MVJCE CURRICULUM

for

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

2024 SCHEME

Semester: III		
Mathematics for AI & ML		
Course Code:	**MVJAI301**	**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 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**	**PO12**
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 SYSTEM		
Course Code:	**MVJAI302**	**CIE Marks: 50**
L: T:P:S	**3:0:2:0**	**SEE Marks: 50**
Credits:	**3**	**Total :100**
Hours:	**40 Hrs Theory and 24 Hrs Practical**	**SEE Duration: 3 Hrs.**

Course Objectives: This course will enable the students to:

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

Module-1	
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)**	8Hrs
Module-2	
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)**	8 Hrs
Module-3	
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)**	8 Hrs
Module-4	
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)**	8Hrs
Module-5	
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 (14.1-14.4)**	8Hrs
Laboratory Experiments- 24P	

1.Develop a c program to implement the Process system calls (fork (), exec(), wait(), create process, terminate process)
2 .Simulate the following CPU scheduling algorithms to find turnaround time and waiting time a) FCFS b) SJF c) Round Robin d) Priority.
3. Develop a C program to simulate producer-consumer problem using semaphores.
4. Develop a C program which demonstrates interprocess communication between a reader process and a writer process. Use mkfifo, open, read, write and close APIsPPPPP in your program
5. Develop a C program to simulate Bankers Algorithm for DeadLock Avoidance
6. Develop a C program to simulate the following contiguous 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
8.Simulate following File Organization Techniques a) Single level directory b) Two level directory
9. Develop a C program to simulate the Linked file allocation strategies.
10. Develop a C program to simulate SCAN disk scheduling algorithm.

Textbooks:

1: 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.

Course Outcomes: At the end of the course, the student will be able to:
CO1: Explain the structure and functionality of operating system
CO2: Apply appropriate CPU scheduling algorithms for the given problem
CO3: Analyse the various techniques for process synchronization and deadlock handling.
CO4:Apply the various techniques for memory management
CO5:Explain file and secondary storage management strategies
CO6:Describe the need for information protection mechanisms

AssessmentDetails(bothCIEandSEE)

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

3- High, 2- Moderate, 1- low

Semester : III		
DIGITAL DESIGN AND COMPUTER ORGANISATION		
Course Code:	**MVJAI303**	**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 demonstrate the functionalities of binary logic system
2. To explain the working of combinational and sequential logic system
3. To realize the basic structure of computer system
4. To illustrate the working of I/O operations and processing unit

Module-1	
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	8 Hrs
Module-2	
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	8Hrs
Module-3	
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	8 Hrs
Module-4	
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	8Hrs
Module-5	
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	8Hrs

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

CO1: Apply the K–Map techniques to simplify various Boolean expressions
CO2: Design different types of combinational and sequential circuits along with Verilog programs
CO3: Describe the fundamentals of machine instructions, addressing modes and Processor performance
CO4: Explain the approaches involved in achieving communication between processor and I/O devices
CO5: Analyze internal Organization of Memory and Impact of cache/Pipelining on Processor Performance

Textbooks:

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, 5 th Edition, Tata McGraw Hill.

CO-PO Mapping

CIE ASSESSMENT:

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

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

3- High, 2- Moderate, 1- Low

Semester : III

DATA STRUCTURES AND APPLICATION		
Course Code:	**MVJAI304**	**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 explain fundamentals of data structures and their applications

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

3.To Design and Develop Solutions to problems using Linear Data Structures

4.To discuss applications of Nonlinear Data Structures in problem solving

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

Module-1	
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 1: Chapter-1:1.2 Chapter-2: 2.1 to 2.7 Chapter-3: 3.1,3.2,3.6	8HRS
Module-2	
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 1: Chapter-3: 3.3, 3.4, 3.7 Chapter-4: 4.1 to 4.4	8HRS
Module-3	
LINKED LISTS: Additional List Operations, Sparse Matrices, Doubly Linked List. TREES: Introduction, Binary Trees, Binary Tree Traversals, Threaded Binary Trees. Text Book 1: Chapter-4: 4.5,4.7,4.8 Chapter-5: 5.1 to 5.3, 5.5	8HRS
Module-4	
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 1: Chapter-5: 5.7 to 5.11 Chapter-6: 6.1, 6.2	8HRS
Module-5	
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 1: Chapter 8: 8.1 to 8.3 Chapter 9: 9.1, 9.2 Chapter 10: 10.1	8HRS

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

CO1: Explain different data structures and their applications

CO2: Apply Arrays, Stacks and Queue data structures to solve the given problems.

