	-
22ISE71.4	3	3	-	-	-	-	-	-	-	-	-	2	-	2	-	-
22ISE71.5	3	3	-	-	-	-	-	-	-	-	-	2	-	2	-	-
Average	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**2**	**-**	**-**

Low-1: Medium-2: High-3

SEMESTER – VII

Course: Big Data Analytics (Integrated)

Course Code	**22ISE72**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:2**	**SEE Marks**	**50**
No. of Credits	**4**	**Examination Hours**	**03**

Prerequisites:

Basic Programming knowledge, Knowledge of SQL

Course Learning Objectives:

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
CLO5	Understand various machine learning algorithms for Big Data Analytics, Web Mining and Social Network Analysis.

Content	**No.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. **Text book 1: Chapter 1: 1.2 -1.7**	**10 Hours L2**
Module 2 **Introduction to Hadoop (T1)**: Introduction, Hadoop and its Ecosystem, Hadoop Distributed File System, MapReduce Framework and Programming Model, Hadoop Yarn, Hadoop Ecosystem Tools. **Hadoop Distributed File System Basics (T2)**: HDFS Design Features, Components, HDFS User Commands. Essential Hadoop Tools (T2): Using Apache Pig, Hive, Sqoop, Flume, Oozie, HBase. **Text book 1: Chapter 2 :2.1-2.6 Text Book 2: Chapter 3** Text Book 2: Chapter 7 (except walk throughs) RBT: L1, L2, L3	**10 Hours L3**
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. **Text book 1: Chapter 3: 3.1-3.7**	**10 Hours L3**
Module 4 **MapReduce, Hive and Pig**: Introduction, MapReduce Map Tasks, Reduce Tasks and MapReduce Execution, Composing MapReduce for Calculations and Algorithms, Hive, HiveQL, Pig. **Text book 1: Chapter 4: 4.1-4.6**	**10 Hours L3**

Module 5	
Machine Learning Algorithms for Big Data Analytics: Introduction, Estimating the relationships, Outliers, Variances, Probability Distributions, and Correlations, Regression analysis, Finding Similar Items, Similarity of Sets and Collaborative Filtering, Frequent Itemsets and Association Rule Mining. 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: Text book 1: Chapter 6: 6.1 to 6.5 and Chapter 9: 9.1 to 9.5	**10 Hours L3**

Program List	
1	Working with Data Storage and Analysis
2	Programming on Big Data Analytics Applications
3	Getting familiar with Pig, Hive, Sqoop in Hadoop
4	Getting familiar with Flume, Oozie, HBase in Hadoop
5	Getting familiar with MongoDB Databases
6	Getting familiar with Cassandra Databases
7	Using MapReduce for Calculations
8	Working with MapReduce Algorithms
9	Getting familiar with Machine Learning Algorithms for Big Data Analytics
10	Working with mining algorithms and getting familiar with Social network Analysis, Text mining, Web mining etc.

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

22ISE72.1	Understand the fundamentals of Big Data Analytics and its applications.
22ISE72.2	Describe Hadoop and its ecosystem and Hadoop Distributed File system.
22ISE72.3	Demonstrate the concepts of NoSQL using MongoDB and Cassandra Databases for Big Data.
22ISE72.4	Illustrate the MapReduce programming model to process the big data along with Hadoop tools.
22ISE72.5	Apply the knowledge of Hadoop framework, HDFS, MongoDB, Casandra, Machine learning algorithms in solving the real world problems associated with Big Data.

Textbooks:

1. Raj Kamal and Preeti Saxena, “Big Data Analytics Introduction to Hadoop, Spark, and Machine-Learning”, McGraw Hill Education, 2018 ISBN: 9789353164966, 9353164966
2. Douglas Eadline, "Hadoop 2 Quick-Start Guide: Learn the Essentials of Big Data Computing in the Apache Hadoop 2 Ecosystem", 1 stEdition, Pearson Education, 2016. ISBN13: 978-9332570351

Reference books:

1. Tom White, “Hadoop: The Definitive Guide”, 4th Edition, O‟Reilly Media, 2015.ISBN-13: 978-9352130672 2.
2. Boris Lublinsky, Kevin T Smith, Alexey Yakubovich, "Professional Hadoop Solutions", 1 stEdition, Wrox Press, 2014ISBN-13: 978-8126551071
3. Eric Sammer, "Hadoop Operations: A Guide for Developers and Administrators",1 stEdition, O'Reilly Media, 2012.ISBN-13: 978-9350239261
4. Arshdeep Bahga, Vijay Madisetti, "Big Data Analytics: A Hands-On Approach", 1st Edition, VPT Publications, 2018. ISBN-13: 978-0996025577

MOOCs:

1. http://nptel.ac.in/
2. https://www.khanacademy.org/
3. E-learning: www.vtu.ac.in
4. https://onlinecourses.nptel.ac.in/noc20_cs92/preview
5. https://www.classcentral.com/course/big-data-analytics-18252

Scheme of Examination:

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 for theory component are to be conducted for 40 marks each. Marks scored in each test is reduced to 30. Two lab CIE is conducted for 20 marks each and average is added to theory component

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 Test-1	**30**	**50**
	CIE Test-2	**30**	
	CIE Test- 3	**30**	
	Laboratory	**20**	
SEE	Semester End Examination	**100**	**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**
22ISE72.1	3	2	2	-	1	-	-	-	-	-	-	2	2	-	-	-
22ISE72.2	3	2	2	-	1	-	-	-	-	-	-	2	2	-	-	-
22ISE72.3	3	2	2	-	1	-	-	-	-	-	-	2	2	-	-	-
22ISE72.4	3	2	2	-	1	-	-	-	-	-	-	2	2	-	-	-
22ISE72.5	3	2	2	-	1	-	-	-	-	-	-	2	2	-	-	-
Average	3	2	2	-	1	-	-	-	-	-	-	2	2	-	-	-

Low-1: Medium-2: High-3

SEMESTER - VII
Course: IOT & Its Applications

Course Code	**22ISE73**	**CIE Marks**	**50**
Hours/Week(L:T:P)	**3:0:2**	**SEE Marks**	**50**
No. of Credits	**04**	**Examination Hours**	**03**

Prerequisite: Computer Network

Course Objectives:

CLO1	Understand the fundamentals of wireless sensor networks and wireless Internet.
CLO2	Describe the various protocols at various layers and its differences with traditional protocols.
CLO3	Understand the issues pertaining to sensor networks and the challenges involved in managing a sensor network.
CLO4	Understand the architecture and design principles for device supporting IoT
CLO5	Develop competence in programming for IoT Applications and its case study

Content	**No.of Hours/ RBT levels**
Module -1 **Overview of Wireless Sensor Networks:** Challenges for Wireless Sensor Networks, Enabling Technologies for Wireless Sensor Networks. Architecture: Single Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes, Operating Systems and Execution Environments, Network Architecture - Sensor Network Scenarios, Design Principles of WSN's.	**08 Hours L3**
Module -2 **Communication Protocols:** Physical Layer and Transceiver Design Considerations, MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols and Wakeup Concepts- S-MAC, The Mediation Device Protocol, Wakeup Radio Concepts, Contention-based protocols (CSMA, PAMAS), Schedule-based protocols (LEACH, SMACS, TRAMA)	**08 Hours L3**
Module -3 **Routing Protocols:** The many faces of forwarding and routing, Gossiping and agent-based unicast forwarding, Energy-efficient unicast, Broadcast and multicast, Geographic routing, Mobile nodes.	**08 Hours L2**
Module -4 **Sensors Participatory Sensing RFID and WSN's:** Introduction, Sensor Technology, Participatory Sensing, Industrial IoT and Automotive IoT, Activator, Sensor Data Communication Protocols, RFID, WSN Technology	**08 Hours L2**

Module -5	
Prototyping the Embedded Devices for IoT and M2M: Introduction, Embedded Computing basics, Embedded Platforms for prototyping, things always connected to internet. Case Study: Connected ATM premises monitoring RFID, Customer monitoring, connected Car, smart city.	**08 Hours L3**

COURSE OUTCOMES:

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

22ISE73.1	Understand the fundamentals of wireless sensor networks and node architecture.
22ISE73.2	Understand the various communication protocols in Wireless Sensor Network's
22ISE73.3	Describes the various Routing protocols and its design issues.
22ISE73.4	Describe various sensor technologies in designing IoT
22ISE73.5	Illustrate Embedded computing systems of IoT and its case study.

Textbooks:

1. **Protocols And Architectures for Wireless Sensor Networks**, Holger Karl & Andreas Willig, John Wiley, 2005.
2. **Internet of Things - Architecture and design principles**, Raj Kamal, McGraw Hill Education.

Reference Books:

1. Wireless Sensor Networks - An Information Processing Approach, Feng Zhao & Leonidas J Guibas , Elsevier 2007.
2. Internet of Things, Srinivasa K G, CENCAGE Learning India,2017
3. Wireless Communications and Networks, William Stallings, Pearson Education – 2004.
4. A survey of routing protocols in wireless sensor networks, K. Akkaya and M. Younis, Elsevier Ad Hoc Network Journal, Vol. 3, no. 3, pp. 325—349
5. Wireless Sensor Network Designs, Anna Ha´c, John Wiley & Sons Ltd

E-Books / Web References:

1. https://www.kth.se/social/files/5431a388f276540a05ad2514/An_Introduction WSNS_V1.8.pdf
2. https://www.researchgate.net/publication/261958666_Fundamentals_of_Wireless Sensor_Networks_Theory_and_Practice

MOOCs

1. http://nptel.ac.in/courses.php?disciplineId=111
2. https://www.khanacademy.org/
3. https://www.class-central.com/subject
4. E-learning: www.vtu.ac.in

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. Marks scored in each test is reduced to 20 and added to test component.

CIE is executed by way of two quizzes / Alternate Assessment Tools (AATs), and three tests.

Quizzes are to be conducted and each quiz can be evaluated for 5 marks adding up to 10 marks.

All quizzes are conducted online. Faculty may adopt innovative methods for conducting quizzes effectively.

