MVJCE CURRICULUM
for

Department of Information Science and Engineering

(2022 Scheme)
3rd semester to 7th semester syllabus

III Semester

Semester: III		
Mathematics for Computer Science		
Course Code:	MVJ22IS31	CIE Marks: 50
L: T:P:S	3:0:0:0	SEE Marks: 50
Credits:	3	Total :100
Hours:	40 Hrs Theory	SEE Duration: 3 Hrs.
Course Learning Objectives: The students will be able to		
Understand and apply probability distribution, sampling theory and joint probability distributions. Organize, manage, and present data using statistical method.		

UNIT-I	
Probability Distributions: Random variables (discrete and continuous), probability mass/density functions. Binomial distribution, Poisson distribution. Exponential and normal distributions, problems. **Joint probability distribution:** Joint Probability distribution for two discrete random variables, expectation, covariance, correlation coefficient.	8 Hrs
UNIT-II	
Sampling Theory: Sampling, Sampling distributions, standard error, test of hypothesis for means and proportions, confidence limits for means, student's t-distribution and Chi-square distribution.	8 Hrs
UNIT-III	
Markov Chains: States and transitions, Transition probabilities, General two-state Markov chain, Powers of the transition matrix for the m-state chain, Gambler's ruin as a Markov chain, Classification of states, Classification of chains, problems.	8 Hrs
UNIT-IV	
Statistical Methods **Correlation and Regression:** Correlation, Regression coefficients, line of regression problems. **Curve fitting:**Fitting of the curves of the form$y = ax + b$, $y = ax^2 + bx + c$, $y = ae^{bx}$ by the method of least squares.	8 Hrs
UNIT-V	
Design of Experiments (ANOVA): One way and Two way classifications, Completely randomized design, Randomized block design, Latin square design.	8 Hrs

Course Outcomes: After completing the course, the students will be able to	
CO1	Develop probability distribution of discrete, continuous random variables and joint probability distribution occurring in digital signal processing, information theory and Design engineering.
CO2	Demonstrate testing of hypothesis of sampling distributions.
CO3	Define transition probability matrix of a Markov chain and solve problems related to discrete parameter random process.
CO4	Fit a suitable curve by the method of least squares and determine the lines of regression for a set of statistical data.
CO5	Understand the need and application of analytic.

Text Books:

1.	B.S. Grewal, "Higher Engineering Mathematics" Khanna Publishers, 43rd Edition, 2013.

Reference Books:

1.	Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley-India publishers, 10thedition,2014.
2.	Fundamentals of Statistics, S C Gupta, Himalaya Publications 2012.
3.	Ramana B. V., "Higher Engineering Mathematics", Tata Mc Graw-Hill, 2006.

Evaluation Method

Continuous Internal Evaluation (CIE):

- Three CIE Will be conducted for 50 marks each and average of three will be taken (A)
- Three Quizzes will be conducted along with CIE for 10 Marks Each. Sum of three quizzes will be considered for 30 marks (B)
- Two Assignments for 10 marks each and the sum of both the assignments will be taken for 20 Marks (C)

Final CIE Marks will be calculated as (A+B+C)/2 for 50 marks

Semester End Examination (SEE):

The question paper consists of two parts, A and B

Part A: consists of 10 questions of 2 marks each. It is designed to cover the entire syllabus comprehensively.

Part B: The question paper will have 10 questions. Each question is set for 16 marks. There will be 2 questions from each module, with a maximum of 2 subdivisions. Students have to answer any 5 questions choosing one full question from each module.

The SEE Theory marks of 100 will be scaled down to 50.

The final score for the course in the ratio of 50:50 of CIE and SEE Marks

CO-PO Mapping											
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	-	3	-	-	-	-	-	-	1
CO2	3	3	-	3	-	-	-	-	-	-	1
CO3	3	3	-	2	-	-	-	-	-	-	1
CO4	3	3	-	3	-	-	-	-	-	-	1
CO5	3	2	-	3	-	-	-	-	-	-	1

SEMESTER -III		
OPERATING SYSTEMS		
Course Code:	MVJ22IS32	CIE Marks: 50
L: T:P:S	3:0:2:0	SEE Marks:50
Credits:	4	Total Marks:100
Hours:	40 Hrs Theory and 24 Hrs Practical	Exam Hours:3

Course objectives:

- To Demonstrate the need for OS and different types of OS
- To discuss suitable techniques for management of different resources
- To demonstrate different APIs/Commands related to processor, memory, storage and file system management.

MODULE-1	8 Hours

Introduction to operating systems, System structures: What operating systems do; Computer System organization; Computer System architecture; Operating System structure; Operating System operations; Process management; Memory management; Storage management; Protection and Security; Distributed system; Special-purpose systems; Computing environments.

Operating System Services: User - Operating System interface; System calls; Types of system calls; System programs; Operating system design and implementation; Operating System structure; Virtual machines; Operating System debugging, Operating System generation; System boot.

Textbook 1: Chapter – 1 (1.1-1.12), 2 (2.2-2.11)

MODULE-2	8 Hours

Process Management: Process concept; Process scheduling; Operations on processes; Inter process communication

Multi-threaded Programming: Overview; Multithreading models; Thread Libraries; Threading issues.

Process Scheduling: Basic concepts; Scheduling Criteria; Scheduling Algorithms; Thread scheduling; Multiple-processor scheduling,

Textbook 1: Chapter – 3 (3.1-3.4), 4 (4.1-4.4), 5 (5.1 -5.5)

MODULE-3	8 Hours

Process Synchronization:Synchronization: The critical section problem;Peterson's solution; Synchronization hardware; Semaphores; Classical problems of synchronization;

Deadlocks: System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock. **Textbook 1: Chapter – 6 (6.1-6.6), 7 (7.1 -7.7)**
MODULE-4 **8 Hours**
Memory Management: Memory management strategies: Background; Swapping; Contiguous memory allocation; Paging; Structure of page table; Segmentation. **Virtual Memory Management:** Background; Demand paging; Copy-on-write; Page replacement; Allocation of frames; Thrashing. **Textbook 1: Chapter -8 (8.1-8.6), 9 (9.1-9.6)**
MODULE-5 **8 Hours**
File System, Implementation of File System: File system: File concept; Access methods; Directory and Disk structure; File system mounting; File sharing; Implementing File system: File system structure; File system implementation; Directory implementation; Allocation methods; Free space management. **Secondary Storage Structure, Protection:** Mass storage structures; Disk structure; Disk attachment; Disk scheduling; Disk management; **Protection:** Goals of protection, Principles of protection, Domain of protection, Access matrix. **Textbook 1: Chapter – 10 (10.1-10.5) ,11 (11.1-11.5),12 (12.1-12.5), 14 (14.1-14.**

PRACTICAL COMPONENT OF IPCC

Sl.NO	Experiments	
1	Develop a c program to implement the Process system calls (fork (), exec(), wait(), create process, terminate process)	2 Hours
2	Simulate the following CPU scheduling algorithms to find turnaround time and waiting time a) FCFS b) SJF c) Round Robin d) Priority.	2 Hours
3	Develop a C program to simulate producer-consumer problem using semaphores.	2 Hours
4	Develop a C program which demonstrates interprocess communication between a reader process and a writer process. Use mkfifo, open, read, write and close APIs in your program.	2 Hours
5	Develop a C program to simulate Bankers Algorithm for DeadLock Avoidance.	2 Hours
6	Develop a C program to simulate the following contiguous	2 Hours

	memory allocation Techniques: a) Worst fit b) Best fit c) First fit.	
7	Develop a C program to simulate page replacement algorithms: a) FIFO b) LRU	2 Hours
8	Simulate following File Organization Techniques a) Single level directory b) Two level directory	2 Hours
9	Develop a C program to simulate the Linked file allocation strategies.	2 Hours
10	Develop a C program to simulate SCAN disk scheduling algorithm.	2 Hours

11	Debug a given C program
	//Moving Disk head to the inner most requested cylinder because this is Circular LOOK. queue[i]=queue2[0];
	//Copying second array queue2[] after that first one is copied, into queue [] for(i=temp1+1,j=0;j<temp2;i++,j++)
	{
	queue[i]=queue2[j];
	}
	//At this point, we have the queue[] with the requests in the
	//correct order of execution as per C-LOOK algorithm.
	//Now we have to set 0th index of queue[] to be the initial headposition. queue[0]=headposition;
	// Calculating SEEK TIME. seek is initially set to 0 in the declaration part. for(j=0; j<n; j++) //Loop starts from headposition. (ie. 0th index of queue)
	{
	// Finding the difference between next position and current position. difference = absoluteValue(queue[j+1]-queue[j]);
	// Adding difference to the current seek time value seek = seek + difference;
	// Displaying a message to show the movement of disk head printf("Disk head moves from position %d to %d with Seek %d \n", queue[j], queue[j+1], difference);
	}
		2 Hours

Course outcomes (Course Skill Set):

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

S.No	Course Outcomes	Description	Program Outcomes
1	CO1	Understand the structure, functions, and services of operating systems and system calls.	PO1
2	CO2	Apply process scheduling and multithreading concepts to manage concurrent execution of processes.	PO1,PO2
3	CO3	Analyze process synchronization and deadlock handling mechanisms for resource sharing.	PO1,PO2,PO
4	CO4	Evaluate memory management strategies and virtual memory techniques for effective resource use.	PO1,PO3
5	CO5	Analyze file system architecture and storage management techniques including protection mechanisms.	PO1

Suggested Learning Resources:

Textbooks

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

Reference Books

1. Ann McHoes Ida M Fylnn, Understanding Operating System, Cengage Learning, 6th Edition
2. D.M Dhamdhere, Operating Systems: A Concept Based Approach 3rd Ed, McGraw- Hill, 2013.

3. P.C.P. Bhatt, An Introduction to Operating Systems: Concepts and Practice 4th Edition, PHI(EEE), 2014.

4. William Stallings Operating Systems: Internals and Design Principles, 6th Edition, Pearson.

Web links and Video Lectures (e-Resources):

1. https://youtu.be/mXw9ruZaxzQ
2. https://youtu.be/vBURTt97EkA
3. 3https://www.youtube.com/watch?v=783KAB-tuE4&list=PLIemF3uozcAKTgsCIj82voMK3TMR0YE
4. https://www.youtube.com/watch?v=3-ITLMMeeXY&list=PL3pGy4HtqwD0n7bQfHjPnsWzke

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

- Assessment Methods

Case Study on Unix Based Systems (10 Marks) Lab Assessment (25 Marks);

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

- Three CIE Will be conducted for 50 marks each and average of three will be taken (A)
- Three Quizzes will be conducted along with CIE for 10 Marks Each. Sum of three quizzes will be considered for 30 marks (B)
- Two Assignments for 10 marks each and the sum of both the assignments will be taken for 20 Marks (C)

Final CIE Marks will be calculated as (A+B+C)/2 for 50 marks

Laboratory- 50 Marks

Weekly Evaluation 30 Marks

Weekly evaluation will be conducted for every experiment. Marks of each evaluation includes Weekly Attendance + Experiment conduction along with Record / Observation + Weekly viva for all the experiments. The total of all these evaluated marks are added and the total marks will be scaled to 30 marks. (A)

Two CIE for 20 Marks each and take the average for 20 Marks (B)

Final CIE Marks will be calculated as A+B for 50 marks

For IPCC Final CIE Marks will be calculated as Average of CIE and Lab CIE for 50 marks.

Semester End Examination (SEE)

SEE Theory Examination (100 Marks)

The question paper consists of two parts, A and B

Part A: consists of 10 questions of 2 marks each. It is designed to cover the entire syllabus comprehensively.

Part B: The question paper will have 10 questions. Each question is set for 16 marks. There will be 2 questions from each module, with a maximum of 2 subdivisions. Students have to answer any 5 questions choosing one full question from each module.

The SEE Theory marks of 100 will be scaled down to 50 (A)

SEE Laboratory Examination (50 Marks)

The laboratory SEE is also evaluated for 50 marks, distributed as follows:

Experiment Conduction with Results: 40 marks

Viva Voce: 10 marks

Total 50 marks (B)

The score for the SEE is A+B of total 100 marks

The final score for the course in the ratio of 50:50 of CIE and SEE Marks

CO PO MAPPING

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2									
CO2	3	3	2		2						
CO3	3	3	3	2	2						
CO4	3	2	3	2	2						
CO5	3	2	2		2						

SEMESTER -III		
DIGITAL DESIGN AND COMPUTER ORGANIZATION		
Course Code:	MVJ22IS33	CIE Marks:50
L: T:P:S	3:0:0:0	SEE Marks:50
Credits:	3	Total Marks:100
Hours:	40Hrs Theory	Exam Hours:3

Course objectives:

To demonstrate the functionalities of binary logic system

To explain the working of combinational and sequential logic system

To realize the basic structure of computer system

To illustrate the working of I/O operations and processing unit

MODULE-1	8 Hr

Introduction to Digital Design: Binary Logic, Basic Theorems And Properties Of Boolean Algebra, Boolean Functions, Digital Logic Gates, Introduction, The Map Method, Four-Variable Map, Don't-Care Conditions, NAND and NOR Implementation, Other Hardware Description Language – Verilog Model of a simple circuit.

Text book 1: 1.9, 2.4, 2.5, 2.8, 3.1, 3.2, 3.3, 3.5, 3.6, 3.9

MODULE-2	8 Hr

Combinational Logic: Introduction, Combinational Circuits, Design Procedure, Binary Adder- Subtractor, Decoders, Encoders, Multiplexers. HDL Models of Combinational Circuits – Adder, Multiplexer, Encoder. Sequential Logic: Introduction, Sequential Circuits, Storage Elements: Latches, Flip-Flops.

Text book 1: 4.1, 4.2, 4.4, 4.5, 4.9, 4.10, 4.11, 4.12, 5.1, 5.2, 5.3, 5.4.

MODULE-3	8 Hr

Basic Structure of Computers: Functional Units, Basic Operational Concepts, Bus structure, Performance – Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement.

Machine Instructions and Programs: Memory Location and Addresses, Memory Operations, Instruction and Instruction sequencing, Addressing Modes.

Text book 2: 1.2, 1.3, 1.4, 1.6, 2.2, 2.3, 2.4, 2.5

MODULE-4	8 Hr

Input/output Organization: Accessing I/O Devices, Interrupts– Interrupt Hardware, Enabling and Disabling Interrupts, Handling Multiple Devices, Direct Memory Access: Bus Arbitration, Speed, size and Cost of memory systems. Cache Memories – Mapping

Functions.

Text book 2: 4.1, 4.2.1, 4.2.2, 4.2.3, 4.4, 5.4, 5.5.1

MODULE-5	8 Hr

Basic Processing Unit: Some Fundamental Concepts: Register Transfers, Performing ALU operations, fetching a word from Memory, Storing a word in memory. Execution of a Complete Instruction. Pipelining: Basic concepts, Role of Cache memory, Pipeline Performance.

Text book 2: 7.1, 7.2, 8.1

Suggested Learning Resources:

Books

1. M. Morris Mano & Michael D. Ciletti, Digital Design With an Introduction to Verilog Design, 5e, Pearson Education.

2. Carl Hamacher, ZvonkoVranesic, SafwatZaky, Computer Organization, 5th Edition, Tata McGraw Hill.

Web links and Video Lectures (e-Resources):
https://cse11-iiith.vlabs.ac.in/

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

Assign the group task to Design the various types of counters and display the output accordingly Assessment Methods

- Lab Assessment (25 Marks)
- GATE Based Aptitude Test

S.No	Course Outcomes	Description	Program Outcomes
1	CO1	Understand Boolean algebra, logic gates, and simplification using Karnaugh maps.	PO1
2	CO2	Apply combinational and sequential logic design concepts in digital circuits and Verilog modeling.	PO1,PO2
3	CO3	Analyze the architecture and functioning of basic computer components and their interaction.	PO1,PO2,PO3
4	CO4	Evaluate system performance considering pipelining, cache memory, and I/O mechanisms.	PO1,PO3,PO4

Continuous Internal Evaluation (CIE):

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The SEE Theory marks of 100 will be scaled down to 50.

The final score for the course in the ratio of 50:50 of CIE and SEE Marks

COPO MAPPING

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2				-	-	-	-	-	-
CO2	3	2	2		2	-	-	-	-	-	-
CO3	3	3	3	2	2	-	-	-	-	-	-
CO4	3	2	3	2	3	-	-	-	-	-	-

SEMESTER -III		
DATA STRUCTURES AND APPLICATIONS		
Course Code:	MVJ22IS34	CIE Marks:50
L: T:P:S	3:0:0:0	SEE Marks:50
Credits:	3	Total Marks:100
Hours:	40Hrs Theory	Exam Hours:3

Course objectives:

CLO 1. To explain fundamentals of data structures and their applications.

CLO 2. To illustrate representation of Different data structures such as Stack, Queues, Linked Lists, Trees, and Graphs.

CLO 3. To Design and Develop Solutions to problems using Linear Data Structures CLO 4. To discuss applications of Nonlinear Data Structures in problem solving.

CLO 5. To introduce advanced Data structure concepts such as Hashing and Optimal Binary Search Trees

Module-1	8Hours

INTRODUCTION TO DATA STRUCTURES: Data Structures, Classifications (Primitive & Non-Primitive), Data structure Operations

Review of pointers and dynamic Memory Allocation,

ARRAYS and STRUCTURES: Arrays, Dynamic Allocated Arrays, Structures and Unions, Polynomials, Sparse Matrices, representation of Multidimensional Arrays, Strings **STACKS:** Stacks, Stacks Using Dynamic Arrays, Evaluation and conversion of Expressions Text Book: Chapter-1:1.2 Chapter-2: 2.1 to 2.7 Chapter-3: 3.1,3.2,3.6

Reference Book 1: 1.1 to 1.4

Module-2	8Hours

QUEUES: Queues, Circular Queues, Using Dynamic Arrays, Multiple Stacks and queues. **LINKED LISTS :** Singly Linked, Lists and Chains, Representing Chains in C, Linked Stacks and Queues, Polynomials

Text Book: Chapter-3: 3.3, 3.4, 3.7 Chapter-4: 4.1 to 4.4

Module-3	8Hours

LINKED LISTS : Additional List Operations, Sparse Matrices, Doubly Linked List.

TREES: Introduction, Binary Trees, Binary Tree Traversals, Threaded Binary

Trees. Text Book: Chapter-4: 4.5,4.7,4.8 Chapter-5: 5.1 to 5.3, 5.5

Module-4 **8Hours**

TREES(Cont..): Binary Search trees, Selection Trees, Forests, Representation of Disjoint sets, Counting Binary Trees,

GRAPHS: The Graph Abstract Data Types, Elementary Graph Operations
Text Book: Chapter-5: 5.7 to 5.11 Chapter-6: 6.1, 6.2

Module-5 **8Hours**

HASHING: Introduction, Static Hashing, Dynamic Hashing

PRIORITY QUEUES: Single and double ended Priority Queues, Leftist Trees

INTRODUCTION TO EFFICIENT BINARY SEARCH TREES: Optimal Binary Search Trees

Text Book: Chapter 8: 8.1 to 8.3 Chapter 9: 9.1, 9.2 Chapter 10: 10.1

Course Outcomes: Students will be able to

Course Outcomes	Description	POS
CO1	Understand the fundamental concepts of data structures such as arrays,structures ,stacks,queues and linked lists	PO1
CO2	Apply linear and non linear data structures to develop efficient C programs	PO1
CO3	Analyze the performance and behavior of trees and graph data structures in various scenarios	PO1,PO2,PO3
CO4	Evaluate advanced data structures like hashing ,priority queues, and efficient binary search trees for optimal operations	Po1,po2,po3

Suggested Learning Resources:

Textbook:

1. Ellis Horowitz, Sartaj Sahni and Susan Anderson-Freed, Fundamentals of Data Structures in C, 2nd Ed, Universities Press, 2014

Reference Books:

1. Seymour Lipschutz, Data Structures Schaum's Outlines, Revised 1st Ed, McGraw Hill, 2014.
2. Gilberg & Forouzan, Data Structures: A Pseudo-code approach with C, 2nd Ed, Cengage Learning,2014.
3. Reema Thareja, Data Structures using C, 3rd Ed, Oxford press, 2012.

4. Jean-Paul Tremblay & Paul G. Sorenson, An Introduction to Data Structures with Applications, 2nd Ed, McGraw Hill, 2013
5. A M Tenenbaum, Data Structures using C, PHI, 1989
6. Robert Kruse, Data Structures and Program Design in C, 2nd Ed, PHI, 199

Web links and Video Lectures (e-Resources):

- http://elearning.vtu.ac.in/econtent/courses/video/CSE/06CS35.html
- https://nptel.ac.in/courses/106/105/106105171/
- http://www.nptelvideos.in/2012/11/data-structures-and-algorithms.html
- https://www.youtube.com/watch?v=3Xo6P_V-qns&t=201s
- https://ds2-iiith.vlabs.ac.in/exp/selection-sort/index.html
- https://nptel.ac.in/courses/106/102/106102064/
- https://ds1-iiith.vlabs.ac.in/exp/stacks-queues/index.html
- https://ds1-iiith.vlabs.ac.in/exp/linked-list/basics/overview.html
- https://ds1-iiith.vlabs.ac.in/List%20of%20experiments.html
- https://ds1-iiith.vlabs.ac.in/exp/tree-traversal/index.html
- https://ds1-iiith.vlabs.ac.in/exp/tree-traversal/depth-first-traversal/dft-practice.html
- https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013501595428077568125 59/overview

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

- Role Play
- Flipped classroom
- Assessment Methods for 25 Marks (opt two Learning Activities)

Case Study

O Programming Assignment

O Gate Based Aptitude Test

MOOC Assignment for selected Module

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The final score for the course in the ratio of 50:50 of CIE and SEE Marks

COPO MAPPING:

CO/ PO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2									
CO2	3	2	2		2						
CO3	3	3	3	2	2						
CO4	3	2	3	2	3						

SEMESTER -III		
DATA STRUCTURES LABORATORY		
Course Code:	MVJ22ISL35	CIE Marks: 50
L: T:P:S	0:0:2:0	SEE Marks :50
Credits:	1	Total Marks:100
Hours:	26P	Exam Hours: 3

Course Learning Objectives:		
This laboratory course enables students to get practical experience in design, develop, implement, analyze and evaluation/testing of ● Dynamic memory management ● Linear data structures and their applications such as stacks, queues and lists ● Non-Linear data structures and their applications such as trees and graphs		
Descriptions (if any):		
● Implement all the programs in "C" Programming Language and Linux OS.		
Programs List:		
1.	Develop a Program in C for the following: a) Declare a calendar as an array of 7 elements (A dynamically Created array) to represent 7 days of a week. Each Element of the array is a structure having three fields. The first field is the name of the Day (A dynamically allocated String), The second field is the date of the Day (A integer), the third field is the description of the activity for a particular day (A dynamically allocated String). b) Write functions create (), read() and display(); to create the calendar, to read the data from the keyboard and to print weeks activity details report on screen.	2Hours
2.	Develop 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.	2Hours

3.	Develop 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	2Hours
4.	Develop a Program in C for converting an Infix Expression to Postfix Expression. Program should support for both parenthesized and free parenthesized expressions with the operators: +, -, *, /, % (Remainder), ^ (Power) and alphanumeric operands.	2Hours
5.	Develop a Program in C for the following Stack Applications a) Evaluation of Suffix expression with single digit operands and operators: +, -, *, /, %, ^ b) Solving Tower of Hanoi problem with n disks	2Hours
6.	Develop a menu driven Program in C for the following operations on Circular QUEUE of Characters (Array Implementation of Queue with maximum size MAX) a) Insert an Element on to Circular QUEUE b) Delete an Element from Circular QUEUE c) Demonstrate Overflow and Underflow situations on Circular QUEUE d) Display the status of Circular QUEUE e) Exit Support the program with appropriate functions for each of the above operations	2Hours
7	Develop a menu driven Program in C for the following operations on Singly Linked List (SLL) of Student Data with the fields: USN, Name, Programme, Sem, PhNo a) Create a SLL of N Students Data by using front insertion. b) Display the status of SLL and count the number of nodes in it	2Hours

	c) Perform Insertion / Deletion at End of SLL d) Perform Insertion / Deletion at Front of SLL(Demonstration of stack) e)Exit	
8	Develop 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, PhNo 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	2Hours
9	Develop a Program in C for the following operations on Singly Circular Linked List (SCLL) with header nodes a. Represent and Evaluate a Polynomial P(x,y,z) = 6x2y2z-4yz5+3x3yz+2xy5z-2xyz3 b. Find the sum of two polynomials POLY1(x,y,z) and POLY2(x,y,z) and store the result in POLYSUM(x,y,z) Support the program with appropriate functions for each of the above operations	2Hours
10	Develop 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 c) Search the BST for a given element (KEY) and report the appropriate message d) Exit	2Hours
11	Develop a Program in C for the following operations on Graph(G) of Cities a. Create a Graph of N cities using Adjacency Matrix. b. Print all the nodes reachable from a given starting node in a digraph using DFS/BFS method	2Hours

12	Given a File of N employee records with a set K of Keys (4-digit) which uniquely determine the records in file F. Assume that file F is maintained in memory by a Hash Table (HT) of m memory locations with L as the set of memory addresses (2-digit) of locations in HT. Let the keys in K and addresses in L are Integers. Develop a Program in C that uses Hash function H: K →L as H(K)=K mod m (remainder method), and implement hashing technique to map a given key K to the address space L. Resolve the collision (if any) using linear probing.	2Hours

Note: During the lab sessions the data structures using python codes will be demonstrated

Textbooks:

1. Data Structures Using C by Reema Thareja (Oxford University Press) and Fundamentals of Data Structures in C by Horowitz, Sahni, and Freed (Computer Science Press).

Reference books:

1. Data Structures Using C and C++ by Langsam, Augenstein, and Tenenbaum (Prentice Hall) and Data Structures Using C by Balagurusamy (McGraw Hill).

Laboratory Outcomes: The student should be able to:

S.No	Course Outcomes	Description	Program Outcomes
1	CO1	Understand and implement fundamental dynamic memory allocation and string operations in C	PO1
2	CO2	Apply stack and queue data structures for problem solving and expression evaluation	PO1,PO2PO3
3	CO3	Analyze and implement linked list-based dynamic data structures for real-world applications	PO1,PO2PO3
4	CO4	Develop and evaluate tree and graph-based data structures including hashing techniques	PO1

CIE Laboratory (50 Marks)

Weekly Evaluation 30 Marks

Weekly evaluation will be conducted for every experiment. Marks of each evaluation includes Weekly Attendance + Experiment conduction along with

Record / Observation + Weekly viva for all the experiments. The total of all these evaluated marks are added and the total marks will be scaled to 30 marks. (A)

Two CIE for 20 Marks each and take the average for 20 Marks (B)

Final CIE Marks will be calculated as (A+B) for 50 marks

SEE Laboratory Examination (50 Marks)

The laboratory SEE is also evaluated for 50 marks, distributed as follows:

Experiment Conduction with Results: 40 marks

Viva Voce: 10 marks

Total 50 marks

The final score for the course out of 100 is the SumTotal of SEE and CIE.

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	1	2	-	-	-	-	1	-
CO2	3	3	3	2	2	-	-	-	1	1	-
CO3	3	3	3	2	2	-	-	-	1	1	-
CO4	3	3	3	3	3	-	-	-	2	2	1

Semester : III		
OBJECT ORIENTED PROGRAMMING WITH JAVA		
Course Code:	MVJ22IS361	CIE Marks: 50
L: T:P:S	3:0:0:0	SEE Marks: 50
Credits:	3	Total :100
Hours:	40 Hrs Theory	SEE Duration: 3 Hrs.

Note - Students who have undergone " Basics of Java Programming- BPLCK105C/205C" in first year are not eligible to opt this course

Course Objectives: This course will enable the students to:

- To learn primitive constructs JAVA programming language.
- To understand Object Oriented Programming Features of JAVA
- To gain knowledge on: packages, multi threaded programming and exceptions.

Module-1	8 hours

An Overview of Java: Object-Oriented Programming (Two Paradigms, Abstraction, The Three OOP Principles), Using Blocks of Code, Lexical Issues (Whitespace, Identifiers, Literals, Comments, Separators, The Java Keywords).

Data Types, Variables, and Arrays: The Primitive Types (Integers, Floating-Point Types, Characters, Booleans), Variables, Type Conversion and Casting, Automatic Type Promotion in Expressions, Arrays, Introducing Type Inference with Local Variables.

Operators: Arithmetic Operators, Relational Operators, Boolean Logical Operators, The Assignment Operator, The ? Operator, Operator Precedence, Using Parentheses.

Control Statements: Java's Selection Statements (if, The Traditional switch), Iteration Statements (while, do-while, for, The For-Each Version of the for Loop, Local Variable Type Inference in a for Loop, Nested Loops), Jump Statements (Using break, Using continue, return).

Module-2	8 hours

Introducing Classes: Class Fundamentals, Declaring Objects, Assigning Object Reference Variables, Introducing Methods, Constructors, The this Keyword, Garbage Collection.

Methods and Classes: Overloading Methods, Objects as Parameters, Argument Passing, Returning Objects, Recursion, Access Control, Understanding static, Introducing final, Introducing Nested and Inner Classes.

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

Course Outcomes: Students will be able to

S.No	Course Outcomes	Description	Program Outcomes
1	CO1	Understand and apply the fundamentals of Java programming, including variables, arrays, and operators	PO1,PO2
2	CO2	Design and implement classes, methods, and constructors, applying object-oriented principles	PO1,PO2,PO3
3	CO3	Develop inheritance hierarchies and work with interfaces, focusing on method overriding and dynamic method dispatch	PO1,PO2,PO3, PO4, PO5
4	CO4	Implement exception handling, multithreaded programming, and work with advanced Java features such as enumerations and autoboxing	PO1,PO2,PO3, PO4,PO5,PO9

Suggested Learning Resources:

Textbooks:

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

Reference Books:

Programming with Java, 6th Edition, by E Balagurusamy, Mar-2019, McGraw Hill Education, ISBN: 9789353162337.

Thinking in Java, Fourth Edition, by Bruce Eckel, Prentice Hall, 2006

(https://sd.blackball.lv/library/thinking_in_java_4th_edition.pdf)

Web links and Video Lectures (e-Resources):

●Java Tutorial: https://www.geeksforgeeks.org/java/

●Introduction To Programming In Java (by Evan Jones, Adam Marcus and Eugene Wu): https://ocw.mit.edu/courses/6-092-introduction-to-programming-in-java-january-iap-2010/

●Java Tutorial: https://www.w3schools.com/java/

●Java Tutorial: https://www.javatpoint.com/java-tutorial

Activity Based Learning (Suggested Activities)/ Practical Based learning

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

Assessment Method

Programming Assignment / Course Project

Continuous Internal Evaluation (CIE):

- Three CIE Will be conducted for 50 marks each and average of three will be taken (A)
- Three Quizzes will be conducted along with CIE for 10 Marks Each. Sum of three quizzes will be considered for 30 marks (B)
- Two Assignments for 10 marks each and the sum of both the assignments will be taken for 20 Marks (C)

Final CIE Marks will be calculated as (A+B+C)/2 for 50 marks

Semester End Examination (SEE):

The question paper consists of two parts, A and B

Part A: consists of 10 questions of 2 marks each. It is designed to cover the entire syllabus comprehensively.

Part B: The question paper will have 10 questions. Each question is set for 16 marks. There will be 2 questions from each module, with a maximum of 2 subdivisions. Students have to answer any 5 questions choosing one full question from each module.

The SEE Theory marks of 100 will be scaled down to 50.

The final score for the course in the ratio of 50:50 of CIE and SEE Marks

CO-PO Mapping

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	2	1	2	-	-	-	-	1	-
CO2	3	3	3	2	2	-	-	-	1	1	-
CO3	3	3	3	3	3	-	-	-	2	2	1
CO4	3	3	3	3	3	-	-	-	3	2	2

Semester : III		
Data Analytics with R		
Course Code:	MVJ22IS363	CIE Marks: 50
L: T:P:S	3:0:0:0	SEE Marks: 50
Credits:	1	Total :100
Hours:	40 Hrs Theory	SEE Duration: 2 Hrs.