CO3: Use the concept of linked list in problem solving.

CO4: Develop solutions using trees and graphs to model the real-world problem

CO5: Explain the advanced Data Structures concepts such as Hashing Techniques and Optimal Binary Search Trees.

Textbooks:

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, 2 nd Ed, McGraw Hill, 2013
5. A M Tenenbaum, Data Structures using C, PHI, 1989
6. Robert Kruse, Data Structures and Program Design in C, 2 nd Ed, PHI, 1996

C O- PO Mapping

CIE ASSESSMENT:

- 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

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

Semester : III		
DATA STRUCTURES LABORATORY		
Course Code:	**MVJAIL305**	**CIE Marks: 50**
L: T:P:S	**0:0:2:0**	**SEE Marks: 50**
Credits:	**1**	**Total :100**

Hours:	24 Hrs of Practical	SEE Duration: 3 Hrs.

Course 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.

	Program 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
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.
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
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.
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
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
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 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
9	Develop a Program in C for the following operationson Singly Circular Linked List (SCLL) with header nodes a. Represent and Evaluate a Polynomial P(x,y,z) = 6x2 y 2 z-4yz5+3x3 yz+2xy5 z-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
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
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
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

Laboratory Outcomes: At the end of the course, The student should be able to:
CO1:Analyze various linear and non-linear data structures
CO2:Demonstrate the working nature of different types of data structures and their applications
CO3:Use appropriate searching and sorting algorithms for the give scenario
CO4: Apply the appropriate data structure for solving real world problems.

CONDUCTION OF PRACTICAL EXAMINATION:

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

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

Semester : III		
FUNCTIONAL PROGRAMMING USING JAVA		
Course Code:	**MVJAI3061**	**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:
To learn primitive constructs JAVA programming language.
To understand Object Oriented Programming Features of JAVA
To gain knowledge on: packages, multithreaded programing and exceptions.

Module-1	
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).	8HRS
Module-2	
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.	8HRS
Module-3	
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 Methods	8HRS
Module-4	
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	8HRS
Module-5	
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).	8HRS

Course Outcomes: At the end of the course, the student will be able to:
CO1: Demonstrate proficiency in writing simple programs involving branching and looping structures.

CO2: Design a class involving data members and methods for the given scenario.
CO3: Apply the concepts of inheritance and interfaces in solving real world problems.
CO4: Use the concept of packages and exception handling in solving complex problem
CO5: Apply concepts of multithreading, autoboxing and enumerations in program development

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)

CIE ASSESSMENT:

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

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		
Python Programming for AI & ML		
Course Code:	**MVJAI3062**	**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	
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)	8HRS
Module-2	
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)	8HRS
Module-3	
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)	8HRS
Module-4	
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.	8HRS
Module-5	
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	8HRS

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:

- 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

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

DataAnalyticswithR		
Course Code:	MVJAI3063	**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.**

Courseobjectives:

- ToexploreandunderstandhowRandRStudiointeractiveenvironment.
- TounderstandthedifferentdataStructures,datatypesinR.
- TolearnandpracticeprogrammingtechniquesusingRprogramming.
- ToimportdataintoRfromvariousdatasourcesandgeneratevisualizations.
- Todrawinsightsfromdatasetsusingdataanalyticstechniques.

Sl.NO	Experiments
1	DemonstratethestepsforinstallationofRandRStudio.Performthefollowing: *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)* DemonstrateArithmeticandLogicalOperationswithsimpleexamples. *c)* Demonstrategenerationofsequencesandcreationofvectors. *d)* DemonstrateCreationofMatrices *e)* DemonstratetheCreationofMatricesfromVectorsusingBindingFunction. *f)* Demonstrateelementextractionfromvectors,matricesandarrays **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, DifferentTypes of Numbers, OtherCommonClasses,CheckingandChangingClasses,ExaminingVariables)
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: *a.* Profitforeachmonth. *b.* Profitaftertaxforeachmonth(TaxRateis30%). *c.* Profitmarginforeachmonthequalstoprofitaftertaxdividedbyrevenue. *d.* GoodMonths– wheretheprofitaftertaxwasgreaterthanthemeanfortheyear. *e.* BadMonths– wheretheprofitaftertaxwaslessthanthemeanfortheyear. *f.* Thebestmonth –wherethe profitaftertaxwasmaxfortheyear. *g.* Theworstmonth–wheretheprofitaftertaxwasminforthe year.