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-athon/ 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 & SEE of Regular courses

	Component	Marks	Total Marks
	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	CIE Test- 3	**40**	
	Quiz 1/AAT	**05**	
	Quiz 2/AAT	**05**	
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
22ISE73.1	3	2	-	-	2	2	-	2	-	-	-	3	-	3	-	-
22ISE73.2	3	2	-	-	2	2	-	2	-	-	-	3	-	3	-	-
22ISE73.3	3	2	-	-	2	2	-	2	-	-	-	3	-	3	-	-
22ISE73.4	3	2	-	-	2	2	-	2	-	-	-	3	-	3	-	-
22ISE73.5	3	2	-	-	2	2	-	2	-	-	-	3	-	3	-	-
Average	**3**	**2**	**-**	**-**	**2**	**2**	**-**	**2**	**-**	**-**	**-**	**3**	**-**	**3**	**-**	**-**

Low-1: Medium-2: High-3

SEMESTER – VII

Course: Natural Language Processing

Course Code	22ISE741	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
No. of Credits	3	Examination Hours	3

Prerequisites:

- Basics of Engineering Mathematics, Algorithms and Programming skills
- Probability and Statistics, Machine learning and deep learning concepts

Course Learning Objectives

CLO1	Identify NLP applications in business and social contexts.
CLO2	Explain the advantages and disadvantages of different NLP technologies and their applicability in different business situations.
CLO3	Understand approaches to syntax and semantics in NLP
CLO4	Understand machine learning techniques used in NLP
CLO5	Apply fundamental algorithms and techniques in the area of natural language processing (NLP)

Contents	No. of Hours RBT Level
Module 1 **Overview and language modeling**: **Overview**: Origins and challenges of NLP-Language and Grammar-Processing Indian Languages- NLP Applications-Information Retrieval. **Language Modeling**: Various Grammar- based Language Models-Statistical Language Model. **Textbook 1: Ch. 1,**2	**08 Hours L2**
Module 2 **Word level and syntactic analysis**: **Word Level Analysis**: Regular Expressions-Finite State Automata-Morphological Parsing-Spelling Error Detection and Correction-Words and Word Classes-Part-of Speech Tagging. **Syntactic Analysis**: Context-free Grammar Constituency- Parsing-Probabilistic Parsing. **Textbook 1: Ch. 3,4**	**08 Hours L3**
Module 3 **Mining Diagnostic Text Reports by Learning to Annotate Knowledge Roles**: Introduction, Domain Knowledge and Knowledge Roles, Frame Semantics and Semantic Role Labeling, Learning to Annotate Cases with Knowledge Roles and Evaluations. **A Case Study in Natural Language Based Web Search**: InFact System Overview, The GlobalSecurity.org Experience. **Textbook 2: Ch. 4,5**	**08 Hours L3**
Module 4 **Automatic Document Separation**: A Combination of Probabilistic Classification and Finite-State Sequence Modeling: Introduction, Related Work, Data Preparation, Document Separation as a Sequence Mapping Problem, Results.	**08 Hours L3**

Evolving Explanatory Novel Patterns for Semantically-Based Text Mining: Related Work, A Semantically Guided Model for Effective Text Mining. **Textbook 2: Ch. 8,9**	
Module 5 **INFORMATION RETRIEVAL AND LEXICAL RESOURCES**: **Information Retrieval**: Design features of Information Retrieval Systems, Information Retrieval Models - Classical, Non classical, Alternative Models of IR, Evaluation of IR System. **Lexical Resources**: WordNet, FrameNet, Stemmers, POS Tagger. **Textbook 1: Ch. 9,12**	**08 Hours** **L2**

COURSE OUTCOMES

Upon completion of this course, student will be able to

22ISE741.1	Understand the natural language text data and perform processing
22ISE741.2	Define the importance of natural language processing.
22ISE741.3	Understand the concepts and importance of Text mining.
22ISE741.4	Demonstrate the machine learning techniques used in NLP
22ISE741.5	Illustrate information retrieval techniques.

Text Books

1. Tanveer Siddiqui, U.S. Tiwary, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008.
2. Anne Kao and Stephen R. Poteet (Eds), "Natural Language Processing and Text Mining", Springer-Verlag London Limited 2007.

Reference Books

1. Daniel Jurafsky and James H Martin, "Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition", 2nd Edition, Prentice Hall, 2008.
2. James Allen, "Natural Language Understanding", 2nd edition, Benjamin/Cummings publishing company, 1995.
3. Gerald J. Kowalski and Mark T. Maybury, "Information Storage and Retrieval systems", Kluwer academic Publishers, 2000.

MOOCs (Format is given below)

1. https://www.upf.edu/web/mtg/nlp-tutorial
2. https://nlp.stanford.edu/fsnlp
3. http://nptel.ac.in
3. https://www.khanacademy.org/
4. https://www.class-central.com (MOOCS)
5. E-learning: www.vtu.ac.in

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 three tests.
Two quizzes can 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.
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 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**	
	Quiz 1/AAT	**05**	
	Quiz 2/AAT	**05**	
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
22ISE741.1	3	2	2	-	-	-	-	-	-	-	-	2	-	2	-	-
22ISE741.2	3	2	2	-	-	-	-	-	-	-	-	2	-	2	-	-
22ISE741.3	3	2	2	-	-	-	-	-	-	-	-	2	-	2	-	-
22ISE741.4	3	2	2	-	-	-	-	-	-	-	-	2	-	2	-	-
22ISE741.5	3	2	2	-	-	-	-	-	-	-	-	2	-	2	-	-
Average	3	2	2	-	-	-	-	-	-	-	-	2	-	2	-	-

Low-1: Medium-2: High-3

SEMESTER – VII

Course: AI & Its Application

Course Code	**22ISE742**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
No. of Credits	**3**	**Examination Hours**	**03**

Prerequisites: Basics of Algorithms

Course Learning Objectives:

CLO1	Identify the problems where AI is required and the different methods available
CLO2	Compare and contrast different AI techniques available.
CLO3	Define and explain learning algorithms

Content	**No.of Hours/ RBT levels**
Module 1 **Introduction**: What is artificial intelligence? Problems, problem spaces and search	**08 Hours L2**
Module 2 **Knowledge Representation** : Knowledge Representation Issues, Using Predicate Logic, Representing knowledge using Rules	**08 Hours L2**
Module 3 **Reasoning** : Symbolic Reasoning under Uncertainty, Statistical reasoning	**08 Hours L2**
Module 4 **Natural Language Processing** : Game Playing, Natural Language Processing	**08 Hours L2**
Module 5 **Expert Systems** : Learning, Expert Systems	**08 Hours L2**

COURSE OUTCOMES:

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

22ISE742.1	Identify problems that can be solved by AI methods
22ISE742.2	Explain the way of representation of knowledge
22ISE742.3	Apply reasoning techniques to solve the AI problems
22ISE742.4	Interpret natural language processing, various learning techniques and expert systems

Textbooks:

1. E. Rich , K. Knight & S. B. Nair - Artificial Intelligence, 3/e, McGraw Hill.

Reference books:

1. Artificial Intelligence: A Modern Approach, Stuart Rusell, Peter Norving, Pearson Education 2nd Edition.
2. Dan W. Patterson, Introduction to Artificial Intelligence and Expert Systems – Prentice Hal of India.
3. G. Luger, "Artificial Intelligence: Structures and Strategies for complex problem Solving", Fourth Edition, Pearson Education, 2002.
4. Artificial Intelligence and Expert Systems Development by D W Rolston-Mc Graw hill.
5. N.P. Padhy "Artificial Intelligence and Intelligent Systems" , Oxford University Press-2015

MOOCs:

1. https://www.coursera.org/lecture/ibm-exploratory-data-analysis-for-machine-learning/introduction-to-artificial-intelligence-and-machine-learning-DMVcd
2. https://nptel.ac.in/courses/106/105/106105077/

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.

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 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**	
	Quiz 1/AAT	**05**	
	Quiz 2/AAT	**05**	
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
22ISE742.1	2	2	2	-	-	-	-	-	-	-	-	1	2	-	-	-
22ISE742.2	2	-	2	-	-	-	-	-	-	-	-	1	2	-	-	-
22ISE742.3	2	2	2	-	-	-	-	-	-	-	-	1	2	-	-	-
22ISE742.4	2	2	2	-	-	-	-	-	-	-	-	1	2	-	-	-
Average	2	2	2	-	-	-	-	-	-	-	-	1	2	-	-	-

Low-1: Medium-2: High-3

SEMESTER – VII

Course: .Net Framework for Applications

Course Code	22ISE743	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
No. of Credits	3	Examination Hours	03

Prerequisites: Basics of Programming

Course Learning Objectives:

CLO1	Inspect Visual Studio programming environment and toolset designed to build applications for Microsoft Windows
CLO2	Understand Object Oriented Programming concepts in C# programming language.
CLO3	Interpret Interfaces and define custom interfaces for application.
CLO4	Build custom collections and generics in C#
CLO5	Construct events and query data using query expressions

Content	No.of Hours/ RBT levels
Module 1 **Introducing Microsoft Visual C# and Microsoft Visual Studio 2015:** Welcome to C#, Working with variables, operators and expressions, Writing methods and applying scope, Using decision statements, Using compound assignment and iteration statements, Managing errors and exceptions	**08 Hours L2**
Module 2 **Understanding the C# object model:** Creating and Managing classes and objects, Understanding values and references, Creating value types with enumerations and structures, Using arrays	**08 Hours L2**
Module 3 **Understanding parameter arrays,** Working with inheritance, Creating interfaces and defining abstract classes, Using garbage collection and resource management.	**08 Hours L3**
Module 4 **Defining Extensible Types with C#:** Implementing properties to access fields, Using indexers, Introducing generics, Using collections	**08 Hours L3**
Module 5 **Enumerating Collections,** Decoupling application logic and handling events, Querying in memory data by using query expressions, Operator overloading	**08 Hours L3**

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

22ISE743.1	Build applications on Visual Studio .NET platform by understanding the syntax and semantics of C#
22ISE743.2	Demonstrate Object Oriented Programming concepts in C# programming language
22ISE743.3	Design custom interfaces for applications and leverage the available built-in interfaces in building complex applications.
22ISE743.4	Illustrate the use of generics and collections in C#
22ISE743.5	Compose queries to query in-memory data and define own operator behavior.