Course objectives:

- To explore and understand how R and R Studio interactive environment.
- To understand the different data Structures, data types in R.
- To learn and practice programming techniques using R programming.
- To import data into R from various data sources and generate visualizations.
- To draw insights from datasets using data analytics techniques.
- To gain the knowledge of R programming concepts, To explain the concepts of Data visualization
- To explain the concept of statistics in R, To work with R charts and graphs

Module-1	8 Hours

Basics of R: Introducing R, Initiating R, Packages in R,Environments and Functions, Flow controls, Loops, Basic Data Types in R, Vectors

Textbook1 : Chapter 1: 1.1 to 1.7 Chapter 2: 2.1 ,2.2

Module-2	8 Hours

Basics of R continued: Matrices and Arrays, Lists, Data Frames, Factors, Strings, Dates and Times

Textbook1 : Chapter 2: 2.3 ,2.4,2.5,2.7,2.8.1,2.8.2

Module-3	8 Hours

Data Preparation: Datasets,importing and exporting files, accessing databases,data cleaning and transformation

Textbook1 : Chapter 3: 3.1,3.2,3.3,3.4

Module-4	8 Hours

Graphics using R Exploratory Data Analysis, Main Graphical packages, Pie charts,Scatter Plots, Line plots, Histograms, Box Plots, Bar Plots, Other Graphical packages Analysis-Linear Regression Analysis of variance

Textbook1 : Chapter 5: 5.1,5.3,5.4,5.6.1,5.7

<table>
<tr><td colspan="2">Module-5</td><td>8 Hours</td></tr>
<tr><td colspan="3">Statistical Analysis using R

Basic statistical measures, Normal distribution, Binomial distribution, Correlation Analysis, Regression Analysis-Linear Regression Analysis of variance

Textbook1: Chapter 5: 5.1,5.3,5.4,5.6.1,5.7</td></tr>
<tr><td>Sl.NO</td><td colspan="2">Programs</td></tr>
<tr><td>1</td><td colspan="2">Demonstrate the steps for installation of R and R Studio. Perform the following:

a) Assign different type of values to variables and display the type of variable. Assign different types such as Double, Integer, Logical, Complex and Character and understand the difference between each data type.

b) Demonstrate Arithmetic and Logical Operations with simple examples.

c) Demonstrate generation of sequences and creation of vectors.

d) Demonstrate Creation of Matrices

e) Demonstrate the Creation of Matrices from Vectors using Binding Function.

f) Demonstrate element extraction from vectors, matrices and arrays

Suggested Reading – Text Book 1 – Chapter 1 (What is R, Installing R, Choosing an IDE – RStudio, How to Get Help in R, Installing Extra Related Software), Chapter 2 (Mathematical Operations and Vectors, Assigning Variables, Special Numbers, Logical Vectors), Chapter 3 (Classes, Different Types of Numbers,

Other Common Classes, Checking and Changing Classes, Examining Variables)</td></tr>
<tr><td>2</td><td colspan="2">Assess the Financial Statement of an Organization being supplied with 2 vectors of data: Monthly Revenue and Monthly Expenses for the Financial Year. You can create your own sample data vector for this experiment) Calculate the following financial metrics:

● Profit for each month.
● Profit after tax for each month (Tax Rate is 30%).
● Profit margin for each month equals to profit after tax divided by revenue.
● Good Months – where the profit after tax was greater than the mean for the year.
● Bad Months – where the profit after tax was less than the mean for the year.
● The best month – where the profit after tax was max for the year.
● The worst month – where the profit after tax was min for the year.
Note:

a) All Results need to be presented as vectors</td></tr>
</table>

	b) Results for Dollar values need to be calculated with $0.01 precision, but need to be presented in Units of $1000 (i.e 1k) with no decimal points c) Results for the profit margin ratio need to be presented in units of % with no decimal point. d) It is okay for tax to be negative for any given month (deferred tax asset) Generate CSV file for the data. **Suggested Reading** – Text Book 1 – Chapter 4 (Vectors, Combining Matrices)
3	Develop a program to create two 3 X 3 matrices A and B and perform the following operations a) Transpose of the matrix b) addition c) subtraction d) multiplication **Suggested Reading** – Text Book 1 – Chapter 4 (Matrices and Arrays – Array Arithmetic)
4	Develop a program to find the factorial of given number using recursive function calls. **Suggested Reading** – Reference Book 1 – Chapter 5 (5.5 – Recursive Programming) Text Book 1 – Chapter 8 (Flow Control and Loops – If and Else, Vectorized If, while loops, for loops),Chapter 6 (Creating and Calling Functions, Passing Functions to and from other functions)
5	Develop an R Program using functions to find all the prime numbers up to a specified number by themethod of Sieve of Eratosthenes. **Suggested Reading** – Reference Book 1 - Chapter 5 (5.5 – Recursive Programming) Text Book 1 – Chapter 8 (Flow Control and Loops – If and Else, Vectorized If, while loops, for loops),Chapter 6 (Creating and Calling Functions, Passing Functions to and from other functions)
6	The built-in data set mammals contain data on body weight versus brain weight. Develop R commands to: a. Find the Pearson and Spearman correlation coefficients. Are they similar? b. Plot the data using the plot command. c. Plot the logarithm (log) of each variable and see if that makes a difference. **Suggested Reading** – Text Book 1 –Chapter 12 – (Built-in Datasets) Chapter 14 – (Scatterplots) Reference Book 2 – 13.2.5 (Covariance and Correlation)
7	Develop R program to create a Data Frame with following details and do the following operations.

Item Code	Item Category	Item Price
1001	Electronics	700
1002	Desktop Supplies	300
1003	Office Supplies	350
1004	USB	400
1005	CD Drive	800

a. Subset the Data frame and display the details of only those items whose price is greater than or equal to 350.
b. Subset the Data frame and display only the items where the category is either "Office Supplies" or "Desktop Supplies"
c. Create another Data Frame called "item-details" with three different fields itemCode, ItemQtyonHandand ItemReorderLvl and merge the two frames

Suggested Reading –Textbook 1: Chapter 5 (Lists and Data Frames)

8	Let us use the built-in dataset air quality which has Daily air quality measurements in New York, May to September 1973. Develop R program to generate histogram by using appropriate arguments for the following statements. a. Assigning names, using the air quality data set. b. Change colors of the Histogram c. Remove Axis and Add labels to Histogram d. Change Axis limits of a Histogram e. Add Density curve to the histogram **Suggested Reading** –Reference Book 2 – Chapter 7 (7.4 – The ggplot2 Package), Chapter 24 (Smoothingand Shading)
9	Design a data frame in R for storing about 20 employee details. Create a CSV file named "input.csv" that defines all the required information about the employee such as id, name, salary, start_date, dept. Import into R and do the following analysis. a. Find the total number rows & columns b. Find the maximum salary c. Retrieve the details of the employee with maximum salary d. Retrieve all the employees working in the IT Department. e. Retrieve the employees in the IT Department whose salary is greater than 20000 and write these details into another file "output.csv" **Suggested Reading** – Text Book 1 – Chapter 12(CSV and Tab Delimited Files)

10	Using the built in dataset mtcars which is a popular dataset consisting of the design and fuel consumption patterns of 32 different automobiles. The data was extracted from the 1974 Motor Trend US magazine, andcomprises fuel consumption and 10 aspects of automobile design and performance for 32 automobiles (1973-74 models). Format A data frame with 32 observations on 11 variables : [1] mpg Miles/(US) gallon, [2] cyl Number of cylinders [3] disp Displacement (cu.in.), [4] hp Gross horsepower [5] drat Rear axle ratio,[6] wt Weight (lb/1000) [7] qsec 1/4 mile time, [8] vs V/S, [9] am Transmission (0 = automatic, 1 = manual), [10] gear Number of forward gears, [11] carb Number of carburetors Develop R program, to solve the following: a. What is the total number of observations and variables in the dataset? b. Find the car with the largest hp and the least hp using suitable functions c. Plot histogram / density for each variable and determine whether continuous variables arenormally distributed or not. If not, what is their skewness? d. What is the average difference of gross horse power(hp) between automobiles with 3 and 4number of cylinders(cyl)? Also determine the difference in their standard deviations. e. Which pair of variables has the highest Pearson correlation? References (Web links): • https://cran.r-project.org/web/packages/explore/vignettes/explore_mtcars.html • https://www.w3schools.com/r/r_stat_data_set.asp https://rpubs.com/BillB/217355

11	Demonstrate the progression of salary with years of experience using a suitable data set (You can create your own dataset). Plot the graph visualizing the best fit line on the plot of the given data points. Plot a curve of Actual Values vs. Predicted values to show their correlation and performance of the model. Interpret the meaning of the slope and y-intercept of the line with respect to the given data. Implement using lm function. Save the graphs and coefficients in files. Attach the predicted values of salaries as a newcolumn to the original data set and save the data as a new CSV file. Suggested Reading – Reference Book 2 – Chapter 20 (General Concepts, Statistical Inference, Prediction)
Note: Data analytics part is also included in the mathematics.	

Course outcomes (Course Skill Set):

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

S.No	Description	Program Outcomes
1	Understand and demonstrate R environment setup, basic syntax, data types, vectors, matrices, and sequences	PO1,PO2
2	Apply R programming to perform basic data analysis, matrix operations, and recursive programming techniques	PO1,PO2, PO3,PO4
3	Analyze structured and unstructured data using data frames, CSVs, data merging, filtering, and transformation	PO1,PO2, PO3,PO4
4	Evaluate statistical relationships using correlation, regression, data visualization, and report findings	PO1,PO2 ,PO3,PO4

Suggested Learning Resources:

Text Book:

1. Cotton, R. (2013). Learning R: A Step by Step Function Guide to Data Analysis. 1st ed. O'Reilly Media Inc.

References:

1.Jones, O., Maillardet. R. and Robinson, A. (2014). Introduction to Scientific Programming and Simulation Using R. Chapman & Hall/CRC, The R Series.

2.Davies, T.M. (2016) The Book of R: A First Course in Programming and Statistics. No Starch Press.

Web links and video lectures (e-Resouurces):

1.URL: https://cran.r-project.org/doc/manuals/r-release/R-intro.pdf

http://www.tutorialspoint.com/r/r_tutorial.pdf

https://users.phhp.ufl.edu/rlp176/Courses/PHC6089/R_notes/inro.html

2.http://www.w3schools.com/r/r_stat_data_set.asp

3. https://rpubs.com/BillB/217355

Activity Based Learning (Suggested Activities in Class)/ Practical Based Learning programming assignments (10 marks)

Continuous Internal Evaluation (CIE):

- Three CIE Will be conducted for 50 marks each and average of three will be taken (A)
- Three Quizzes will be conducted along with CIE for 10 Marks Each. Sum of three quizzes will be considered for 30 marks (B)
- Two Assignments for 10 marks each and the sum of both the assignments will be taken for 20 Marks (C)

Final CIE Marks will be calculated as (A+B+C)/2 for 50 marks

Semester End Examination (SEE):

The question paper consists of two parts, A and B

Part A: consists of 10 questions of 2 marks each. It is designed to cover the entire syllabus comprehensively.

Part B: The question paper will have 10 questions. Each question is set for 16 marks. There will be 2 questions from each module, with a maximum of 2 subdivisions. Students have to answer any 5 questions choosing one full question from each module.

The SEE Theory marks of 100 will be scaled down to 50.

The final score for the course in the ratio of 50:50 of CIE and SEE Marks

COPO MAPPING

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	2	2	3	–	–	–	1	1	–
CO2	3	3	3	3	3	–	–	–	2	2	1
CO3	3	3	3	3	3	–	–	–	2	3	2
CO4	3	3	3	3	3	–	–	–	3	3	3

Semester : III		
Python Programming for Data Science		
Course Code:	MVJ22IS364	CIE Marks: 50
L: T:P:S	3:0:0:0	SEE Marks: 50
Credits:	3	Total :100
Hours:	40 Hrs Theory	SEE Duration: 3 Hrs.

Course Objectives: This course will enable the students to:

1. To understand Python constructs and use them to build the programs.
2. To analyse different conditional statements and their applications in programs
3. To learn and use basic data structures in python language
4. To learn and demonstrate array manipulations by reading data from files
5. To understand and use different data in a data analytics context.

Module-1	8Hrs

Introduction to python: Elements of python language, python block structure, variables and assignment statement, data types in python, operations, simple input/output print statements, formatting print statement

Text Book 1: Chapter 3 (3.2, 3.3, 3.4, 3.6, 3.7, 3.9 and 3.10)

Module-2	8Hrs

Decision structure: forming conditions, if statement, the if-else and nested if-else, looping statements: introduction to looping, python built in functions for looping, loop statements, jump statement.

Text Book 1: Chapter 4 (4.2 to 4.6) , Chapter 5 (5.1 to 5.4)

Module-3	8Hrs

Lists: lists, operation on list, Tuples: introduction, creating,indexing and slicing, operations on tuples. sets: creating, operation in sets, introduction dictionaries, creating, operations, nested dictionary, looping over dictionary.

Text Book 1: Chapter 7 (7.2 to 7.3) , Chapter 8 (8.1 to 8.4) and Chapter 9(9.1 to 9.3, 9.7 to 9.12)

Module-4	8 Hrs

The NumPy Library: Ndarray: the heart of the library, Basic operations, indexing, slicing and iterating, conditions and boolean arrays, array manipulation, general concepts, reading and writing array data on files. The pandas Library: an introduction to Data structure, other functionalities on indexes, operations between data structures, function application and mapping.

Text Book 2: Chapter 3 and Chapter 4.

Module-5	8 Hrs

The pandas : Reading and Writing data: i/o API tools, CSV and textual files, Reading data in CSV or text files, reading and writing HTML files, reading data from XML files, Microsoft excel files, JSON data, Pickle python object serialization. Pandas in Depth : data manipulation: data

preparation, concatenating data transformation discretization binning, permutation, string manipulation, data aggregation group iteration.

Text Book 2: Chapter 5 and Chapter 6

Course Outcomes: At the end of the course1, the student will be able to:

CO1: Describe the constructs of python programming

CO2: Use looping and conditional constructs to build programs

CO3: Apply the concept of data structure to solve the real-world problem

CO4: Use the NumPy constructs for matrix manipulations

CO5: Apply the Panda constructs for data analytics.

Textbooks:

1. S. Sridhar, J. Indumathi, V.M. Hariharan "Python Programming" Pearson publishers, 1st edition 2023. Fabio Nelli, "Python Data Analytics", Apress, Publishing, 1st Edition, 2015.

Reference Books:

1. Paul Deitel and Harvey deitel,"Intro to Python for Computer Science and Data science", 1st edition Pearson Publisher 2020.

CIE ASSESSMENT:

1. Three CIE Will be conducted for 50 marks each and average of three will be taken (A)
2. Three Quizzes will be conducted along with CIE for 10 Marks Each. Sum of three quizzes will be considered for 30 marks (B)
3. Two Assignments for 10 marks each and the sum of both the assignments will be taken for 20 Marks (C)

Final CIE Marks will be calculated as (A+B+C)/2 for 50 marks

SEE ASSESSMENT:

The theory exam consists of a written paper structured into two parts:

Part A: Carries 20 marks which include either objective-type or short descriptive questions. It is designed to cover the entire syllabus comprehensively.

Part B: This section carries a total of 80 marks and consists of 5 questions, with Either or choices. Students are required to answer one full question per module, selecting from the choices. Each question is valued at 16 marks and may include up to two sub-parts.

The SEE Theory marks of 100 will be scaled down to 50.

The final score for the course in the ratio of 50:50 of CIE and SEE Marks

CO-PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	3	2	3						2
CO2	3	2	3	2	3						2
CO3	3	3	2	2	3						2
CO4	3	2	3	2	3						2
CO5	3	3	3	3	3						2

Semester: III		
Social Connect & Responsibility		
Course Code:	MVJ22SCR37	CIE Marks: 100
L: T:P:S	1:0:0:0 / 2:0:0:0	SEE Marks: -
Credits:	1	Total :100
Hours:	12 Hrs Theory /24 Hrs Theory	SEE Duration: -

Course objectives: The course will enable the students to:

1. Provide a formal platform for students to communicate and connect to the surroundings.
2. create a responsible connection with society.
3. Understand the community in general in which they work.
4. Identify the needs and problems of the community and involve them in problem –solving.
5. Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems.
6. Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.

General Instructions - Pedagogy:

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

1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the activities will develop students' theoretical and applied social and cultural skills.
2. State the need for activities and its present relevance in society and provide real-life examples.

3. Support and guide the students for self-planned activities.
4. You will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress in real activities in the field.
5. Encourage the students for group work to improve their creative and analytical skills.

Contents :

The course is mainly activity-based that will offer a set of activities for the students that enables them to connect with fellow human beings, nature, society, and the world at large.

The course will engage students for interactive sessions, open mic, reading group, storytelling sessions, and semester-long activities conducted by faculty mentors.

In the following a set of activities planned for the course have been listed:

Social Connect & Responsibility - Contents

MODULE I 4 Hours

Plantation and adoption of a tree:

Plantation of a tree that will be adopted for four years by a group of BE / B.Tech students. (ONE STUDENT ONE TREE) They will also make an excerpt either as a documentary or a photo blog describing the plant's origin, its usage in daily life, its appearance in folklore and literature - – Objectives, Visit, case study, report, outcomes.

MODULE II 5 Hours

Heritage walk and crafts corner:

Heritage tour, knowing the history and culture of the city, connecting to people around through their history, knowing the city and its craftsman, photo blog and documentary on evolution and practice of various craft forms - – Objectives,Visit, case study, report, outcomes.

MODULE III 5 Hours

Organic farming and waste management:

Usefulness of organic farming, wet waste management in neighboring villages, and implementation in the campus – Objectives, Visit, case study, report, outcomes.

MODULE IV 5 Hours

Water conservation:

Knowing the present practices in the surrounding villages and implementation in the campus, documentary or photoblog presenting the current practices – Objectives, Visit, case study, report, outcomes.

MODULE V 5 Hours

Food walk:

City's culinary practices, food lore, and indigenous materials of the region used in cooking – Objectives, Visit, case study, report, outcomes.

MODULE V 5 Hours

Food walk:

City's culinary practices, food lore, and indigenous materials of the region used in cooking – Objectives, Visit, case study, report, outcomes.

Course outcomes (Course Skill Set):

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

S.No	Course Outcomes	Description	Program Outcomes
1	CO1	Communicate and connect to the surroundings	PO1,PO2
2	CO2	Create a responsible connection with sociey	PO1,PO2, PO3,PO4
3	CO3	Involve in the community in general in which they work.	PO1,PO2
4	CO4	Notice the needs and problems of the community and involve them in problem –solving.	PO3,PO4
5	CO5	Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems	PO3,PO4
6	CO6	Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing	PO1,PO2,

		community participation to acquire leadership qualities and democratic attitudes	PO3,PO4

Activities:

Jamming session, open mic, and poetry: Platform to connect to others. Share the stories with others. Share the experience of Social Connect. Exhibit the talent like playing instruments, singing, one-act play, art-painting, and fine art.

PEDAGOGY:

The pedagogy will include interactive lectures, inspiring guest talks, field visits, social immersion, and a course project. Applying and synthesizing information from these sources to define the social problem to address and take up the solution as the course project, with your group. Social immersion with NGOs/social sections will be a key part of the course. Will all lead to the course project that will address the needs of the social sector?

COURSE TOPICS:

The course will introduce social context and various players in the social space, and present approaches to discovering and understanding social needs. Social immersion and inspiring conversional will culminate in developing an actual idea for problem-based intervention, based on an in-depth understanding of a key social problem.

Duration:

A total of 40 - 50 hrs engagement per semester is required for the 3rd semester of the B.E.
/B.Tech. program. The students will be divided into groups. Each group will be handled by faculty mentors. Faculty mentor will design the activities (particularly Jamming sessions open mic, and poetry) Faculty mentors has to design the evaluation system as per VTU guidelines of scheme & syllabus.

Guideline for Assessment Process:

Continuous Internal Evaluation (CIE):

After completion of the course, the student shall prepare, with daily diary as reference, a comprehensive report in consultation with the mentor/s to indicate what he has observed and learned in the social connect period. The report should be signed by the mentor. The report shall be evaluated on the basis of the following criteria and/or other relevant criteria pertaining to the activity completed. Marks allotted for the diary are out of 50. Planning and scheduling the social connect Information/Data collected during the social connect Analysis of the

information/data and report writing Considering all above points allotting the marks as mentioned below

Excellent : 80 to 100
Good : 60 to 79
Satisfactory : 40 to 59 Unsatisfactory and fail: <39

Special Note:

NO SEE – Semester End Exam – Completely Practical and activities-based

Pedagogy – Guidelines:

It may differ depending on local resources available for the study as well as environment and climatic differences, location and time of execution.

Sl No	Topic	Group size	Location	Activity execution	Reporting	Evaluation Of the Topic
1.	Plantation and adoption of a tree:	May be individual or team	Farmers land/ parks / Villages / roadside/ community area / College campus etc.	Site selection /Proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by Faculty

2.	**Heritage walks and crafts corner:**	May be individual or team	Temples / monumental places / Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc.	Site selection /Proper consultation/Continuous monitoring/ Information board	Report should be submitted by individuals to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by Faculty
3.	**Organic farming and waste management:**	May be individual or team	Farmers land / parks / Villages visits / roadside/ community area / College campus etc.	Group selection / proper consultation / Continuous monitoring / Information board	Report should be submitted by individuals to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by Faculty
4.	**Water conservation:** & conservation techniq	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers	site selection / proper consultation/Continuous monitoring/ Information board	Report should be submitted by	Evaluation as per the rubrics of scheme and

	ues		/ campus etc.		individuals to the concerned evaluation authority	syllabus by Faculty
5.	**Food walk: Practices in society**	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc.	Group selection / proper consultation / Continuous monitoring / Information board	Report should be submitted by individuals to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by Faculty

Plan of Action (Execution of Activities)

Sl.NO	Practice Session Description
1	Lecture session in field to start activities
2	Students' Presentation on Ideas
3	Commencement of activity and its progress
4	Execution of Activity
5	Execution of Activity
6	Execution of Activity

7	Execution of Activity
8	Case study-based Assessment, Individual performance
9	Sector/ Team wise study and its consolidation
10	Video based seminar for 10 minutes by each student at the end of semester with Report.

- Each student should do activities according to the scheme and syllabus.
- At the end of semester student performance has to be evaluated by the faculty for the assigned activity progress and its completion.
- At last consolidated report of all activities from 1st to 5th, the compiled report should be submitted as per the instructions and scheme.

Assessment Details for CIE (both CIE and SEE, no SEE)

Weightage CIE – 100% Implementation strategies of the project (NSS work). The last report should be signed by NSS officer of the institute / Department SCR Faculty, the HOD and Principal. At last report should be evaluated by the NSS officer of the institute / Department SCR Faculty. Finally, the consolidated marks sheet should be sent to the Controller of Examination office.

Rubrics to be followed:

Field Visit, Plan, Discussion - 10 Marks

Commencement of activities and its progress weekly - 20 Marks

Case study-based Assessment Individual performance with report - 20 Marks

Sector wise study & its consolidation 5*5 = 25 25 Marks

Seminar for 10 minutes by each student at the end of semester with Report.
Activities 1 to 5, 5*5 = 25 25 Marks

Total marks for the course in ea ch semester - 100 Marks

For each activity, 20 marks CIE will be evaluated for IA marks at the end of semester, Report and assessment copy should be made available in the department.

Students should present the progress of the activities as per the schedule in the prescribed practical session in the field. There should be positive progress in the vertical order for the benefit of society in general through activities.

Semester: 3/4/5/6		
NATIONAL SERVICE SCHEME(NSS)		
Course Code:	MVJ22NSS 39/49/59/69	CIE Marks: 50
L: T:P:S	0:0:2:0	SEE Marks: --
Credits:	0	Total :100
Hours:	30 Hrs Theory	SEE Duration: --

Course Objectives: **National Service Scheme (NSS) will enable the students to:**

1. Understand the community in general in which they work.
2. Identify the needs and problems of the community and involve them in problem–solving.
3. Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems.
4. Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.
5. Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony in general.

National Service Scheme (NSS) – Contents

1.Organic farming, Indian Agriculture (Past, Present and Future), Connectivity for marketing.

2.Waste management – Public, Private and Govt organization, 5R's.

3.Setting of the information imparting club for women leading to contribution in social and economic issues.

4.Water conservation techniques – Role of different stakeholders –

Implementation.

5.Preparing an actionable business proposal for enhancing the village income and approach for implementation.

6.Helping local schools to achieve good results and enhance their enrolment in Higher/technical/vocational education.

7.Developing Sustainable Water management system for rural areas and implementation approaches.

8.Contribution to any national level initiative of Government of India. For e.g. Digital India, Skill India, Swatch Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc.

9.Spreading public awareness under rural outreach programs. (Minimum 5 programs).

10.Plantation and adoption of plants. Know your plants.

11.Organize National integration and social harmony events/workshops/seminars. (Minimum 02 programs).

12.Govt. school rejuvenation and helping them to achieve good infrastructure.

NOTE:

Student/s in individual or in a group should select any one activity at the beginning of each semester till end of that respective semester for successful completion as per the instructions of NSS officer with the consent of HOD of the department.

At the end of the semester, an activity report should be submitted for evaluation.

Distribution of Activities

Sem	Topics/Activities to be Covered

25 Marks	1. Organic farming, Indian Agriculture (Past, Present and Future), Connectivity for marketing. 2. Waste management – Public, Private and Govt organization, 5R's. 3. Setting of the information imparting club for women leading to contribution in social and economic issues.
25 Marks	1. Water conservation techniques – Role of different stakeholders – Implementation. 2. Preparing an actionable business proposal for enhancing the village income and approach for implementation. 3. Helping local schools to achieve good results and enhance their enrolment in Higher/technical/vocational education.
25 Marks	1. Developing Sustainable Water management system for rural areas and implementation approaches. 2. Contribution to any national level initiative of Government of India. For e.g. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc. 3. Spreading public awareness under rural outreach programs. (Minimum 5 programs). 4. Plantation and adoption of plants. Know your plants
25 Marks	1. Organize National integration and social harmony events/workshops/seminars. (Minimum 02 programs). 2. Govt. school rejuvenation and helping them to achieve good infrastructure.

Pedagogy–Guidelines, it may differ depending on local resources available for the study as well as environment and climatic differences, location and time of execution.

Sl	Topic	Grou	Location	Activity execution	Reporting	Evaluation

No		p siz e				of the Topic
1.	Organic farming, Indian Agriculture(Past, Present and Future) Connectivity for marketing.	May be individual or team	Farmers land/Villages/roadside / Community area/ College campus etc.	Site selection /Proper consultation/Continuous monitoring/ Information board	Report should be submitted by individuals to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
2.	Waste management– Public, Private and Govt organization, 5 R's.	May be individual or team	Villages/City Areas/ Grama panchayat/public associations/Government t Schemes officers/ campus etc.	Site selection /Proper consultation/Continuous monitoring/ Information board	Report should be submitted by individuals to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
3.	Setting of the information imparting club for women leading to	May be individual or team	Women empowerment groups/ Consulting NGO's & Govt. Teams/ College campuses etc.	Group selection/proper consultation/Continuous monitoring/ information board	Report should be submitted by individuals to the concer	Evaluation as per the rubrics of scheme and

	contribution in social and economic issues.				ned evaluation authority	syllabus by NSS officer
4.	Water conservation techniques – Role of different stake holders– Implementation.	May be individual or team	Villages/city Areas/ Grama panchayat/public associations/Government Schemes officers/ campuses etc.	site selection / proper consultation/Continuous monitoring/ Information board	Report should be submitted by individuals to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
5.	Preparing an actionable business proposal for enhancing the village income and approach for implementation.	May be individual or team	Villages/city Areas/ Grama panchayat/public associations/Government Schemes officers/ campuses.	Group selection/proper consultation/Continuous monitoring/ Information board	Report should be submitted by individuals to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
6.	Helping local schools to achieve good	May be individual or	Local government/ private/ aided schools/Government	School selection/proper consultation/Continuous	Report should be submi	Evaluation as per the rubric

	results and enhance their enrolment in Higher/ technical/ vocational education.	team	Schemes officers/ etc....	monitoring/ Information board	tted by indivi duals to the conce rned evalu ation autho rity	s of sche me and syllab us by NSS officer
7.	Developin g Sustainabl e Water managem ent system for rural areas and implemen tation approache s.	May be indivi dual alort eam	Villages/City Areas/ Grama panchayat/pub lic associations/G overn ment Schemes officers/ campusetc....	Site selection/prope r consultation/C ontinuous monitoring/ Information board	Repor t shoul d be submi tted by indivi duals to the conce rned evalu ation autho rity	Evalua tion as per the rubric s of sche me and syllab us by NSS officer

8.	Contribution to any national level initiative of Government of India. For e.g. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in	May be individu al alortea m	Villages/City Areas/ Grama panchayat/p ublic associations/ Government Schemes officers/ campus etc.	Group selection/ pro per consultati on/Contin u ous monitori ng / Informati on board	Report should be submitted by individuals to the concerned evaluation authority	Evalua tion as per the rubrics of schem e and syllabu s by NSS officer

	India, Mudra scheme, Skill developmen t programs etc.					
9.	Spreading public awareness under rural outreach programs. (minimum5pro grams). Socials connect and responsibilities.	May be individu al alortea m	Villages /CityAreas / Grama panchayat/p ublic associations/ Govern ment Schemes officers/ campusetc….	Group selection/ pro per consultati on/ Continu ous monitori ng / Informati on board	Report should be submitted by individuals to the concerned evaluation authority	Evalua tion as per the rubrics of schem e and syllabu s by NSS officer
10.	Plantation and adoption of plants. Know your plants.	May be individu al alortea m	Villages/City Areas/ Grama panchayat/p ublic associations/ Govern ment nt Schemes officers/ campusetc….	Place selection/ proper consultati on/Contin u ous monitori ng / Informati on board	Report should be submitted by individualsto the concerned evaluation authority	Evalua tion as per the rubrics of schem e and syllabu s by NSS officer
11.	Organize National integration and social harmonyeve nts /Workshops	May be individu al alortea m	Villages/City Areas/ Grama panchayat/p ublic associations/ Govern ment Schemes	Place selection/ proper consultati on/Conti nu ous monitorin g /	Report should be submitted by individuals to the concerned evaluation	Evalua tion as per the rubrics of schem e and

	/Seminars.(Minimum 02 programs).		officers/ campusetc....	Information board	authority	syllabus by NSS officer
12.	Govt. school Rejuvenation and helping them to achieve good infrastructure.	May be individual alorteam	Villages/City Areas/ Grama panchayat/public associations/ Govern ment nt Schemes officers/ campusetc....	Place selection/ proper consultation/Continu ous monitoring / Information board	Report should be submitted by individuals to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer

Plan of Action (Execution of Activities)

Sl.NO	Practice Session Description
1	Lecture session by NSS Officer
2	Students' Presentation Topics
3	Presentation-1, Selection of topic, PHASE-1
4	Commencement of activity and its progress-PHASE-2
5	Execution of Activity
6	Execution of Activity
7	Execution of Activity
8	Execution of Activity
9	Execution of Activity
10	Case study-based Assessment, Individual performance
11	Sector wise study and its consolidation
12	Video based seminar for 10minutes by each student at the end of semester with Report.
• In semester end, each student should do activities according to the scheme and syllabus.	

- At the end of the semester, student performance must be evaluated by the NSS officer for the assigned activity progress and its completion.
- Finally, at the end of the semester, a consolidated report of activities should be compiled and submitted as per the instructions.

Course Outcomes (Course Skill Set)

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

CO1: Understand the importance of his/her responsibilities towards society.

CO2: Analyze the environmental and societal problems/issues and will be able to design solutions for the same.

CO3: Evaluate the existing system and propose practical solutions for the same for sustainable development.

CO4: Implement government or self-driven projects effectively in the field.

CO5: Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony in general

Assessment Details for CIE(both CIE and SEE)

Weightage

CIE–100%

- Implementation strategies of the project(NSS work).
- The last report should be signed by NSSOfficer,the HOD and principal.
- Finally, the report should be evaluated bythe NSS officer of the institute.

Finally,the consolidated marks sheet should be sent to the university and to be made available at LIC visit.

Presentation-1

Selection of topic, PHASE-1 10 Marks

Commencement of activity and its progress- PHASE-2 10 Marks

Case study-based Assessment

Individual performance 10 Marks

Sector wise study and its consolidation 10 Marks

Video based seminar for 10minutes by each

Student at the end of semester with Report. 10 Marks

Total marks for the course in end semester 50Marks

Marks scored for 50 by the students should be Scale down to 25 Marks in end semester

For CIE entry in the VTU portal.

CIE (50 Marks)

Weekly Evaluation 30 Marks

Weekly evaluation will be conducted for each activity. Marks of each evaluation includes Weekly Attendance & activities performed by students. The total of all these evaluated marks are added and the total marks will be scaled to 30 marks.(A)

Two CIE for 20 Marks each and take the average for 20 Marks (B)

Final CIE Marks will be calculated as (A+B) for 50 marks

Suggested Learning Resources:

Books:

1. **NSS Course Manual,** Published by NSS Cell, VTU Belagavi.
2. Government of Karnataka, NSS cell, activities reports and its manual.

Course Outcomes(COs)	**CO1**: Understand the importance of social responsibility and civic engagement	**CO2**: Develop leadership qualities and democratic attitudes	**CO3**: Work effectively as an individual and as a team in diverse fields of community	**CO4**: Acquire skills in mobilizing community participation and local resources
PO1	2	-	2	-
PO2		2		

	2		-	-
PO3	-	-	-	2
PO4	-	-	-	-
PO5	-	-	-	1
PO6	3	2	3	3
PO7	3	2	2	3
PO8	2	3	3	2
PO9	2	3	3	2
PO10	2	2	2	2
PO11	-	-	-	2
Government of India, NSS cell, Activities reports and its manual.				

SEMESTER 3/4/5/6		
PHYSICAL EDUCATION (SPORTS & ATHLETICS)		
Course Code:	MVJ22PE39/49/59/69	CIE Marks: 100
L: T:P:S	0:0:2:0	SEE Marks: -
Credits:	0	Total :100
Hours:	24 Hrs Theory	SEE Duration: -

Course Objectives: the student will be able to	
1	Understand the meaning and importance of the fitness and the benefits of fitness
2	Types of fitness and fitness tips.
3	Importance of Sports, and Yoga in a day-to-day life.
4	Understand the importance of aerobics and other activities for healthy lifestyle.
5	Know about the different roles of organization and administration in sports events.

Module I	4 Hours
Orientation ➢ Lifestyle ➢ Fitness ➢ Food & Nutrition: Sports diet. ➢ Stress Management	
Module II	**4 Hours**
General Fitness & Components of Fitness ➢ Warming up (Free Hand Exercises). ➢ Strength—Push-up/Pull-ups ➢ Speed—30MtrDash. ➢ Agility—Shuttle Run ➢ Flexibility—Sit and Reach	
Module III	**6 Hours**

Specific Games (Anyone to be selected by the student)

Volleyball— Attack, Block, Service, Upper Hand Pass and Lower Hand and Pass.