	Note: *a.* AllResultsneedtobepresentedasvectors *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.* Resultsfortheprofitmarginrationeedtobepresentedinunitsof%withnodecimal point. *d.* Itisokayfortaxtobenegativeforanygivenmonth(deferredtax asset) *e.* GenerateCSVfileforthe data. **SuggestedReading**– TextBook1–Chapter4(Vectors,CombiningMatrices)
3	Developa program tocreatetwo 3 X3 matrices A and B and perform thefollowing operations a) Transpose of the matrix b) addition c) subtraction d) multiplication **SuggestedReading**– TextBook1–Chapter4(MatricesandArrays–ArrayArithmetic)
4	Developaprogramtofindthefactorialofgivennumberusingrecursivefunctioncalls. **SuggestedReading**–ReferenceBook1–Chapter5(5.5 –RecursiveProgramming) TextBook1–Chapter8(FlowControlandLoops–IfandElse,VectorizedIf,whileloops,for loops),Chapter 6 (Creating and Calling Functions, Passing Functions to and from other functions)
5	DevelopanRProgramusingfunctionstofindalltheprimenumbersuptoaspecifiednumberby themethod of Sieve of Eratosthenes. **SuggestedReading**–ReferenceBook 1-Chapter5(5.5–RecursiveProgramming) TextBook1–Chapter8(FlowControlandLoops–IfandElse,VectorizedIf,whileloops,for loops),Chapter 6 (Creating and Calling Functions, Passing Functions to and from other functions)
6	Thebuilt-indatasetmammalscontaindataonbodyweightversusbrainweight.DevelopR commands to: *a)* FindthePearsonandSpearmancorrelationcoefficients.Aretheysimilar? *b)* Plotthedatausingtheplotcommand. *c)* Plotthelogarithm(log)ofeachvariableandseeifthatmakesa difference. **SuggestedReading**–TextBook1–Chapter12–(Built-inDatasets)Chapter14–(Scatterplots) Reference Book 2 – 13.2.5 (Covariance and Correlation)

<table>
<tr><td>7</td><td>DevelopRprogramtocreateaDataFramewithfollowingdetailsanddothefollowing operations.
<table>
<tr><th>Item Code</th><th>Item Category</th><th>Item Price</th></tr>
<tr><td>1001</td><td>Electronics</td><td>700</td></tr>
<tr><td>1002</td><td>DesktopSupplies</td><td>300</td></tr>
<tr><td>1003</td><td>OfficeSupplies</td><td>350</td></tr>
<tr><td>1004</td><td>USB</td><td>400</td></tr>
<tr><td>1005</td><td>CDDrive</td><td>800</td></tr>
</table>
a) SubsettheDataframeanddisplaythedetailsofonlythoseitemswhosepriceisgreaterthanor equal to 350.
b) SubsettheDataframeanddisplayonlytheitemswherethecategoryiseither “OfficeSupplies”or “Desktop Supplies”
c) CreateanotherDataFramecalled“item-details”withthreedifferentfieldsitemCode, ItemQtyonHandand ItemReorderLvl and merge the two frames

SuggestedReading–Textbook1:Chapter5(Listsand DataFrames)</td></tr>
<tr><td>8</td><td>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) Assigningnames,usingtheairqualitydata set.
b) Changecolorsofthe Histogram
c) RemoveAxisandAddlabelstoHistogram
d) ChangeAxislimits ofa Histogram
e) AddDensitycurvetothehistogram
SuggestedReading–ReferenceBook2–Chapter7(7.4–Theggplot2Package),Chapter24 (Smoothingand Shading)</td></tr>
<tr><td>9</td><td>DesignadataframeinRforstoringabout20employeedetails.CreateaCSVfilenamed“input.csv” thatdefinesalltherequiredinformationabouttheemployeesuchasid,name,salary,start_date,dept. Import into R and do the following analysis.

a) Findthetotalnumberrows&columns
b) Findthemaximum salary
c) Retrievethedetailsoftheemployeewithmaximumsalary
d) RetrievealltheemployeesworkingintheITDepartment.
e) RetrievetheemployeesintheITDepartmentwhosesalaryisgreaterthan20000andwritethese detailsintoanotherfile “output.csv”