Textbooks:

1. John Sharp, Microsoft Visual C# Step by Step, 8th Edition, PHI Learning Pvt. Ltd. 2016

Reference books:

1. Christian Nagel, "C# 6 and .NET Core 1.0", 1st Edition, Wiley India Pvt Ltd, 2016. Andrew Stellman and Jennifer Greene, "Head First C#", 3rd Edition, O'Reilly Publications, 2013.
2. Mark Michaelis, "Essential C# 6.0", 5th Edition, Pearson Education India, 2016.
3. Andrew Troelsen, "Prof C# 5.0 and the .NET 4.5 Framework", 6th Edition, Apress and Dreamtech Press, 2012.

MOOCs

1. http://nptel.ac.in
2. https://www.coursera.org/
3. https://www.udemy.com

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.

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 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**	
	Quiz 1/AAT	**05**	
	Quiz 2/AAT	**05**	
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**
22ISE743.1	3	3	-	-	3	-	-	-	-	-	-	-	2	-	-	-
22ISE743.2	3	3	-	-	3	-	-	-	-	-	-	-	2	-	-	-
22ISE743.3	3	3	-	-	3	-	-	-	-	-	-	-	2	-	-	-
22ISE743.4	3	3	-	-	3	-	-	-	-	-	-	-	2	-	-	-
22ISE743.5	3	3	-	-	3	-	-	-	-	-	-	-	2	-	-	-
Average	3	3	-	-	3	-	-	-	-	-	-	-	2	-	-	-

Low 1: Medium-2: High-3

SEMESTER – VII

Course: Blockchain Technology

Course Code	22ISE744	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
No. of Credits	3	Examination Hours	3

Prerequisites: Basics of networking and Cryptography

Course Learning Objectives:

CLO1	Understand the basic terminologies of cryptography.
CLO2	Understand how blockchain systems (mainly Bitcoin and Ethereum) work.
CLO3	Explain smart contracts and distributed applications.
CLO4	Understand various applications of Blockchain.

Content	No.of Hours/ RBT levels
Module 1 Blockchain 101: Distributed systems, History of blockchain, Introduction to blockchain, Types of blockchain, CAP theorem and blockchain, Benefits and limitations of blockchain.	**08 Hours L2**
Module 2 Decentralization and Cryptography: Decentralization using blockchain, Methods of decentralization, Routes to decentralization, Decentralized organizations. Cryptography and Technical Foundations: Cryptographic primitives, Asymmetric cryptography, Public and private keys.	**08 Hours L2**
Module 3 Bitcoin and Alternative Coins A: Bitcoin, Transactions, Blockchain, Bitcoin payments B: Alternative Coins, Theoretical foundations, Bitcoin limitations, Namecoin, Litecoin, Primecoin, Zcash.	**08 Hours L2**
Module 4 Smart Contracts and Ethereum 101: Smart Contracts: Definition, Ricardian contracts. Ethereum 101:Introduction, Ethereum blockchain, Elements of the Ethereum blockchain, Precompiled contracts.	**08 Hours L3**
Module 5 Alternative Blockchains: Blockchains Blockchain-Outside of Currencies: Internet of Things, Government, Health, Finance, Media.	**08 Hours L2**

COURSE OUTCOMES:

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

22ISE744.1	Summarize the terminologies and types of block chain.
22ISE744.2	Understand the basics of distributed system and cryptographic terminologies.
22ISE744.3	Outline distributed consensus in Bitcoin and its alternative options.
22ISE744.4	Develop Smart contracts which can be applied for various use cases.
22ISE744.5	Illustrate various applications of Blockchain.

Textbooks:

1. Mastering Blockchain - Distributed ledgers, decentralization and smart contracts explained, Author- Imran Bashir, Packt Publishing Ltd, Second Edition, ISBN 978-1- 78712-544-5, 2017

Reference books:

1. Bitcoin and Cryptocurrency Technologies, Author- Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, Steven Goldfeder, Princeton University, 2016 Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System
2. DR. Gavin Wood, ``ETHEREUM: A Secure Decentralized Transaction Ledger,''Yellow paper.2014.

E-Books / Web References :

1. Blockchain for dummies-IBM limited edition http://gunkelweb.com/coms465/texts/ibm_blockchain.pdf.
2. https://www.blockchainexpert.uk/book/blockchain-book.pdf

MOOCs:

1. https://www.upgrad.com/blog/blockchain-free-online-course/

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.

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 2.

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

	Component	Marks	Total Marks
	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	CIE Test- 3	**40**	
	Quiz 1/AAT	**05**	
	Quiz 2/AAT	**05**	
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**
22ISE744.1	3	2	1	-	-	-	-	-	-	-	-	-	-	3	-	-
22ISE744.2	3	2	1	-	-	-	-	2	-	-	-	-	-	3	-	-
22ISE744.3	3	2	1	-	-	-	-	3	-	-	-	-	-	3	-	-
22ISE744.4	3	3	1	2	-	-	-	3	-	-	-	-	-	3	-	-
22ISE744.5	3	-	1	-	-	-	-	3	-	-	-	-	-	3	-	-
Average	3	3	1	2	-	-	-	3	-	-	-	-	-	3	-	-

Low-1: Medium-2: High-3

SEMESTER – VII

Course: Introduction to JAVA

Course Code	22ISE751	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
No. of Credits	3	Examination Hours	3

Course Learning Objectives:

CLO1	Understand the object-oriented concepts in JAVA.
CLO2	Implement the concepts of control structures
CLO3	Discuss the concepts of Inheritance and its types
CLO4	Learn the concepts of importing packages and exception handling mechanism.
CLO5	Discuss the String Handling examples with Object Oriented concepts

Content	No.of Hours/ RBT levels
Module 1 **Introduction to Java**: Java's magic: The Byte code; Java Development Kit (JDK); the Java Buzzwords, Object-oriented programming; Simple Java programs. Data types, variables and arrays.	**08 Hours L2**
Module 2 **Operators:** Arithmetic Operators, The Bitwise Operators, Relational Operators, Boolean Logical Operators, The Assignment Operator, The ? Operator, Operator Precedence, Using Parentheses, Control Statements: Java‟s Selection Statements, Iteration Statements, Jump Statements	**08Hours L2**
Module 3 **Classes:** Classes fundamentals; Declaring objects; Constructors, this keyword, garbage collection. **A Closer Look at Methods and Classes:** Overloading methods, Using Objects as parameters, Returning objects **Inheritance:** Inheritance basics, using super, creating multilevel hierarchy, method overriding, Using Abstract classes.	**08 Hours L3**
Module 4 **Exception handling:** Exception handling in Java. Packages, Access Protection, Importing Packages, Interfaces.	**08 Hours L3**

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 , Additional String Methods, StringBuffer, StringBuilder	**08 Hours L3**

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

22ISE751.1	Illustrate the fundamentals of Java Programming.
22ISE751.2	Demonstrate object-oriented concepts in Java.
22ISE751.3	Implement the concepts of inheritance to solve real world problems in Java
22ISE751.4	Apply exception handling mechanism in Java application development.
22ISE751.5	Develop Java programs to process strings using string handler methods.

Textbooks:

1. **Java the Complete Reference,** Herbert Schildt, 11th Edition, Tata McGraw Hill, 2019.

Reference books:

1. **Starting Out with Java**: From Control Structures through Objects Tony Gaddis, Haywood Community College.—6th edition, Pearson Education.2017
2. **Big Java**: **Early Objects**, Cay S. Horstmann, 7th Edition, Wiley Publication.
3. **Advanced JAVA programming**, Uttam K Roy, Oxford University press, 2015.

MOOCs:

1. Programming in java:https://nptel.ac.in/courses/106/105/106105191/
2. Java Tutorial for Complete Beginners: https://www.udemy.com/course/java-tutorial/
3. Core Java Specialization:https://www.coursera.org/specializations/core-java

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 carrying20 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. CIE is executed by way of two quizzes / Alternate Assessment Tools (AATs), and three 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.

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-athon/ 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 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**	
	Quiz 1/AAT	**05**	
	Quiz 2/AAT	**05**	
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
22ISE751.1	3	3	3	-	2	-	-	-	-	-	-	1	1	-	-	-
22ISE751.2	3	3	3	-	2	-	-	-	-	--	-	1	2	-	-	-
22ISE751.3	3	3	3	-	2	-	-	-	-	-	-	1	2	-	-	-
22ISE751.4	3	3	3	-	2	-	-	-	-	-	-	1	2	-	-	-
22ISE751.5	3	3	3	-	2	-	-	-	-	-	-	1	2	-	-	-
Average	**3**	**3**	**3**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**1.8**	**-**	**-**	**-**

Low-1: Medium-2: High-3

SEMESTER – VII

Course: IT law and Ethics

Course Code	22ISE752	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
No. of Credits	3	Examination Hours	3

Course Learning Objectives:

CLO1	Understand the Cyber Law, Cyber Ethics, Cyber Jurisdiction, Hierarchy of courts, Civil and criminal jurisdictions, Cyberspace-Web space.
CLO2	Understand the Information Technology Act, Cyber Regulations Appellate Tribunal, Penalties and Adjudication.
CLO3	Understand the Patent Law, Trademark Law, Copyright, Software – Copyright or Patented, Domain Names and Copyright disputes.
CLO4	Understand the Electronic Business and Legal Issues.
CLO5	Understand the Importance of Cyber Law, Significance of cyber Ethics.