Throw ball—Service, Receive, Spin attack, Net Drop & Jump throw.

Kabaddi— Hand touch, Toe Touch, Thigh Hold, Ankle hold and Bonus.

Basketball-dribbling, passing, shooting etc.

Table Tennis—Service (Fore Hand & Back Hand)

Receive (Fore Hand & Back Hand)

Smash, Athletics (Track / Field Events) -Running, Jumping, Throwing.

Module IV **6 Hours**

Role of Organization and administration

- Planning.
- Organizing.
- Staffing.
- Directing.
- Coordinating & controlling.
- Reporting & Recording.
- Budgeting.

Module V **4 Hours**

Aerobics

- Dance Aerobics
- Sport Aerobics
- Warm up Aerobics
- Cardiovascular Aerobics

Topics / Activities to be Covered (100Marks)

Course Outcomes: After completing the course, the students will be able to

CO1	Understand the fundamental concepts and skills of Physical Education, Health, Nutrition and Fitness.
CO2	Familiarization of health-related Exercises, Sports for overall growth and

	development.
CO3	Create a foundation for the professionals in physical Education and Sports.
CO4	Participate in the competition at regional / state / national / international levels.
CO5	Create consciousness among the students on Health, Fitness and Wellness in developing and maintaining a healthy lifestyle.

Assessment Details for CIE (both CIE and SEE)

Weight age	**CIE – 100%**	• Implementation strategies of the project (PE work). • The last report should be signed by PED, the HOD and principal. • At last report should be evaluated by the PED of the institute. • Finally, the consolidated marks sheet should be sent to the Controller of Examinations office.
Participation of student in all the modules	50 Marks	
Final presentation / exhibition / Participation In competitions / practical on specific tasks Assigned to the students	50 Marks	
Total marks for the course in eachsemester	**100 Marks**	

Marks scored for 100 by the students should be Scale to 50 marks in each semester.

Students should present the progress of the activities as per the schedule in the prescribed practical session in the field. There should be positive progress in the vertical order for the benefit of society in general.

CO/PO Mapping

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO 1	-	-	-	-	-	-	-	2	2	-	-
CO 2	-	-	-	-	-	-	-	2	2	-	-
CO 3	-	-	-	-	-	-	-	2	2	-	-
CO 4	-	-	-	-	-	-	-	2	2	-	-
CO 5	-	-	-	-	-	-	-	3	3	-	-

.Semester:3/4/5/6		
YOGA		
Course Code:	MVJ22YO39/49/59/69	CIE Marks:100
L: T:P:S	0:0:2:0	SEE Marks: --
Credits:	0	Total :100
Hours:	24 Hrs Theory	SEE Duration: ---

Course Objectives:

- Promote Holistic Wellness Practice in Students.
- Develop Physical Awareness and Flexibility.
- Improve Focus and Academic Performance.
- Encourage Healthy Lifestyle Habits.
- Support mental Health and Emotional balance.
- Maintain physical Body Health.

The Health Benefits of Yoga:

Yoga helps with a person-centered approach to well-being offering **physical, mental(cognitive), and spiritual(emotional) benefits** for students. These benefits can help students cope with the demands of academic journeys, improve their overall health, and promote personal development.

Key Benefits of Various Yoga Techniques:

- Enhances Physical Well-being.
- Boosts Mental Focus.
- Promotes Emotional Stability.
- Reduces Stress Levels.
- Encourages Inner Growth.

It is also used as an adjunct therapy to support recovery from various physical health conditions such as:

- Chronic Pain.
- Back Pain.
- Arthritis.
- Cardiovascular Diseases.

- Asthma.
- Chronic Fatigue Syndrome.
- Menstrual Disorders.
- Digestive Issues.
- Thyroid Imbalances.
- Migraine and headache.

2) Core observations on how yoga functions as a complementary mind-body intervention to support the psychological, physiological and spiritual healing processes associated with various health conditions.

Psychological Benefits:

- Stress reduction.
- Anxiety relief.
- Trauma healing.
- Cognitive and clarity focus.
- Emotional Regulation.
- Aid in managing depression.

Physiological Benefits:

- Enhance Blood Circulation.
- Boost Cardiovascular Health.
- Supports Overall Gut Function.
- Promotes Thyroid Function.
- Relief from Headaches.
- Increased Energy level.

Spiritual Benefits:

- Cultivating gratitude and Compassion
- Self –realization
- Balance and Harmony
- Inner Peace

- Sense of oneness.
- Mindfulness.

Module I -Discipline and Awareness Reflect Habits s Thoughts	
• **Basic theory of Yoga, Yamas s Niyamas** Yoga definition, Aims and Objectives, importance of yoga in students. • **Introduction to Yoga asana** Yoga asana meaning, principle and health benefits. • **Ashtanga yoga** Meaning, breathing techniques. • **Four paths of yoga** Karma yoga, Bhakthi yoga, Raja yoga, Jnana yoga. • **Surya namaskar** Surya namaskar prayer and its meaning, benefits and importance. • **Yoga asanas** Asanas it's need, importance, name and technique. **Sitting:** -Vajrasana, sukhasana **Standing:** - adasana, Ardhachakrasana **Prone line:** -Advasana, Bhujangasana **Supine line:** -Shavasana, Supta baddhakonasana **Balancing posture:** -Vrikshasana, Garudasana	6 hours
Module II-Building strength and focus Finding out the obstacle	
• **Kriya Yoga** Tapas, Svadhyaya, Ishwarapranidhana • **Five Kleshas**	6 hours

Obstacles. • **Pranayama** Introduction to Pranayama. • **Pratyahara** Preparing mind for meditation, Breathe focus techniques. • **Yoga asanas** Standing: -Virabhadrasana,Parshvakona Sitting: -Vajrasana, Paschimottanasana Prone Line: -Dhanurasana, Shalabhasana Supine Line: -Ananda Balasana, Supta Matsyendrasana Balancing: -Natarajasana (Dancer Pose)	
Module III – Awareness and inner balance **Finding how focused is the mind**	
• **Dharana :** Concentration • **Dhyana:** Meditation • **Swasthya, Smrithi, Sankalpa.** Tool of academic excellence. • ***Samyama*** Patanjali's concept of samyama • **Yogasanas** **Standing**: - ArdhaChandrasana, Utkatasana **Sitting**: - Padmasana (or prep), Gomukhasana **Prone Line**: - Adho Mukha Svanasana, Naukasana **Supine Line: -** SuptaBaddhaKonasana, Chakrasana **Balancing**: - Garudasana (Eagle Pose)	6 hours
Module IV – integrating Yoga in daily Life	
• **Yama niyama Acharam** Practice of ethical Discipline (practicing nonviolence, truth, cleanliness) • **Ahara- Vihara Samyama** Practice discipline in diet C lifestyle.	6 hours

- **Asana- pranayama sadhana**

  Daily practice of asanas and pranayama

- **Yogasanas**

  Standing: -PrasaritaPadottanasana, ParivrttaTrikonasana

  Sitting: -Baddha Konasana, Marichyasana

  Prone Line: -Ustrasana (Camel), Makarasana (relaxation)

  Supine Line: -Sarvangasana, Shavasana

  Balancing: - Bakasana (Crow – optional or modified)

Course outcomes

1. Identify and reflect on personal habits and thoughts.
2. Explain the basic theory of Yoga, including Yamas C Niyama.
3. Understand the definition, aims, objectives, and importance of Yoga, especially for students.
4. Enhance physical and mental strength through advanced Yog asanas.
5. Practice Dharana (concentration) and Dhyana (meditation) to improve focus.

CO/PO Mapping											
CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO 1		2						3	2	2	
CO 2	2						2	2			
CO 3	2					2	2	3			
CO 4					2		3	3			
CO 5		2					2	3			

Weekley assessment will be done by the instructor by giving different poses / Asanas. The final assessment scaled up to 100 marks.

Semester: III		
Additional Mathematics-I (Common to all branches)		
Course Code:	MVJ22MATDIP-1	CIE Marks:100
L:T:P :S :	2:0:0:0	SEE Marks: 0
Credits:	0	Total:100
Hours:	25 Hrs Theory	
Course Learning Objectives: The students will be able to		
	To familiarize the important and introductory concepts of Differential calculus, Integral calculus, Vector differentiation, Probability, ordinary differential equations of first order, and analyze the engineering problems.	

UNIT 1	
Differential calculus: Recapitulation of successive differentiation -nth derivative -Leibnitz theorem (without proof) and Problems,Polar curves - angle between the radius vector and tangent, angle between two curves, pedal equation, Taylor's and Maclaurin's series expansions- Illustrative examples. Self study: Radius of curvature. Video link : https://www.khanacademy.org/ https://www.youtube.com/watch?v=s6F5yjY6jWk&list=PLMLsjhQWWlUqBoTCQDtYlloI-o-9hxp11	5 Hrs.
UNIT 2	
Integral Calculus: Statement of reduction formulae for the integrals of sinn (x) , cosn (x) , sinn (x) cosn (n) and evaluation of these integrals with standard limits-problems. Double and triple integrals-Simple examples. Self study: Volume revolution, Surface area of revolution. Video link : https://www.youtube.com/watch?v=rCWOdfQ3cwQ	5 Hrs.

https://www.khanacademy.org/math/ap-calculus-ab/ab-integration-new/ab-6-1/v/introduction-to-integral- calculus	
UNIT 3	
Vector Differentiation: Differentiation of vector functions. Velocity and acceleration of a particle moving on a space curve. Scalar and Vector point functions, Gradient, Divergence, Curl, Solenoidal and Irrotational vector fields. 23 23 23 11 11 11 Vector identities - *div*(♮ *A*) , *curl*(♮ *A*) , *curl*(*grad*(♮)) , div(curl A) . Self study: Line integrals, Green's theorem, Gauss and stokes theorem. Video link : https://www.whitman.edu/mathematics/calculus_online/chapter16.html https://www.math.ust.hk/~machas/vector-calculus-for-engineers.pdf https://www.youtube.com/watch?v=sO9Z2RSeH4s	5 Hrs.
UNIT 4	
Probability: Basic terminology, Sample space and events. Axioms of probability. Addition and multiplication theorems. Conditional probability – illustrative examples. Bayes theorem-examples. Self study: Applications of Bayes' Theorem. Video link : https://www.khanacademy.org/math/statistics-probability/probability-library https://nptel.ac.in/courses/111/105/111105041/	5 Hrs.
UNIT 5	
Ordinary Differential Equations of First Order: Introduction – Formation of differential equation, solutions of first order and first degree differential equations: variable separable form, homogeneous, exact, linear differential equations. Some special first order equations: Bernoulli equation, Clairaut's equation Self study: Applications of differential equations(ODE): Newton's law cooling. Video link : https://www.mathsisfun.com/calculus/differential-equations.html	5 Hrs.

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply the knowledge of calculus to solve problems related to polar curves and its applications
CO2	Apply the concept of integration and variables to evaluate multiple integrals and their usage in computing the area and volumes.
CO3	Illustrate the applications of multivariate calculus to understand the solenoidal and irrotational vectors and also exhibit the inter dependence of line, surface and volume integrals.
CO4	Understand the basic Concepts of Probability
CO5	Recognize and solve first-order ordinary differential equations occurring in different branches of engineering.

Text Books	
1.	B.S. Grewal, "Higher Engineering Mathematics" Khanna Publishers, 43rd Edition, 2013.
2.	Ramana B. V., "Higher Engineering Mathematics", Tata Mc Graw-Hill, 2006.
Reference Books	
1.	Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley-India publishers, 10th edition,2014.
2.	G. B. Gururajachar: Calculus and Linear Algebra, Academic Excellent Series Publication, 2018-19

Continuous Internal Evaluation (CIE):

- Three CIE Will be conducted for 50 marks each and average of three will be taken (A)
- Three Quizzes will be conducted along with CIE for 10 Marks Each. Sum of three quizzes will be considered for 30 marks (B)
- Two Assignments for 10 marks each and the sum of both the assignments will be taken for 20 Marks (C)

Final CIE Marks will be calculated as (A+B+C) for 100 marks

CO-PO Mapping												
CO/PO	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO12
CO1	3	3	-	2	-	-	-	-	-	-	1	1
CO2	3	3	-	2	-	-	-	-	-	-	1	1
CO3	3	3	-	3	-	-	-	-	-	-	-	1
CO4	2	2	-	3	-	-	-	-	-	-	1	1
CO5	2	2	-	2	-	-	-	-	-	-	-	1

IV Semester

SEMESTER -IV		
ANALYSIS AND DESIGN OF ALGORITHMS		
Course Code:	MVJ22IS41	CIE Marks: 50
L: T:P:S	3:0:0:0	SEE Marks: 50
Credits:	3	Total :100
Hours:	40 Hrs Theory	SEE Duration: 3 Hrs.

Course objective is to: *This course will enable students to*

- Identify the importance of different asymptotic notation.
- Determine the complexity of recursive and non-recursive algorithms.
- Compare the efficiency of various design techniques like greedy method, backtracking etc.
- Apply appropriate method to solve a given problem.

Module-1 **8 Hours**

Basic Concept of Algorithms: Introduction-What is an Algorithm, Algorithm Specification, Analysis Framework, Performance Analysis: Space complexity, Time complexity. Asymptotic Notations: Big-Oh notation (O), Omega notation (Ω), Theta notation (Θ), Mathematical analysis of Non-Recursive and recursive Algorithms with Examples .

Applications: developing computational tools and bioinformatics software, Mathematics.

Video link / Additional online information (related to module if any):

- http://www.nptelvideos.com/video.php?id=1442
- https://nptel.ac.in/courses/106105085/

Module-2	8 Hours
Simple Design Techniques – Brute force : Selection sort, Bubble sort, Sequential Search and Brute-Force String Matching , Exhaustive search – Traveling Salesman problem, Knapsack problem , Assignment Problem. **Divide and Conquer:** General method, Binary search, Finding the maximum and minimum , Merge sort, Quick sort , Strassen's matrix multiplication. **Applications:** power distribution (electrical field), Online shopping and delivery (real time) Video link / Additional online information (related to module if any): • https://nptel.ac.in/courses/106102064/ https://www.youtube.com/watch?v=MFfD57DTDQY	
Module-3	**8 Hours**
Decrease and Conquer approach: Topological Sort, Decrease-by-a-Constant-Factor **Greedy Method**: General method, Coin Change Problem, Knapsack Problem, Job sequencing with deadlines. Minimum cost spanning trees: Prim's Algorithm, Kruskal's Algorithm. Single source shortest paths: Dijkstra's Algorithm. Huffman Trees and Codes. **Laboratory Sessions/ Experimental learning:** Solving real time problems using Greedy Technique. **Applications:** Optimization Problems. **Video link :** https://nptel.ac.in/courses/106/106/106106131/	
Module-4	**8 Hours**
Dynamic Programming: General method with Examples, Multistage Graphs. Transitive Closure: Warshall's Algorithm, All Pairs Shortest Paths: Floyd's Algorithm, Optimal Binary Search Trees, Knapsack problem, Bellman-Ford Algorithm , Travelling Sales Person problem. **Laboratory Sessions/ Experimental learning:** Solving real time problems using Dynamic Programming.	

Applications: Computer Networks. **Video link:** https://nptel.ac.in/courses/106/106/106106131/	
Module-5	**8 Hours**
Backtracking: General method, N-Queens problem, Sum of subsets problem, Graph coloring, Hamiltonian cycles Programme and Bound: Assignment Problem, Travelling Sales Person problem, 0/1 Knapsack problem. **LC Programme and Bound solution :** FIFO Programme and Bound solution. NP-Complete and NP-Hard problems: P, NP, NP-Complete, and NP-Hard classes	
Laboratory Sessions/ Experimental learning: Solving real time problems using Backtracking Technique. **Applications:** To solve puzzles such as crosswords, Sudoku etc. **Video link:** https://nptel.ac.in/courses/106/106/106106131/	
Course outcomes:	
CO1	Understand the fundamentals of algorithm design, performance analysis, and asymptotic notations.
CO2	Apply design strategies like Brute Force, Divide & Conquer, and Greedy methods to solve standard algorithmic problems.
CO3	Analyze algorithms using advanced techniques like Dynamic Programming and Backtracking for real-world applications.
CO4	Evaluate the computational complexity and classify problems into P, NP, NP-Complete, and NP-Hard categories.
Text Books:	
1	Introduction to the Design and Analysis of Algorithms, Anany Levitin:, 2rd Edition, 2009. Pearson.
2	Computer Algorithms/C++, Ellis Horowitz, Satraj Sahni and Rajasekaran, 2nd Edition, 2014, Universities Press
Reference Books :	
1.	Design and Analysis of Algorithms, S. Sridhar, Oxford (Higher Education).

2.	Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, 3rd Edition, PHI.

Continuous Internal Evaluation (CIE):

- Three CIE Will be conducted for 50 marks each and average of three will be taken (A)
- Three Quizzes will be conducted along with CIE for 10 Marks Each. Sum of three quizzes will be considered for 30 marks (B)
- Two Assignments for 10 marks each and the sum of both the assignments will be taken for 20 Marks (C)

Final CIE Marks will be calculated as (A+B+C)/2 for 50 marks

Semester End Examination (SEE):
The theory exam consists of a written paper structured into two parts:

Part A: Carries 20 marks which include either objective-type or short descriptive questions. It is designed to cover the entire syllabus comprehensively.

Part B: This section carries a total of 80 marks and consists of 5 questions, with Either or choices. Students are required to answer one full question per module, selecting from the choices. Each question is valued at 16 marks and may include up to two sub-parts.
The SEE Theory marks of 100 will be scaled down to 50.

The final score for the course in the ratio of 50:50 of CIE and SEE Marks

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	2	2	2	–	–	–	1	1	–
CO2	3	3	3	3	3	–	–	–	1	2	–
CO3	3	3	3	3	3	–	–	–	2	2	1
CO4	3	3	3	3	3	–	–	–	3	3	2

High-3, Medium-2, Low-1

Semester:IV		
Advanced Java		
Course Code:	MVJ22IS42	CIE Marks:50
L: T:P:S	3:0:2	SEE Marks:50
Credits:	4	Total Marks:100
Hours:	40 Hrs Theory + 24 Hrs of Practical	Exam Hours:3

Course Learning Objectives: The students will be able to	
1	Understanding the fundamentals of collection framework
2	Demonstrate the fundamental concepts of String operations and Swing applications
3	Design and develop web applications using Java servlets and JSP
4	Apply database interaction through Java database Connectivity

UNIT-I	
The collections and Framework: Collections Overview, The Collection Interfaces, The Collection Classes, Accessing a collection Via an Iterator, Storing User Defined Classes in Collections, The Random Access Interface, Working With Maps, Comparators, The Collection Algorithms, Arrays,, The legacy Classes and Interfaces, Parting Thoughts on Collections. Text Book 1: Ch. 17	8 Hrs
UNIT-II	
String Handling : The String Constructors, String Length, Special String Operations, Character Extraction, String Comparison, Searching Strings, Modifying a String, Data Conversion Using valueOf( ), Changing the Case of Characters Within a String, joining strings, Additional String Methods, StringBuffer , StringBuilder. Text Book 1: Ch 15	8 Hrs
UNIT-III	
Introducing Swing: The Origin of Swing, Swing Is Built on AWT, Two Key Swing Features, The MVC Connection, Components and Containers, The Swing Packages, A Simple Swing Application, Event Handling, Painting in Swing.	8 Hrs

Exploring Swing : JLabel and ImageIcon,JTextField,The Swing Buttons-JButton, JToggleButton, Check Boxes, Radio Buttons. **Text Book 1: Ch 29 and Ch. 30**	
UNIT-IV	
Introducing servlets: Background; The Life Cycle of a Servlet; Using Tomcat for Servlet Development; A simple Servlet; The Servlet API; The Jakarta. Servlet Package; Reading Servlet Parameter; The Jakarta.servlet.http package; Handling HTTP Requests and Responses; Using Cookies; Session Tracking. **Java Server Pages (JSP):** JSP tags, Variables and Objects, Methods, Control statements, Loops, Request String, Parsing other information, User sessions, Cookies, Session Objects. **Text Book 1: Ch 3 Text Book2: Ch 11**	**8 Hrs**
UNIT-V	
JDBC Objects: The Concept of JDBC; JDBC Driver Types; JDBC Packages; A Brief Overview of the JDBC process; Database Connection; Associating the JDBC/ODBC Bridge with the Database; Statement Objects; ResultSet; Transaction Processing; Metadata, Data types; Exceptions. **TextBook 2**: Ch 06	**8 Hrs**

LABORATORY EXPERIMENTS	
1. Implement a java program to demonstrate creating an ArrayList, adding elements, removing elements,sorting elements of ArrayList. Also illustrate the use of toArray() method.	2Hours
2. Implement a java program to illustrate the use of comparator.	2Hours
3. Implement a java program to illustrate storing user defined classes in collection.	2Hours
4. Implement a java program to illustrate the use of different types of string class constructors.	2Hours
5. Implement a java program to illustrate the use of different	2Hours

types of character extraction, string comparison, string search and string modification methods.	
6. Implement a java program to illustrate the use of different types of StringBuffer methods	2Hours
7. Demonstrate a swing event handling application that creates 2 buttons Alpha and Beta and displays the text "Alpha pressed" when alpha button is clicked and "Beta pressed" when beta button is clicked.	2Hours
8. A program to display greeting message on the browser "Hello UserName", "How Are You?", accept username from the client using servlet.	2Hours
9. A servlet program to display the name, USN, and total marks by accepting student detail	2Hours
10. A Java program to create and read the cookie for the given cookie name as "EMPID" and its value as "AN2356".	2Hours
11. Write a JAVA Program to insert data into Student DATA BASE and retrieve info based on particular queries(For example update, delete, search etc…).	2Hours
12. A program to design the Login page and validating the USER_ID and PASSWORD using JSP and DataBase.	2Hours
Any 10 experiments to be conducted	

Course Outcomes: After completing the course, the students will be able to	
CO1	Understand core concepts of Java Collections, Frameworks, and String handling mechanisms.
CO2	Apply the concepts of GUI programming using Swing components to develop interactive applications.
CO3	Analyze and implement web-based applications using Servlets and JSP to handle HTTP requests, sessions, and cookies.
CO4	Evaluate database access techniques using JDBC to build secure and robust data-driven applications.
Text Books	
1	Herbert Schildt: JAVA the Complete Reference, 7th/9th Edition, Tata McGraw Hill, 2007.

2	Jim Keogh: J2EE-TheCompleteReference, McGraw Hill, 2007.
Reference Books:	
1	Stephanie Bodoff et al: The J2EE Tutorial, 2nd Edition, Pearson Education,2004.
2	Y. Daniel Liang: Introduction to JAVA Programming, 7th Edition, Pearson Education, 2007.
3	Uttam K Roy, Advanced JAVA programming, Oxford University press, 2015.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

Three CIE Will be conducted for 50 marks each and average of three will be taken (A)

- Three Quizzes will be conducted along with CIE for 10 Marks Each. Sum of three quizzes will be considered for 30 marks (B)
- Two Assignments for 10 marks each and the sum of both the assignments will be taken for 20 Marks (C)

Final CIE Marks will be calculated as (A+B+C)/2 for 50 marks

Laboratory- 50 Marks

Weekly Evaluation 30 Marks

Weekly evaluation will be conducted for every experiment. Marks of each evaluation includes Weekly Attendance + Experiment conduction along with Record / Observation + Weekly viva for all the experiments. The total of all these evaluated marks are added and the total marks will be scaled to 30 marks. (A)

Two CIE for 20 Marks each and take the average for 20 Marks (B)

Final CIE Marks will be calculated as A+B for 50 marks

For IPCC Final CIE Marks will be calculated as Average of CIE and Lab CIE for 50 marks.

Semester End Examination (SEE)

SEE Theory Examination (100 Marks)

The question paper consists of two parts, A and B

Part A: consists of 10 questions of 2 marks each. It is designed to cover the entire syllabus comprehensively.

Part B: The question paper will have 10 questions. Each question is set for 16 marks. There will be 2 questions from each module, with a maximum of 2 subdivisions. Students have to answer any 5 questions choosing one full question from each module.

The SEE Theory marks of 100 will be scaled down to 50 (A)

SEE Laboratory Examination (50 Marks)

The laboratory SEE is also evaluated for 50 marks, distributed as follows:

Experiment Conduction with Results: 40 marks

Viva Voce: 10 marks

CO PO MAPPING:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	1	2	–	–	–	1	2	–
CO2	3	3	3	2	3	–	–	–	2	2	–
CO3	3	3	3	3	3	–	–	–	3	3	1
CO4	3	3	3	3	3	–	–	–	3	3	2

Semester: III		
DATABASE MANAGEMENT SYSTEMS		
Course Code:	MVJ22IS43	CIE Marks: 50
L: T:P:S	3:0:0:0	SEE Marks: 50
Credits:	3	Total :100
Hours:	40Hrs Theory +26 Hrs of Practical	SEE Duration: 3 Hrs.

Course Learning Objectives: The students will be able to

1.To Provide a strong foundation in database concepts, technology, and practice.
2.To Practice SQL programming through a variety of database problems
3.To Understand the relational database design principles
4.To Demonstrate the use of concurrency and transactions in database.
5.To Design and build database applications for real world problems
6.To become familiar with database storage structures and access techniques

Module-1 **8 Hours**

Introduction to Databases: Introduction, Characteristics of database approach, Advantages of using the DBMS approach, History of database applications.

Overview of Database Languages and Architectures: Data Models, Schemas, and Instances. Three schema architecture and data independence, database languages, and interfaces, The Database System environment.

Conceptual Data Modelling using Entities and Relationships: Entity types, Entity sets and structural constraints, Weak entity types, ER diagrams,Specialization and Generalization.

Textbook 1:Ch 1.1 to 1.8, 2.1 to 2.6, 3.1 to 3.10 RBT: L1, L2, L3

Module -2 **8 Hours**

Relational Model: Relational Model Concepts, Relational Model Constraints and relational database schemas, Update operations, transactions, and dealing with constraint violations.

Relational Algebra: Unary and Binary relational operations, additional relational operations (aggregate, grouping, etc.) Examples of Queries in relational algebra.

Mapping Conceptual Design into a Logical Design: Relational Database Design using ER- to- Relational mapping.

SQL: SQL data definition and data types, Schema change statements in SQL, specifying constraints in SQL, retrieval queries in SQL, INSERT, DELETE, and UPDATE statements in SQL, Additional features of SQL Textbook 1: Ch 5.1 to 5.3, Ch 8.1 to 8.5; Ch 9.1 to 9.2 Ch 6.1 to 6.5 Textbook 2: ch3.5 RBT: L1, L2, L3
Module- 3 **8 Hours**
SQL: Advanced Queries: More complex SQL retrieval queries, Specifying constraints as assertions and action triggers, Views in SQL. **Normalization**: Database Design Theory – Introduction to Normalization using Functional and Multivalued Dependencies: Informal design guidelines for relation schema, Functional Dependencies, Normal Forms based on Primary Keys, Second and Third Normal Forms, Boyce- Codd Normal Form, Multivalued Dependency and Fourth Normal Form, Join Dependencies and Fifth Normal Form. Textbook 1: Ch 14.1 to 14.7, Ch 20.1 to 20.6 RBT: L1, L2, L3
Module-4 **8 Hours**
Transaction Processing: Introduction to Transaction Processing, Transaction and System concepts, Desirable properties of Transactions, Characterizing schedules based on recoverability, Characterizing schedules based on Serializability, Transaction support in SQL. Textbook 1: Ch 7.1 to 7.3, RBT: L1, L2, L3
Module -5 **8 Hours**
Concurrency Control in Databases: Two-phase locking techniques for Concurrency control, Concurrency control based on Timestamp ordering, Multiversion Concurrency control techniques, Validation Concurrency control techniques, Granularity of Data items and Multiple Granularity Locking. NOSQL Databases and Big Data Storage Systems: Introduction to NOSQL Systems, The CAP Theorem, Document-Based NOSQL Systems and MongoDB, NOSQL Key-Value Stores, Column-Based or Wide Column NOSQL Systems, NOSQL Graph Databases and Neo4j Textbook 1:Chapter 21.1 to 21.5, Chapter 24.1 to 24.6 RBT: L1, L2, L3

PRACTICAL COMPONENTS FOR IPCC

Exp 1:	Create a table called Employee C execute the following. Employee(EMPNO,ENAME,JOB, MANAGER_NO, SAL, COMMISSION) 1. Create a user and grant all permissions to the user. 2. Insert the any three records in the employee table contains attributes EMPNO,ENAME JOB, MANAGER_NO, SAL, COMMISSION and use rollback. Check the result.	2hrs
Exp 2:	Create a table called Employee C execute the following. Employee(EMPNO,ENAME,JOB, MANAGER_NO, SAL, COMMISSION) 3. Add primary key constraint and not null constraint to the employee table. 4. Insert null values to the employee table and verify the result.	2hrs
Exp 3:	Create a table called Employee that contain attributes EMPNO,ENAME,JOB, MGR,SAL C execute the following. 1. Add a column commission with domain to the Employee table. 2. Insert any five records into the table. 3.Update the column details of job 4. Rename the column of Employ table using alter command. 5. Delete the employee whose Empno is 105.	2 hrs
Exp 4:	Queries using aggregate functions(COUNT,AVG,MIN,MAX,SUM),Group by,Orderby. Employee(E_id, E_name, Age, Salary) 1. Create Employee table containing all Records E_id, E_name, Age, Salary. 2. Count number of employee names from employee table	2 hrs

	3. Find the Maximum age from employee table. 4. Find the Minimum age from employee table.	
Exp 5:	Queries using aggregate functions(COUNT,AVG,MIN,MAX,SUM),Group by,Orderby. Employee(E_id, E_name, Age, Salary) 5. Find salaries of employee in Ascending Order. 6. Find grouped salaries of employees.	2 hrs
Exp 6:	Create arow level trigger for the customers table that would fire for INSERT or UPDATE or DELETE operations performed on the CUSTOMERS table. This trigger will display the salary difference between the old C new Salary. CUSTOMERS(ID,NAME,AGE,ADDRESS,SALARY)	2 hrs
Exp 7:	Implementations of Normal Forms	2 hrs
Exp 8:	Create cursor for Employee table C extract the values from the table. Declare the variables ,Open the cursor C extract the values from the cursor. Close the cursor. Employee(E_id, E_name, Age, Salary)	2 hrs
Exp 9:	Write a PL/SQL block of code using parameterized Cursor, that will merge the data available in the newly created table N_RollCall with the data available in the table O_RollCall. If the data in the first table already exist in the second table then that data should be skipped.	2 hrs
Exp10:	Install an Open Source NoSQL Data base MangoDB C perform basic CRUD(Create, Read, Update C Delete) operations. Execute MangoDB basic Queries using CRUD operations.	2 hrs

Course Outcomes: After completing the course, the students will be able to	
CO1	Describe the basic elements of a relational database management system
CO2	Design entity relationship for the given scenario.
CO3	Apply various Structured Query Language (SQL) statements for database manipulation
CO4	Analyse various normalization forms for the given application

CO5	Develop database applications for the given real world problem. And Understand the concepts related to NoSQL databases.

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

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

Mini Project:

- Project Based Learning

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

- Three CIE Will be conducted for 50 marks each and average of three will be taken (A)
- Three Quizzes will be conducted along with CIE for 10 Marks Each. Sum of three quizzes will be considered for 30 marks (B)
- Two Assignments for 10 marks each and the sum of both the assignments will be taken for 20 Marks (C)

Final CIE Marks will be calculated as (A+B+C)/2 for 50 marks

Laboratory- 50 Marks

Weekly Evaluation 30 Marks

Lab Continuous Evaluation :30 Marks

Continuous evaluation will be conducted for Lab experiment. Marks of each evaluation includes based on attendance, Experiment conduction, performance in lab, Record / Observation and viva, for all the experiments. The total Continuous evaluated marks will be scaled to 30 marks. (A)

Two CIE for 20 Marks each and take the average for 20 Marks (B)

Final CIE Marks will be calculated as A+B for 50 marks

For IPCC Final CIE Marks will be calculated as Average of CIE and Lab CIE for 50 marks.

Semester End Examination (SEE)

SEE Theory Examination (100 Marks)

The theory exam consists of a written paper structured into two parts:

Part A: Carries 20 marks which include either objective-type or short descriptive questions. It is designed to cover the entire syllabus comprehensively.

Part B: This section carries a total of 80 marks and consists of 5 questions, with Either or choices. Students are required to answer one full question per module, selecting from the choices. Each question is valued at 16 marks and may include up to two sub-parts.

The SEE Theory marks of 100 will be scaled down to 50 (A)

SEE Laboratory Examination (50 Marks)
The laboratory SEE is also evaluated for 50 marks, distributed as follows:
Experiment Conduction with Results: 40 marks
Viva Voce: 10 marks
Total 50 marks (B)

The score for the SEE is A+B of total 100 marks

The final score for the course in the ratio of 50:50 of CIE and SEE Marks

CO PO MAPPING:

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	1										
CO2	1		2	2			1			2	2
CO3	1							2	2	2	1
CO4	1	2				2					

SEMESTER -IV		
ANALYSIS AND DESIGN OF ALGORITHMS LABORATORY		
Course Code:	MVJ22ISL44	CIE Marks:50
L: T:P:S	0:0:2:0	SEE Marks:50
Credits:	1	Total Marks:100
Hours:	24 Hrs of Practical	Exam Hours:3

Course Learning Objectives:		
To provide design and implement various algorithms in JAVA. To employ various design strategies for problem solving. To provide exposure to measure and compare the performance of different algorithms		
Descriptions (if any):		
Prerequisites: Basic programming Languages like C,C++,Java.		
Programs List:		
1.	Sort a given set of n integer elements using Quick Sort method.	2 Hours
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 non graph sheet. The elements can be read from a file or can be generated using the random number generator. Demonstrate using Java how the divide-and- conquer method works along with its time complexity analysis: worst case, average case and best case.	2 Hours
3.	Implement in Java, the 0/1 Knapsack problem using (a) Dynamic Programming method	2 Hours

	(b) Greedy method	
4	From a given vertex in a weighted connected graph, find shortest paths toother vertices using Dijkstra's algorithm. Write the program in Java.	2 Hours
5	Find Minimum Cost Spanning Tree of a given connected undirected graphusing Kruskal's algorithm. Use Union-Find algorithms in your program.	2 Hours
6	Find Minimum Cost Spanning Tree of a given connected undirected graph using Prim's algorithm.	2 Hours
7	Write Java programs to Implement All-Pairs Shortest Paths problem usingFloyd's algorithm using Dynamic programming.	2 Hours
8	Write Java programs to Implement Travelling Sales Person problem usingDynamic programming.	2 Hours
9	Design and implement in Java to Implement Queens Backtracking usingDynamic programming	2 Hours
10	Design and implement in Java to find a subset of a given set S = {Sl, S2,.....,Sn} of n positive integers whose SUM is equal to a given positive integer d. 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.	2Hours

Laboratory Outcomes: The student wil be able to:	
CO1	Design algorithms using appropriate design techniques (brute-force, greedy, dynamic programming,etc.)
CO2	Implement a variety of algorithms such as sorting, graph related, combinatorial, etc., in a high levellanguage.
CO3	Analyze and compare the performance of algorithms using language features
CO4	Apply and implement learned algorithm design techniques and data structuresto solve real-worldproblems.
CO5	Employ various design strategies for problem solving and implement various algorithms in JAVA .

CIE Laboratory (50 Marks)

Lab Continuous Evaluation :30 Marks

Continuous evaluation will be conducted for Lab experiment. Marks of each evaluation includes based on attendance, Experiment conduction, performance in lab, Record / Observation and viva, for all the experiments. The total Continuous evaluated marks will be scaled to 30 marks. (A)

Two CIE for 20 Marks each and take the average for 20 Marks (B)

Final CIE Marks will be calculated as

(A+B) for 50 marks

SEE Laboratory Examination (50 Marks)

The laboratory SEE is also evaluated for 50 marks, distributed as follows:
Experiment Conduction with Results: 40 marks
Viva Voce: 10 marks
Total 50 marks

The final score for the course out of 100 is the SumTotal of SEE and CIE.

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	3	2	3	–	–	–	2	2	–
CO2	3	3	3	3	3	–	–	–	2	3	–
CO3	3	3	3	3	3	1	1	1	3	3	1
CO4	3	3	3	3	3	1	–	–	3	3	2

SEMESTER -IV			
Discrete Mathematical Structures			
Course Code:	MVJ22IS451	CIE Marks	50
L: T:P:S	3:0:0:0	SEE Marks	50
Credits:	3	Total Marks	100
Hours:	40 Hrs Theory	Exam Hours	3

Course Learning Objectives: The students will be able to	
Identify the differences between a relation and a function. Understand the role of between-group and within-group variability in testing differences between group means.	
UNIT-I	
Basic Connectives and Truth Tables: Logic Equivalence – The Laws of Logic. Logical Implication – Rules of Inference. The Use of Quantifiers, Quantifiers, Definitions and the Proofs of Theorems.	8 Hrs
UNIT-II	
Cartesian Products and Relations: Properties of Relations, Computer Recognition – Zero-One Matrices and Directed Graphs, Partial Orders – Hasse Diagrams, Equivalence Relations and Partitions.	8 Hrs
UNIT-III	
Functions: Plain and One-to-One, Onto Functions – Stirling Numbers of the Second Kind, Special Functions, The Pigeon-hole Principle, Function Composition and Inverse Functions.	8 Hrs
UNIT-IV	
Mathematical Induction: The Well Ordering Principle – Mathematical Induction, **Groups:** Definitions, Examples, and Elementary Properties, Homomorphisms, Isomorphisms, and Cyclic Groups, Cosets, and Lagrange's Theorem.	8 Hrs
UNIT-V	
Coding Theory and Rings: Elements of Coding Theory, The Hamming Metric, The Parity Check, and Generator Matrices **Group Codes:** Decoding with Coset Leaders, Hamming Matrices **Rings and Modular Arithmetic:** The Ring Structure – Definition and Examples, Ring Properties and Substructures, The Integers Modulo n	8 Hrs

Course Outcomes: After completing the course, the students will be able to	
CO1	Explain and apply basic notions of symbolic logic and define proposition and argument.
CO2	Solving logical problems using concepts of relations.
CO3	To determine whether a relation is a function and identify the domain and range of a function.
CO4	Link the fundamental concepts of groups and symmetries of geometrical objects.
CO5	Use algebraic techniques to construct efficient codes.

Reference Books	
1.	Ralph P. Grimaldi: Discrete and Combinatorial Mathematics, 5th Edition, Pearson Education, 2004.
2.	Kenneth H. Rosen: Discrete Mathematics and its Applications, 7th Edition, McGraw Hill, 2010.
3.	Jayant Ganguly: A Treatise on Discrete Mathematical Structures, Sanguine-Pearson, 2010.
4.	P B. Bhattacharya, S K. Jain & P. Nagpaul, "Basic Abstract Algebra", Cambridge University Press , Second edition ,1994.

Continuous Internal Evaluation (CIE):
Three CIE Will be conducted for 50 marks each and average of three will be taken (A)
Three Quizzes will be conducted along with CIE for 10 Marks Each. Sum of three quizzes will be considered for 30 marks (B)
Two Assignments for 10 marks each and the sum of both the assignments will be taken for 20 Marks (C)

Final CIE Marks will be calculated as (A+B+C)/2 for 50 marks

Semester End Examination (SEE):

The theory exam consists of a written paper structured into two parts:

Part A: Carries 20 marks which include either objective-type or short descriptive questions. It is designed to cover the entire syllabus comprehensively.

Part B: This section carries a total of 80 marks and consists of 5 questions, with

Either or choices. Students are required to answer one full question per module, selecting from the choices. Each question is valued at 16 marks and may include up to two sub-parts.

The SEE Theory marks of 100 will be scaled down to 50.
The final score for the course in the ratio of 50:50 of CIE and SEE Marks

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3		3							
CO2	3	3		3					1		
CO3	3	3		2						1	
CO4	3	3		3				1			1
CO5	3	2		3			1				

Semester: IV		
BIOLOGY FOR ENGINEERS		
Course Code:	MVJ22BI47	CIE Marks: 50
L: T:P:S	1:0:0:0 / 2:0:0:0	SEE Marks: 50
Credits:	1 / 2	Total :100
Hours:	12 Hrs Theory /24 Hrs Theory	SEE Duration: 2 Hrs.

Course objectives:

To familiarize the students with the basic biological concepts and their engineering applications.

To enable the students with an understanding of bio design principles to create novel devices and structures.

To provide the students with an appreciation of how biological systems can be re-designed as substitute products for natural systems.

To motivate the students to develop interdisciplinary vision of biological engineering.

Module-1 **(4 Hours)**

CELL BASIC UNIT OF LIFE

Introduction. Structure and functions of a cell. Stem cells and their application. Biomolecules: Properties

and functions of Carbohydrates, Nucleic acids, proteins, lipids. Importance of special biomolecules: Properties and functions of enzymes, vitamins and hormones.

Module-2 **(5 Hours)**

APPLICATION OF BIOMOLECULES

Carbohydrates in cellulose-based water filters production, PHA and PLA in bioplastics production, Nucleic acids in vaccines and diagnosis, Proteins in food production, lipids in biodiesel and detergents production, Enzymes in biosensors fabrication, food processing, detergent formulation and textile processing.

Module-3 (5 Hours)
ADAPTATION OF ANATOMICAL PRINCIPLES FOR BIOENGINEERING DESIGN Brain as a CPU system. Eye as a Camera system. Heart as a pump system. Lungs as purification system. Kidney as a filtration system.
Module-4 (5 Hours)
NATURE-BIOINSPIRED MATERIALS AND MECHANISMS: Echolocation,Photosynthesis. Bird flying, Lotus leaf effect, Plant burrs, Shark skin, Kingfisher beak. Human Blood substitutes - hemoglobin-based oxygen carriers (HBOCs) and perfluoro carbons (PFCs).
Module-5 (5 Hours)
TRENDS IN BIOENGINEERING: Muscular and Skeletal Systems as scaffolds, scaffolds and tissue engineering, Bioprinting techniques and materials. Electrical tongue and electrical nose in food science, DNA origami and Biocomputing, Bioimaging and Artificial Intelligence for disease diagnosis. Bioconcrete. Bioremediation. Biomining.

Course outcome (Course Skill Set)

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

- Elucidate the basic biological concepts via relevant industrial applications and case studies.
- Evaluate the principles of design and development, for exploring novel bioengineering projects.
- Corroborate the concepts of biomimetics for specific requirements.
- Think critically towards exploring innovative biobased solutions for socially

relevant problems.

Continuous Internal Evaluation (CIE) – 50 Marks

The CIE for the mandatory credit courses common across all disciplines comprises of two components as follows:

Internal Assessment Tests (30 Marks):

Two Internal Assessment tests will be conducted, each comprising 50 multiple choice questions for a total of 50 marks. The average of the two test scores will be scaled down to 30 marks.

Assignments (20 Marks):

Students are required to complete two assignments, each carrying 10 marks. These assignments may include projects*, poster presentations*, seminars*, or similar academic activities. The marks of the two assignments are added to get 20 marks.

*Each assignment will undergo two rounds of evaluation to assess progress and quality

At the beginning of the semester, the instructor/faculty teaching the course has to announce the methods of Assignment for the course.

Together, these two components are added to get the Final CIE marks of 50.

Semester End Examination (SEE) – 50 Marks

A Semester End Examination is conducted for 50 marks comprising of multiple-choice questions (MCQ) type each of one mark.

The final score for the course out of 100 is the Sum Total of SEE and CIE.

Suggested Learning Resources:

Text Books

1. Biology for Engineers, Rajendra Singh C and Ratnakar Rao N, Rajendra Singh C and

Ratnakar Rao N Publishing, Bengaluru, 2023.

2. Human Physiology, Stuart Fox, Krista Rompolski, McGraw-Hill eBook. 16th Edition, 2022

3. Biology for Engineers, Thyagarajan S., Selvamurugan N., Rajesh M.P., Nazeer R.A., Thilagaraj W., Barathi S., and Jaganthan M.K., Tata McGraw-Hill, New Delhi, 2012.

4. Biology for Engineers, Arthur T. Johnson, CRC Press, Taylor and Francis, 2011

5. Biomedical Instrumentation, Leslie Cromwell, Prentice Hall 2011.

6. Biology for Engineers, Sohini Singh and Tanu Allen, Vayu Education of India, New Delhi, 2014.

7. Biomimetics: Nature-Based Innovation, Yoseph Bar-Cohen, 1st edition, 2012, CRC Press.

8. Bio-Inspired Artificial Intelligence: Theories, Methods and Technologies, D. Floreano and C. Mattiussi, MIT Press, 2008.

9. .Bioremediation of heavy metals: bacterial participation, by C R Sunilkumar, N GeethaA C Udayashankar Lambert Academic Publishing, 2019.

10. 3D Bioprinting: Fundamentals, Principles and Applications by Ibrahim Ozbolat, Academic Press, 2016.

11. Electronic Noses and Tongues in Food Science, Maria Rodriguez Mende, Academic Press, 2016

Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/121106008
- https://freevideolectures.com/course/4877/nptel-biology-engineers-other-non-biologists
- https://ocw.mit.edu/courses/20-020-introduction-to-biological-engineering-design-spring-2009
- https://ocw.mit.edu/courses/20-010j-introduction-to-bioengineering-be-010j-spring-2006
- https://www.coursera.org/courses?query=biology
- https://onlinecourses.nptel.ac.in/noc19_ge31/preview
- https://www.classcentral.com/subject/biology
- https://www.futurelearn.com/courses/biology-basic-concepts

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

1. Group Discussion of Case studies

2. Model Making and seminar/poster presentations

3. Design of novel device/equipment like Cellulose-based water filters, Filtration system

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	-	-	-	-	-	-	-	1	-	1
CO2	-	-	-	-	-	-	-	-	1	-	1
CO3	-	-	-	-	-	-	-	-	1	-	1
CO4	-	-	-	-	-	-	-	-	1	-	1
CO5	-	-	-	-	-	-	-	-	1	-	1

Semester: IV		
Universal human values course		
Course Code:	MVJ22UHV48	CIE Marks: 50
L: T:P:S	1:0:0:0 / 2:0:0:0	SEE Marks: 50
Credits:	1 / 2	Total :100
Hours:	12 Hrs Theory /24 Hrs Theory	SEE Duration: 2 Hrs.

Course Learning Objectives: The students will be able to	
1	Appreciate the essential complimentary between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
2	Facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
3	Highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature.

UNIT-I	
Review on Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education), Self-exploration as the Process for Value Education, Happiness and Prosperity-– Current Scenario **Value Education:** Understanding Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Method to Fulfill the Basic Human Aspirations. Practical Sessions: Sharing about Oneself (Tutorial 1), Exploring Human Consciousness (Tutorial 2), Exploring Natural Acceptance (Tutorial 3) Video link: https://www.youtube.com/watch?v=85XCw8SU084 https://www.youtube.com/watch?v=E1STJoXCXUU&list=PLWDeKF97v9SP_Kt6jqzA3p Z3yA7g_OAQz https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw	3 Hrs
UNIT-II	
Review on Understanding Human being as the Co-existence of the Self	

and the Body, The Body as an Instrument of the Self, Harmony of the Self with the Body. **Harmony in the human being:** Distinguishing between the Needs of the Self and the Body, Understanding Harmony in the Self, Programme to ensure self-regulation and Health. **Practical Sessions**: Exploring the difference of Needs of Self and Body (Tutorial 4) Exploring Sources of Imagination in the Self (Tutorial 5) Exploring Harmony of Self with the Body (Tutorial 6) Video link: https://www.youtube.com/watch?v=GpuZo495F24 https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw	3 Hrs
UNIT-III	
Review on Harmony in the Family – the Basic Unit of Human Interaction, Other Feelings, Justice in Human-to-Human Relationship, Understanding Harmony in the Society. **Harmony in the Family and Society:** 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Vision for the Universal Human Order. **Practical Sessions:** Exploring the Feeling of Trust (Tutorial 7), Exploring the Feeling of Respect (Tutorial 8), Exploring Systems to fulfill Human Goal (Tutorial 9) Video link: • https://www.youtube.com/watch?v=F2KVW4WNnS • https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw	3 Hrs
UNIT-IV	
Harmony in the Nature/Existence: Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfillment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence. **Practical Sessions**: Exploring the Four Orders of Nature (Tutorial 10), Exploring Co-existence in Existence (Tutorial 11) Video link: • https://www.youtube.com/watch?v=1HR-QB2mCF0 • https://www.youtube.com/watch?v=lfN8q0xUSpw • https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw	3 Hrs
UNIT-V	
Review on Natural Acceptance of Human Values, Basis for Humanistic	3 Hrs

Education, Humanistic Constitution and Universal Human Order, Holistic Technologies, Production Systems and Management Models-Typical Case Studies. **Implications of the Holistic Understanding – a Look at Professional Ethics:** Definitiveness of (Ethical) Human Conduct, Competence in Professional Ethics, Strategies for Transition towards Value-based Life and Profession Practical Sessions: Exploring Ethical Human Conduct (Tutorial 12) Exploring Humanistic Models in Education (Tutorial 13) Exploring Steps of Transition towards Universal Human Order (Tutorial 14) Video link: • https://www.youtube.com/watch?v=BikdYub6RY0 • https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw	

Course Outcomes: After completing the course, the students will be able to	
CO1	Explore themselves, get comfortable with each other and with the teacher
CO2	Enlist their desires and the desires are not vague.
CO3	Restate that the natural acceptance (intention) is always for living in harmony, only competence is lacking
CO4	Differentiate between the characteristics and activities of different orders and study the mutual fulfillment among them
CO5	Present sustainable solutions to the problems in society and nature

Textbooks	
1	AICTE SIP UHV-I Teaching Material, https://fdp-si.aicte india.org/ AicteSipUHV _download.php
2	A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
3.	Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2
Reference Books	
1.	Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010
2.	Jeevan Vidya Ek Parichaya. A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
3.	Human Values, A N Tripathi, New Age Intl. Publishers, New Delhi, 2004.
4.	The Story of Stuff (Book)
5.	The Story of My Experiments with Truth – by Mohandas Karamchand Gandhi

Continuous Internal Evaluation (CIE) – 50 Marks

The CIE for the mandatory credit courses common across all disciplines comprises of two components as follows:

Internal Assessment Tests (30 Marks):

Two Internal Assessment tests will be conducted, each comprising 50 multiple choice questions for a total of 50 marks. The average of the two test scores will be scaled down to 30 marks.

Assignments (20 Marks):

Students are required to complete two assignments, each carrying 10 marks. These assignments may include projects*, poster presentations*, seminars*, or similar academic activities. The marks of the two assignments are added to get 20 marks.

*Each assignment will undergo two rounds of evaluation to assess progress and quality

At the beginning of the semester, the instructor/faculty teaching the course has to announce the methods of Assignment for the course.

Together, these two components are added to get the Final CIE marks of 50.

Semester End Examination (SEE) – 50 Marks

A Semester End Examination is conducted for 50 marks comprising of multiple-choice questions (MCQ) type each of one mark.

The final score for the course out of 100 is the SumTotal of SEE and CIE.

CO-PO Mapping											
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1		1				2	2	3	2	1	2
CO2		1				2	2	3	2	1	2
CO3		1				2	2	3	2	1	2
CO4		1				2	2	3	2	1	2
CO5		1				2	2	3	2	1	2

Semester: IV		
Additional Mathematics-II (Common to all branches)		
Course Code:	MVJ22MATDIP2	CIE Marks:100
L:T:P :S :	2:0:0:0	SEE Marks: 0
Credits:	0	Total:100
Hours:	25 Hrs Theory	
Course Learning Objectives: The students will be able to		
	To familiarize the important tools Linear Algebra, differential Calculus, Beta and Gamma functions, Three-dimentional Geometry and higher order ODE's and PDE's for analyzing the engineering problems.	

UNIT 1	
Linear Algebra: **Introduction** - Rank of matrix by elementary row operations - Echelon form. Consistency of system of linear equations - Gauss elimination method. Eigen values and eigen vectors of a square matrix. Diagonalization of a square matrix of order two. Self study: Application of Cayley-Hamilton theorem (without proof) to compute the inverse of a matrix- Examples. Video Links : https://www.math.ust.hk/~machas/matrix-algebra-for-engineers.pdf https://nptel.ac.in/content/storage2/courses/122104018/node18.htmlhttps://www.youtube.com/watch?v=Pq- tUQzeSRw	5 Hrs.
UNIT 2	
Differential calculus: **Indeterminate forms:** L-Hospital rule (without proof), Total derivatives, Composite functions. Maxima and minima for a function of two variables. Jacobians- simple examples. Beta and Gamma functions: Beta and Gamma functions, Relation between Beta and Gamma function-simple problems. Self study: Asymptotes, Curve tracing.	5 Hrs.

Video Links : https://www.youtube.com/watch?v=6RwOoPN2zqE https://www.youtube.com/watch?v=s6F5yjY6jWk&list=PLMLsjhQWWlUqBoTCQDtYlloI-o-9hxp11	5 Hrs.
UNIT 3	
Analytical solid geometry : Introduction –Directional cosine and Directional ratio of a line, Equation of line in space- differentforms, Angle between two line, shortest distance between two line, plane and equation of plane in different forms and problems. Video Link https://www.toppr.com/guides/maths/three-dimensional-geometry/ https://www.toppr.com/guides/maths/three-dimensional-geometry/distance-between-skew-lines/	5 Hrs.
UNIT 4	
Differential Equations of higher order: Linear differential equations of second and higher order equations with constant coefficients. Inverse Differential operator, Operators methods for finding particular integrals, Method of variation of parameters, and Euler – Cauchy equation. Self study: Undetermined coefficients Video link: https://www.slideshare.net/ayeshajavednoori/application-of-higher-order-differential-equations https://www.math24.net/topics-higher-order-differential-equations/	5 Hrs.
UNIT 5	
Partial differential equation: Introduction- Classification of partial differential equations, formation of partial differential equations. Method of elimination of arbitrary constants and functions. Solutions of non-homogeneous partial differential equations by direct integration. Solution of Lagrange's linear PDE. Self study: One dimensional heat and wave equations and solutions by the method of separable of variable	5 Hrs.

Video Link : https://www.khanacademy.org/PDE http://www.nptelvideos.in/	

Course Outcomes: After completing the course, the students will be able to	
CO1	Make use of matrix theory for solving system of linear equations and compute eigenvalues and eigen vectors required for matrix diagonalization process.
CO2	Learn the notion of partial differentiation to calculate rates of change of multivariate functions and solve problems related to composite functions and Jacobians.
CO3	Understand the Three-Dimensional geometry basic, Equation of line in space- different forms, Angle between two line and studying the shortest distance .
CO4	Demonstrate various physical models through higher order differential equations and solve such linear ordinary differential equations.
CO5	Construct a variety of partial differential equations and solution by exact methods.

Text Books	
1.	B.S. Grewal, "Higher Engineering Mathematics" Khanna Publishers, 43rd Edition, 2013.
2.	Ramana B. V., "Higher Engineering Mathematics", Tata Mc Graw-Hill, 2006.
Reference Books	
1.	Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley-India publishers, 10th edition,2014.
2.	G. B. Gururajachar: Calculus and Linear Algebra, Academic Excellent Series Publication, 2018-19
3.	Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley-India publishers, 10th edition,2014.

Continuous Internal Evaluation (CIE):

- Three CIE Will be conducted for 50 marks each and average of three will be taken (A)
- Three Quizzes will be conducted along with CIE for 10 Marks Each. Sum of three quizzes will be considered for 30 marks (B)
- Two Assignments for 10 marks each and the sum of both the assignments will be taken for 20 Marks (C)

Final CIE Marks will be calculated as (A+B+C) for 100 marks

CO-PO Mapping												
CO/PO	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO12
CO1	3	3	-	2	-	-	-	-	-	-	1	1
CO2	3	3	-	2	-	-	-	-	-	-	1	1
CO3	3	3	-	3	-	-	-	-	-	-	-	1
CO4	2	2	-	3	-	-	-	-	-	-	1	1
CO5	2	2	-	2	-	-	-	-	-	-	-	1

V SEMESTER

SEMESTER -V		
Software Engineering and Project Management		
Course Code:	MVJ22IS51	CIE Marks:50
L: T:P:S	3:0:0	SEE Marks:50
Credits:	3	Total :100
Hours:	40Hrs Theory	Exam Duration:3

Course Objective : *This course will enable students to*

1. Outline software engineering principles and activities involved in building large software programs and identify ethical and professional issues faced by Software Engineers.

2. Describe the process of requirement gathering, requirement classification, requirement specification and requirements validation.

3. Infer the fundamentals of object-oriented concepts, differentiate system models, use UML diagrams, apply design patterns and explain the role of DevOps in Agile Implementation.

4. Discuss various types of software testing practices and software evolution processes. Recognize the importance of Project Management with its methods and methodologies and identify software quality parameters and quantify software using measurements and metrics. List software quality standards and outline the practices involved.

MODULE 1	8 HRS

Introduction: The evolving role of software, Software, The changing nature of software, Software engineering, A Process Framework, Process Patterns, Process Assessment, Personal and Team Process Models, Process Technology, Product and Process.

Process Models: Prescriptive models, Waterfall model, Incremental process models, Evolutionary. process models, Specialized process models.

Requirements Engineering: Requirements Engineering Task, Initiating the Requirements Engineering process, Eliciting Requirements, Developing use cases, Building the analysis model, Negotiating Requirements, Validating Requirements, Software Requirement Document.

MODULE 2	8 HRS

Introduction, Modelling Concepts and Class Modelling: What is Object orientation? What is OO development? OO Themes; Evidence for usefulness of OO development; OO modelling history. Modelling as Design technique: Modelling,

abstraction, The Three models. Class Modelling: Object and Class Concept, Link and associations concepts, Generalization and Inheritance, A sample class model, Navigation of class models, Introduction to RUP and UML diagrams.

Building the Analysis Models: Requirement Analysis, Analysis Model Approaches, Data modelling Concepts, Object Oriented Analysis, Scenario-Based modelling, Flow-Oriented Modelling, class Based modelling, Creating a Behavioural Model.

MODULE 3	8 HRS

Software Testing: A Strategic Approach to Software Testing, Strategic Issues, Test Strategies for Conventional Software, Test Strategies for Object -Oriented Software, Validation Testing, System Testing, The Art of Debugging. Agile Methodology & DevOps: Before Agile – Waterfall, Agile Development. What is DevOps? DevOps Importance and Benefits, DevOps Principles and Practices, 7 C's of DevOps Lifecycle for Business Agility, DevOps and Continuous Testing, How to Choose Right DevOps Tools?, Challenges with DevOps Implementation

MODULE 4	8 HRS

Contract Management, Activities Covered by Software Project Management, Plans, Methods and Methodologies, Some ways of categorizing Software Projects, Stakeholders, Setting Objectives, Business Case, Project Success and Failure, Management and Management Control, Project Management life cycle, Traditional versus Modern Project Management Practices.

MODULE 5	8 HRS

Activity Planning: Objectives of Activity Planning, When to Plan, Project Schedules Sequencing and Scheduling Activities, Network Planning Models, Forward Pass- Backward Pass, Identifying critical path, Activity Float, Shortening Project Duration Activity on Arrow Networks.

Software Economics: Evolution of Software Economics, Improving Software Economics, The old way and the new way. Life-Cycle Phases and Process artifacts.

Introduction to Project Management: Introduction, Project and Importance of Project Management,

Course Outcome: students will be able to

CO1	Understand the activities involved in software engineering and analyze the role of various process models
CO2	Explain the basics of object-oriented concepts and build a suitable class model using modelling. Techniques.
CO3	Describe various software testing methods and to understand the importanc of agile methodology and DevOps.
CO4	Illustrate the role of project planning and quality management in software

	development
CO5	Understand the importance of activity planning and different planning models.
Textbooks :	
1	Roger S. Pressman: Software Engineering-A Practitioners approach, 7th Edition, Tata McGraw
2	Michael Blaha, James Rumbaugh: Object Oriented Modelling and Design with UML, 2nd Edition, Pearson Education, 2005.
3	Bob Hughes, Mike Cotterell, Rajib Mall: Software Project Management, 6th Edition, McGraw Hill Education, 2018
4	Deepak Gaikwad, Viral Thakkar, DevOps Tools from Practitioner's Viewpoint, Wiley
5	Ian Sommerville: Software Engineering, 9th Edition, Pearson Education, 2012.
6	Management and Entrepreneurship, N V R Naidu, T Krishna Rao 4th reprint Willey Publications.
7	Schaum's outline oftheory and problems ofsoftware engineering, David A Gustafson, McGrawHill's
References:	
1	Principles of Management, P C Tripathi, P N Reddy, 5th edition, Tata Mc Graw Hill, 2012
2	Dynamics of Entrepreneurial Development & Management, Vasant Desai, Himalaya publishing house, 2009

Continuous Internal Evaluation (CIE):

- Three CIE Will be conducted for 50 marks each and average of three will b taken (A)
- Three Quizzes will be conducted along with CIE for 10 Marks Each. Sum three quizzes will be considered for 30 marks (B)
- Two Assignments for 10 marks each and the sum of both the assignmen will be taken for 20 Marks (C)

Final CIE Marks will be calculated as (A+B+C)/2 for 50 marks

Semester End Examination (SEE):

The theory exam consists of a written paper structured into two parts:

Part A: Carries 20 marks which include either objective-type or short descriptive questions. It is designed to cover the entire syllabus comprehensively.

Part B: This section carries a total of 80 marks and consists of 5 questions, wit Either or choices. Students are required to answer one full question per modul selecting from the choices. Each question is valued at 16 marks and may include up to two sub-parts.

The SEE Theory marks of 100 will be scaled down to 50.

The final score for the course in the ratio of 50:50 of CIE and SEE Marks

CO-PO Mapping :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	3	2	3					2	3
CO2	1	3	3	2	2					2	3
CO3	2	3	2	2	3					2	3
CO4	2	2	2	2	2					3	3
CO5	1	2	3	2	2					2	3

3- HIGH 2- MODERATE 1- LOW

SEMESTER -V		
Computer Networks		
Course Code:	MVJ22IS52	CIE Marks:50
L: T:P:S	3:0:2:0	SEE Marks:50
Credits:	4	Total:100
Hours:	40Hrs Theory+24 Hrs of Practical	Exam Duration:3

Course Objectives : This course will enable students to

1. To develop an understanding of modern network architectures from a design and performance perspective.
2. To introduce the student to the major concepts involved in network protocols.
3. Get details about Functions of Network layer, Router and delivery of data to host network.
4. Learn the function of mobile networking and switching. 5. Multimedia data transmission in network.

Module 1	8 hrs
Data communication Components: Representation of data and its flow Networks, Various Connection Topology, Protocols and Standards, OSI model, Transmission Media, LAN: Wired LAN, Wireless LANs, Techniques for Bandwidth utilization: Multiplexing - Frequency division, Time division andmWave division.	
Module 2	**8 hrs**
Data Link Layer: Error Detection and Error Correction - Fundamentals, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, Go back – N ARQ, Selective Repeat ARQ. Medium Access Sub Layer: Switching, Random Access, Multiple access protocols - Pure ALOHA, Slotted ALOHA, CSMA/CD, CDMA/CA, IEEE802 standard protocol	
Module 3	**8 hrs**
The Network Layer: Network layer design issues, Logical Addressing: IPV4, IPV6; Address mapping, routing algorithms, Congestion control algorithms, Internetworking, the network layer in the internet (IPv4 and IPv6), Quality of Service.	
Module 4	**8 hrs**
Transport Layer: Elements of Transport protocols: Addressing, Connection	

establishment, Connection release, Crash recovery, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), TCP Congestion Control; Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm.	
Module 5	**8 hrs**
Application Layer: Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls; AI in network infrastructure, Self-Healing Networks.	
LABORATORY EXPERIMENTS	
Course Outcome : At the end of the course students will be able to	
CO1	Analyze and compare different methods of bandwidth utilization to optimize data transfer efficiency.
CO2	Select the specific IEEE 802 standard protocols to be implemented in the network environment.
CO3	Apply theoretical knowledge of network layer design issues to real-world networking scenarios and troubleshoot network problems effectively.
CO4	Analyze metrics such as throughput, delay, and packet loss rate to see how the protocols behave in each scenario.
CO5	create a user-friendly website that meets modern standards in terms of navigation, design, and performance.
Textbooks : 1. Computer Networks:5th ed by Andrew. S. Tanenbaum PHI Publication. 2. Data Communications and Networks: 3 rd ed byBehrouz A. Forouzan. TataMcGraw Hill publication.	
References :	
1. William Stallings, Data and Computer Communication, Tenth Edition, Pearson Education, 2013.	
2. James F. Kurose and Keith W. Ross: Computer Networking: A Top-Down Approach Featuring the Internet, 3 rd Edition	
Continuous Internal Evaluation (CIE): **Theory for 50 Marks** • Three CIE Will be conducted for 50 marks each and average of three will be taken (A) • Three Quizzes will be conducted along with CIE for 10 Marks Each. Sum of three quizzes will be considered for 30 marks (B) • Two Assignments for 10 marks each and the sum of both the assignments will be taken for 20 Marks (C)	

Final CIE Marks will be calculated as (A+B+C)/2 for 50 marks

Laboratory- 50 Marks

Weekly Evaluation 30 Marks
Lab Continuous Evaluation :30 Marks
Continuous evaluation will be conducted for Lab experiment. Marks of each evaluation includes based on attendance, Experiment conduction, performance in lab, Record / Observation and viva, for all the experiments. The total Continuous evaluated marks will be scaled to 30 marks. (A)

Two CIE for 20 Marks each and take the average for 20 Marks (B)

Final CIE Marks will be calculated as A+B for 50 marks

For IPCC Final CIE Marks will be calculated as Average of CIE and Lab CIE for 50 marks.

Semester End Examination (SEE)

SEE Theory Examination (100 Marks)

The theory exam consists of a written paper structured into two parts:

Part A: Carries 20 marks which include either objective-type or short descriptive questions. It is designed to cover the entire syllabus comprehensively.

Part B: This section carries a total of 80 marks and consists of 5 questions, with Either or choices. Students are required to answer one full question per module, selecting from the choices. Each question is valued at 16 marks and may include up to two sub-parts.