Contents	No. of Hours RBT Level
Module 1 **Introduction to Cyber Law:** Evolution of computer technology, emergence of cyber space. Cyber Jurisprudence, Jurisprudence and law, Doctrinal approach, Consensual approach, Real Approach, Cyber Ethics, Cyber Jurisdiction, Hierarchy of courts, Civil and criminal jurisdictions, Cyberspace-Web space, Web hosting and web Development agreement, Legal and Technological Significance of domain Names, Internet as a tool for global access.	**08 Hours L2**
Module 2 **Information Technology Act:** Overview of IT Act, 2000, Amendments and Limitations of IT Act, Digital Signatures, Cryptographic Algorithm, Public Cryptography, Private Cryptography, Electronic Governance, Legal Recognition of Electronic Records, Legal Recognition of Digital Signature, Certifying Authorities, Cyber Crime and Offences, Network Service Providers Liability, Cyber Regulations Appellate Tribunal, Penalties and Adjudication.	**08 Hours L3**
Module 3 **Cyber Law and Related Legislation:** Patent Law, Trademark Law, Copyright, Software – Copyright or Patented, Domain Names and Copyright disputes, Electronic Data Base and its Protection, IT Act and Civil Procedure Code, IT Act and Criminal Procedural Code, Relevant Sections of Indian Evidence Act, Relevant Sections of Bankers Book Evidence Act, Relevant Sections of Indian Penal Code, Relevant Sections of Reserve Bank of India Act, Law Relating To Employees And Internet, Alternative Dispute Resolution , Online Dispute Resolution (ODR).	**08 Hours L3**

Module 4 **Electronic Business and Legal Issues:** Evolution and development in E-commerce, paper vs paper less contracts E-Commerce models- B2B, B2C, E security. Business, taxation, electronic payments, supply chain, EDI, E-markets, Emerging Trends.	**08 Hours L3**
Module 5 **Cyber Ethics:** The Importance of Cyber Law, Significance of cyber Ethics, Need for Cyber regulations and Ethics. Ethics in Information society, Introduction to Artificial Intelligence Ethics: Ethical Issues in AI and core Principles, Introduction to Block chain Ethics	**08 Hours L2**

COURSE OUTCOMES

Upon completion of this course, student will be able to

22ISE752.1	Understand Cyber laws, Cyber Ethics, Cyber Jurisdiction, Hierarchy of courts, Civil and criminal jurisdictions, Cyberspace-Web space
22ISE752.2	Describe Information Technology act and Related Legislation & Cyber Law and Related Legislation.
22ISE752.3	Demonstrate Electronic business and legal issues.
22ISE752.4	Interpret Cyber Ethics, Significance of cyber Ethics, Need for Cyber regulations and Ethics. Ethics in Information society.

Text Books

1. Cyber Security and Cyber Laws, Nilakshi Jain, Ramesh Menon, Wiley
2. Cyber Laws and IT protection, Harish Chander PHI publications

Reference Books

1. Cyber Laws and Ethics, ISBN: 9789390450244, Edition: 1st, 2021, Technical Publications
2. Cyber Law and Ethics Regulation of the Connected World By Mark Grabowski, Eric P. Robinson

MOOCs

1. https://www.khanacademy.org/
2. E-learning: www.vtu.ac.in

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.
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 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**	
	Quiz 1/AAT	**05**	
	Quiz 2/AAT	**05**	
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
22ISE752.1	-	-	-	-	-	-	-	3	-	1	2	2	-	-	-	-
22ISE752.2	-	-	-	-	-	-	-	3	-	1	2	2	-	-	-	-
22ISE752.3	-	-	-	-	-	-	-	3	-	1	2	2	-	-	-	-
22ISE752.4	-	-	-	-	-	-	-	3	-	1	2	2	-	-	-	-
Average	-	-	-	-	-	-	-	3	-	1	2	2	-	-	-	-

Low-1: Medium-2: High-3

SEMESTER – VII

Course: Introduction to Software Engineering

Course Code	22ISE753	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
No. of Credits	3	Examination Hours	3

Prerequisites: Basics of computers

Course Learning Objectives

CLO1	Discuss the software engineering principles, process, and requirements in building large software programs.
CLO2	To Infer the fundamentals of object-oriented concepts, different system models, and design patterns
CLO3	Discuss the various types of software testing practices and software evolution processes
CLO4	Identify the importance of agile practices in software development and Real Time OS
CLO5	Recognize the Project planning with its methods and methodologies

Contents	No. of Hours RBT Level
Module 1 **Introduction to Software Engineering:** Introduction: Professional Software development , Software Engineering Ethics, Case Studies (Textbook 1: Chapter 1: 1.1 to 1.3) **Software Process:** Software Process models, Process Activities, Process Improvement. (Textbook 1: Chapter 2: 2.1, 2.2, 2.4) **Requirements Engineering**: Functional and non Functional requirements, Requirements Engineering process, Eliciting Requirements, Requirements specification, Validating Requirements, Requirements change. Textbook 1: Chapter 4: 4.1 to 4.6	**08 Hours L2**
Module 2 **Introduction, System Modeling:** Context models, Interaction models, Structural models, Behavioral models, Model-driven architecture Textbook 1: Chapter 5: 5.1 to 5.5 **Architectural Designs :** Architectural design decisions, View, Patterns, Application Architecture Textbook 1: Chapter 6: 6.1 to 6.4	**08 Hours L2**
Module 3 **Software Testing:** A Strategic Approach to Software Testing, Strategic Issues, Test Strategies for Conventional Software, Test Strategies for Object -Oriented Software, Validation Testing, System Testing, The Art of Debugging. Textbook 2: Chapter 17: 17.1 to 17.8 **Software Evolution:** Evolution processes, Program evolution dynamics, Software maintenance, Legacy system management Textbook 1: Chapter 9: 9.1 to 9.3	**08 Hours L2**

Module 4 **Agile Software Development :**Agile Methods, Agile development techniques, Agile project management, Scaling agile methods Textbook 1: Chapter 3:3.1 to 3.4 **Real-Time Software Engineering:** Embedded system design, Architectural patterns for real-time software systems, Real Time Operating Systems(RTOS) Textbook 1: Chapter 21:21.1 to 21.4	**08 Hours L2**
Module 5 **Introduction to Project Management:** Risk Management, Managing people, Teamwork Textbook 1: Chapter 22: 22.1 to 22.3 **Project Planning:** Software pricing, Plan Driven Development, Project scheduling Agile planning, Estimation techniques, COCOMO cost modeling. Textbook 1: Chapter 23: 23.1 to 23.6 **Quality Management:** Software Quality, Software standards, Reviews and inspections, Software measurement. Textbook 1: Chapter 24: 24.1 to 24.3 & 24.5	**08 Hours L2**

COURSE OUTCOMES

Upon completion of this course, student will be able to

22ISE753.1	Understand the activities involved in software engineering and analyze the role of various process models and Requirements
22ISE753.2	Explain the basics of class models using modeling techniques and Architectural designs
22ISE753.3	Illustrate the various software testing methods and understand the importance of agile methodology
22ISE753.4	Describe software practices in agile methodology
22ISE753.5	Illustrate the role of project planning and quality management in software development

Text Books

1. Software Engineering, Ian Sommerville, 10th Edition, Pearson Education
2. Roger S. Pressman: Software Engineering-A Practitioners approach, 7th Edition, Tata McGraw Hill.

Reference Books

1. Software Engineering-A Practitioners Approach, Roger S. Pressman, 7th Edition, Tata McGraw Hill.
2. An Integrated Approach to Software Engineering, Pankaj Jalote:, Wiley India

MOOCs (Format is given below)

1. http://nptel.ac.in
2. https://www.class-central.com (MOOCS)
3. E-learning: www.vtu.ac.in

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.
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 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**	
	Quiz 1/AAT	**05**	
	Quiz 2/AAT	**05**	
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**
22ISE753.1	3	3	3	-	-	2	2	3	1	1	-	2	3	2	-	-
22ISE753.2	3	3	3	-	1	2	2	3	1	1	-	2	3	2	-	-
22ISE753.3	3	3	2	-	1	2	2	2	1	1	-	2	3	2	-	-
22ISE753.4	3	3	3	-	2	1	1	1	1	1	1	2	3	2	-	-
22ISE753.5	3	3	2	-	-	1	1	1	1	1	2	2	3	2	-	-
Average	**3**	**3**	**2.6**	**-**	**1.3**	**1.6**	**1.6**	**2**	**1**	**1**	**1.5**	**2**	**3**	**2**	**-**	**-**

Low-1: Medium-2: High-3

SEMESTER – VII

Course: Introduction to Data Science

Course Code	22ISE754	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
No. of Credits	3	Examination Hours	3

Prerequisites:

Course Learning Objectives

CLO1	To provide fundamental knowledge on data science and different levels of a data representation.
CLO2	To enable the use of statistics, sampling the data and hypothesis testing.
CLO3	To understand the concepts of machine learning in data science.
CLO4	To provide the knowledge on model building and its performance evaluation.
CLO5	To understand process of visualization for identifying the effectiveness of the data.

Contents	No. of Hours RBT Level
Module 1 **How to Sound Like a Data Scientist:** What is data science? The data science Venn diagram. **Types of Data:** Flavors of data, Structured versus unstructured data, Quantitative versus qualitative data, The four levels of data. **The Five Steps of Data Science:** Overview of the five steps.	**08 Hours L2**
Module 2 **Basic Statistics:** What are statistics? How do we obtain sample data? Sampling data, how do we measure statistics? The empirical rule. **Advanced Statistics:** Hypothesis tests.	**08 Hours L2**
Module 3 **Introduction to Machine Learning:** Introduction, what is Human Learning? Types of Human Learning, what is Machine Learning? Types of Machine Learning, Applications of Machine Learning, State of the art Languages / Tools in Machine Learning, Issues in Machine Learning.	**08 Hours L2**
Module 4 **Modeling and Evaluation:** Introduction, Selecting a Model, Training a Model, Model Representation and Interpretability, Evaluating the Performance of a Model, Improving Performance of a Model.	**08 Hours L3**
Module 5 **Communicating Data:** Why does communication matter? Identifying effective and interactive visualizations, When graphs and statistics lie, Verbal communication.	**08 Hours L3**

COURSE OUTCOMES

Upon completion of this course, student will be able to

22ISE754.1	Describe the basics of data science and different levels of data of data representation.
22ISE754.2	Discuss the fundamental statistical analysis of data.
22ISE754.3	Explain the types of machine learning algorithms and its applications in data science.
22ISE754.4	Build and evaluate the model using various performance metrics.
22ISE754.5	Visualize the results graphically and analyze the performance of the models.