The SEE Theory marks of 100 will be scaled down to 50 (A)

SEE Laboratory Examination (50 Marks)

The laboratory SEE is also evaluated for 50 marks, distributed as follows:
Experiment Conduction with Results: 40 marks
Viva Voce: 10 marks
Total 50 marks (B)

The score for the SEE is A+B of total 100 marks

The final score for the course in the ratio of 50:50 of CIE and SEE Marks

CO-PO Mapping

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2	2	2	1	2					
CO2	1	1	2	2	3					
CO3	2	2	2	2	2					
CO4	3	2	2	3	3					
CO5	2	2	2	3	3					

3-High 2-Moderate 1- low

SEMESTER -V		
Theory of Computation		
Course Code:	MVJ22IS53	CIE Marks:50
L: T:P:S	4:0:0:0	SEE Marks:50
Credits:	4	Total :100
Hours:	40 Hrs Theory	Exam Duration:3

Course Objectives : This Course will enable the students to	
1. Acquire knowledge of Automata Theory as the basis of all computer science languages design. 2. Understand the concept of Context Free Grammars and Languages. 3. Understand the concepts of Turing Machine and Chomskian Languages. 4. Acquire knowledge of Decidability. 5. Enrich the knowledge in various phases of compiler ant its use.	
Module 1	8 Hrs
Finite Automata: Mathematical preliminaries and notations – Central concepts of automata theory – Finite automata -Deterministic Finite Automata - Nondeterministic Finite Automata – Equivalence of DFA and NFA –Finite Automata with Epsilon transitions - Application of FA	
Module 2	8 Hrs
Regular Expressions: Regular languages: Regular Expressions – Finite Automata and Regular Expressions –Applications of Regular Expressions - Regular Grammars. Problems on CFG, pushdown automata	
Module 3	8 Hrs
Regular Languages: Properties of regular languages: Pumping lemma for regular languages – Closure properties of regular languages –Equivalence and Minimization of Finite Automata. C Problems on Turing Machine, Halting Problem	
Module 4	8Hrs
Context Free Grammar: Context Free languages: Context Free Grammars – Parse Trees - Ambiguity in Grammars and languages– Applications of Context Free Grammars – Pushdown automata (PDA) – Languages of a PDA - Equivalence of PDA 's and CFG 's, Conversion of PDA -CFG and CFG - PDA	

Problems on Computational Complexity		
Module 5		**8Hrs**
Context Free Languages: Properties of Context Free Languages: Normal Forms (CNF, GNF) for Context Free Grammars - Pumping lemma for CFL 's - Closure properties of CFL Turing Machines: Turing Machines- Programming Techniques for Turing Machines – Multitape Turing Machines. Problems on lexical analysis		
Course Outcomes: At the end of the course students will be able to		
CO1	Construct finite automata for given pattern and find its equivalent regular expressions.	
CO2	Design and simplify context free grammar and find equivalent pushdown automata for given language	
CO3	Design Turing Machines for any languages	
CO4	Derive whether a problem is decidable or not	
CO5	Understand the basic concepts of compiler Design	
Textbooks: 1.Hopcroft J E, MotwaniR and Ullman J D, Introduction to Automata Theory, Languages and Computations, Second Edition, Pearson Education, 2012.		
2.Rich Eiane—Automata Computability and Complexity: Theory and Applications, Second Edition, PHI, 2003.		
References:		
1. Padma Reddy.A, —Finite Automata and Formal Languages: A Simple Approach.		
2. Raghavan V, Principles of Compiler Design, Third Edition, Tata Mc-Graw Hill Education Pvt. Ltd., New Delhi, 2009		
Continuous Internal Evaluation (CIE): • Three CIE Will be conducted for 50 marks each and average of three will be taken (A) • Three Quizzes will be conducted along with CIE for 10 Marks Each. Sum of three quizzes will be considered for 30 marks (B) • Two Assignments for 10 marks each and the sum of both the assignments will be taken for 20 Marks (C) **Final CIE Marks will be calculated as (A+B+C)/2 for 50 marks** **Semester End Examination (SEE):** The theory exam consists of a written paper structured into two parts:		

Part A: Carries 20 marks which include either objective-type or short descriptive questions. It is designed to cover the entire syllabus comprehensively.

Part B: This section carries a total of 80 marks and consists of 5 questions, with Either or choices. Students are required to answer one full question per module, selecting from the choices. Each question is valued at 16 marks and may include up to two sub-parts.

The SEE Theory marks of 100 will be scaled down to 50.

The final score for the course in the ratio of 50:50 of CIE and SEE Marks

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	1	3	3	2	3						
CO2	2	2	2	2	3						
CO3	1	3	3	2	3						
CO4	2	3	2	2	3						
CO5	2	3	1	2	3						

3-High 2-Moderate 1- low

SEMESTER -V		
Data Visualization Lab		
Course Code:	MVJ22ISL54	CIE Marks:50
L: T:P:S	0:0:2:0	SEE Marks:50
Credits:	1	Total :100
Hours:	24Hrs of Practical	Exam Duration:3

Course Objectives : This Course will enable the students to		
1. Effective use of Business Intelligence (BI) technology (Tableau) to apply data visualization 2. Discern patterns and relationships in the data. 3. Build Dashboard applications. 4. Communicate the results clearly and concisely. 5. Work with different formats of data sets.		
Sl no	LIST OF PROGRAMS	
1	Understanding Data, what is data, where to find data, Foundations for building Data Visualizations, Creating Your First visualization?	2 Hours
2	Getting started with Tableau Software using Data file formats, connecting your Data to Tableau, creating basic charts (line, bar charts, Tree maps), Using the Show me panel.	2 Hours
3	Tableau Calculations, Overview of SUM, AVR, and Aggregate features, Creating custom calculations and fields.	2 Hours
4	Applying new data calculations to your visualizations, Formatting Visualizations, Formatting Tools and Menus, Formatting specific parts of the view	2 Hours
5	Editing and Formatting Axes, Manipulating Data in Tableau data, Pivoting Tableau data.	2 Hours
6	Structuring your data, Sorting and filtering Tableau data, Pivoting Tableau data	2 Hours
7	Advanced Visualization Tools: Using Filters, Using the Detail panel, using the Size panels, customizing filters, Using and	2 Hours

	Customizing tooltips, Formatting your data with colors.	
8	Creating Dashboards & Storytelling, creating your first dashboard and Story, Design for different displays, adding interactivity to your Dashboard, Distributing & Publishing your Visualization.	2 Hours
9	Tableau file types, publishing to Tableau Online, Sharing your visualizations, printing, and Exporting.	2 Hours
10	Creating custom charts, cyclical data and circular area charts, Dual Axis charts	2 Hours

Course Outcomes: At the end of the course students will be able to

CO1	Understand How to import data into Tableau
CO2	Understand Tableau concepts of Dimensions and Measures.
CO3	Develop Programs and understand how to map Visual Layouts and Graphical Properties
CO4	Create a Dashboard that links multiple visualizations
CO5	Use graphical user interfaces to create Frames for providing solutions to real world problems.

Textbooks:

1. Microsoft Power BI cookbook, Brett Powell, 2nd edition

2. R Programming for Data Science by Roger D. Peng (References)

3. The Art of R Programming by Norman Matloff Cengage Learning India

CIE Laboratory (50 Marks)

Weekly Evaluation 30 Marks

Weekly evaluation will be conducted for every experiment. Marks of each evaluation includes Weekly Attendance + Experiment conduction along with Record / Observation + Weekly viva for all the experiments. The total of all these evaluated marks are added and the total marks will be scaled to 30

marks. (A)

Two CIE for 20 Marks each and take the average for 20 Marks (B)

Final CIE Marks will be calculated as (A+B) for 50 mark.

SEE Laboratory Examination (50 Marks)

COPO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	2	2	3						
CO2	2	2	3	2	3						
CO3	2	3	3	2	3						
CO4	2	3	3	2	3						
CO5	2	3	3	2	3						

SEMESTER -V		
Computer Vision		
Course Code:	MVJ22IS551	CIE Marks:50
L: T:P:S	3: 0: 0 : 0	SEE Marks:50
Credits:	3	Total :100
Hours:	40Hrs Theory	Exam Duration:3

Course Objectives : This Course will enable the students to

1. Understanding of the fundamental concepts related to multi-dimensional signal processing, feature extraction, pattern analysis visual geometric modeling, stochastic optimization

2. Knowledge of these concepts is necessary in this field, to explore and contribute to research and further developments in the field of computer vision

3. Applications range from Biometrics, Medical diagnosis, document processing, mining of visual content, to surveillance, advanced rendering etc.

Module 1 **8 Hours**

Overview of computer vision and its applications: Image Formation and Representation: Imaging geometry, radiometry, digitization, cameras and Projections, rigid and affine transformation

Image Processing: Pixel transforms, color transforms, histogram processing, histogram equalization, filtering, convolution, Fourier transformation and its applications in sharpening, blurring and noise removal

Module 2 **8 Hours**

Feature detection: edge detection, corner detection, line and curve detection, active contours, SIFT and HOG descriptors, shape context descriptors, Morphological operations.

Segmentation: Active contours, split & merge, watershed, region splitting, region merging, graph- based segmentation, mean shift and model finding, Normalized cut

Module 3 **8 Hours**

Camera calibration: camera models; intrinsic and extrinsic parameters; radial lens distortion; direct parameter calibration; camera parameters from projection matrices; orthographic, weak perspective, affine, and perspective camera models.

Module 4 **8 Hours**

Motion representation: the motion field of rigid objects; motion parallax; optical

flow, the image brightness ,constancy equation, affine flow; differential techniques; feature-based techniques; regularization and robust estimation Motion tracking: statistical filtering; iterated estimation; observability and linear systems; the Kalman filter	
Module 5	**8 Hours**
Object recognition and shape representation: alignment, appearance-based methods, invariants, image eigenspaces	
Course Outcome	
CO1	Learn fundamentals of computer vision and its applications
CO2	Understand the basic image processing operations to enhance, segment the images.
CO3	Understand the analyzing and extraction of relevant features of the concerned domain problem
CO4	Understand and apply the motion concepts and its relevance in real time applications
CO5	Apply the knowledge in solving high level vision problems like object recognition, image classification etc
Textbooks:	
1	Computer Vision: Algorithms and Applications, R. Szeliski, Springer, 2011
2	Introductory techniques for 3D computer vision, E. Trucco and A. Verri, Prentice Hall, 1998

Continuous Internal Evaluation (CIE):

- Three CIE Will be conducted for 50 marks each and average of three will be taken (A)
- Three Quizzes will be conducted along with CIE for 10 Marks Each. Sum of three quizzes will be considered for 30 marks (B)
- Two Assignments for 10 marks each and the sum of both the assignments will be taken for 20 Marks (C)

Final CIE Marks will be calculated as (A+B+C)/2 for 50 marks

Semester End Examination (SEE):

The theory exam consists of a written paper structured into two parts:

Part A: Carries 20 marks which include either objective-type or short descriptive questions. It is designed to cover the entire syllabus comprehensively.

Part B: This section carries a total of 80 marks and consists of 5 questions, with Either or choices. Students are required to answer one full question per module, selecting from the choices. Each question is valued at 16 marks and may include up to two sub-parts.

The SEE Theory marks of 100 will be scaled down to 50.

The final score for the course in the ratio of 50:50 of CIE and SEE Marks

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	2	2	3						2
CO2	2	2	3	2	3						2
CO3	2	3	3	2	3						2
CO4	2	3	3	2	3						2
CO5	2	3	3	2	3						2

3-High 2- Moderate 1-Low

SEMESTER -V		
Artificial Intelligence		
Course Code:	MVJ22IS552	CIE Marks:50
L: T:P:S	3: 0: 0 : 0	SEE Marks:50
Credits:	3	Total:100
Hours:	40Hrs Theory	Exam Duration:3

Course Objectives : This Course will enable the students to

1. Understand fundamental concepts in Artificial Intelligence.
2. Understand and analyze the problem-solving techniques and knowledge representation.
3. Design intelligent components or programs to meet desired needs.
   4.Implement, and evaluate computer-based intelligent systems.
4. 5.Understand fundamental concepts in Artificial Intelligence.

Module 1 **8 hrs**

Introduction: AI problems, foundation of AI and history of AI, Intelligent agents: Agents and Environments, The concept of rationality, The nature of environments, Structure of agents, Problem solving agents, Problem formulation

Module 2 **8 hrs**

Knowledge Representation & Reasons: Knowledge – Based Agents, The Wumpus world. Propositional Logic: Reasoning patterns in propositional logic - Resolution, Forward & Backward Chaining. Inference in First order logic: Propositional vs. first order inference, Unification & lifting, Forward chaining, Backward chaining, Resolution

Module 3 **8 hrs**

Searching: Searching for solutions, uniformed search strategies – Breadth first search, depth first search, Depth limited search, Iterative deepening depth first search bi-direction search, Comparing uninformed search strategies. Search with partial information (Heuristic search), Greedy best first search, A* search, Memory bounded heuristic search, Heuristic functions.

Local search Algorithms: Hill climbing, Simulated annealing search, Local beam search, Genetic algorithms

Module 4 **8 hrs**

Constrain satisfaction problems: Backtracking search for CSPs local search for constraint satisfaction problems.

Game Playing: Games, Minimax algorithm, Optimal decisions in multiplayer games, Alpha-Beta pruning, Evaluation functions, Cutting of search.

Module 5	8 hrs
Planning: Classical planning problem, Language of planning problems, Expressiveness and extension, planning with state – space search, Forward state spare search, Backward state space search, Heuristics for state space search, Partial order planning Graphs, Planning graphs Learning: what is learning, Forms of learning, Inductive learning, Learning Decision Trees.	
Course Outcomes	
CO1	Understand the various types and working units of an expert systems
CO2	Evaluate the logic behind the building of knowledge base and knowledge representation
CO3	Deploy Searching Techniques to design intelligent agents
CO4	Implement various Constraint Satisfaction Problem, Game Playing techniques to use in various intelligent system designs
CO5	Apply suitable learning methodology while designing systems based on their applications
Textbooks:	
1	Stuart Russel, Peter Norvig, (2009), Artificial Intelligence – A Modern Approach,3rd Edition,
	Pearson Education.
2	E.Rich and K.Knight, (2008), Artificial Intelligence , 3rd Edition, Tata McGraw Hill
References:	
1	Patterson, (2009), Artificial Intelligence and Expert Systems, 2nd Edition, PHI.
2	Ivan Bratka, (2000), PROLOG Programming for Artificial Intelligence. 3rdEdition – Pearson Education.
Continuous Internal Evaluation (CIE): • Three CIE Will be conducted for 50 marks each and average of three will be taken (A) • Three Quizzes will be conducted along with CIE for 10 Marks Each. Sum of three quizzes will be considered for 30 marks (B) • Two Assignments for 10 marks each and the sum of both the	

assignments will be taken for 20 Marks (C)

Final CIE Marks will be calculated as (A+B+C)/2 for 50 marks

Semester End Examination (SEE):

The question paper consists of two parts, A and B

Part A: consists of 10 questions of 2 marks each. It is designed to cover the entire syllabus comprehensively.

Part B: The question paper will have 10 questions. Each question is set for 16 marks. There will be 2 questions from each module, with a maximum of 2 subdivisions. Students have to answer any 5 questions choosing one full question from each module.

The SEE Theory marks of 100 will be scaled down to 50.

The final score for the course in the ratio of 50:50 of CIE and SEE Marks

CO-PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	3	2	3	2						1
CO2	2	3	3	2	3						1
CO3	3	3	2	2	2						2
CO4	2	3	3	3	3						1
CO5	2	3	2	2	2						1

3-High 2-Moderate 1-Low

Semester: V		
Unix System Programming		
Course Code:	MVJ22IS553	CIE Marks: 50
L: T:P:S	3:0:2:0	SEE Marks: 50
Credits:	2	Total :100
Hours:	40Hrs Theory	SEE Duration: 3 Hrs.

Course Objectives : This Course will enable the students to
1. Understand fundamental concepts in Unix Programming . 2. Understand the problem solving techniques and knowledge representation. 3. Design intelligent components or programs to meet desired needs. 4. Ability to understand and reason out the working of Unix Systems 5. Build an application/service over a Unix system.
Module 1 **8 Hours**
UNIX and ANSI Standards: The ANSI C Standard, The ANSI/ISO C++ Standards, Difference between ANSI C and C++, The POSIX Standards, The POSIX.1 FIPS Standard, The X/Open Standards. UNIX and POSIX APIs: The POSIX APIs, The UNIX and POSIX Development Environment, API Common Characteristics. Introduction to UNIX - Introduction, History, Architecture, Experience the Unix environment, Basic commands ls, cat, cal, date, calendar, who, printf, tty, sty, uname, passwd, echo, tput, and bc.
Module 2 **8 Hours**
UNIX Files and APIs : File Types, The UNIX and POSIX File System, The UNIX and POSIX File Attributes, Inodes in UNIX System V, Application Program Interface to Files, UNIX Kernel Support for Files, Relationship of C Stream Pointers and File Descriptors, Directory Files, Hard and Symbolic Links. UNIX File APIs.
Module 3 **8 Hours**
UNIX Processes and Process Control: The Environment of a UNIX Process: Introduction, main function, Process Termination, Command-Line Arguments, Environment List, Memory Layout of a C Program, Shared Libraries, Memory Allocation, Environment Variables, setjmp and longjmp Functions, getrlimit, setrlimit Functions, UNIX Kernel Support for Processes. Process Control: Introduction, Process Identifiers, fork, vfork, exit, wait, waitpid, wait3, wait4 Functions, Race Conditions, exec Functions, Changing User IDs and Group IDs, Interpreter Files, system Function, Process Accounting, User Identification, Process Times, I/O Redirection.

Module 4	8 Hours
Signals and Daemon Processes: Signals: The UNIX Kernel Support for Signals, signal, Signal Mask, sigaction, The SIGCHLD Signal and the waitpid Function, The sigsetjmp and siglongjmp Functions, Kill, Alarm, Interval Timers, POSIX.lb Timers. Daemon Processes: Introduction, Daemon Characteristics, Coding Rules, Error Logging, Client- Server Model	
Module 5	**8 Hours**
Interprocess Communication : Overview of IPC Methods, Pipes, popen, pclose Functions, Coprocesses, FIFOs, System V IPC, Message Queues, Semaphores. Shared Memory, Client-Server Properties, Stream Pipes, Passing File Descriptors, An Open Server-Version 1, Client-Server Connection Functions.	
Course Outcomes:At the end of the course the students will be able to	
CO1	Learn fundamentals of Unix system and its applications
CO2	Understand the basic image processing operations to enhance, segment the images
CO3	Understand the analyzing and extraction of relevant features of the concerned domain problem
CO4	Understand and apply the motion concepts and its relevance in real time applications
CO5	Apply the knowledge in solving high level unix system problems.
Textbooks:	
1	Charlie jacob, "Unix Programming System: An Introduction", Springer-Verlag
2	Hassan K Khalil, Unix Systems, Prentice - Hall International (US), 2006.
References:	
1	V R Ganapthi, "Interprocess Communication", Prentice-Hall, India, 1991, 2. Shankar Sastry, "Nonlinear System Analysis, Stability and Control", Springer, 1999

Continuous Internal Evaluation (CIE):

- Three CIE Will be conducted for 50 marks each and average of three will be taken (A)
- Three Quizzes will be conducted along with CIE for 10 Marks Each. Sum of three quizzes will be considered for 30 marks (B)

- Two Assignments for 10 marks each and the sum of both the assignments will be taken for 20 Marks (C)

Final CIE Marks will be calculated as (A+B+C)/2 for 50 marks

Semester End Examination (SEE):

The question paper consists of two parts, A and B

Part A: consists of 10 questions of 2 marks each. It is designed to cover the entire syllabus comprehensively.

Part B: The question paper will have 10 questions. Each question is set for 16 marks. There will be 2 questions from each module, with a maximum of 2 subdivisions. Students have to answer any 5 questions choosing one full question from each module.

The SEE Theory marks of 100 will be scaled down to 50.

The final score for the course in the ratio of 50:50 of CIE and SEE Marks

CO-PO MAPPING

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	3	3	3	3						
CO2	2	3	3	2	3						
CO3	2	2	3	2	3						
CO4	2	2	3	2	3						
CO5	2	2	2	2	3						

3-High 2- Moderate 1- Low

Semester V		
Distributed Systems		
Course Code:	MVJ22IS554	CIE Marks:50
L: T:P:S	3: 0: 0 : 0	SEE Marks:50
Credits:	3	Total Marks:100
Hours:	40Hrs Theory	Exam Hours:3

Course Objectives : This Course will enable the students to	
Understand fundamental concepts in Distributed systems Understand the problem-solving techniques and knowledge representation. Design intelligent components or programs to meet desired needs. Implement, and evaluate a computer-based distributed systems. Understand fundamental concepts in Distributed systems.	
Module 1	**8 Hrs**
Distributed Systems: Characterization of Distributed Systems: Introduction Examples of DS, Resource sharing and the Web, Challenges System Models Architectural Models, Fundamental Models	
Module 2	**8 Hrs**
Files and APIs: For complete syllabus and results, class timetable and more pls download iStudy. It's a light weight, easy to use, no images, no pdfs platform to make students life easier.	
Module 3	**8 Hrs**
Operating System Support: Introduction, The OS layer, Protection, Processes and Threads, Communication and Invocation, Operating system architecture Distributed File Systems: Introduction, File Service architecture, Sun Network File System	
Module 4	**8 Hrs**
Time and Global States: Introduction, Clocks, events and process status, synchronizing physical clocks, Logical time and logical clocks, Global states Coordination and Agreement: Introduction, Distributed mutual exclusion, Elections	
Module 5	**8 Hrs**
Inter-process Communication: Introduction, The API for the Internet Protocols, External Data Representation and Marshalling, Client-Server Communication, Group Communication, Case Study: IPC in UNIX.	

Course Outcome: At the end of the course the students will be able to

S.No	Description	Bloom's Level	Mapping with PO & PSO
CO1	Understand the characteristics, models, and challenges of distributed systems and their relevance in modern computing.	L1	PO1, PO2, PO6, PO12, PSO1
CO2	Analyze file system structures, operating system support, and distributed file system architectures.	L2	PO1, PO2, PO3, PO5, PO6, PO12, PSO2
CO3	Apply time synchronization techniques, logical clocks, and coordination methods in distributed systems.	L3	PO3, PO4, PO5, PO7, PO8, PSO2
CO4	Evaluate inter-process communication mechanisms and their efficiency in distributed environments.	L4	PO1, , PSO1, PSO2
CO5	Develop distributed applications by integrating file systems, IPC, and time coordination principles.	L6	PO1, , PO11, PSO1, PSO2

Textbooks:

1	George Coulouris, Jean Dollimore and Tim Kindberg: Distributed Systems – Concepts and Design, 5th Edition, Pearson Publications, 2009

References:

1	T Andrew S Tanenbaum: Distributed Operating Systems, 3rd edition, Pearson publication, 2007
2	AjayD. Kshemkalyani and MukeshSinghal, Distributed Computing: Principles, Algorithms and Systems, Cambridge University Press, 2008
3	Sunita Mahajan, Seema Shan, Distributed Computing, Oxford University Press,2015

Continuous Internal Evaluation (CIE):

- Three CIE Will be conducted for 50 marks each and average of three will be taken (A)
- Three Quizzes will be conducted along with CIE for 10 Marks Each. Sum of three quizzes will be considered for 30 marks (B)
- Two Assignments for 10 marks each and the sum of both the assignments will be taken for 20 Marks (C)

Final CIE Marks will be calculated as (A+B+C)/2 for 50 marks

Semester End Examination (SEE):

The theory exam consists of a written paper structured into two parts:
Part A: Carries 20 marks which include either objective-type or short descriptive questions. It is designed to cover the entire syllabus comprehensively.
Part B: This section carries a total of 80 marks and consists of 5 questions, with Either or choices. Students are required to answer one full question per module, selecting from the choices. Each question is valued at 16 marks and may include up to two sub-parts.
The SEE Theory marks of 100 will be scaled down to 50.

The final score for the course in the ratio of 50:50 of CIE and SEE Marks

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	3	2	3							3
CO2	2	2	3	3							2
CO3	2	2	2	3							3
CO4	3	2	3	2							2
CO5	2	3	3	2							3

3-High 2- Moderate 1-low

Semester: V		
INNOVATIVE AND ENTREPRENEURSHIP		
Course Code:	MVJ22IE555	CIE Marks: 50
L: T:P:S	3:0:0	SEE Marks: 50
Credits:	3	Total :100
Hours:	40Hrs Theory	SEE Duration: 3 Hrs.

Course Learning Objectives: The students will be able to	
1	Inspired; develop entrepreneurial mindset and attributes; entrepreneurial skill sets for venture creation and intrapreneurial leadership
2	Apply the process of problem-opportunity identification and feasibility assessment by developing a macro perspective of the real market, industries, domains, and customers while using design thinking principles to refine and pivot their venture idea.
3	Analyze Customer and Market segmentation, estimate Market size, and develop and validate Customer Persona.
4	Initiate Solution design, develop MVP, and determine Product-Market fit prototypes.
5	Craft initial Business plan, Develop go-to-market strategies apply storytelling skills in presenting a persuasive and defensible Venture Pitch.

UNIT-I	
Entrepreneurship Fundamentals & Context Meaning and concept, attributes and mindset of entrepreneurial and intrapreneurial leadership, role models in each and their role in economic development. Gamified role play-based exploration aligned to one's short-term career aspiration and ambition. An understanding of how to build an entrepreneurial mindset, skillsets, attributes, and networks while on campus. **Core Teaching Tool:** Simulation, Game, Industry Case Studies (Personalized for students – 16 industries to choose from), Venture Activity	8Hrs

UNIT-II	
Problem & Customer Identification: Understanding and analyzing the macro-problem and Industry perspective, technological, socio-economic, and urbanization trends and their implication on new opportunities. Identifying passion, identifying and defining problems using Design thinking principles. Analyzing problems and validating with the potential customer. Iterating problem-customer fit. Understanding customer segmentation, creating and validating customer personas. Competition and Industry trends mapping and assessing initial opportunity. **Core Teaching Tool:** Several types of activities including Class, game, Gen AI, 'Get out of the building', and Venture Activities.	8Hrs

UNIT-III	
Solution design & Prototyping: Understanding Customer Jobs-to-be-done and crafting innovative solution design to map to customers' needs and create a strong value proposition. Developing Problem-solution fit iteratively. Understanding prototyping and MVP. Developing a feasibility prototype with differentiating values, features, and benefits. Initial testing for proof-of-concept and iteration on the prototype. **Core Teaching Tool:** Venture Activity, no code Innovation tools, Class activity	8Hrs
UNIT-IV	
Opportunity Assessment and Sizing, Business & Financial Model: Assess relative market position via competition analysis, sizing the market, and assessing the scope and potential scale of the opportunity. **Core Teaching Tool**: Class and Venture Activity Introduction to Business model and types, Lean approach, 9 block lean canvas model, riskiest assumptions to Business models. Importance of Build–Measure–Lean approach. Business planning: components of Business plan- Sales plan, People plan, and financial plan.	8Hrs
UNIT-V	
Go-to-Market Plan, Scale Outlook, and Venture Pitch Readiness: Financial Planning: Types of costs, preparing a financial plan for profitability using a financial template, understanding the basics of Unit economics, and analyzing financial performance. Introduction to Marketing and Sales, Selecting the Right Channel, creating a digital presence, and building customer acquisition strategy. Choosing a form of business organization specific to your venture, identifying sources of funds: Debt & Equity, Map the Start-up Lifecycle to Funding Options. **Core Teaching Tool:** Founder Case Studies – Sama and Securely Share; Class activity and discussions; Venture Activities. **Scale Outlook and Venture Pitch readiness**: Understand and identify potential and aspiration for scale vis a vis your venture idea. Persuasive Storytelling and its key components. Build an Investor-ready pitch deck. **Core Teaching Tool**: Expert talks; Cases; Class activity and discussions; Venture Activities	8Hrs

Course outcomes	Description	POs
CO1	Understand Entrepreneurial Skillset and Mindset	1,2,3,9,12
CO2	Understand and analyze industry problems and Enhance customer personas based on market/other feedback	3,4,5,12
CO3	Understand and develop MVPs	3,5,6,9,12
CO4	Understand and apply Business models and Business planning.	3,5,9,12
CO5	Develop a go-to-market strategy and build a Persuasive sales pitch	3,6,7,8,10,12

Textbooks

1. Robert D. Hisrich, Michael P. Peters, Dean A. Shepherd, Sabyasachi Sinha (2020). Entrepreneurship, McGrawHill, 11th Edition.
2. Ries, E. (2011). The Lean Startup: How Today's Entrepreneurs Use Continuous
Innovation to Create Radically Successful Businesses. Crown Business
3. Osterwalder, A., & Pigneur, Y. (2010). Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers. John Wiley & Sons.
4. Chowdhry Ajay, (2023) Just Aspire: Notes on Technology, Entrepreneurship and the Future.
5. Simon Sinek (2011) Start with Why, Penguin Books limited.
6. Brown Tim (2019) Change by Design Revised & Updated: How Design Thinking Transforms Organizations and Inspires Innovation, Harper Business
7. Namita Thapar (2022) The Dolphin and the Shark: Stories on Entrepreneurship, Penguin Books Limited.

References

1. Collins Jim, Porras Jerry, (2004) Built to Last: Successful Habits of Visionary Companies
2. Burlington Bo, (2016) Small Giants: Companies That Choose to Be Great Instead of Big
3.. Saras D. Sarasvathy, (2008) Effectuation: Elements of Entrepreneurial Expertise, Elgar Publishing Ltd

Web Resources

• Learning resource- IgniteX Course Wadhwani platform (Includes 200+ components of
custom created modular content + 500+ components of the most relevant curated content)

Continuous Internal Evaluation (CIE) – 50 Marks

The CIE for the mandatory credit courses common across all disciplines comprises of two components as follows:

Internal Assessment Tests (30 Marks):

Two Internal Assessment tests will be conducted, each comprising 50 multiple choice questions for a total of 50 marks. The average of the two test scores will be scaled down to 30 marks.

Assignments (20 Marks):

Students are required to complete two assignments, each carrying 10 marks. These assignments may include projects*, poster presentations*, seminars*, or similar academic activities. The marks of the two assignments are added to get 20 marks.

*Each assignment will undergo two rounds of evaluation to assess progress and quality

At the beginning of the semester, the instructor/faculty teaching the course has to announce the methods of Assignment for the course.

Together, these two components are added to get the Final CIE marks of 50.

Semester End Examination (SEE) – 50 Marks

A Semester End Examination is conducted for 50 marks comprising of multiple-choice questions (MCQ) type each of one mark.

The final score for the course out of 100 is the SumTotal of SEE and CIE.

MAPPING OF COs AND POs:

CO/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2						2			2	2		
CO2			2	2	2							2			
CO3			2		2	2			2			2			
CO4			2		2				2			2			
CO5			2			2	2	2		2		2			

3-High 2- Moderate 1-low

Semester: V		
RESEARCH METHODOLOGY AND IPR		
Course Code:	MVJ22RMI57	CIE Marks: 50
L: T:P:S	3:0:2:0	SEE Marks: 50
Credits:	1	Total :100
Hours:	26Hrs Theory	SEE Duration: 3 Hrs.

Course Learning Objectives: The students will be able to	
1	To give an overview of the research methodology and explain the technique of defining a research problem and explain the basic ethics in research.
2	To develop a suitable outline for research studies through various sources of information from literature review and data collection.
3	To develop an understanding of the results and on analysis of the work carried.
4	To Demonstrate enhanced Scientific writing skills.
5	To Develop an Understanding on Various Intellectual Property Rights and importance of filing patents.

UNIT-I	
Research Methodology: Introduction, Meaning of Research, Objectives of Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Research Process, Criteria of Good Research, Defining the Research Problem: Research Problem, Selecting the Problem, Necessity of Defining the Problem. Technique Involved in defining a problem and Illustrations. **Ethics in Engineering Research:** Ethics in Engineering Research Practice, Types of Research Misconduct, Ethical Issues Related to Authorship.	8 Hrs
UNIT-II	
Research Writing and Journal Publication Skills: Understanding the importance of quality research papers, Differences between conference papers, journal articles, and other academic publications, criteria for selecting a journal, understanding impact factors and journal rankings. place of the literature review in research, how to review the literature, structure of a research paper, effective use of figures and tables, preparing a cover letter and author contributions, Responding to reviewers' comments. **Attributions and Citations:** Giving Credit Wherever Due, Citations: Functions and Attributes, Impact of Title and Keywords on Citations,	8 Hrs

Knowledge Flow through Citation, Citing Datasets, Styles for Citations, Tools for citation management, Acknowledgments and Attributions, What Should Be Acknowledged, Acknowledgments in, Books Dissertations, Dedication or Acknowledgments.	
UNIT-III	
Research Design: Meaning of Research Design, Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs case of Exploratory research studies, case of descriptive and diagnostic research, case of hypothesis -testing, Basic Principles of Experimental Designs, Important Experimental Designs. **Results and Analysis:** Importance and scientific methodology in recording results, importance of negative results, different ways of recording, industrial requirement, artifacts versus true results, types of analysis (analytical, objective, subjective), outcome as new idea, hypothesis, concept, theory, model etc.	**8 Hrs**
UNIT-IV	
Interpretation and Report Writing: Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, types of reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports.	**8 Hrs**
UNIT-V	
Introduction to Intellectual Property Rights: Meaning of property, Origin, Nature, Meaning of Intellectual Property Rights. **Kinds of Intellectual property rights**—Copy Right, Patent, Trademark, Trade Secret and trade dress, Design, Layout Design, Geographical Indication, Plant Varieties and Traditional Knowledge. **Patents:** Trips Definition, Patentable and Non-Patentable inventions, Legal requirements for patents. **Patent application process:** Prior art search, drafting of a patent, Filing of a patent, Patent document: specification and claims, Granting of patent, Management of IP, Commercialization of IP – Assignment, licensing and infringement.	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Formulate the research problem and follow research ethics.
CO2	Carry out a Literature survey for the topic identified
CO3	Analyse the research and interpret the outcomes of the research.
CO4	Enhance their technical writing skills
CO5	Understand the importance of Patenting, Licensing and technology transfer.

Text Books

1.	C.R. Kothari, Research Methodology, Methods and Techniques, 2nd Revised edition, New Age International Publishers, 2015
2.	Neeraj Pandey and Khushdeep Dharni, Intellectual Property Rights, PHI Learning Pvt Ltd, 2014

Reference Books	
1.	Geoffrey Marczyk, David De Matteo, David Festinger (2005) Essentials of Research Design and Methodology, John Wiley & Sons, Inc.
2.	Carol Ellison (2010) McGraw-Hill's Concise Guide to Writing Research Papers, McGraw-Hill
3.	Sinha, S.C. and Dhiman, A.K., (2002). Research Methodology, Ess Publications. 2nd volume.
4.	Wadehra, B.L. (2000). Law relating to patents, trademarks, copyright designs and geographical indications. Universal Law Publishing

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%.

The student has to obtain a minimum of 40% of maximum marks in CIE and a minimum of 40% of maximum marks in SEE.

Semester End Exam (SEE) is conducted for 50 marks (2 hours duration).

Based on this grading will be awarded.

The student has to score a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

Three Unit Tests each of 30 Marks (30 MCQ's) (duration 01 hour)

1. First test at the end of 5th week of the semester.
2. Second test at the end of the 10th week of the semester.
3. Third test at the end of the 15th week of the semester.

Report Writing /Presentation/ Assignment to attain the COs and POs for 20 Marks, (Students can decide the topic for Mini Project and start doing literature survey, report of literature survey can be considered for assignments) At the end of the 13th week of the semester

The average of three tests and report writing/presentation/Assignment summing to 50 marks

Semester End Examination:

Theory SEE will be conducted by College as per the scheduled timetable, with common question paper for the subject

SEE paper will be set for 50 questions of each of 01 marks. The pattern of the question paper is MCQ. The time allotted for SEE is 02 hours.

CO-PO/PSO Mapping													
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9	PO1 0	PO 11	PSO 1	PSO 2
CO1	3	2	-	1	2	2	-	-	1	1	1	1	1
CO2	3	2	3	2	2	2	-	1	1	1	-	2	2
CO3	1	2	3	3	2	2	-	1	1	1	-	1	2
CO4	1	2	3	3	3	2	-	1	1	-	1	1	2
CO5	1	1	1	2	2	1						2	2

High-3, Medium-2, Low-1

Semester: V		
ENVIRONMENTAL STUDIES		
Course Code:	MVJ22ENV58	CIE Marks: 50
L: T:P:S	1:0:0:0/2:0:0:0	SEE Marks: 50
Credits:	1 / 2	Total :100
Hours:	12 Hrs Theory / 24 Hrs Theory	SEE Duration: 3 Hrs.

UNIT-I	L1,L2
Introduction to environmental studies, Multidisciplinary nature of environmental studies; Scope and importance; Concept of sustainability and sustainable development. **Ecosystems (Structure and Function):** Forest, Desert, Rivers, **Ocean Biodiversity:** Types, Hot spots; Threats and Conservation of biodiversity, Deforestation. Video link: https://nptel.ac.in/courses/127/106/127106004/	6 Hrs
UNIT-II	**L1,L2**
Advances in Energy Systems (Merits, Demerits, Global Status and Applications): Hydrogen, Solar, Tidal and Wind. **Natural Resource Management (Concept and case-study):** Disaster Management, Sustainable Mining and Carbon Trading. Video link: https://nptel.ac.in/courses/121/106/121106014/	6 Hrs
UNIT-III	**L1,L2**
Environmental Pollution: Surface and Ground Water Pollution, Noise pollution, Soil Pollution and Air Pollution. **Waste Management & Public Health Aspects:** Bio-medical Waste, Solid waste, Hazardous waste and E-waste. Video link: • https://nptel.ac.in/courses/122/106/122106030/ • https://nptel.ac.in/courses/105/103/105103205/ • https://nptel.ac.in/courses/120/108/120108005/ • https://nptel.ac.in/courses/105/105/105105160/	6 Hrs
UNIT-IV	**L1,L2**
Global Environmental Concerns (Concept, policies, and case-studies): Global Warming, Climate Change, Acid Rain, Ozone Depletion and Fluoride problem in drinking water. Video link: • https://nptel.ac.in/courses/122/106/122106030/ • https://nptel.ac.in/courses/120108004/ https://onlinecourses.nptel.ac.in/noc19_ge23/preview	6 Hrs
UNIT-V	**L1,L2**
Latest Developments in Environmental Pollution Mitigation Tools	6 Hrs

(Concept and Applications): G.I.S. & Remote Sensing, Environment Impact Assessment, Environmental Management Systems. Video link: • https://nptel.ac.in/courses/105/102/105102015/ • https://nptel.ac.in/courses/120/108/120108004/	
Course Outcomes: After completing the course, the students will be able to	
CO1	Describe the principles of ecology and environmental issues that apply to air, land, and water issues on a global scale.
CO2	Develop critical thinking and/or observation skills, and apply them to the analysis of a problem or question related to the environment.
CO3	Demonstrate ecology knowledge of a complex relationship between biotic and Abiotic components.
CO4	Apply their ecological knowledge to illustrate and graph a problem
CO5	Describe the realities that managers face when dealing with complex issues.
Reference Books	
1.	Raman Siva kumar, "Principals of Environmental Science and Engineering", 2nd Edition, Cengage learning, Singapur.
2.	G.Tyler Miller, "Environmental Science – working with the Earth", 11th Edition, Jr. Thomson Brooks /Cole publications, California.
3	Pratiba Singh, Anoop Singh & Piyush Malaviya , "Environmental and Ecology", 1st Edition , ACME Learning Pvt. Ltd. New Delhi.

Continuous Internal Evaluation (CIE) – 50 Marks

The CIE for the mandatory credit courses common across all disciplines comprises of two components as follows:

Internal Assessment Tests (30 Marks):

Two Internal Assessment tests will be conducted, each comprising 50 multiple choice questions for a total of 50 marks. The average of the two test scores will be scaled down to 30 marks.

Assignments (20 Marks):

Students are required to complete two assignments, each carrying 10 marks. These assignments may include projects*, poster presentations*, seminars*, or similar academic activities. The marks of the two assignments are added to get 20 marks.

*Each assignment will undergo two rounds of evaluation to assess progress and quality

At the beginning of the semester, the instructor/faculty teaching the course has to announce the methods of Assignment for the course.

Together, these two components are added to get the Final CIE marks of 50.

Semester End Examination (SEE) – 50 Marks

A Semester End Examination is conducted for 50 marks comprising of multiple-choice questions (MCQ) type each of one mark.

The final score for the course out of 100 is the SumTotal of SEE and CIE.

VI SEMESTER

SEMESTER -VI		
Full Stack Development		
Course Code:	MVJ22IS61	CIE Marks:50
L: T:P:S	3: 0: 2:0	SEE Marks:50
Credits:	4	Total Marks:100
Hours:	40 Hrs Theory +24 Hrs Practical	Exam Hours:3

COURSE OBJECTIVES: This course will enable students to

1. Explain the use of learning full stack web development.
2. Make use of rapid application development in the design of responsive web pages.
3. Illustrate Models, Views and Templates with their connectivity in Django for full stack web development.
4. Demonstrate the use of state management and admin interfaces automation in Django.

Module 1	8hrs

The Modern Web: Rise of the web, Mobile web, The state of HTML, Applications vs web sites

Planning your Work: Identifying Requirements, Defining the work, Tracking the work, Continuous Improvements

User Experience: Information Architecture, Getting the user Experience, Polishing the user Experience, Implementing The user Experience.

MODULE-II	8hrs

Front End: HTML, From Server to browser, Styling, Components, Responsive design, Progressive Enhancement, search engine Optimization.

Javascript: Asynchronicity, Javascript in the browser, Offline First Development, Document object Model, Server side javascript, Javascript Modules, Structuring your javascript, javascript types, Functional Programming, Connecting components together , communication between components

MODULE-III	8hrs

Accessibility : working with Assistive Technologies, Dealing with interative UI, Testing for Accessibilty, Avoiding common mistakes

API: API responsibilities, Designing REST API, Securing Your API, Event Based APIs, Discovering APIs, Using APIs, API testing – postman

MODULE-IV	8hrs

Deployment: Twelve Factor Apps, Developer Machines, Production Environments, Moving code into Production, Infrastructure, Immutable infrastructure, Continuous

Delivery and Continuous Deployment	
MODULE-V	**8hrs**
Introduction to React JS: Introduction, understanding Components and Props, State and Lifecycle, React Hooks, handling Events, Working with Forms, Conditional Rendering, List and Keys, Styling in React JS .	
LABORATORY EXPERIMENTS	
1. Write a program to create a simple webpage using HTML.	2 Hours
2. Write a program to create a website using HTML CSS and JavaScript	2 Hours
3. Write a program to build a Chat module using HTML CSS and JavaScript	2 Hours
4. Write a program to create a simple calculator Application using React JS	2 Hours
5. Write a program to create a voting application using React JS	2 Hours
6. Write a program to create and Build a Password Strength Check using JQuery	Hours
7. Write a program to create and Build a star rating system using JQuery	2 Hours
8. Create a Simple Login form using React JS	2 Hours
9. Using the CMS users must be able to design a web page using the drag and drop method	2 Hours
10. Create a project on Grocery delivery application	2 Hours
11. Connecting our TODO React js Project with Firebase	2 Hours
Course outcomes: Students will able to	
CO1	Understand modern web architecture, planning workflows, and designing for user experience.
CO2	Apply front-end technologies like HTML, CSS, and JavaScript to develop responsive and SEO-friendly web interfaces.
CO3	Analyze accessibility needs and develop accessible, API-integrated applications.
CO4	Evaluate deployment strategies, CI/CD workflows, and advanced component-based UI development using ReactJS.

Textbooks:	
1	The Full Stack Developer Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer, Chris Northwood https://doi.org/10.1007/978-1-4842-4152-3
2	Learning React JavaScript Library From Scratch eBook : Sidelnikov, Greg.
Reference Books:	
1	Designing Web APIs" by Brenda Jin, Saurabh Sahni, Amir Shevat Publisher: O'Reilly Media Edition: 1st (2018) ISBN: 9781492026924
2	"Learning React: Modern Patterns for Developing React Apps" by Alex Banks and Eve Porcello Publisher: O'Reilly Media Edition: 3rd Edition (2023) ISBN: 9781098116743
3	Frontend Architecture for Design Systems" by Micah Godbolt Publisher: O'Reilly Media Edition: 1st (2016) ISBN: 9781491926782

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

- Three CIE Will be conducted for 50 marks each and average of three will be taken (A)
- Three Quizzes will be conducted along with CIE for 10 Marks Each. Sum of three quizzes will be considered for 30 marks (B)
- Two Assignments for 10 marks each and the sum of both the assignments will be taken for 20 Marks (C)

Final CIE Marks will be calculated as (A+B+C)/2 for 50 marks

Laboratory- 50 Marks

Weekly Evaluation 30 Marks
Lab Continuous Evaluation :30 Marks
Continuous evaluation will be conducted for Lab experiment. Marks of each evaluation includes based on attendance, Experiment conduction, performance in lab, Record / Observation and viva, for all the experiments. The total Continuous evaluated marks will be scaled to 30 marks. (A)

Two CIE for 20 Marks each and take the average for 20 Marks (B)

Final CIE Marks will be calculated as A+B for 50 marks

For IPCC Final CIE Marks will be calculated as Average of CIE and Lab CIE for 50 marks.

Semester End Examination (SEE)

SEE Theory Examination (100 Marks)

The theory exam consists of a written paper structured into two parts:

Part A: Carries 20 marks which include either objective-type or short descriptive questions. It is designed to cover the entire syllabus comprehensively.

Part B: This section carries a total of 80 marks and consists of 5 questions, with Either or choices. Students are required to answer one full question per module, selecting from the choices. Each question is valued at 16 marks and may include up to two sub-parts.

The SEE Theory marks of 100 will be scaled down to 50 (A)

SEE Laboratory Examination (50 Marks)

The laboratory SEE is also evaluated for 50 marks, distributed as follows:

Experiment Conduction with Results: 40 marks

Viva Voce: 10 marks

Total 50 marks (B)

The score for the SEE is A+B of total 100 marks

The final score for the course in the ratio of 50:50 of CIE and SEE Marks

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	2	2	1	–	–	2	3	–
CO2	3	3	3	3	3	–	–	–	2	3	–
CO3	3	3	3	3	3	2	2	2	3	3	1
CO4	3	3	3	3	3	1	–	–	2	3	2

3-High 2- Moderate 1-low

SEMESTER -VI		
Machine Learning		
Course Code:	MVJ22IS62	CIE Marks:50
L: T:P:S:	3:0:0:0	SEE Marks:50
Credits:	3	Total :100
Hours:	40Hrs Theory	Exam Duration:3

Course objectives: The course will enable the students to

1. Understand fundamentals of machine learning, including the types of learning, data pre-processing techniques, and design principles, to enable them to develop effective learning systems that can tackle real-world problems.\

2. Implement and evaluate regression and classification models, including linear and polynomial regression, logistic regression, and decision trees, to solve real-world problems and make informed decisions.

3. Understand classification techniques, including decision trees, random forests, naive Bayes, K-NN, SVM, and evaluation metrics, to develop robust and accurate classification models that can handle complex data sets and real-world applications.

4. Understand the concepts and techniques of clustering and artificial neural networks, enabling them to apply clustering algorithms and design neural networks to solve real-world problems, including data clustering, classification, and prediction.

5. Understand the fundamentals of reinforcement learning and deep learning, enabling them to understand the concepts of learning from feedback and building deep neural networks to solve complex problems in artificial intelligence, such as decision-making and pattern recognition.

Module 1	8hrs

Introduction: Well-Posed learning problems, Basic concepts, Designing a learning system, Issues in machine learning. Types of machine learning: Learning associations, Supervised learning, Unsupervised learning, and Reinforcement learning.

Data Pre-processing: Need of Data Pre-processing, Data Pre-processing Methods: Data Cleaning, Data Integration, Data Transformation, Data Reduction; Feature Scaling (Normalization and Standardization), Splitting dataset into Training and Testing set.

Association Rules Learning: Need and Application of Association Rules Learning, Basic concepts of Association Rule Mining, Naïve algorithm, Apriori algorithm

Module-2	8 Hours
Regression: Linear Regression, Multiple Linear Regression and Polynomial Regression, Evaluation Regression Model's Performance (RMSE, Mean Absolute Error, Correlation,RSquare),Regularization Methods Classification: Need and Applications of Classification, Logistic Regression, Decision tree.	
Module 3	**8hrs**
Advanced Classification: Tree induction algorithm – split algorithm based on information theory, split algorithm based on Gini index; Random Forest classification, Naïve Bayes algorithm; K-Nearest Neighbors (K-NN), Support Vector Machine (SVM), Evaluating Classification Model's Performance (Sensitivity, Specificity, Precision, Recall, etc.)	
Module 4	**8 hrs**
Clustering: Need and Applications of Clustering, Partitioned methods, Hierarchical methods, Density- based methods. Artificial Neural Networks: Introduction, Neural Network representation, Appropriate problems, Perceptron, Backpropagation algorithm	
Module 5	**8hrs**
Reinforcement Learning: Introduction, Learning Task, Q Learning. Deep Learning: Introduction to Deep Learning-Reasons to go Deep Learning.	
Course outcomes: Students will able to	
CO1	Understand the fundamental concepts and types of machine learning(supervised,unsupervised,reinforcement), including data preprocessing and association rule mining.
CO2	Apply regression, classification, and evaluation techniques(holdout, k-fold cross-validation, and leave-one-out cross-validation) to solve machine learning problems using real-world datasets.
CO3	Analyze performance of advanced classification, clustering, and neural networks with suitable evaluation metrics(accuracy, precision, recall, F1 score and confusion matrix).
CO4	Evaluate and select suitable ML strategies like reinforcement learning or deep learning based on learning tasks and performance.
Textbooks:	

1	Tom M. Mitchell, Machine Learning, India Edition 2013, McGraw Hill Education.
2	Alpaydin E., Introduction to Machine Learning, MIT Press (2014) 3rd Edition.
3	Vijayvargia Abhishek, Machine Learning with Python, BPB Publication (2018)
Reference Books:	
1	Trevor Hastie, Robert Tibshirani, Jerome Friedman, h The Elements of Statistical Learning, 2nd edition, springer series in statistics.
2	Ethem Alpaydin,Introduction toMachine learning,2nd Edition,MIT Press.

Continuous Internal Evaluation (CIE):

- Three CIE Will be conducted for 50 marks each and average of three will be taken (A)
- Three Quizzes will be conducted along with CIE for 10 Marks Each. Sum of three quizzes will be considered for 30 marks (B)
- Two Assignments for 10 marks each and the sum of both the assignments will be taken for 20 Marks (C)

Final CIE Marks will be calculated as (A+B+C)/2 for 50 marks

Semester End Examination (SEE):

The theory exam consists of a written paper structured into two parts:

Part A: Carries 20 marks which include either objective-type or short descriptive questions. It is designed to cover the entire syllabus comprehensively.

Part B: This section carries a total of 80 marks and consists of 5 questions, with Either or choices. Students are required to answer one full question per module, selecting from the choices. Each question is valued at 16 marks and may include up to two sub-parts.

The SEE Theory marks of 100 will be scaled down to 50.

The final score for the course in the ratio of 50:50 of CIE and SEE Marks

CO PO MAPPING

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	2	2	–	–	–	2	3	–
CO2	3	3	3	3	3	–	–	–	2	3	–
CO3	3	3	3	3	3	1	–	–	2	3	–
CO4	3	3	3	3	3	1	–	–	2	3	2

SEMESTER -VI		
Blockchain Technology		
Course Code:	MVJ22IS631	CIE Marks:50
L: T:P:S	3:0:0:0	SEE Marks: 50
Credits:	3	Total :100
Hours:	40Hrs Theory	Exam Duration:3

COURSE OBJECTVES: This course will enable students to

1. Familiarize the functional/operational aspects of cryptocurrency ecosystem.
2. Understand emerging abstract models for Blockchain Technology.
3. Understand how block chain systems (mainly Bitcoin and Ethereum) work and how to securely interact with them.
4. Identify major research challenges and technical gaps existing between theory and practice in cryptocurrency domain.
5. Design, build, and deploy smart contracts and distributed applications.

Module 1	8hrs

Basics: Distributed Database, Two General Problem, Byzantine General problem and Fault Tolerance, Hadoop Distributed File System, Distributed Hash Table, ASIC resistance, Turing Complete. Cryptography: Hash function, Digital Signature - ECDSA, Memory Hard Algorithm, Zero Knowledge Proof.

Module 2	8hrs

Block chain: Introduction, Advantage over conventional distributed database, Block chain Network, Mining Mechanism, Distributed Consensus, Merkle Patricia Tree, Gas Limit, Transactions and Fee, Anonymity, Reward, Chain Policy, Life of Block chain application, Soft & Hard Fork, Private and Public block chain.

Module 3	8hrs

Distributed Consensus: Nakamoto consensus, Proof of Work, Proof of Stake, Proof of Burn, Difficulty Level, Sybil Attack, Energy utilization and alternate.

Module 4	8hrs

Cryptocurrency: History, Distributed Ledger, Bitcoin protocols - Mining strategy and rewards, Ethereum - Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Sidechain,Name coin

Module 5	8 Hrs

Cryptocurrency Regulation: Stakeholders, Roots of Bit coin, Legal Aspects-Crypto currency Exchange, Black Market and Global Economy. Applications: Internet of Things, Medical Record Management System, Domain Name Service and future of Blockchain.

Course outcomes: Students will able to	
CO1	Understand the fundamental concepts of distributed databases, cryptography, and blockchain basics.
CO2	Apply distributed consensus mechanisms and blockchain components in relevant problem-solving scenarios.
CO3	Analyze the structure and functioning of cryptocurrencies like Bitcoin and Ethereum, and assess their vulnerabilities and protocols.
CO4	Evaluate the regulatory, economic, and real-world applications of blockchain and cryptocurrency systems.
Textbooks:	
1	Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction,Princeton University Press (July 19, 2016).
2	Antonopoulos, Mastering Bitcoin: Unlocking Digital Cryptocurrencies.
References:	
1	Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System.
2	DR. Gavin Wood, "ETHEREUM: A Secure Decentralized Transaction Ledger,"Yellow paper.2014
3	Nicola Atzei, Massimo Bartoletti, and Tiziana Cimoli, A survey of attacks on Ethereum smart contracts

Continuous Internal Evaluation (CIE):

- Three CIE Will be conducted for 50 marks each and average of three will be taken (A)
- Three Quizzes will be conducted along with CIE for 10 Marks Each. Sum of three quizzes will be considered for 30 marks (B)
- Two Assignments for 10 marks each and the sum of both the assignments will be taken for 20 Marks (C)

Final CIE Marks will be calculated as (A+B+C)/2 for 50 marks

Semester End Examination (SEE):

The theory exam consists of a written paper structured into two parts:

Part A: Carries 20 marks which include either objective-type or short descriptive questions. It is designed to cover the entire syllabus comprehensively.

Part B: This section carries a total of 80 marks and consists of 5 questions, with Either or choices. Students are required to answer one full question per module, selecting from the choices. Each question is valued at 16 marks and may include up to two sub-parts.

The SEE Theory marks of 100 will be scaled down to 50.

The final score for the course in the ratio of 50:50 of CIE and SEE Marks

CO-PO MAPPING

COPO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	2	2	–	–	–	–	2	–
CO2	3	3	3	3	3	–	–	–	2	3	–
CO3	3	3	3	3	3	1	2	–	2	3	–
CO4	3	3	3	3	3	2	3	2	2	3	2

SEMESTER -VI		
Internet of Things		
Course Code:	MVJ22IS632	CIE Marks:50
L: T:P:S	3:0:0:0	SEE Marks:50
Credits:	3	Total Marks:100
Hours:	40Hrs Theory	Exam Hours:3

Course Objectives

This course will enable the students to:

Assess the genesis and impact of IoT applications, architectures in real world

Illustrate diverse methods of deploying smart objects and connect them to network.

Compare different Application protocols for IoT.

Module 1	8hrs

What is IoT, Genesis of IoT, IoT and Digitization, IoT Impact, Convergence of IT and IoT, IoT Challenges, IoT Network Architecture and Design, Drivers Behind New Network Architectures, Comparing IoT Architectures, A Simplified IoT Architecture, The Core IoT Functional Stack, IoT Data Management and Compute Stack.

Textbook 1: Ch. 1,2

Module 2	8hrs

Smart Objects: The "Things" in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects, Communications Criteria, IoT Access Technologies, IP as the IoT Network Layer, The Business Case for IP, the need for Optimization, Optimizing IP for IoT, Profiles and Compliances.

Textbook 1: Chapter 3, 4, 5, 6

Module 3	8hrs

Application Protocols for IoT: The Transport Layer, IoT Application Transport Methods, Data and Analytics for IoT, An Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytics Tools and Technology, Edge Streaming Analytics, Network Analytics, Securing IoT, A Brief History of IOT Security

Textbook 1: Chapter 7

Module 4	8hrs
Common Challenges in OT Security, **How IT and OT Security Practices and Systems Vary, Formal** Risk Analysis Structures: OCTAVE and FAIR, The Phased Application of Security in an Operational Environment, IoT Physical Devices and Endpoints - Arduino UNO: Introduction to Arduino, Arduino UNO, Installing the Software, Fundamentals of Arduino Programming. IoT Physical Devices and Endpoints. **Textbook: Chapter 8, 12**	
Module 5	**8hrs**
RaspberryPi: Introduction to RaspberryPi, About the RaspberryPi Board: Hardware Layout, Operating Systems on RaspberryPi, Configuring RaspberryPi, Programming RaspberryPi with Python, Wireless Temperature Monitoring System Using Pi, DS18B20 Temperature Sensor, Connecting Raspberry Pi via SSH, Accessing Temperature from DS18B20 sensors, Remote access to RaspberryPi, Smart and Connected Cities, An IoT Strategy for Smarter Cities, Smart City IoT Architecture, Smart City Security Architecture, Smart City Use-Case Examples. **Textbook 2:** Ch.7.1 to 7.4, Ch.8.1 to 8.4, 8.6	
Course outcomes: Students will able to	
CO1	Understand the fundamentals of IoT architecture, components, and network design.
CO2	Apply knowledge of smart devices, protocols, and communication models in IoT environments.
CO3	Analyze IoT security issues, risk models, and data analytics in IoT-based systems.
CO4	Evaluate practical applications using Arduino, Raspberry Pi, and propose IoT-based solutions for smart cities and industrial automation.
Textbooks: **1** "IoTFundamentals: Networking Technologies, Protocols, and Use Cases for the Internet Of Things", David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, 1stEdition, Pearson Education (Cisco Press Indian Reprint). (ISBN: 978-9386873743 **2** "Internet of Things", Srinivasa K G,CENGAGE Leaning India,2017 **Video link** https://onlinecourses.nptel.ac.in/noc22_cs53/preview	

https://onlinecourses.nptel.ac.in/noc22_cs52/preview

Continuous Internal Evaluation (CIE):

- Three CIE Will be conducted for 50 marks each and average of three will be taken (A)
- Three Quizzes will be conducted along with CIE for 10 Marks Each. Sum of three quizzes will be considered for 30 marks (B)
- Two Assignments for 10 marks each and the sum of both the assignments will be taken for 20 Marks (C)

Final CIE Marks will be calculated as (A+B+C)/2 for 50 marks

Semester End Examination (SEE):

The theory exam consists of a written paper structured into two parts:

Part A: Carries 20 marks which include either objective-type or short descriptive questions. It is designed to cover the entire syllabus comprehensively

Part B: This section carries a total of 80 marks and consists of 5 questions, with Either or choices. Students are required to answer one full question per module, selecting from the choices. Each question is valued at 16 marks and may include up to two sub-parts.

The SEE Theory marks of 100 will be scaled down to 50.

The final score for the course in the ratio of 50:50 of CIE and SEE Marks

CO PO MAPPING

COPO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	2	2	–	–	–	–	2	–
CO2	3	3	3	3	3	–	–	–	2	3	–
CO3	3	3	3	3	3	2	2	–	2	3	1
CO4	3	3	3	3	3	2	3	2	2	3	2
CO5	3	2	2	2	2	–	–	–	–	2	–

SEMESTER -VI		
Compiler Design		
Course Code:	MVJ22IS633	CIE Marks:50
L: T:P:S	3:0:0:0	SEE Marks:50
Credits:	3	Total:100
Hours:	40Hrs Theory	Exam Duration:3

COURSE OBJECTIVES: *This course will enable students to*

1. Learn the various parsing techniques and different levels of translation.
2. Learn how to obtain specific object code from source language.
3. Learn how to optimize the code and schedule for optimal performance.

Module 1	8hrs

FRONT END OF COMPILERS: The Structure of Compiler – Lexical Analysis: Role of Lexical Analyzer, Specification and Recognition of Tokens, Syntax Analysis: Top Down Parsing, Bottom up Parsing, LR Parsers: SLR, CLR, and LALR.

Module 2	8hrs

INTERMEDIATE CODE GENERATION: Syntax Directed Definitions, Evaluation Orders for Syntax Directed Definitions, Syntax Directed Translation Schemes, Intermediate Languages: Syntax Tree, Three Address Code, Postfix Code, Declarations, Translation of Expressions, Type Checking, Back Patching.

Module 3	8hrs

RUNTIME AND OBJECT CODE GENERATION: Storage Organization, Stack Allocation Space, Access to Non-local Data on the Stack, Heap Management - Issues in Code Generation - Design of Code Generator - Register Allocation and Assignment – Instruction Selection by Tree Rewriting – Optimal Code Generation for Expressions – Dynamic Programming Code Generation.

Module 4	8hrs

CODE OPTIMIZATION: Basic Blocks and Flow Graphs – Optimization of Basic Blocks – Principal Sources of Optimizations – Data Flow Analysis – Constant Propagation – Partial Redundancy Elimination – Peephole Optimizations.

Module 5	8hrs

SCHEDULING AND OPTIMIZING FOR PARALLELISM:

Code Scheduling Constraints – Basic Block Scheduling – Global Code Scheduling - Basic Concepts in Parallelization – Parallelizing Matrix Multiplication – Iteration Spaces – Affine Array Indexes

Course outcomes: Students will able to	
CO1	Design compiler phases from language specification.
CO2	Design code generators for the specified machine.
CO3	Analyze Object Code Generation techniques.
CO4	Apply the various optimization techniques.
CO5	Understand the Optimizing for Parallelism

Textbooks:

1 Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, —Compilers: Principles, Techniques and Tools, Second Edition, Pearson Education, 2009.

2 Randy Allen, Ken Kennedy, —Optimizing Compilers for Modern Architectures: A Dependence based Approach, Morgan Kaufmann Publishers, 2002.

3 Keith D Cooper and Linda Torczon, —Engineering a Compiler, Morgan Kaufmann Publishers Elsevier Science, 2004

4 V. Raghavan, —Principles of Compiler Design, Tata McGraw Hill Education Publishers, 2010.

5 Allen I. Holub, —Compiler Design in C ‖ , Prentice-Hall Software Series, 1993.

6 Steven S. Muchnick, —Advanced Compiler Design and Implementation, Morgan Kaufmann Publishers - Elsevier Science, India, Indian Reprint 2003.

7 Keith D Cooper and Linda Torczon, —Engineering a Compiler ‖ , Morgan Kaufmann Publishers Elsevier Science, 2004

Continuous Internal Evaluation (CIE):

- Three CIE Will be conducted for 50 marks each and average of three will be taken (A)
- Three Quizzes will be conducted along with CIE for 10 Marks Each. Sum of three quizzes will be considered for 30 marks (B)
- Two Assignments for 10 marks each and the sum of both the assignments will be taken for 20 Marks (C)

Final CIE Marks will be calculated as (A+B+C)/2 for 50 marks

Semester End Examination (SEE):

The theory exam consists of a written paper structured into two parts:

Part A: Carries 20 marks which include either objective-type or short descriptive

questions. It is designed to cover the entire syllabus comprehensively.

Part B: This section carries a total of 80 marks and consists of 5 questions, with Either or choices. Students are required to answer one full question per module, selecting from the choices. Each question is valued at 16 marks and may include up to two sub-parts.

The SEE Theory marks of 100 will be scaled down to 50.

The final score for the course in the ratio of 50:50 of CIE and SEE Marks

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	1	3	3	2	3						
CO2	2	2	2	2	3						
CO3	1	3	3	2	3						
CO4	2	3	2	2	3						
CO5	2	3	1	2	3						

Semester: VI		
Cloud computing		
Course Code:	MVJ22IS634	CIE Marks: 50
L: T:P:S	3:0:0:0	SEE Marks: 50
Credits:	3	Total :100
Hours:	40Hrs Theory	SEE Duration: 3 Hrs.

COURSE OBJECTIVES: This Course will enable the students to

1. Understands cloud computing models and infrastructure for larger networks
2. Identify policies, mechanisms and scheduling for resource management, virtualization, and optimization of networks.
3. Compare multiple approaches to cloud system design and solve real world problems.
4. Illustrate storage concept and self-organizing capability for different cloud systems.

Understands cloud security and risk

Module 1	8hrs

Introduction, Cloud Infrastructure: Cloud computing, Cloud computing delivery models and services, Ethical issues, Cloud vulnerabilities, Cloud computing at Amazon, Cloud computing the Google perspective, Microsoft Windows Azure and online services

Module 2	8hrs

Cloud Computing: Application Paradigms: Challenges of cloud computing, Architectural styles of cloud computing, Workflows: Coordination of multiple activities, Coordination based on a state machine model: The Zookeeper, The Map Reduce programming model, A case study: The Gre The Web application, Cloud for science and engineering, High-performance computing on a cloud.

Module 3	8hrs

Cloud Resource Virtualization: Virtualization, Layering and virtualization, Virtual machine monitors, Virtual Machines, Performance and Security Isolation, Full virtualization and paravirtualization

Case Study: Xen a VMM based paravirtualization, Optimization of network virtualization, vBlades, Performance comparison of virtual machines, The dark side of virtualization, Exercises and problems

Module 4	8hrs

Cloud Resource Management and Scheduling: Policies and mechanisms for resource management, Application of control theory to task scheduling on a cloud, Stability of a two-level resource allocation architecture, Feedback control based on dynamic

thresholds, Coordination of specialized autonomic performance managers, A utility-based model for cloud-based Web services, Resourcing bundling: Combinatorial auctions for cloud resources, Scheduling algorithms for computing clouds, Exercises and problems.

Module 5	8hrs

Cloud Security, Cloud Application Development: Cloud security risks, Security: The top concern for cloud users, Privacy and privacy impact assessment, Trust, Operating system security, Virtual machine Security, Security of virtualization, Security risks posed by shared images, Security risks posed by a management OS, A trusted virtual machine monitor, A trust management service, A cloud service for adaptive data streaming, Cloud based optimal FPGA synthesis .Exercises and problems.

Course outcomes: Students will able to

CO1	Understand cloud computing concepts, architecture, service models, and major platforms like AWS, Google Cloud, and Azure.
CO2	Apply cloud programming models and virtualization techniques in real-world applications.
CO3	Analyze resource management, scheduling algorithms, and performance issues in a cloud environment.
CO4	Evaluate cloud security challenges, solutions, and ethical considerations in cloud deployment scenarios.

Textbooks:

1	Cloud Computing Theory and Practice, Dan C Marinescu ,Elsevier(MK) 2013.
2	Computing Principles and Paradigms, Rajkumar Buyya , James Broberg, Andrzej Goscinski Willey 2014.
3	Cloud Computing Implementation, Management and Security, John W Rittinghouse, James F Ransome CRC Press 2013

Continuous Internal Evaluation (CIE):

- Three CIE Will be conducted for 50 marks each and average of three will be taken (A)
- Three Quizzes will be conducted along with CIE for 10 Marks Each. Sum of three quizzes will be considered for 30 marks (B)
- Two Assignments for 10 marks each and the sum of both the assignments will be taken for 20 Marks (C)

Final CIE Marks will be calculated as (A+B+C)/2 for 50 marks

Semester End Examination (SEE):

The theory exam consists of a written paper structured into two parts:

Part A: Carries 20 marks which include either objective-type or short descriptive

questions. It is designed to cover the entire syllabus comprehensively.