Text Books

1. Sinan Ozdemir, Principles of Data Science: Learn the techniques and math you need to start making sense of your data, Packt Publishing, 2016.
2. Saikat dutt, Subramanian Chandramouli and Amith Kumar Das, Machine Learning, Pearson India Education Services Pvt. Ltd., 2020.

Reference Books

1. Davy Cielen, Arno D. B. Meysman, and Mohamed Ali, Introducing Data Science, Manning and dreamtech publication, 2021.
2. Joel Grus, Data Science from Scratch, First Principles with Python, 2nd Edition, O'Reilly, 2019
3. Cathy O'Neil and Rachel Schutt, Doing Data Science, Straight Talk from the Frontline. O'Reilly, 2013
4. Tom M Mitchell, Machine Learning, McGraw Hill Education, India Edition, 2013.

MOOCs (Format is given below)

1. https://onlinecourses.nptel.ac.in/noc21_cs23/preview
2. https://onlinecourses.nptel.ac.in/noc23_cs18/preview

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.

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 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**	
	Quiz 1/AAT	**05**	
	Quiz 2/AAT	**05**	
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
22ISE754.1	3	2	-	-	1	1	-	1	-	-	-	2	-	2	-	-
22ISE754.2	3	2	-	-	1	1	-	1	-	-	-	2	-	2	-	-
22ISE754.3	3	2	-	-	1	1	-	1	-	-	-	2	-	2	-	-
22ISE754.4	3	2	-	-	1	1	-	1	-	-	-	2	-	2	-	-
22ISE754.5	3	2	-	-	1	1	-	1	-	-	-	2	-	2	-	-
Average	**3**	**2**	**-**	**-**	**1**	**1**	**-**	**1**	**-**	**-**	**-**	**2**	**-**	**2**	**-**	**-**

Low-1: Medium-2: High-3

8th Semester Syllabus

SEMESTER – VIII

Course: Software Architecture and Design Pattern

Course Code	22ISE81	CIE Marks	50
Hours/Week (L: T: P)	4:0:0	SEE Marks	50
No. of Credits	4	Examination Hours	03

Course Learning Objectives:

CLO1	Understand how design patterns solve design problems, how to select a design pattern
CLO2	Understand how to gather requirements functional requirements specification in design.
CLO3	Understand various Structural patterns
CLO4	Understand the MVC architectural pattern, analyzing a simple drawing program
CLO5	Understand how to implementing an object-oriented system on the web

Content	No. of Hours/ RBT levels
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	**10 Hours 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.	**10 Hours L2,**
Module 3 **Design Pattern Catalog:** Structural patterns, Adapter, bridge, composite, decorator, facade, flyweight, proxy.	**10 Hours 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.	**10 Hours 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.	**10 Hours L2**

COURSE OUTCOMES:

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

22ISE81.1	Discuss the design patterns and design principles to solve the software design problems.
22ISE81.2	Explain object-oriented modeling and design concepts.
22ISE81.3	Identify the range of structural patterns in the design of object-oriented systems.
22ISE81.4	Discuss the interactive systems and MVC architecture.
22ISE81.5	Demonstrate the design of distributed objects.

Text books:

1. Object-oriented analysis, design and implementation, brahma dathan, sarnath rammath, universities press, 2013
2. Design patterns, erich gamma, Richard helan, Ralph Johan, john vlissides, PEARSON Publication, 2013.

Reference Books:

1. Frank Bachmann, RegineMeunier, Hans Rohnert "Pattern Oriented Software Architecture" –Volume 1, 1996.
2. William J Brown et al., "Anti-Patterns: Refactoring Software, Architectures and Projects in Crisis", John Wiley, 1998.

MOOCs

1. https://nptel.ac.in/courses/107104076
2. https://www.khanacademy.org/
3. https://www.class-central.com/subject (MOOCS)
4. E-learning: www.vtu.ac.in

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.

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	Component	Marks	Total Marks
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	CIE Test-3	**40**	
	Quiz 1/AAT	**05**	
	Quiz 2/AAT	**05**	
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**
22ISE81.1	3	3	3	-	-	-	-	-	-	-	-	3	2	2	2	2
22ISE81.2	3	3	3	-	-	-	-	-	-	-	-	3	2	2	2	2
22ISE81.3	3	3	3	-	-	-	-	-	-	-	-	3	2	2	2	2
22ISE81.4	3	3	3	-	-	-	-	-	-	-	-	3	2	2	2	2
22ISE81.5	3	3	3	-	-	-	-	-	-	-	-	3	2	2	2	2
Average	3	3	3	-	-	-	-	-	-	-	-	3	2	2	2	2

Low-1: Medium-2: High-3

SEMESTER – VIII
Course: Software Defined Network

Course Code	22ISE821	CIE Marks	50
Hours/Week(L:T:P)	3:0:0	SEE Marks	50
No. of Credits	03	Examination Hours	03

Prerequisites: Computer Networks, Web Technologies

Course Learning Objectives: This Course will enable the students to:

CLO1	To understand key benefits of SDN by the separation of data and control planes.
CLO2	To understand SDN data plane devices and OpenFlow Protocols.
CLO3	To understand Implement the operation of SDN control plane with different controllers.
CLO4	To understand Network Functions Virtualization components and their roles in SDN.

Content	No. of Hours/ RBT levels
Module 1 **SDN Background and Motivation:** Evolving network requirements-The SDN Approach: Requirements, SDN Architecture, Characteristics of Software-Defined Networking, SDN and NFV-Related Standards: Standards-Developing Organizations, Industry Consortia, Open Development Initiatives.	**08 Hours L2**
Module 2 **SDN Data plane and OpenFlow:** SDN data plane: Data plane Functions, Data plane protocols, OpenFlow logical network Device: Flow table Structure, Flow Table Pipeline, The Use of Multiple Tables, Group Table-OpenFlow Protocol.	**08 Hours L2**
Module 3 **SDN Control Plane:** SDN Control Plane Architecture: Control Plane Functions, Southbound Interface, Northbound Interface, Routing, ITU-T Model-OpenDaylight-REST-Cooperation and Coordination Among Controllers.	**08 Hours L2**
Module 4 **SDN Application Plane:** SDN Application Plane Architecture: Northbound Interface, Network Applications, User Interface-Network Services Abstraction Layer: Abstractions in SDN, Frenetic- Traffic Engineering Measurement and Monitoring-Security-Data Center Networking-Mobility and Wireless.	**08 Hours L2**
Module 5 **Network Functions Virtualization Background and Motivation for NFV-Virtual Machines-NFV Concepts:** Simple Example of the Use of NFV, NFV Principles, High-Level NFV Framework, NFV Benefits and Requirements-NFV Reference Architecture: NFV Management and Orchestration.	**08 Hours L2**

COURSE OUTCOMES:

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

22ISE821.1	Explain the key benefits of SDN by the separation of data and control planes.
22ISE821.2	Interpret the SDN data plane devices and OpenFlow Protocols.
22ISE821.3	Describe the operation of SDN control plane with different controllers.
22ISE821.4	Discuss the techniques that enable applications to control the underlying network using SDN.
22ISE821.5	Describe Network Functions Virtualization components and their roles in SDN.

Text Books:

1. William Stallings, "Foundations of Modern Networking", Pearson Ltd.,2016.2.
2. Software Defined Networks: A Comprehensive Approach by Paul Goransson and Chuck Black, Morgan Kaufmann Publications, 2014.

Reference Books:

1. SDN -Software Defined Networks by Thomas D. Nadeau & Ken Gray, O'Reilly, 2013.
2. Feamster, Nick, Jennifer Rexford, and Ellen Zegura. "The road to SDN: an intellectual history of programmable networks." ACM SIGCOMM Computer Communication Review 44.2 (2014): 87-98.2.
3. Kreutz, Diego, et al. "Software-defined networking: A comprehensive survey." Proceedings of the IEEE 103.1 (2015): 14-76
4. Monsanto, Christopher, et al. "Composing software defined networks." Presented as part of the 10th USENIX Symposium on Networked Systems Design and Implementation (NSDI 13). 2013.

E-Books / Web References:

1. https://www.coursera.org/learn/sdn

MOOCs:

1. https://www.udemy.com/topic/cisco/
2. https://www.udemy.com/topic/cisco-ccna/
3. https://www.udemy.com/topic/cisco-sd-wan/

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 Three 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.