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The SEE Theory marks of 100 will be scaled down to 50.

The final score for the course in the ratio of 50:50 of CIE and SEE Marks

CO-PO MAPPING

COPO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	1	2	2	1	–	–	1	–
CO2	3	3	3	2	3	–	–	–	–	2	–
CO3	3	3	3	3	3	–	–	–	–	2	1
CO4	3	2	2	2	3	3	2	2	–	3	1

SEMESTER -VI			
Introduction To Data Structures			
Course Code:	MVJ22IS641	CIE Marks	50
L: T:P:S	3:0:0:0	SEE Marks	50
Credits:	3	Total Marks	100
Hours:	40Hrs Theory	Exam Hours	3

COURSE OBJECTIVES: *This course will enable students to*

1. Discuss the fundamental concepts and principles of data structures.
2. Understand the importance of data structures in computer programming and problem solving.
3. A compressive overview of various data structures such as arrays, linked lists, stacks, queues, trees and graphs.
4. Prepare the students for advanced courses in algorithms, data analysis.

Module 1	8hrs

Introduction : Data Structures definition , classification of data structures , Arrays – Definition, Declaration , Types of arrays, Structures , Pointers.

Module 2	8hrs

Stacks- definition, implementation of stacks using arrays, operations of stacks.

Queues- Introduction, Types of queues, Linear queue using arrays, operations on linear queue, circular queue. Limitation of linear queue, Linear Queue vs circular queue.

Module 3	8hrs

Linked List -Linked-list and its types- singly linked lists- doubly-linked lists- circular linked lists, Applications of Linear Data Structures.

Module 4	8hrs

Non Linear Data Structures: Trees – Introduction , Terminologies, Representation of trees , Types of Trees, Application of trees , Binary Tree – Representation, Traversal techniques, Binary Search trees – Tree Construction, Expression trees. Application of Binary search tree.

Module 5	8hrs

Graphs: Introduction , terminologies, Representation of graphs , Connected graph , graph traversal techniques, Application of graphs in data structures .

Hashing- Hash Functions – Separate Chaining – Open Addressing – Rehashing –

Extensible Hashing.	
Course outcomes: Students will able to	
CO1	Understand cloud computing concepts, architecture, service models, and major platforms like AWS, Google Cloud, and Azure.
CO2	Apply cloud programming models and virtualization techniques in real-world applications.
CO3	Analyze resource management, scheduling algorithms, and performance issues in a cloud environment.
CO4	Evaluate cloud security challenges, solutions, and ethical considerations in cloud deployment scenarios.

Textbooks:	
1	Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education, 2011
2	Fundamentals of Data structures , Ellis Horowitz, sartaj sahni,
3	Alfred V. Aho, John E. Hopcroft and Jeffry D. Ullman, Data Structures & Algorithms, Pearson Education, New Delhi, 2006

Continuous Internal Evaluation (CIE):

- Three CIE Will be conducted for 50 marks each and average of three will be taken (A)
- Three Quizzes will be conducted along with CIE for 10 Marks Each. Sum of three quizzes will be considered for 30 marks (B)
- Two Assignments for 10 marks each and the sum of both the assignments will be taken for 20 Marks (C)

Final CIE Marks will be calculated as (A+B+C)/2 for 50 marks

Semester End Examination (SEE):

The theory exam consists of a written paper structured into two parts:

Part A: Carries 20 marks which include either objective-type or short descriptive questions. It is designed to cover the entire syllabus comprehensively.

Part B: This section carries a total of 80 marks and consists of 5 questions, with Either or choices. Students are required to answer one full question per module, selecting from the choices. Each question is valued at 16 marks and may include up to two sub-parts.

The SEE Theory marks of 100 will be scaled down to 50.

The final score for the course in the ratio of 50:50 of CIE and SEE Marks

CO-PO MAPPING

Semester: VI		
Fundamentals of Operating system		
Course Code:	MVJ22IS642	CIE Marks: 50
L: T:P:S	3:0:0:0	SEE Marks: 50
Credits:	3	Total :100
Hours:	40Hrs Theory	SEE Duration: 3 Hrs.

COURSE OBJECTIVES: *This course will enable students to*

1. understanding the fundamental concepts of operating systems.
2. Analyse the exchanging data between different process.
3. Discuss the deadlock mechanism in operating systems.
4. Recognize the importance of process and memory management.
5. Outline the features of files and file management systems.

Module 1	8hrs

The Basics: An overview: Introduction to operating systems, components of an operating systems, Evolution of operating system, architecture of operating system, Functions of operating system.

Module 2	8hrs

Operating system services, user and operating system interface, system calls and services, operating system structure, **Process:** Introduction, Process management, OS view of processes. Process states. **Interrupts:** Interrupts in operating systems, Interprocess communication, types of interprocess communications.

Module 3	8hrs

Deadlocks: what is Deadlock, Deadlock Characteristics, resource management, conditions of deadlock – Handling Deadlocks, deadlock avoidance, Deadlock Detection, Deadlock Recovery.

Module 4	8hrs

Process scheduling: Concept of Process Scheduling, operation on Processes scheduling, Scheduling criteria.

Memory Management: Memory organization in operating system, Memory Hierarchy, Memory Management Strategies. Contiguous Memory Allocation, Non-contiguous Memory Allocation.

Module 5	8hrs

File and Database Systems: File concept, Access methods, Data Hierarchy, Directory Structure, File Protection, File System Structure. File access control.

Course outcomes: Students will able to

CO1	Understand the structure, functions, and evolution of modern operating systems.
CO2	Apply OS concepts such as process management, memory management, and file systems.
CO3	Analyze process scheduling, deadlock handling, and inter-process communication mechanisms.
CO4	Evaluate different OS architectures and their strategies for resource management.

Textbooks:

1	"Operating System Concepts" by Abraham Silberschatz, Peter B. Galvin, and Greg Gagne, 10th ed.
2	"Modern Operating Systems" by Andrew S. Tanenbaum and Herbert Bos,5th ed.
3	"Operating Systems: Internals and Design Principles" by William Stallings,7th ed

Continuous Internal Evaluation (CIE):

- Three CIE Will be conducted for 50 marks each and average of three will be taken (A)
- Three Quizzes will be conducted along with CIE for 10 Marks Each. Sum of three quizzes will be considered for 30 marks (B)
- Two Assignments for 10 marks each and the sum of both the assignments will be taken for 20 Marks (C)

Final CIE Marks will be calculated as (A+B+C)/2 for 50 marks

Semester End Examination (SEE):

The theory exam consists of a written paper structured into two parts:

Part A: Carries 20 marks which include either objective-type or short descriptive questions. It is designed to cover the entire syllabus comprehensively.

Part B: This section carries a total of 80 marks and consists of 5 questions, with Either or choices. Students are required to answer one full question per module, selecting from the choices. Each question is valued at 16 marks and may include up to two sub-parts.

The SEE Theory marks of 100 will be scaled down to 50.

The final score for the course in the ratio of 50:50 of CIE and SEE Marks

CO-PO MAPPING

COPO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	1	2	–	–	–	–	1	–
CO2	3	3	2	2	2	–	–	–	–	2	–
CO3	3	3	3	3	2	–	–	–	–	2	1
CO4	3	2	3	3	3	–	–	–	–	3	1

SEMESTER -VI		
Mobile Application Development		
Course Code:	MVJ22IS643	CIE Marks:50
L: T:P:S	3:0:0:0	SEE Marks:50
Credits:	3	Total :100
Hours:	40Hrs Theory	Exam Duration-3

COURSE OBJECTIVES: *This course will enable students to*

1. Understand system requirements for mobile applications.
2. Generate suitable design using specific mobile development frameworks.
3. Implement the design using specific mobile development frameworks.
4. Deploy the mobile applications in marketplace for distribution.

Module 1	8hrs
Introduction: Introduction to mobile application - Market values for mobile applications System requirements for mobile application,Mobile application development architecture.	
Module 2	**8hrs**
Designing Applications using Android: Developing user interfaces -Layout -Input Controls and Events- Menus - Dialogs, Notifications and Toasts	
Module 3	**8hrs**
Multimedia & Services: Lifecycle of a Service - Managing ServicesGPS API Playing audio, video.	
Module 4	**8hrs**
Technology I Android: Introduction Establishing the development environment, Android architecture Activities and views Interacting with UI Persisting data using SQLite Packaging and deployment.	
Module 5	**8hrs**
Technology II IOS: Introduction to Objective C IOS features UI implementation Touch frameworks Data persistence using Core Data and SQLite.	

Course outcomes: Students able to

CO1	Understand the fundamentals of mobile application development and system requirements.
CO2	Apply design principles to create user interfaces and handle events using Android

CO3	Analyze and implement multimedia features and services within Android applications.
CO4	Evaluate and compare development environments and persistence mechanisms in Android and iOS platforms.

Textbooks:

1 James Dovey and Ash Furrow ,"Beginning objective C",Apress,20212 2 Android in Practice",Dream Tech,2012 Charlie Collins,Michael Galpin and MatthiasKappler

Continuous Internal Evaluation (CIE):

- Three CIE Will be conducted for 50 marks each and average of three will be taken (A)
- Three Quizzes will be conducted along with CIE for 10 Marks Each. Sum of three quizzes will be considered for 30 marks (B)
- Two Assignments for 10 marks each and the sum of both the assignments will be taken for 20 Marks (C)

Final CIE Marks will be calculated as (A+B+C)/2 for 50 marks

Semester End Examination (SEE):

The theory exam consists of a written paper structured into two parts:

Part A: Carries 20 marks which include either objective-type or short descriptive questions. It is designed to cover the entire syllabus comprehensively.
Part B: This section carries a total of 80 marks and consists of 5 questions, with Either or choices. Students are required to answer one full question per module, selecting from the choices. Each question is valued at 16 marks and may include up to two sub-parts.
The SEE Theory marks of 100 will be scaled down to 50.
The final score for the course in the ratio of 50:50 of CIE and SEE Marks

CO PO MAPPING

COPO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	1	2	–	–	–	–	1	–
CO2	3	3	3	2	3	–	–	–	–	2	–
CO3	3	3	3	3	3	–	–	–	–	2	1
CO4	3	2	3	3	3	–	–	–	–	3	1

Semester: VI		
Introduction to AI		
Course Code:	MVJ22IS644	CIE Marks: 50
L: T:P:S	3:0:0:0	SEE Marks: 50
Credits:	3	Total :100
Hours:	40Hrs Theory	SEE Duration: 3 Hrs.

COURSE OBJECTIVES: *This course will enable students to*

1. Identify the problems where AI is required and the different methods available
2. Compare and contrast different AI techniques available.
3. Define and explain learning algorithms

Module 1	8hrs
What is artificial intelligence?, Problems, Problem Spaces and search	
Module 2	**8hrs**
Knowledge Representation Issues, Using Predicate Logic, Representing knowledge using Rules.	
Module 3	**8hrs**
Symbolic Reasoning under Uncertainty, Statistical reasoning	
Module 4	**8hrs**
Heuristic search techniques: Generate and test, Hill Climbing, Best First Search, Problem Reduction, Constraint Satisfaction, Means-ends Analysis.	
Module 5	**8hrs**
Learning, Expert Systems.	

Course outcomes: Students will able to

CO1	Understand fundamental concepts, problem spaces, and search strategies in Artificial Intelligence.
CO2	Apply knowledge representation methods and predicate logic to model AI problems.
CO3	Analyze heuristic search techniques and constraint-solving strategies.
CO4	Evaluate learning approaches and expert systems used in decision-making processes.

Textbooks:

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

	Hill.
2	Stuart Russel, Peter Norvig, "Artificial Intelligence: A Modern Approach" , 2nd Edition, Pearson Education, 2003.
3	Dan W. Patterson, Introduction to Artificial Intelligence and Expert Systems – Prentice Hal of India.

Continuous Internal Evaluation (CIE):

- Three CIE Will be conducted for 50 marks each and average of three will be taken (A)
- Three Quizzes will be conducted along with CIE for 10 Marks Each. Sum of three quizzes will be considered for 30 marks (B)
- Two Assignments for 10 marks each and the sum of both the assignments will be taken for 20 Marks (C)

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Semester End Examination (SEE):

The theory exam consists of a written paper structured into two parts:

Part A: Carries 20 marks which include either objective-type or short descriptive questions. It is designed to cover the entire syllabus comprehensively.

Part B: This section carries a total of 80 marks and consists of 5 questions, with Either or choices. Students are required to answer one full question per module, selecting from the choices. Each question is valued at 16 marks and may include up to two sub-parts.

The SEE Theory marks of 100 will be scaled down to 50.

The final score for the course in the ratio of 50:50 of CIE and SEE Marks

COPO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	2	–	–	–	–	–	1	–
CO2	3	3	3	2	2	–	–	–	–	2	–
CO3	3	3	3	3	2	–	–	–	–	2	1
CO4	3	3	3	3	3	–	–	–	–	3	1

SEMESTER -VI		
MACHINE LEARNING LAB		
Course Code:	MVJ22ISL66	CIE Marks: 50
L: T:P:S	0:0:2:0	SEE Marks: 50
Credits:	1	Total :100
Hours:	24 Hrs Practical	SEE Duration: 3 Hrs.

COURSE OBJECTIVES: *This course will enable students to*

1. Make use of Data sets in implementing the machine learning algorithms

2.Implement the machine learning concepts and algorithms in any suitable language of choice.

LIST OF PROGRAMS		
1	Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.	2 hours
2	Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.	2 hours
3	Develop a program to demonstrate the prediction of values of a given dataset using Linear regression.	2 hours
4	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.	2 hours
5	Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.	2 hours
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.	2 hours
7	Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for	2 hours

	your data set.	
8	Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.	2hours

Course outcomes: Students will able to	
CO1	Understand and interpret supervised learning algorithms such as FIND-S, Decision Trees, and Naive Bayes.
CO2	Apply machine learning techniques like regression, classification, and clustering on real-world datasets.
CO3	Analyze results from algorithms such as KNN, ANN, EM, and compare their performance metrics.
CO4	Evaluate the accuracy, precision, recall, and quality of ML models and justify the choice of models for applications.
Textbooks:	
1	Tom M. Mitchell, Machine Learning, India Edition 2013, McGraw Hill Education.
2	Trevor Hastie, Robert Tibshirani, Jerome Friedman, h The Elements of Statistical Learning, 2nd edition, springer series in statistics.

CIE Laboratory (50 Marks)

Weekly Evaluation 30 Marks

Weekly evaluation will be conducted for every experiment. Marks of each evaluation includes Weekly Attendance + Experiment conduction along with Record / Observation + Weekly viva for all the experiments. The total of all these evaluated marks are added and the total marks will be scaled to 30

marks. (A)

Two CIE for 20 Marks each and take the average for 20 Marks (B)

Final CIE Marks will be calculated as (A+B) for 50 marks

SEE Laboratory Examination (50 Marks)

The laboratory SEE is also evaluated for 50 marks, distributed as follows:

Experiment Conduction with Results: 40 marks

Viva Voce: 10 marks

Total 50 marks

The final score for the course out of 100 is the SumTotal of SEE and CIE

COPO MAPPING
High-3,Medium-2, Low-1

COPO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO2
CO1	3	2	2	2	2	–	–	–	–	1	–	1
CO2	3	3	3	3	3	–	–	–	–	2	–	1
CO3	3	3	3	3	3	–	–	–	–	2	1	1
CO4	3	3	3	3	3	–	–	–	–	3	1	1

Semester: VI		
INDIAN KNOWLEDGE SYSTEMS		
Course Code:	MVJ22IKK68	CIE Marks: 50
L: T:P:S	1:0:0:0	SEE Marks: 50
Credits:	1	Total :100
Hours:	12 Hrs Theory	SEE Duration: 2 Hrs.
Course Learning Objectives: The students will be able to		
1	To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the Importance of roots of knowledge system.	
2	To make the students understand the traditional knowledge and analyse it and apply it to their day-to-day life.	

Unit-I	05 Hrs
Introduction to Indian Knowledge Systems (IKS): Overview, Vedic Corpus, Philosophy, Character scope and importance, traditional knowledge vis-a-vis indigenous knowledge, traditional knowledge vs. western knowledge.	
Unit – II	**05 Hrs**
Traditional Knowledge in Humanities and Sciences: Lingistics, Number and measurements- Mathematics, Chemistry, Physics, Art, Astronomy, Astrology, Crafts and Trade in India and Engineering and Technology.	
Unit -III	**05 Hrs**
Traditional Knowledge in Professional domain: Town planning and architecture- Construction, Health, wellness and Psychology-Medicine, Agriculture, Governance and public administration, United Nations Sustainable development goals.	

Course Outcomes: After completing the course, the students will be able to	
CO1:	Provide an overview of the concept of the Indian Knowledge System and its importance.
CO2:	Appreciate the need for and importance of protecting traditional knowledge.

CO3:	Recognize the relevance of Traditional knowledge in different domains.
CO4:	Establish the significance of Indian Knowledge systems in the contemporary world.

Text Books	
1	**Introduction to Indian Knowledge System- concepts and applications**, B Mahadevan, Vinayak Rajat Bhat, Nagendra Pavana R N, 2022, PHI Learning Private Ltd, ISBN-978-93- 91818-21-0
2	**Traditional Knowledge System in India**, Amit Jha, 2009, Atlantic Publishers and Distributors (P) Ltd., ISBN-13: 978-8126912230,
3	**Knowledge Traditions and Practices of India**, Kapil Kapoor, Avadesh Kumar Singh, Vol. 1, 2005, DK Print World (P) Ltd., ISBN 81-246-0334,
Suggested Web Links:	
1.	**https://www.youtube.com/watch?v=LZP1StpYEPM**
2.	**http://nptel.ac.in/courses/121106003/**
3.	http://www.iitkgp.ac.in/department/KS;jsessionid=C5042785F727F6EB46CBF432D7683B63 (Centre of Excellence for Indian Knowledge System, IIT Kharagpur)
4.	https://www.wipo.int/pressroom/en/briefs/tk_ip.html
5.	https://unctad.org/system/files/official-document/ditcted10_en.pdf
6.	http://nbaindia.org/uploaded/docs/traditionalknowledge_190707.pdf
7.	https://unfoundation.org/what-we-do/issues/sustainable-development- goals/?gclid=EAIaIQobChMInp-Jtb_p8gIVTeN3Ch27LAmPEAAYASAAEgIm1vD_BwE

Continuous Internal Evaluation (CIE) – 50 Marks

The CIE for the mandatory credit courses common across all disciplines comprises of two components as follows:

Internal Assessment Tests (30 Marks):

Two Internal Assessment tests will be conducted, each comprising 50 multiple choice questions for a total of 50 marks. The average of the two test scores will be scaled down to 30 marks.

Assignments (20 Marks):

Students are required to complete two assignments, each carrying 10 marks. These assignments may include projects*, poster presentations*, seminars*, or similar academic activities. The marks of the two assignments are added to get 20 marks.

*Each assignment will undergo two rounds of evaluation to assess progress and quality

At the beginning of the semester, the instructor/faculty teaching the course has to announce the methods of Assignment for the course.

Together, these two components are added to get the Final CIE marks of 50.

Semester End Examination (SEE) – 50 Marks

A Semester End Examination is conducted for 50 marks comprising of multiple-choice questions (MCQ) type each of one mark.

The final score for the course out of 100 is the SumTotal of SEE and CIE.

CO-PO Mapping											
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	-	-	-	-	-	-	3	-	-	1
CO2	-	-	-	-	-	2	-	-	-	-	-
CO3	-	-	2	2	-	-	-	-	-	-	-
CO4	-	-	-	-	-	3	2	-	-	-	-

High-3 : Medium-2 : Low-1

VII SEMESTER

Semester: VII		
Big Data Analytics		
Course Code:	MVJ22IS71	CIE Marks: 50
L: T:P:S	3:0:2:0	SEE Marks: 50
Credits:	4	Total :100
Hours:	40Hrs Theory +24 Hrs Practical	SEE Duration: 3 Hrs.

COURSE OBJECTIVES: *This course will enable students to*

1. Understand the Big Data Platform and its Use cases
2. Provide an overview of Apache Hadoop
3. Provide HDFS Concepts and Interfacing with HDFS
4. Understand Map Reduce Jobs
5. Provide hands on Hadoop Eco System.
6. Explain different approaches for text analysis and big data.

Module 1	8hrs

Introduction To Big Data : Types of Digital Data, Introduction to Big Data, Analysing Data with Unix tools, The Big Data Foundation, Big Data Computing Platforms (or Computing Platforms That Handle the Big Data Analytics Tsunami), Big Data Computation, More on Big Data Storage, Big Data Computational Limitations, Big Data Emerging Technologies.

Module 2	8hrs

Basics of Hadoop: Hadoop Architecture, The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop file system interfaces, Data flow, Data Ingest with Flume and Scoop and Hadoop archives, Hadoop I/O: Compression, Serialization, Avro and File-Based Data structures. Anatomy of File Write and Read, NameNode, Secondary NameNode, and DataNode, Hadoop MapReduce paradigm, Map and Reduce tasks, Job, Task trackers - Cluster Setup – SSH & Hadoop Configuration – HDFS Administering –Monitoring & Maintenance. Analysing Data with Hadoop, Hadoop Streaming, IBM Big Data Strategy, Introduction to Infosphere BigInsights and Big Sheets.

Module 3	8hrs
Map Reduce: Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Types and Formats, Map Reduce Features. **Hadoop Ecosystem And Yarn**: Hadoop ecosystem components - SPARK, FLUME, Hadoop 2.0 New Features- NameNode High Availability, HDFS Federation, MRv2, YARN.	
Module 4	**8hrs**
Pig: Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators. **Hive:** Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases, HiveQL, Tables, Querying Data and User Defined Functions. **Zookeeper** - how it helps in monitoring a cluster, HBase uses Zookeeper and how to Build Applications with Zookeeper.	
Module 5	**8hrs**
Understanding Text Analytics and big Data: Exploring Unstructured data, Understanding Text Analytics, Analysis and extraction techniques, Putting the results together with structured data, putting big data to use, Text analytics tools for Big Data. **Customized approaches for Analysis of Big Data:** Different approaches to big data Analysis, custom and semi-custom applications for big data analysis.	

LABORATORY EXPERIMENTS	
1. Installation of Hadoop and basic commands execution on Hadoop.	2 Hours
2. Implementation of wordcount program using MapReduce.	2 Hours
3. Implementation of max avg of student marks using MapReduce programs.	2 Hours
4. Implement MapReduce program to find the max temperature.	2 Hours
5. Implementation of matrix multiplication using map reduce program.	2 Hours
6. Implement MapReduce program to find the max. Fuel consumed by the vehicles in the city.	2 Hours
7. Implement MapReduce program to find the average of city MPG just for electric cars for the given data sets	2 Hours
8. Implement the MapReduce program to find Even and odd numbers.	2 Hours
9. Implement the MapReduce program to find the list of prime numbers in the given data sets.	2 Hours
10 Implement MapReduce program to find the total and Average salary of the	

employee. 2 Hours	
Course outcomes: Students will able to	
CO1	Understand Big Data fundamentals, digital data types, Hadoop architecture, and storage formats.
CO2	Apply Big Data tools such as Hadoop, HDFS, MapReduce, Pig, and Hive for data processing and storage.
CO3	Analyze Hadoop ecosystem components (e.g., Spark, YARN, Flume, ZooKeeper) for efficient big data management.
CO4	Evaluate and compare various big data analysis techniques including text analytics and custom analytics tools.
Textbooks:	
1	Big Data Analytics" , Seema Acharya, Subhasini Chellappan, Wiley 2015
2	Understanding Big data: Analytics for Enterprise Class Hadoop and Streaming Data,Chris Eaton, Dirk deroos et al., 1 st edition, Tata McGraw Hill, 2015, ISBN 13: 978-9339221270
3	Tom White "Hadoop: The Definitive Guide" Third Edit on, O'reily Media, 2012.
References	
1	Big data for dummies, Judith Hurwitz, Alan Nugent,Fern Halper, Marcia Kaufman, Wiley Publications, 1st edition, 2013, ISBN: 978-1-118-50422-2
2	Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses, Michael Minelli ,Michele Chambers , Ambiga Dhiraj

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

- Three CIE Will be conducted for 50 marks each and average of three will be taken (A)
- Three Quizzes will be conducted along with CIE for 10 Marks Each. Sum of three quizzes will be considered for 30 marks (B)
- Two Assignments for 10 marks each and the sum of both the assignments will be taken for 20 Marks (C)

Final CIE Marks will be calculated as (A+B+C)/2 for 50 marks

Laboratory- 50 Marks

Weekly Evaluation 30 Marks

Lab Continuous Evaluation :30 Marks

Continuous evaluation will be conducted for Lab experiment. Marks of each evaluation includes based on attendance, Experiment conduction, performance in lab, Record / Observation and viva, for all the experiments. The total Continuous evaluated marks will be scaled to 30 marks. (A)

Two CIE for 20 Marks each and take the average for 20 Marks (B)

Final CIE Marks will be calculated as A+B for 50 marks

For IPCC Final CIE Marks will be calculated as Average of CIE and Lab CIE for 50 marks.

Semester End Examination (SEE)

SEE Theory Examination (100 Marks)

The theory exam consists of a written paper structured into two parts:

Part A: Carries 20 marks which include either objective-type or short descriptive questions. It is designed to cover the entire syllabus comprehensively.

Part B: This section carries a total of 80 marks and consists of 5 questions, with Either or choices. Students are required to answer one full question per module, selecting from the choices. Each question is valued at 16 marks and may include up to two sub-parts.

The SEE Theory marks of 100 will be scaled down to 50 (A)

SEE Laboratory Examination (50 Marks)

The laboratory SEE is also evaluated for 50 marks, distributed as follows:

Experiment Conduction with Results: 40 marks

Viva Voce: 10 marks

Total 50 marks (B)

The score for the SEE is A+B of total 100 marks

The final score for the course in the ratio of 50:50 of CIE and SEE Marks

CO-PO MAPPING

COPO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	2	2	–	–	–	–	1	–
CO2	3	3	3	3	3	–	–	–	–	2	–
CO3	3	3	3	3	3	–	–	–	–	2	1
CO4	3	3	3	3	3	–	–	–	–	3	1

Semester VII		
Parallel Computing		
Course Code:	MVJ22IS72	CIE Marks: 50
L: T:P:S	3:0:2:0	SEE Marks: 50
Credits:	4	Total :100
Hours:	40 Hrs Theory+24 Hrs Practical	SEE Duration: 3 Hrs.

COURSE OBJECTIVES: *This course will enable students to*

1. Understand fundamental concepts in Parallel Computing.
2. Understand Distributed-Memory Programming with MPI.
3. Understand parallel programming model, analyse synchronization in real computing problems.
4. Apply open MP on Shared memory programming.

Module 1	8hrs
Introduction to Parallel Computing: Motivating Parallelism, Scope of Parallel Computing. Parallel Programming Platforms: Trends in microprocessor architectures - limitations of memory system performance – parallel computing platforms – communication costs in parallel machines – routing mechanisms for interconnection networks.	
Module 2	**8hrs**
Principles of Parallel Algorithm Design: Preliminaries – decomposition techniques – characteristics of tasks and interactions – mapping techniques for load balancing – methods for containing interaction overheads – parallel algorithm models. Basic Communication Operations: One-to-all broadcast and all- to-one reduction – all-to-all broadcast reduction – all-reduce and prefix-sum operations – scatter and gather – all to-all personalized communication – circular shift – improving the speed of some communication Operation.	
Module 3	**8hrs**
Examples of Distributed Systems–Trends in Distributed Systems – Focus on resource sharing – Challenges. Case study: World Wide Web.	
Module 4	**8hrs**
System Model Inter process Communication – the API for internet protocols – External data representation and Multicast communication. Network virtualization: Overlay networks. Case study: MPI Remote Method Invocation And Objects: Remote Invocation – Introduction – Request-reply protocols – Remote procedure call – Remote method invocation. Case study: Java RMI.	
Module 5	**8hrs**
Peer-to-peer Systems – Introduction – Napster and its legacy – Peer-to-peer – Middleware – Routing overlays. Overlay case studies: Pastry, Tapestry. Distributed File Systems –Introduction – File service architecture – Andrew File system.	

LABORATORY EXPERIMENTS	
1. Familiarization with HPC programming paradigms: Single program multiple data (SPMD) & MPMD	2 Hours
2. To interface Speeding up C/Fortran/Python programs: Vectorization; Compiler options.	2 Hours
3. Programming in Message Passing Interface (MPI): Point-to-point and collective communications; Parallel I/O; MPI for Python and C/Fortran.	2 Hours
4. Programming in OpenMP.	2 Hours
5. Programming GPUs using OpenACC.	2 Hours
6. Programming GPUs using CuPy and CUDA	2 Hours
7. Reduction clause in OpenMP	2 Hours
8. Scheduling loops in OpenMP-odd even transposition sort	2 Hours
9. Synchronization in OpenMp – Producer – Consumer problem	2 Hours
10. OpenMP program for fork join model	2 Hours

Course outcomes: Students will able to	
CO1	Understand the principles of parallel computing and communication overheads in modern computing architectures.
CO2	Apply decomposition and mapping techniques in designing parallel algorithms.
CO3	Analyze communication operations and inter-process communication techniques in distributed systems.
CO4	Evaluate distributed computing systems and peer-to-peer architectures using case studies like MPI and RMI.
Textbooks:	
1	P. S. Pacheco, An Introduction to Parallel Programming, Elsevier (2011)
2	M. Quinn, Parallel Programming in C and OpenMP, McCraw Hill Education (India) (2003)
3	A. Grama, A. Gupta, G. Karypis, and V. Kumar, Introduction to Parallel Computing, Pearson (2007)
References:	
1	G. Zaccone. Python Parallel Programming Cookbook, Packt Publ. (2015)

2	R. Farber, Parallel Programming with OpenACC, Morgan Kaufmann

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

- Three CIE Will be conducted for 50 marks each and average of three will be taken (A)
- Three Quizzes will be conducted along with CIE for 10 Marks Each. Sum of three quizzes will be considered for 30 marks (B)
- Two Assignments for 10 marks each and the sum of both the assignments will be taken for 20 Marks (C)

Final CIE Marks will be calculated as (A+B+C)/2 for 50 marks

Laboratory- 50 Marks

Weekly Evaluation 30 Marks
Lab Continuous Evaluation :30 Marks
Continuous evaluation will be conducted for Lab experiment. Marks of each evaluation includes based on attendance, Experiment conduction, performance in lab, Record / Observation and viva, for all the experiments. The total Continuous evaluated marks will be scaled to 30 marks. (A)

Two CIE for 20 Marks each and take the average for 20 Marks (B)

Final CIE Marks will be calculated as A+B for 50 marks

For IPCC Final CIE Marks will be calculated as Average of CIE and Lab CIE for 50 marks.

Semester End Examination (SEE)

SEE Theory Examination (100 Marks)

The theory exam consists of a written paper structured into two parts:

Part A: Carries 20 marks which include either objective-type or short descriptive questions. It is designed to cover the entire syllabus comprehensively.

Part B: This section carries a total of 80 marks and consists of 5 questions, with Either or choices. Students are required to answer one full question per module, selecting from the choices. Each question is valued at 16 marks and may include up to two sub-parts.

The SEE Theory marks of 100 will be scaled down to 50 (A)

SEE Laboratory Examination (50 Marks) The laboratory SEE is also evaluated for 50 marks, distributed as follows:

Experiment Conduction with Results: 40 marks

Viva Voce: 10 marks

Total 50 marks (B)

The score for the SEE is A+B of total 100 marks

CO-PO MAPPING

COPO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	3	3	2	1	2	1	–	1	2
CO2	3	3	3	3	3	2	2	1	1	2	2
CO3	3	3	3	3	3	2	2	2	2	3	2
CO4	3	3	3	3	3	3	3	2	2	3	3

Semester VII		
Information and Network Security		
Course Code:	MVJ22IS73	CIE Marks: 50
L: T:P:S	4:0:0	SEE Marks: 50
Credits:	4	Total :100
Hours:	40Hrs Theory	SEE Duration: 3 Hrs.

COURSE OBJECTIVES: *This course will enable students to*

1. Identify the major types of threats to information security and the associated attacks, Services and Mechanisms.
2. Design and develop cryptographic algorithms using public key cryptography.
3. Generate the own key for developing cryptography algorithms.
4. Understand various Transport-level Security and Wireless Network Security
5. Generate and distribute a PGP key pair and use the PGP package to send an encrypted e- mail message.

Module 1	8hrs

Computer Security Concepts: Introduction, The need for security, Security approaches, Principles of security, The OSI Security Architecture, Types of Security attacks, Security services, Security Mechanisms, A model for Network Security.

Cryptography: Symmetric Encryption Principles, Symmetric Block Encryption Algorithms, Random and Pseudo random Numbers, Stream Ciphers and RC4 45, Cipher Block Modes of Operation, Approaches to Message Authentication, Secure Hash Functions, Message Authentication Codes, Public-Key Cryptography Algorithms (Knapsack, RSA, Diffie-Hellman, Elliptic Curve Cryptography), Digital Signatures.

Module 2	8hrs

Network Security Applications: Symmetric Key Distribution Using Symmetric Encryption, Kerberos, Key Distribution Using Asymmetric Encryption, Public key infrastructure, Federated Identity Management.

Transport Level Security: Secure Socket Layer and Transport Layer Security, Transport Layer Security, HTTPS, Secure Shell (SSH).