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 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**	
	Quiz 1/AAT	**05**	
	Quiz 2/AAT	**05**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

CO/PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	P09	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
22ISE821.1	3	2	-	-	2	2	-	2	-	-	-	2	-	3	-	-
22ISE821.2	3	2	-	-	2	2	-	2	-	-	-	2	-	3	-	-
22ISE821.3	3	2	-	-	2	2	-	2	-	-	-	2	-	3	-	-
22ISE821.4	3	2	-	-	2	2	-	2	-	-	-	2	-	3	-	-
22ISE821.5	3	2	-	-	2	2	-	2	-	-	-	2	-	3	-	-
Average	**3**	**2**	-	-	**2**	**2**	-	**2**	-	-	-	**2**	-	**3**	-	-

Low-1: Medium-2: High-3

SEMESTER – VIII

Course: Green Computing

Course Code	22ISE822	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
No. of Credits	03	Examination Hours	03

Course Learning Objectives:

CLO1	Learn about the basics of Green computing
CLO2	Learn about Green assets and modeling
CLO3	Explain Grid framework of green computing
CLO4	Learn Socio-cultural aspects of Green IT, Protocols, Standards, and Audits
CLO5	Learn Case Studies related to Green computing

Content	No. of Hours/ RBT levels
Module 1 **Fundamentals:** Green IT Fundamentals: Business, IT, and the Environment – Green computing: carbon foot print, scoop on power – Green IT Strategies: Drivers, Dimensions, and Goals – Environmentally Responsible Business: Policies, Practices, and Metrics. **Text Book-1: Chapter 1**	**08 Hours L2**
Module 2 **Green Assets and Modelling:** 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-1: Chapter 2**	**08 Hours 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 centre – Green Grid framework. **Text Book-1: Chapter 3**	**08 Hours L2**
Module 4 **Green Compliance:** Socio-cultural aspects of Green IT – Green Enterprise Transformation Roadmap – Green Compliance: Protocols, Standards, and Audits – Emergent Carbon Issues: Technologies and Future. **Text Book-1: Chapter 4**	**08 Hours L2**
Module 5 **Case Studies:** 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. **Text Book-1: Chapter 5**	**08 Hours L2**

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

22ISE822.1	Describe Green IT Fundamentals
22ISE822.2	Describe Green Assets, Green Enterprise Architecture, Green Information Systems
22ISE822.3	Explain Virtualization of IT systems, Green Data centre & Green Grid framework
22ISE822.4	Illustrate Socio-cultural aspects of Green IT, Protocols, Standards, and Audits
22ISE822.5	Demonstrate Case Studies related to Green computing

Textbooks:

1. Bhuvan Unhelkar, —**Green IT Strategies and Applications-Using Environmental Intelligence**, CRC Press, June 2014.
2. Woody Leonhard, Katherine Murray, —**Green Home computing for dummies**, August 2012

Reference books:

1. Gales, Michael Schaefer, Mike Ebbers, —Green Data Centre: steps for the Journey, Shroff/IBM redbook, 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

MOOCs:

1. Green Computing from SketchUp to Grasshopper
https://www.acedge.in/courses/green-computing
2. How To Start Green Home Computing- Udemy
https://www.udemy.com/course/how-to-start-green-home-computing/

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.

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 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**	
	Quiz 1/AAT	**05**	
	Quiz 2/AAT	**05**	
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
22ISE822.1	3	3	-	-	-	2	2	-	-	-	-	2	-	2	-	-
22ISE822.2	3	3	-	-	-	2	2	-	-	-	-	2	-	2	-	-
22ISE822.3	3	3	-	-	-	2	2	-	-	-	-	2	-	2	-	-
22ISE822.4	3	3	-	-	-	2	2	-	-	-	-	2	-	2	-	-
22ISE822.5	3	3	-	-	-	2	2	-	-	-	-	2	-	2	-	-
Average	**3**	**3**	**-**	**-**	**-**	**2**	**2**	**-**	**-**	**-**	**-**	**2**	**-**	**2**	**-**	**-**

Low-1: Medium-2: High-3

SEMESTER – VIII

Course: Social Network Analysis

Course Code	22ISE823	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
No. of Credits	3	Examination Hours	3

Prerequisites: Computer Networks

Course Learning Objectives

CLO1	Understand basics of graph theory and statistical properties of network
CLO2	Describe network structure properties
CLO3	Understand various network metrics and affiliation networks
CLO4	Describe various propagation models and its visualization
CLO5	Illustrate mining in real network

Contents	No. of Hours RBT Level
Module 1 **Introduction to social network analysis and Descriptive network analysis:** Introduction to new science of networks. Networks examples. Graph theory basics. Statistical network properties. Degree distribution, clustering coefficient. Frequent patterns. Network motifs. Cliques and k-cores.	**08 Hours L2**
Module 2 **Network structure, Node centralities and ranking on network:** Nodes and edges, network diameter and average path length. Node centrality metrics: degree, closeness and betweenness centrality. Eigenvector centrality and PageRank. Algorithm HITS.	**08 Hours L3**
Module 3 **Network communities and Affiliation networks:** Networks communities. Graph partitioning and cut metrics. Edge betweenness. Modularity clustering. Affiliation network and bipartite graphs. 1-mode projections. Recommendation systems.	**08 Hours L3**
Module 4 **Information and influence propagation on networks and Network visualization:** Social Diffusion. Basic cascade model. Influence maximization. Most influential nodes in network. Network visualization and graph layouts. Graph sampling. Low - dimensional projections	**08 Hours L3**
Module 5 **Social media mining and SNA in real world:** FB/VK and Twitter analysis: Natural language processing and sentiment mining. Properties of large social networks: friends, connections, likes, re-tweets.	**08 Hours L2**

COURSE OUTCOMES

Upon completion of this course, student will be able to

22ISE823.1	Describe notation and terminology used in network science
22ISE823.2	Illustrate various network structure parameters
22ISE823.3	Describe basic principles behind network analysis algorithms
22ISE823.4	Interpret real world network

Text Books

1. David Easley and John Kleinberg. "Networks, Crowds, and Markets: Reasoning About a Highly Connected World." Cambridge University Press 2010.
2. Eric Kolaczyk, Gabor Csardi. “Statistical Analysis of Network Data with R (Use R!)”. Springer, 2014.
3. Stanley Wasserman and Katherine Faust. "Social Network Analysis. Methods and Applications." Cambridge University Press, 1994.

Reference Books

1. Mohammad Gouse Galety , Chiai Al Atroshi , Buni Balabantaray , Sachi Nandan Mohanty , Social Network Analysis – Theory and Applications, Wiley Publications

MOOCs (Format is given below)

1. https://www.coursera.org/learn/social-network-analysis
2. https://www.udemy.com/course/social-network-analysis/
3. https://onlinecourses.nptel.ac.in/noc22_cs117/preview

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.
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 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**	
	Quiz 1/AAT	**05**	
	Quiz 2/AAT	**05**	
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
22ISE823.1	3	2	2	-	-	1	-	-	-	-	-	3	-	1	-	2
22ISE823.2	3	2	2	-	-	1	-	-	-	-	-	3	-	1	-	2
22ISE823.3	3	2	2	-	-	1	-	-	-	-	-	3	-	1	-	2
22ISE823.4	3	2	2	-	-	1	-	-	-	-	-	3	-	1	-	2
Average	3	2	2	-	-	1	-	-	-	-	-	3	-	1	-	2

Low-1: Medium-2: High-3

SEMESTER – VII

Course: DIGITAL IMAGE PROCESSING

Course Code	22ISE824	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
No. of Credits	3	Examination Hours	3

Prerequisites:

- Basics of Engineering Mathematics, Algorithms and Programming skills
- Probability and Statistics, Machine learning and deep learning concepts

Course Learning Objectives

CLO1	Understand the fundamentals of digital image processing
CLO2	Explain the image transform techniques used in digital image processing
CLO3	Apply different image enhancement techniques on digital images
CLO4	Evaluate image restoration techniques and methods used in digital image processing
CLO5	Understand the Morphological Operations and Segmentation used in digital image processing

Contents	No. of Hours RBT Level
Module 1 **Digital Image Fundamentals**: What is Digital Image Processing? Origins of Digital Image Processing, Examples of fields that use DIP, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Elements of Visual Perception, Image Sensing and Acquisition, Image Sampling and Quantization, Some Basic Relationships Between Pixels, Linear and Nonlinear Operations .Textbook 1: Chapter 1 and Chapter 2: Sections 2.1 to 2.5, 2.6.2	**08 Hours L2**
Module 2 Spatial Domain: Some Basic Intensity Transformation Functions, Histogram Processing, Fundamentals of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters Frequency Domain: Preliminary Concepts, The Discrete Fourier Transform (DFT) of Two Variables, Properties of the 2-D DFT, Filtering in the Frequency Domain, Image Smoothing and Image Sharpening Using Frequency Domain Filters, Selective Filtering. Textbook 1: Chapter 3: Sections 3.2 to 3.6 and Chapter 4: Sections 4.2, 4.5 to 4.10	**08 Hours L3**
Module 3 **Restoration:** Noise models, Restoration in the Presence of Noise Only using Spatial Filtering and Frequency Domain Filtering, Linear, Position-Invariant Degradations, Estimating the Degradation Function, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering, Constrained Least Squares Filtering. Textbook 1: Chapter 5: Sections 5.2, to 5.9	**08 Hours L3**
Module 4 **Color Image Processing:** Color Fundamentals, Color Models, Pseudo color Image Processing. Wavelets: Background, Multiresolution Expansions.	**08 Hours L3**

Morphological Image Processing: Preliminaries, Erosion and Dilation, Opening and Closing, The Hit-or- Miss Transforms, Some Basic Morphological Algorithms. Text: Chapter 6: Sections 6.1 to 6.3, Chapter 7: Sections 7.1 and 7.2, Chapter 9: Sections 9.1 to 9.5	
Module 5 **Segmentation: Introduction**, classification of image segmentation algorithms, Detection of Discontinuities, Edge Detection, Hough Transforms and Shape Detection, Corner Detection, Principles of Thresholding. Representation and Description: Representation, Boundary descriptors. Text2: Chapter 9: Sections 9.1, to 9.7 and Text 1: Chapter 11: Sections 11.1and 11.2	**08 Hours L2**

COURSE OUTCOMES

Upon completion of this course, student will be able to

22ISE824.1	Understand the fundamentals of Digital Image Processing
22ISE824.2	Apply different Image transformation techniques
22ISE824.3	Analyze various image restoration techniques
22ISE824.4	Understand colour image and morphological processing
22ISE824.5	Design image analysis and segmentation techniques

Text Books

1. Rafael C. Gonzalez and Richard E. Woods, Digital Image Processing, Third Ed., Prentice Hall, 2008.
2. S. Sridhar, Digital Image Processing, Oxford University Press, 2ndEdition, 2016

Reference Books

1. Digital Image Processing- S. Jayaraman, S. Sakurajima, T. Veerakumar, TataMcGraw Hill 2014.

2. Fundamentals of Digital Image Processing-A. K. Jain, Pearson 2004

MOOCs (Format is given below)

1. https://https://nptel.ac.in/courses/106/105/106105032/
2. https://github.com/PrajwalPrabhuiisc/Image-processing-assignments

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 three tests.
Two quizzes can 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.

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 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**	
	Quiz 1/AAT	**05**	
	Quiz 2/AAT	**05**	
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
22ISE824.1	3	2	2	-	-	-	-	-	-	-	-	2	-	2	-	-
22ISE824.2	3	2	2	-	-	-	-	-	-	-	-	2	-	2	-	-
22ISE824.3	3	2	2	-	-	-	-	-	-	-	-	2	-	2	-	-
22ISE824.4	3	2	2	-	-	-	-	-	-	-	-	2	-	2	-	-
22ISE824.5	3	2	2	-	-	-	-	-	-	-	-	2	-	2	-	-
Average	3	2	2	-	-	-	-	-	-	-	-	2	-	2	-	-

Low-1: Medium-2: High-3

SEMESTER – VIII

Course: System Modeling and Simulation

Course Code	22ISE831	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
No. of Credits	3	Examination Hours	3

Prerequisites: Probability, Basics of Mathematics

Course Learning Objectives:

CLO1	Define the basics of simulation modelling and replicating the practical situations in organizations
CLO2	Develop simulation model using heuristic methods.
CLO3	Generate random numbers and random variates using different techniques.
CLO4	Analysis of Simulation models using input /output analysers
CLO5	Explain Verification and Validation of simulation model.

Content	No. of Hours/ RBT levels
Module 1 **Introduction**: When simulation is the appropriate tool and when it is not appropriate, Advantages and disadvantages of Simulation; Areas of application, Systems and system environment; Components of a system; Discrete and continuous systems, Model of a system; Types of Models. **Discrete-Event System Simulation examples:** Simulation of queuing systems. General Principles, Simulation Software: Concepts in Discrete-Event Simulation. The Event-Scheduling / Time-Advance Algorithm, Manual simulation Using Event Scheduling	**08 Hours L3**
Module 2 **Statistical Models in Simulation:** Review of terminology and concepts, Useful statistical models, Discrete distributions. Continuous distributions, Poisson process, Empirical distributions.	**08 Hours L3**
Module 3 **Random-Number Generation:** Properties of random numbers; Generation of pseudo-random numbers, Techniques for generating random numbers, Tests for Random Numbers, Random-Variate Generation: Inverse transform technique Acceptance-Rejection technique	**08 Hours L3**
Module 4 **Input Modeling:** Data Collection; Identifying the distribution with data, Parameter estimation, Goodness of Fit Tests, fitting a non-stationary Poisson process, Selecting input models without data, Multivariate and Time-Series input models.	**08 Hours L3**

Module 5	
Estimation Of Absolute performance Output Analysis For A Single Model: Types of simulations with Respect to Output analysis, Stochastic Nature of Output Data, Measures of Performance and their Estimation, Output Analysis for Terminating Simulations, Output analysis for steady-State Simulations. Problems **Verification, Calibration And Validation**: Optimization: Model building, verification and validation, Verification of simulation models, Verification of simulation models, Calibration and validation of models, Optimization via Simulation.	**08 Hours L2**

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

22ISE831.1	Describe the role of important elements of discrete event simulation and modelling paradigm.
22ISE831.2	Conceptualize real world situations related to systems development decisions, originating from source requirements and goals.
22ISE831.3	Interpret the model and its results to resolve critical issues in a real world environment.
22ISE831.4	Apply random number variates to develop simulation models
22ISE831.5	Analyze output data produced by a model and test validity of the model
22ISE831.6	Explain the concepts of verification and validation

Textbooks:

1. Jerry Banks, John S. Carson II, Barry L. Nelson, David M. Nicol: Discrete-Event System Simulation 5th Edition, Pearson Education, 2010.

Reference books:

1. Lawrence M. Leemis, Stephen K. Park: Discrete – Event Simulation: A First Course, Pearson Education, 2006.
2. Averill M. Law: Simulation Modeling and Analysis, 4th Edition, Tata McGraw-Hill, 2007

MOOCs:

1.http://nptel.ac.in/courses/112107214/2
2.https://cs.wmich.edu/alfuqaha/Spring10/cs6910/lectures/Chapter11.pdf

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.

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.

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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**	
	Quiz 1/AAT	**05**	
	Quiz 2/AAT	**05**	
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**
22ISE831.1	2	2	1	1	-	1	-	-	-	-	-	1	1	-	-	-
22ISE831.2	2	3	-	1	-	1	2	1	2	-	-	2	1	-	-	-
22ISE831.3	2	3	2	2	2	2	1	-	1	-	-	1	1	-	-	-
22ISE831.4	1	2	1	-	2	1	-	-	-	-	-	1	1	-	-	-
22ISE831.5	2	2	-	-	2	-	-	-	-	-	-	2	1	-	-	-
22ISE831.6	-	-	-	-	1	-	-	--	-	-	-	-	1	-	-	-
Average	**1.8**	**2.4**	**1.3**	**1.3**	**1.7**	**1.2**	**1.5**	**1**	**1.5**			**1.2**	**1**			

Low-1: Medium-2: High-3

SEMESTER – VIII

Course: Augmented Reality and Virtual Reality

Course Code	22ISE832	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
No. of Credits	3	Examination Hours	3

Prerequisites: Basic of math and geometry, programming languages, computer graphics

Course Learning Objectives:

CLO1	To provide the Historical and modern overviews and perspectives on virtual reality.
CLO2	To understand the fundamentals of sensation, perception, technical and engineering aspects of virtual reality systems.
CLO3	To understand the fundamentals of Visual Rendering aspects of virtual reality systems.
CLO4	To acquire fundamentals of Computer Vision for Augmented Reality

Content	No.of Hours/ RBT levels
Module 1 Defining Virtual Reality, Modern VR Experience, History of VR, Hardware, Software, Human Physiology and Perception. **(Text Book 1 - Chapter 1,2)**	**08 Hours L2**
Module 2 Geometric Models, Changing Position and Orientation, Axis-Angle Representations of Rotation, Viewing Transformations, Chaining the Transformations, Human Eye, eye movements & implications for VR. **(Text Book 1 - Chapter 3 to 3.5, 4.4, 5.3, 5.4)**	**08Hours L3**
Module 3 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 - Chapter 6 to 6.4, 7.1 to 7.4)**	**08 Hours L3**
Module 4 What Is Augmented Reality - Defining augmented reality, history of augmented reality, Related fields, applications of augmented reality. Augmented Reality Hardware – Displays – Multimodal Displays, Visual Perception, Requirements and Characteristics, Spatial Display Model, Visual Displays. **(Text Book 2 - Chapter 1,2)**	**08 Hours L3**

Module 5	
Tracking & Sensors - Tracking, Calibration, and Registration, 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, Simultaneous Localization and Mapping, Outdoor Tracking **(Text Book 2 - Chapter 3,4)**	**08 Hours L3**

Mini-Projects/ Case Study as Assignment:

Create a virtual environment for any use case. The application must include at least 04 scenes which can be changed dynamically, a good UI, animation, and interaction with game objects.

COURSE OUTCOMES:

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

22ISE832.1	Understand the fundamentals of the Virtual Reality
22ISE832.2	Acquire the knowledge on geometrical principles of Virtual Reality.
22ISE832.3	Illustrate the system of human vision and its implication on perception and rendering.
22ISE832.4	Interpret the working of AR System, hardware and its applications.
22ISE832.5	Explain the concepts of computer vision for AR

Textbooks:

1. Virtual Reality, Steven M. LaValle, Cambridge University Press, 2019

2. Augmented Reality: Principles & Practice by Schmalstieg / Hollerer, Pearson Education India, First edition (12 October 2016), ISBN-10: 9332578494

Reference books:

1. Developing Virtual Reality Applications: Foundations of Effective Design, Alan B Craig, William R Sherman and Jeffrey D Will, Morgan Kaufmann, 2009.

2. Understanding Virtual Reality: Interface, Application and Design, William R Sherman and Alan B Craig, (The Morgan Kaufmann Series in Computer Graphics)". Morgan Kaufmann Publishers, San Francisco, CA, 2002

3.AR Game Development, Allan Fowler-, 1st Edition, A press Publications, 2018, ISBN 978-1484236178

MOOCs:

1. https://nptel.ac.in/courses/106/106/106106138/
2. https://www.coursera.org/learn/introduction-virtual-reality
3. https://www.coursera.org/learn/ar
4. https://www.udemy.com/share/101XPi/

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.

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**	
	Quiz 1/AAT	**05**	
	Quiz 2/AAT	**05**	
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
22ISE832.1	3	-	-	-	-	-	-	-	-	-	-	3	-	1	-	-
22ISE832.2	3	2	2	2	2	-	-	-	2	2	2	3	3	1	-	-
22ISE832.3	3	2	2	2	2	-	-	-	2	2	2	3	3	1	-	-
22ISE832.4	3	2	2	2	2	-	-	-	2	2	2	3	3	1	-	-
22ISE832.5	3	2	2	2	2	-	-	-	2	2	2	3	3	1	-	-
Average	3	2	2	2	2	-	-	-	2	2	2	3	3	1	-	-

Low-1: Medium-2: High-3

SEMESTER -VIII

Course: Introduction to Devops

Course Code	22ISE833	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
No. of Credits	03	Examination Hours	03

Prerequisites: Knowledge of cloud computing and Software Engineering

Course Learning Objectives:

CLO1	Introduce concepts of Devops and Continuous delivery
CLO2	Learn about need of Coding and Building the code
CLO3	Learn about importance of Testing and Deploying the Code
CLO4	Learn about need and importance of Monitoring the Code and Issue Tracking
CLO5	Gather knowledge about Challenges, Story and Myths related to Devops