Wireless Network Security: Wireless Application Protocol Overview, Wireless Transport Layer Security, WAP End-to-End Security.

Module 3	8hrs

Electronic Mail Security: Pretty Good Privacy, S/MIME 241, Domain Keys Identified Mail.

IP Security: IP Security Policy, Encapsulating Security Payload, Combining Security Associations, Internet Key Exchange, Cryptographic Suites, Intrusion

Detection, Password Management, Firewalls – Types, Location and Configurations, Basics of SNMP, Legal and Ethical Aspects - Intellectual Property, Privacy, Ethical Issue

Module 4	8hrs

Hash Functions: Introduction, The Birthday Problem, Non-Cryptographic Hashes, Tiger Hash, HMAC, Uses. **Advanced Cryptanalysis:** Linear and differential Cryptanalysis, Side Channel Attack on RSA, Lattice Reduction and Knapsack, Hellman's time memory trade off. **Access Control:** Authentication, Authorization, Simple Authentication Protocols

Module 5	8hrs

Malware: Introduction, Types **Insecurity in software:** Software Reverse Engineering, Software Tamper Resistance, Digital Rights Management, Software Development. **Operating System and Security:** Operating System Security Functions, Trusted Operating Systems

Course outcomes: Students will able to	
CO1	Understand the fundamental concepts of computer security, including cryptography, network security, and attacks.
CO2	Apply various encryption techniques, including symmetric and asymmetric encryption algorithms, for secure communication.
CO3	Analyze security mechanisms such as firewalls, intrusion detection systems, and public-key infrastructure.
CO4	Evaluate the security measures in real-world applications such as secure email, IP security, and malware protection.

Textbooks:

1	Principles of Information Security - Michael E. Whitman and Herbert J. Mattord, 2nd Edition, Thompson, 2005.
2	Network Security Essentials Applications and Standards - William Stallings, Person Education, 2000
3	Cryptography and Network Security - Behrouz A. Forouzan, Tata McGraw-Hill, 2007

Continuous Internal Evaluation (CIE):

- Three CIE Will be conducted for 50 marks each and average of three will be taken (A)
- Three Quizzes will be conducted along with CIE for 10 Marks Each. Sum of three quizzes will be considered for 30 marks (B)
- Two Assignments for 10 marks each and the sum of both the assignments will be taken for 20 Marks (C)

Final CIE Marks will be calculated as (A+B+C)/2 for 50 marks

Semester End Examination (SEE):

The theory exam consists of a written paper structured into two parts:

Part A: Carries 20 marks which include either objective-type or short descriptive questions. It is designed to cover the entire syllabus comprehensively.

Part B: This section carries a total of 80 marks and consists of 5 questions, with Either or choices. Students are required to answer one full question per module, selecting from the choices. Each question is valued at 16 marks and may include up to two sub-parts.

The SEE Theory marks of 100 will be scaled down to 50.

The final score for the course in the ratio of 50:50 of CIE and SEE Marks

COPO MAPPING

COPO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	3	3	2	1	2	1	–	1	2
CO2	3	3	3	3	3	2	2	1	1	2	2
CO3	3	3	3	3	3	2	2	2	2	3	2
CO4	3	3	3	3	3	3	3	2	2	3	3

High-3,Medium-2,Low-1

Semester VII		
Deep Learning		
Course Code:	MVJ22IS741	CIE Marks: 50
L: T:P:S	3:0:0:0	SEE Marks: 50
Credits:	3	Total :100
Hours:	40 Hrs Theory	SEE Duration: 3 Hrs.

COURSE OBJECTIVES: *This course will enable students to*

1. Learn feed forward deep networks.
2. Understand convolutional networks and sequence modelling.
3. Study probabilistic models and auto encoders.
4. Expose the students to various deep generative models.
5. Study the various applications of deep learning.

Module 1	8hrs

DEEP NETWORKS: Machine Learning Basics: Learning Algorithms – Supervised and Unsupervised learning – Feed forward Deep networks – regularization – Optimization for training Deep models.

Module 2	8hrs

CONVOLUTIONAL NETWORKS AND SEQUENCE MODELLING: Convolutional Networks – Convolution operation – Motivation Pooling – Basic Convolution function – Algorithms – Recurrent and recursive nets : Recurrent neural networks – Bidirectional RNN – Recursive Neural networks – Auto regressive networks – Long term dependencies – Temporal dependencies – Approximate search.

Module 3	8hrs

PROBABILISTIC MODELS AND AUTO ENCODERS : Structured Probabilistic models : Challenges of unstructured modelling – using graphs to describe model structure – Learning about dependencies – inference – Deep learning approach – Monte carlo models Linear Factor models and Auto encoders

Module 4	8hrs

DEEP GENERATIVE MODELS : Restricted Boltzmann Machines – Deep Belief networks – Deep Boltzmann machine – Convolutional Boltzmann machine

Module 5	8hrs

APPLICATIONS: Speech, Audio and Music processing – Language modelling and Natural language processing – information retrieval – object recognition and computer vision – Multi modal and multitask learning

Course outcomes: Students will able to

CO1	Understand the basics of machine learning algorithms, deep networks, and optimization for training deep models
CO2	Apply convolutional networks, sequence modeling, and recurrent neural networks to solve problems in deep learning.

CO3	Analyze probabilistic models, autoencoders, and deep generative models in the context of learning and inference.
CO4	Evaluate the application of deep learning models in real-world problems like speech processing, NLP, and computer vision.
Textbooks:	
1	Yoshua Bengio and Ian J.Goodfellow and Aaron Courville, "Deep Learning", MIT Press, 2015
2	Li Deng, Dong Yu, "Deep Learning: Methods and Applications", now publishers, 2014

Continuous Internal Evaluation (CIE):

- Three CIE Will be conducted for 50 marks each and average of three will be taken (A)
- Three Quizzes will be conducted along with CIE for 10 Marks Each. Sum of three quizzes will be considered for 30 marks (B)
- Two Assignments for 10 marks each and the sum of both the assignments will be taken for 20 Marks (C)

Final CIE Marks will be calculated as (A+B+C)/2 for 50 marks

Semester End Examination (SEE):

The theory exam consists of a written paper structured into two parts:

Part A: Carries 20 marks which include either objective-type or short descriptive questions. It is designed to cover the entire syllabus comprehensively.

Part B: This section carries a total of 80 marks and consists of 5 questions, with Either or choices. Students are required to answer one full question per module, selecting from the choices. Each question is valued at 16 marks and may include up to two sub-parts.

The SEE Theory marks of 100 will be scaled down to 50.

The final score for the course in the ratio of 50:50 of CIE and SEE Marks

CO-PO MAPPING

COPO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	3	2	3	2	2	1	–	2	1
CO2	3	3	3	3	3	3	2	2	1	3	2
CO3	3	3	3	3	3	3	3	3	2	3	3
CO4	3	3	3	3	3	3	3	2	2	3	3

Semester: VII		
Natural Language Processing		
Course Code:	MVJ22IS742	CIE Marks: 50
L: T:P:S	3:0:0: 0	SEE Marks: 50
Credits:	3	Total :100
Hours:	40Hrs Theory	SEE Duration: 3 Hrs.

COURSE OBJECTIVES: *This course will enable students to*

1. Learn the fundamentals of natural language processing
2. Understand the use of CFG and PCFG in NLP
3. Understand the role of semantics of sentences and pragmatics
4. Gain knowledge in automated Natural Language Generation and Machine Translation.

Module 1	8hrs

INTRODUCTION: Origins and challenges of NLP – Language Modelling: Grammar-based LM, Statistical LM –Regular Expressions, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance values of real symmetric matrices: Jacobi and Givens method.

Module 2	8hrs

WORD LEVEL AND SYNTACTIC ANALYSIS: N grams Models of Syntax - Counting Words Unsmoothed N grams-Smoothing-Back off Deleted Interpolation – Entropy – English Word Classes - Tag sets for English-Part of Speech Tagging-Rule Based Part of Speech Tagging - Stochastic Part of Speech Tagging - Transformation-Based Tagging -Issues in PoS tagging – Hidden Markov and Maximum Entropy models.

Module 3	8hrs

CONTEXT FREE GRAMMARS: Context-Free Grammars, Grammar rules for English, Tree banks, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing, Ambiguity, Dynamic Programming parsing – Shallow parsing Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs – Feature structures, Unification of feature structures.

Module 4	8hrs

Representing Meaning - Meaning Structure of Language, First Order Predicate Calculus-Representing Linguistically Relevant Concepts –SyntaxDriven Semantic Analysis - Semantic Attachments –Syntax Driven Analyzer- Robust Analysis – Lexemes and Their Senses - Internal Structure - Word Sense

Disambiguation -Information Retrieval.

Module 5	8hrs

LANGUAGE GENERATION AND DISCOURSEANALYSIS: Discourse segmentation, Coherence – Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm – Co reference Resolution – Resources: Porter Stemmer, Lemmatize, Penn ,Treebank, Brill's Tagger, Word Net, Prop Bank, Frame Net, Brown Corpus, and British National Corpus (BNC).	
Course outcomes: Students will able to	
CO1	Understand the origins and challenges of NLP, language modeling, and various methods for text analysis.
CO2	Apply techniques for word-level analysis, syntactic parsing, and part-of-speech tagging to solve NLP problems.
CO3	Analyze the syntactic structures, context-free grammars, and parsing methods for language understanding.
CO4	Evaluate the meaning representations, discourse analysis, and language generation techniques in real-world NLP tasks.
Textbooks:	
1	Daniel Jurafsky, James H. Martin—Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 2014
2	C. Manning and H. Schutze, "Foundations of Statistical Natural Language Processing", MITPress. Cambridge, MA:1999

Continuous Internal Evaluation (CIE):

- Three CIE Will be conducted for 50 marks each and average of three will be taken (A)
- Three Quizzes will be conducted along with CIE for 10 Marks Each. Sum of three quizzes will be considered for 30 marks (B)
- Two Assignments for 10 marks each and the sum of both the assignments will be taken for 20 Marks (C)

Final CIE Marks will be calculated as (A+B+C)/2 for 50 marks

Semester End Examination (SEE):

The theory exam consists of a written paper structured into two parts:

Part A: Carries 20 marks which include either objective-type or short descriptive questions. It is designed to cover the entire syllabus comprehensively.

Part B: This section carries a total of 80 marks and consists of 5 questions, with Either or choices. Students are required to answer one full question per module, selecting from the choices. Each question is valued at 16 marks and may include up to two sub-parts.

The SEE Theory marks of 100 will be scaled down to 50.

The final score for the course in the ratio of 50:50 of CIE and SEE Mark

COPO MAPPING

COPO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	3	2	3	2	2	1	–	2	1
CO2	3	3	3	3	3	3	2	2	1	3	2
CO3	3	3	3	3	3	3	3	3	2	3	3
CO4	3	3	3	3	3	3	3	2	2	3	3

Semester: VII		
Embedded Systems		
Course Code:	MVJ22IS743	CIE Marks: 50
L: T:P:S	3:0:0: 0	SEE Marks: 50
Credits:	3	Total :100
Hours:	40Hrs Theory	SEE Duration: 3 Hrs.

COURSE OBJECTIVES: *This course will enable students to*

1. Comprehend the underlying features and building blocks of embedded system development.
2. Outline the advanced architecture components of 8051 microcontroller.
3. Build the assembly language routines using 8051 microcontroller.
4. Analyze various models of embedded system development
5. Evaluate the RTOS concepts of embedded system applications
6. Design embedded systems prototypes for real-time applications.

Module 1	8hrs
Introduction to Embedded Systems: Definition, Purpose, Embedded systems Vs. General computing systems, Classifications, Applications, Innovative bonding of lifestyle with embedded technologies, Building Blocks of Embedded Systems: Core components including all types of processor/controller, Memory, Sensors, Actuators, LED, 7 segment LED display, stepper motor, Keyboard, Push button switch, Communication Interface (on board and external types), Embedded firmware, Other system components	

Module 2	8hrs
Microprocessors versus Microcontrollers, ARM Embedded Systems: The RISC design philosophy, The ARM Design Philosophy, Embedded System Hardware, Embedded System Software. ARM Processor Fundamentals: Registers, Current Program Status Register, Pipeline, Exceptions, Interrupts, and the Vector Table , Core Extensions	

Module 3	8hrs
Introduction to the ARM Instruction Set : Data Processing Instructions , Programme Instructions, Software Interrupt Instructions, Program Status Register Instructions, Co-processor Instructions, Loading Constants ,ARM programming using Assembly language: Writing Assembly code, Profiling and cycle counting, instruction scheduling.	

Module 4	8hrs
Exception, Interrupt Handling : Exception handling,Interrupts, Interrupt handling Schemes. Memory Management Unit : The Memory Hierarchy and Cache Memory, Cache Architecture, Cache Policy, Moving from MPU to an MMU,How Virtual Memory Works, Details of ARM MMU.	

Module 5	8hrs
Real Time Operating System (RTOS) based Embedded System Design: Operating System basics, Types of operating systems, Task, process and threads (Only POSIX Threads with an example program), Thread pre-emption, Multiprocessing and Multitasking, Task Communication (without any program), Task synchronization issues – Racing and Deadlock, Concept of Binary and counting semaphores (Mutex example without any program), How to choose an RTOS.	
Course outcomes: Students will able to	
CO1	Understand the components, classifications, and applications of embedded systems and their design principles.
CO2	Apply ARM processor architecture and programming concepts to develop embedded system applications.
CO3	Analyze ARM instruction sets, memory management, and interrupt mechanisms to evaluate system-level control.
CO4	Evaluate RTOS-based embedded system designs with a focus on task synchronization, scheduling, and inter-task communication.
TextBooks:	
1	Andrew N Sloss, Dominic Symes and Chris Wright, ARM system developer's guide, Elsevier, Morgan Kaufman publishers, 2008.
2	Shibu K V, "Introduction to Embedded Systems", Tata McGraw Hill Education, Private Limited, 2nd Edition

Continuous Internal Evaluation (CIE):

- Three CIE Will be conducted for 50 marks each and average of three will be taken (A)
- Three Quizzes will be conducted along with CIE for 10 Marks Each. Sum of three quizzes will be considered for 30 marks (B)
- Two Assignments for 10 marks each and the sum of both the assignments will be taken for 20 Marks (C)

Final CIE Marks will be calculated as (A+B+C)/2 for 50 marks

Semester End Examination (SEE):

The theory exam consists of a written paper structured into two parts:

Part A: Carries 20 marks which include either objective-type or short descriptive questions. It is designed to cover the entire syllabus comprehensively.
Part B: This section carries a total of 80 marks and consists of 5 questions, with Either or choices. Students are required to answer one full question per module, selecting from the choices. Each question is valued at 16 marks and may include up to two sub-parts.

The SEE Theory marks of 100 will be scaled down to 50.

The final score for the course in the ratio of 50:50 of CIE and SEE Mark

CO PO MAPPING

COPO	PO1	PO2	PO3	PO4	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	2	1	–	–	–	2	–
CO2	3	3	3	2	–	–	–	1	2	1
CO3	3	3	3	3	–	–	–	2	2	2
CO4	3	3	3	3	–	–	–	3	3	2

High-3 Medium-2 Low-1

Semester- VII		
Distributed File System		
Course Code:	MVJ22IS744	CIE Marks: 50
L: T:P:S	3:0:2:0	SEE Marks: 50
Credits:	3	Total :100
Hours:	40Hrs Theory	SEE Duration: 3 Hrs.

Course Objectives : This Course will enable the students to	
Understand fundamental concepts in Distributed systems Understand the problem-solving techniques and knowledge representation. Design intelligent components or programs to meet desired needs. Implement, and evaluate a computer-based distributed systems. Understand fundamental concepts in Distributed systems.	
Module 1	**8 Hrs**
Distributed Systems: Characterization of Distributed Systems: Introduction, Examples of DS, Resource sharing and the Web, Challenges System Models: Architectural Models, Fundamental Models	
Module 2	**8 Hrs**
Files and APIs: For complete syllabus and results, class timetable and more pls download iStudy. It's a light weight, easy to use, no images, no pdfs platform to make students life easier.	
Module 3	**8 Hrs**
Operating System Support: Introduction, The OS layer, Protection, Processes and Threads, Communication and Invocation, Operating system architecture Distributed File Systems: Introduction, File Service architecture, Sun Network File System	
Module 4	**8 Hrs**
Time and Global States: Introduction, Clocks, events and process status, synchronizing physical clocks, Logical time and logical clocks, Global states Coordination and Agreement: Introduction, Distributed mutual exclusion, Elections	
Module 5	**8 Hrs**
Inter-process Communication: Introduction, The API for the Internet Protocols, External Data Representation and Marshalling, Client-Server Communication, Group Communication, Case Study: IPC in UNIX.	

Course Outcome: At the end of the course the students will be able to	
CO1	Illustrate the mechanism of IPC between distributed objects
CO2	Describe the distributed file service architecture and the important characteristics of SUN NFS.
CO3	Discuss concurrency control algorithms applied in distributed transactions
CO4	Apply logical time and logical clocks to order events correctly in a distributed system
CO5	Design and implement communication systems between processes in various computing environments.
Textbooks:	
1	George Coulouris, Jean Dollimore and Tim Kindberg: Distributed Systems – Concepts and Design, 5th Edition, Pearson Publications, 2009
References:	
1	T Andrew S Tanenbaum: Distributed Operating Systems, 3rd edition, Pearson publication, 2007
2	AjayD. Kshemkalyani and MukeshSinghal, Distributed Computing: Principles, Algorithms and Systems, Cambridge University Press, 2008
3	Sunita Mahajan, Seema Shan, Distributed Computing, Oxford University Press,2015

Continuous Internal Evaluation (CIE):

- Three CIE Will be conducted for 50 marks each and average of three will be taken (A)
- Three Quizzes will be conducted along with CIE for 10 Marks Each. Sum of three quizzes will be considered for 30 marks (B)
- Two Assignments for 10 marks each and the sum of both the assignments will be taken for 20 Marks (C)

Final CIE Marks will be calculated as (A+B+C)/2 for 50 marks

Semester End Examination (SEE):

The theory exam consists of a written paper structured into two parts:

Part A: Carries 20 marks which include either objective-type or short descriptive questions. It is designed to cover the entire syllabus comprehensively.

Part B: This section carries a total of 80 marks and consists of 5 questions, with Either or choices. Students are required to answer one full question per module, selecting from the choices. Each question is valued at 16 marks and may include up to two sub-parts.

The SEE Theory marks of 100 will be scaled down to 50.
The final score for the course in the ratio of 50:50 of CIE and SEE Marks

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	3	2	3							3
CO2	2	2	3	3							2
CO3	2	2	2	3							3
CO4	3	2	3	2							2
CO5	2	3	3	2							3

3-High 2- Moderate 1-low

Semester:VII		
Introduction To DBMS		
Course Code:	MVJ22IS751	CIE Marks: 50
L: T:P:S	3:0:0:0	SEE Marks: 50
Credits:	3	Total :100
Hours:	40Hrs Theory	SEE Duration: 3 Hrs.

COURSE OBJECTIVES: *This course will enable students to*

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

Module 1	8hrs

Introduction to Databases: Introduction; An example; 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; when Not to use a DBMS.

Module 2	8hrs

Relational Model: Relational Model Concepts, Relational Model Constraints and relational database schemas, Update operations, dealing with constraint violations. Relational Algebra: Unary and Binary relational operations, additional relational operations (aggregate, grouping, etc.) Examples of Queries in relational algebra.

Module 3	8hrs

SQL: Advances Queries: More complex SQL retrieval queries, Specifying constraints as assertions and action triggers, Views in SQL, Schema change statements in SQL

Module 4	8hrs

Normalization: Database Design Theory – Introduction to Normalization using Functional and Multivalued Dependencies: Informal design guidelines for relation schema, Functional Dependencies,

Normal Forms based on Primary Keys, Second and Third Normal Forms, Boyce- Codd Normal Form,

Module 5	8hrs

Transaction Processing: Introduction to Transaction Processing, Transaction and System concepts, Desirable properties of Transactions, Characterizing schedules based on recoverability, Characterizing schedules based on Serializability, Transaction support in SQL.

Course outcomes: Students will able to	
CO1	Understand the fundamental concepts and architecture of database systems and the DBMS approach.
CO2	Apply relational algebra and SQL to retrieve, manipulate, and query data from relational databases.
CO3	Analyze database design using normalization techniques and functional dependencies.
CO4	Evaluate database transactions for correctness based on serializability and recovery techniques.
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
References:	
1	Silberschatz Korth and Sudharshan, Database System Concepts, 6th Edition, McGrawHill, 2013.

Continuous Internal Evaluation (CIE):

- Three CIE Will be conducted for 50 marks each and average of three will be taken (A)
- Three Quizzes will be conducted along with CIE for 10 Marks Each. Sum of three quizzes will be considered for 30 marks (B)
- Two Assignments for 10 marks each and the sum of both the assignments will be taken for 20 Marks (C)

Final CIE Marks will be calculated as (A+B+C)/2 for 50 marks

Semester End Examination (SEE):

The theory exam consists of a written paper structured into two parts:

Part A: Carries 20 marks which include either objective-type or short descriptive questions. It is designed to cover the entire syllabus comprehensively.

Part B: This section carries a total of 80 marks and consists of 5 questions, with Either or choices. Students are required to answer one full question per module, selecting from the choices. Each question is valued at 16 marks and may include up to two sub-parts.

The SEE Theory marks of 100 will be scaled down to 50.

The final score for the course in the ratio of 50:50 of CIE and SEE Marks

CO-PO MAPPING

COPO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	1	–	–	–	–	–	1	–
CO2	3	3	3	2	2	–	–	–	1	2	1
CO3	3	3	3	3	3	–	–	–	1	2	2
CO4	3	3	3	3	3	–	–	–	2	3	2

High-3,Medium-2,Low-1

Semester: VII		
INTRODUCTION TO ALGORITHMS		
Course Code:	MVJ22IS752	CIE Marks: 50
L: T:P:S	3:0:0	SEE Marks: 50
Credits:	3	Total :100
Hours:	40Hrs Theory	SEE Duration: 3 Hrs.

COURSE OBJECTIVES: *This course will enable students to*

1. Learn the basics Algorithms
2. Learn to write algorithms and its performance.
3. Learn the different functions of algorithms.
4. Understand the concept of recurrence algorithms
5. Understand probabilistic analysis.

Module 1	8hrs
The Role of Algorithms in Computing: Algorithms, kinds of problems are solved by algorithms, Algorithms as a technology, Efficiency, Data structures, Technique, Hard problems	
Module 2	**8hrs**
Getting Started Insertion sort, Analyzing algorithms, Analysis of insertion sort, Worst-case and average-case analysis, Designing algorithms	
Module 3	**8hrs**
Growth of Functions Growth of Functions, Asymptotic notation, Comparison of functions, Standard notations and common functions, Functional iteration	
Module 4	**8hrs**
Recurrences The substitution method, The recursion-tree method, The master method, Proof of the master theorem, The proof for exact powers	
Module 5	**8hrs**
Probabilistic Analysis and Randomized Algorithms The hiring problem, Indicator random variables, Randomized algorithms, Probabilistic analysis and further uses of indicator random variables	

Course outcomes: Students will able to	
CO1	Understand the fundamental concepts of algorithms, efficiency, and problem-solving techniques.
CO2	Apply basic sorting techniques and perform algorithmic analysis using asymptotic notations.
CO3	Analyze algorithm performance using recurrence relations and asymptotic behavior.
CO4	Evaluate the efficiency of randomized algorithms using probabilistic analysis techniques

Textbooks:	
1	Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, 3rd Edition, PHI.
2	Introduction to the Design and Analysis of Algorithms, Anany Levitin:, 2rd Edition, 2009 Pearson.
3	Design and Analysis of Algorithms, S. Sridhar, Oxford (Higher Education).
4	Introduction to the Design and Analysis of Algorithms, Anany Levitin:, 2rd Edition, 2009 Pearson.
5	Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Cliffordtein, 3rd Edition, PHI.

Continuous Internal Evaluation (CIE):

- Three CIE Will be conducted for 50 marks each and average of three will be taken (A)
- Three Quizzes will be conducted along with CIE for 10 Marks Each. Sum of three quizzes will be considered for 30 marks (B)
- Two Assignments for 10 marks each and the sum of both the assignments will be taken for 20 Marks (C)

Final CIE Marks will be calculated as (A+B+C)/2 for 50 marks

Semester End Examination (SEE):

The theory exam consists of a written paper structured into two parts:

Part A: Carries 20 marks which include either objective-type or short descriptive questions. It is designed to cover the entire syllabus comprehensively.

Part B: This section carries a total of 80 marks and consists of 5 questions, with

Either or choices. Students are required to answer one full question per module, selecting from the choices. Each question is valued at 16 marks and may include up to two sub-parts.

The SEE Theory marks of 100 will be scaled down to 50.

The final score for the course in the ratio of 50:50 of CIE and SEE Marks

CO PO MAPPING:

COPO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO
CO1	3	2	2	2	–	–	–	–	–	1	–
CO2	3	3	3	2	2	–	–	–	–	2	–
CO3	3	3	3	3	2	–	–	–	–	2	–
CO4	3	3	3	3	3	–	–	–	–	3	2

Semester: VII		
Software Engineering		
Course Code:	MVJ22IS753	CIE Marks: 50
L: T:P:S	3:0:0	SEE Marks: 50
Credits:	3	Total :100
Hours:	40Hrs Theory	SEE Duration: 3 Hrs.

COURSE OBJECTIVES: This Course will enable the students to

Understand principles, concepts, methods, and techniques of the software engineering approach to producing quality software (particularly for large, complex systems).

Impart skills in the design and implementation of efficient software systems across disciplines.

Familiarize engineering practices and standards used in developing software products and components.

Gather knowledge on various software testing, maintenance methods.

Module 1	8hrs
FUNDAMENTALS OF SOFTWARE ENGINEERING AND REQUIREMENTS ENGINEERING Software Engineering Fundamentals; Software processes: Software life-cycle models; Software requirements and specifications: Requirements elicitation; Requirements analysis modeling techniques; Functional and non-functional requirements.	
Module 2	**8hrs**
Fundamental design concepts and principles; Design characteristics; System Models - Context, Behavioral, Data and, Object models.	
Module 3	**8hrs**
SOFTWARE VALIDATION AND MAINTENANCE Software validation: Validation planning; Testing fundamentals, including test plan creation and test case generation; Black-box and white-box testing techniques; Unit, integration, validation, and system testing; Object-oriented testing; Inspections	
Module 4	**8hrs**
COMPONENT BASED SOFTWARE ENGINEERING Engineering of Component-Based Systems; The CBSE Process; Domain Engineering; Component Based Development; Classifying and Retrieving Components; Economics of CBSE	
Module 5	**8hrs**
SOFTWARE QUALITY PROCESS IMPROVEMENT Overview of Quality management and Process Improvement; Overview of SEI -CMM, ISO 9000, CMMI, PCMM, TQM and Six Sigma; overview of CASE tools. Software tools and environments: Programming	

environments; Project management tools	
Course outcomes: Students will able to	
CO1	Understand the fundamental principles of software engineering, life cycle models, and requirements engineering.
CO2	Apply appropriate design principles, modeling methods, and testing strategies to develop software systems.
CO3	Analyze software quality practices, component-based engineering, and evaluate reuse and domain engineering.
CO4	Evaluate software process improvement models like CMMI, ISO, TQM and tools supporting software development.

Textbooks:	
1	Ian Sommerville, "Software Engineering", 9th Edition, Addison- Wesley, 2011
2	R. S. Pressman, Software Engineering, a practitioner's approach, McGraw Hill,7th Edition, 2010
References	
1	Rajib Mall, "Fundamentals of Software Engineering", PHI Publication, 3rd edition, 2009
2	Pankaj Jalote: An Integrated Approach to Software Engineering, Wiley India.

Continuous Internal Evaluation (CIE):

- Three CIE Will be conducted for 50 marks each and average of three will be taken (A)
- Three Quizzes will be conducted along with CIE for 10 Marks Each. Sum of three quizzes will be considered for 30 marks (B)
- Two Assignments for 10 marks each and the sum of both the assignments will be taken for 20 Marks (C)

Final CIE Marks will be calculated as (A+B+C)/2 for 50 marks

Semester End Examination (SEE):

The theory exam consists of a written paper structured into two parts:

Part A: Carries 20 marks which include either objective-type or short descriptive questions. It is designed to cover the entire syllabus comprehensively.

Part B: This section carries a total of 80 marks and consists of 5 questions, with Either or choices. Students are required to answer one full question per module, selecting from the choices. Each question is valued at 16 marks and may include up to two sub-parts.

The SEE Theory marks of 100 will be scaled down to 50.

The final score for the course in the ratio of 50:50 of CIE and SEE Marks

CO PO MAPPING:

COPO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	2	–	–	–	–	–	1	–
CO2	3	3	3	3	3	–	–	–	–	2	–
CO3	3	3	3	3	2	2	–	–	–	2	1
CO4	3	2	3	3	3	2	2	–	–	3	2

Semester: VII		
Cloud Computing		
Course Code:	MVJ22IS754	CIE Marks: 50
L: T:P:S	3:0:0	SEE Marks: 50
Credits:	3	Total :100
Hours:	40Hrs Theory	SEE Duration: 3 Hrs.

COURSE OBJECTIVES: This Course will enable the students to

5.Understands cloud computing models and infrastructure for larger networks

6. Identify policies, mechanisms and scheduling for resource management, virtualization, and optimization of networks.

7. Compare multiple approaches to cloud system design and solve real world problems.

8. Illustrate storage concept and self-organizing capability for different cloud systems.

9. Understands cloud security and risk

Module 1	8hrs

Defining a Cloud, Cloud Computing Reference Model, Characteristics and Benefits, Historical Developments, Building Cloud Computing Environments, Computing Platforms and Technologies, Eras of Computing, Parallel vs. Distributed Computing, Elements of Parallel Computing.

Module 2	8hrs

Characteristics of Virtualized Environments, Taxonomy of Virtualization Techniques, Virtualization and Cloud Computing, Pros and Cons of Virtualization, Technology Examples, Xen, VMware, Microsoft Hyper-V, Cloud Reference Model and Architecture, Infrastructure as a Service, Platform as a Service, Software as a Service, Types of Clouds, Economics of the Cloud, Open Challenges in Clouds

Module 3	8hrs

Data-intensive computing Characterizing data-intensive computations, Challenges ahead, Historical perspective, Technologies for data-intensive computing – Storage systems, Programming platforms – Map Reduce. Public Cloud Infrastructures: Amazon Web Services - Compute, Storage, and Communication Services; Google App Engine – Architecture, Application Life-Cycle, Cost Model; and Microsoft Azure

Module 4	8hrs

ECG Data Analysis on Cloud, Protein Structure Prediction, Satellite Image Processing; Business and Consumer Applications – CRM, Social Networks, Media Applications, and Multiplayer Online Gaming. Advanced Topics in Cloud Computing, Energy efficiency in clouds, Energy-efficient and green cloud computing architecture, Market-based management of clouds, Market-oriented cloud computing, A reference model for MOCC,3 Technologies and initiatives supporting MOCC, Observations

Module 5	8hrs
Cloud security risks, Security: The top concern for cloud users, Privacy and privacy impact assessment, Trust, Operating system security, Virtual machine Security, Security of virtualization, Security risks posed by shared images, Security risks posed by a management OS, A trusted virtual machine monitor.	

Course outcomes: Students will able to	
CO1	Understand the fundamentals of cloud computing, its reference models, benefits, evolution with enabling technologies.
CO2	Apply virtualization concepts and cloud service models (IaaS, PaaS, SaaS) in real-world cloud environments.
CO3	Analyze architectures and platforms for data-intensive and large-scale cloud-base applications.
CO4	Evaluate cloud security challenges, risks, and privacy implications in cloud environments.

Textbooks:	
1	Mastering Cloud Computing, Rajkumar Buyya, Christian Vecchiola, and ThamaraiSelvi, 2013, McGraw Hill, New Delhi, India, ISBN-13: 978-1-25-902995-0. (Module 1, Module 2, Module 3, Module 4, Module 5)
2	Cloud Computing Theory and Practice, Dan C Marinescu, 1st Edition, 2013, Elsevier (MK), ISBN: 9780124046276. (Module 5)

References:	
1	Distributed Computing and Cloud Computing, from parallel processing to interne things, Kai Hwang, GeofferyC. Fox, Jack J Dongarra, 1st Edition, 2012, Elsevier (M ISBN: 978-0-12385880-1.

Continuous Internal Evaluation (CIE):

- Three CIE Will be conducted for 50 marks each and average of three will be t (A)
- Three Quizzes will be conducted along with CIE for 10 Marks Each. Sum of t quizzes will be considered for 30 marks (B)
- Two Assignments for 10 marks each and the sum of both the assignments w taken for 20 Marks (C)

Final CIE Marks will be calculated as (A+B+C)/2 for 50 marks

Semester End Examination (SEE):

The theory exam consists of a written paper structured into two parts:

Part A: Carries 20 marks which include either objective-type or short descri questions. It is designed to cover the entire syllabus comprehensively.

Part B: This section carries a total of 80 marks and consists of 5 questions, with Eith choices. Students are required to answer one full question per module, selecting from choices. Each question is valued at 16 marks and may include up to two sub-parts.

The SEE Theory marks of 100 will be scaled down to 50.

The final score for the course in the ratio of 50:50 of CIE and SEE Marks

CO-PO MAPPING

COPO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	2	–	–	–	–	–	1	–
CO2	3	3	3	2	3	–	–	–	–	2	–
CO3	3	3	3	3	3	2	1	–	–	2	–
CO4	3	2	2	3	2	3	3	2	–	3	1