Content	No. of Hours/ RBT levels
Module-1: **Introduction to DevOps and Continuous Delivery** **Introduction:** Introducing DevOps, How fast is fast? The Agile wheel of wheels, Beware the cargo cult Agile fallacy, DevOps and ITIL, Summary **A View from Orbit**: The DevOps process and Continuous Delivery – an overview, Release management, Scrum, Kanban, and the delivery pipeline, Wrapping up – a complete example, Identifying bottlenecks, Summary **How DevOps Affects Architecture:** Introducing software architecture, The monolithic scenario, Architecture rules of thumb, The separation of concerns, The principle of cohesion, Coupling, Back to the monolithic scenario, A practical example, Three-tier systems, The presentation tier, The logic tier, The data tier, Handling database migrations, Rolling upgrades, Hello world in Liquibase, The changelog file, The pom.xml file, Manual installation, Microservices, Interlude – Conway's Law, How to keep service interfaces forward compatible, Microservices and the data tier, DevOps, architecture, and resilience, Summary **Textbook 1: Chapter 1, 2 & 3**	**08 hours** **L2**
Module-2: Coding and Building the code **Everything is Code:** The need for source code control, The history of source code management, Roles and code, Which source code management system?, A word about source code management system migrations, Choosing a branching strategy, Branching problem areas, Artifact version naming , Choosing a client, Setting up a basic Git server, Shared authentication, Hosted Git servers, Large binary files, Trying out different Git server implementations, Docker intermission, Gerrit, The pull request model, GitLab, Summary	**08 hours** **L2**

Building the Code: Why do we build code?, The many faces of build systems, The Jenkins build server, Managing build dependencies, The final artifact, Cheating with FPM, Continuous Integration, Continuous Delivery, Jenkins plugins, The host server, Build slaves, Software on the host, Triggers, Job chaining and build pipelines, A look at the Jenkins filesystem layout, Build servers and infrastructure as code, Build phases, Alternative build servers, Collating quality measures, About build status visualization, Taking build errors seriously, Robustness, Summary **Textbook 1: Chapter 4 & 5**	
Module-3: Testing the Code and Deploying the Code **Testing the Code:** Manual testing, Pros and cons with test automation, Unit testing, JUnit in general and JUnit in particular, A JUnit example, Mocking, Test Coverage, Performance testing, Automated acceptance testing, Automated GUI testing, Integrating Selenium tests in Jenkins, JavaScript testing, Testing backend integration points, Test-driven development, REPL-driven development, A complete test automation scenario, Automated integration testing, Summary **Deploying the Code:** Why are there so many deployment systems?, Virtualization stacks, Executing code on the client, The Puppet master and Puppet agents, Ansible, PalletOps, Deploying with Chef, Deploying with SaltStack, Salt versus Ansible versus Puppet versus PalletOps execution models, Vagrant, Deploying with Docker, Comparison tables, Cloud solutions, AWS, Azure, Summary **Textbook 1: Chapters 6 & 7**	**08 hours** **L2**
Module-4: **Monitoring the Code and Issue Tracking** **Monitoring the Code:** Nagios, Munin, Ganglia, Graphite, Log handling, Summary **Issue Tracking:** What are issue trackers used for?, Some examples of workflows and issues, What do we need from an issue tracker?, Problems with issue tracker proliferation, All the trackers, Summary **Textbook 1: Chapters 9, 11 and 12**	**08 hours** **L3**
Module-5: **Challenges, Story and Myths** Using DevOps to Solve New Challenges: Mobile Applications, ALM Processes, Scaling Agile, Multiple-Tier Applications, DevOps in the Enterprise, Supply Chains The Internet of Things. Taking a Look at the Executive's Role, Putting Together the Team, Setting DevOps Goals, learning from the DevOps Transformation, Looking at the DevOps Results DevOps Is Only for "Born on the Web" Shops, DevOps Is Operations Learning How to Code, DevOps Is Just for Development and Operations, DevOps Isn't for ITIL Shops , DevOps Isn't for Regulated Industries, DevOps Isn't for Outsourced Development, No Cloud Means No DevOps, DevOps Isn't for Large, Complex Systems, DevOps Is Only about Communication, DevOps Means Continuous Change Deployment **Textbook 2: Chapters 5, 6 and 7**	**08 Hours** **L2**

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

22ISE833.1	Understand the fundamentals of DevOps and Continuous Delivery
22ISE833.2	Explain need of Coding and Building the code in Devop process
22ISE833.3	Illustrate the process of Testing and Deploying the Code in Devop Process
22ISE833.4	Summarize the importance of Monitoring the Code and Issue Tracking related to Devops
22ISE833.5	Outline about Challenges, Story and Myths related to Devops

Textbooks:

1. **Practical DevOps:** Harness the power of DevOps to boost your skill set and make your IT organization perform better by Joakim Verona, Published by Packt Publishing Ltd, 2016, ISBN 978-1-78588-287-6

https://github.com/sreddy-bwi/Free-DevOps-Books-1/blob/master/book/Practical%20DevOps.pdf

2. **DevOps For Dummies®,** 2nd IBM Limited Edition by Sanjeev Sharma and Bernie Coyne , Published by John Wiley & Sons, Inc. 2015
https://www.immagic.com/eLibrary/ARCHIVES/EBOOKS/W150421S.pdf

Reference books:

1. Learning DevOps: The complete guide to accelerate collaboration with Jenkins, Kubernetes, Terraform and Azure DevOps by Mikael Krief, Published by Packt Publishing Ltd. 2019, ISBN 978-1-83864-273-0
https://online-pmo.com/wp-content/Education/Learning%20DevOps.pdf

2. Effective DevOps: Building a Culture of Collaboration, Affinity, and Tooling at Scale by Jennifer Davis and Ryn Daniels Published by O'Reilly Media, Inc., 2018 ISBN: 978-1-492-07309-3

http://www.sauleh.ir/fc98/static_files/materials/Effective_DevOps.pdf

MOOCs

1. https://www.udemy.com/topic/devops/
2. https://aws.amazon.com/solutions/consulting-offers/capgemini-devops-automation-springboard/
3. Azure Devops by Infosys Spring board
4. Azure DevOps and Micro Services & Azure Kubernetes – Deployment Models by NPTEL

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.
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 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**	
	Quiz 1/AAT	**05**	
	Quiz 2/AAT	**05**	
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
22ISE833.1	3	3	3	-	3	-	-	-	-	-	-	2	2	-	-	-
22ISE833.2	3	3	3	-	3	-	-	-	-	-	-	2	2	-	-	-
22ISE833.3	3	3	3	-	3	-	-	-	-	-	-	2	2	-	-	-
22ISE833.4	3	3	3	-	3	-	-	-	-	-	-	2	2	-	-	-
22ISE833.5	3	3	3	-	3	-	-	-	-	-	-	2	2	-	-	-
Average	**3**	**3**	**3**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**-**	**-**	**-**

Low-1: Medium-2: High-3

SEMESTER – VIII

Course: Robotic Process Automation & Development

Course Code	22ISE834	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
No. of Credits	3	Examination Hours	3

Prerequisites: Programming skills, Knowledge of any database query language like SQL, Command over HTML, JavaScript

Course Learning Objectives

CLO1	Understand the fundamental ideas of RPA
CLO2	Describe IIPA, its potential applications, and its implementation
CLO3	Describe the many variables, Control Flow, and data manipulation methods
CLO4	Understand Automation of images, texts, and data tables
CLO5	Describe different exception types and handling techniques

Contents	No. of Hours RBT Level
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-APIs- AI-Cognitive Automation-Agile, Scrum, Kanban and Waterfall0 DevOps- Flowcharts.	**08 Hours L2**
Module 2 **RPA Platforms-** Components of RPA- RPA Platforms-About Ui Path- About UiPath - The future of automation - **Record and Play** - Downloading and installing UiPath Studio - Learning Ui Path Studio- - Task recorder - Step-by step examples using the recorder.	**08 Hours L3**
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).	**08 Hours L3**
Module 4 **Taking Control of the Controls**-Finding and attaching windows- Finding the control-Techniques for waiting for a control- Act on controls – mouse and keyboard activities-Working with Ui Explorer- Handling events- Revisit recorder- Screen Scraping- When to use OCR- Types of OCR available- How to use OCR- Avoiding typical failure points.	**08 Hours L2**

Module 5	08 Hours L3
Exception Handling, Debugging, and Logging- Exception handling- Common exceptions and ways to handle them- Logging and taking screenshots Debugging techniques- Collecting crash dumps- Error reporting- Future of RPA.	

COURSE OUTCOMES

Upon completion of this course, student will be able to

22ISE834.1	Understand the fundamental ideas of RPA.
22ISE834.2	Describe several RPA platforms and components.
22ISE834.3	Describe the many sorts of variables, control flow, and data manipulation techniques.
22ISE834.4	Understand Different techniques for control and OCR in RPA.
22ISE834.5	Describe various exception handling types and techniques.

Text Books

1. Tom Taulli, The Robotic Process Automation Handbook : A Guide to Implementing RPA Systems,2020, ISBN-13 (electronic): 978-1-4842-5729-6, Publisher : A press.

2. Alok Mani Tripathi, Learning Robotic Process Automation, Publisher: Packt Publishing Release Date: March 2018 ISBN: 9781788470940.

Reference Books

1. Frank Casale, Rebecca Dilla, Heidi Jaynes, Lauren Livingston, "Introduction to Robotic Process Automation: A Primer", Institute of Robotic Process Automation.

2. Richard Murdoch, Robotic Process Automation: Guide to Building Software robots, Automate Repetitive Tasks & Become an RPA Consultant

3. Srikanth Merianda, Robotic Process Automation Tools, Process Automation and their benefits: Understanding RPA and Intelligent Automation

MOOCs (Format is given below)

1. http://nptel.ac.in
2. https://www.khanacademy.org/
3. https://www.class-central.com (MOOCS)
4. E-learning: www.vtu.ac.in

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.**

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	CIE Test-3	**40**	
	Quiz 1/AAT	**05**	
	Quiz 2/AAT	**05**	
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
22ISE834.1	3	2	2	1	2	-	-	-	-	-	1	-	2	2	1	1
22ISE834.2	3	3	3	1	3	-	-	-	-	-	1	-	3	3	2	1
22ISE834.3	3	3	3	1	3	-	-	-	-	-	1	-	3	3	2	1
22ISE834.4	3	3	3	1	3	-	-	-	-	-	1	-	3	3	2	1
22ISE834.5	3	2	2	1	2	-	-	-	-	-	1	-	2	2	1	1
Average	**3**	**3**	**3**	**1**	**3**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**3**	**3**	**2**	**1**

Low-1: Medium-2: High-3

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