SuggestedReading–TextBook1–Chapter12(CSVandTabDelimitedFiles)</td></tr>
<tr><td>10</td><td>Using the built in dataset mtcars which is a popular dataset consisting of the design and fuel consumptionpatternsof32differentautomobiles.Thedatawasextractedfromthe1974MotorTrend US magazine,andcomprises fuel consumption and 10 aspects of automobile design and performance for32automobiles(1973-74models).FormatAdataframewith32observationson11variables:[1] mpg Miles/(US) gallon,

[2] cylNumberofcylinders[3]dispDisplacement(cu.in.),[4]hpGrosshorsepower[5]dratRear axle ratio,[6] wt Weight (lb/1000) [7] qsec 1/4 mile time, [8] vs V/S, [9] am Transmission</td></tr>
</table>

	(0 = automatic, 1 = manual), [10] gear Number of forward gears, [11] carb Number of carburetors DevelopRprogram,tosolve thefollowing: *a)* Whatisthetotalnumberof observationsandvariablesinthedataset? *b)* Findthecarwiththelargest hpandtheleasthpusingsuitablefunctions *c)* Plothistogram/densityforeachvariableanddeterminewhethercontinuousvariables arenormally distributed or not. If not, what is their skewness? *d)* Whatistheaveragedifferenceofgrosshorsepower(hp)betweenautomobileswith3 and 4number of cylinders(cyl)? Also determine the difference in their standard deviations. *e)* WhichpairofvariableshasthehighestPearsoncorrelation? **References(Web links):** 1. https://cran.r-project.org/web/packages/explore/vignettes/explore_mtcars.html 2. 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.PlotacurveofActualValuesvs.Predictedvaluestoshowtheircorrelationandperformance of the model. Interpretthemeaningoftheslopeandy-interceptofthelinewithrespecttothegivendata.Implement usinglmfunction.Savethegraphsandcoefficientsinfiles.Attachthepredictedvaluesofsalariesasa newcolumn to the original data set and save the data as a new CSV file. **SuggestedReading**–ReferenceBook2–Chapter20(GeneralConcepts,StatisticalInference, Prediction)
Note: Data analyticspart isalso includedin the mathematics.	

Courseoutcomes(CourseSkillSet):

Attheendofthecoursethestudentwillbeableto:

- ExplainthefundamentalsyntaxofRdatatypes,expressionsandtheusageoftheR-StudioIDE
- DevelopaprograminRwithprogrammingconstructs:conditionals,loopingandfunctions.
- Applythelistanddataframestructureoftheprogramming language.
- Usevisualizationpackages andfilehandlersfordataanalysis..

SuggestedLearningResources:

Book:

1. Cotton,R.(2013).LearningR:AStepbyStepFunctionGuidetoDataAnalysis.1st ed.O'ReillyMedia 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) TheBookofR:AFirstCourseinProgrammingandStatistics.NoStarchPress.

AssessmentDetails(bothCIEandSEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. Theminimumpassingmarkforthe CIEis40%ofthemaximummarks(20marksoutof50)andforthe SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

ContinuousInternalEvaluation(CIE):

CIEmarksforthepracticalcourseare **50Marks***.*

*Thesplit-upofCIEmarksforrecord/journalandtestareintheratio***60:40***.*

- *Each experiment is to be evaluated for conduction with an observation sheet and record write-up. Rubricsfortheevaluationofthejournal/write-upforhardware/softwareexperimentsaredesigned by the faculty who is handling the laboratory session and are made known to students atthe beginning of the practical session.*
- *Recordshouldcontainallthespecifiedexperimentsinthesyllabusandeachexperimentwrite-up will be evaluated for 10 marks.*
- *Totalmarksscoredbythestudentsarescaleddownto***30marks***(60%ofmaximummarks).*
- *Weightagetobegivenforneatnessandsubmissionofrecord/write-upontime.*
- *Departmentshallconductatestof100marksafterthecompletionofalltheexperimentslistedin the syllabus.*
- *Inatest,testwrite-up,conductionofexperiment,acceptableresult,andproceduralknowledgewill carry a weightage of 60% and the rest 40% for viva-voce.*
- *Thesuitablerubricscanbedesignedtoevaluateeachstudent'sperformanceandlearningability.*
- *Themarksscoredshallbescaleddownto***20marks***(40%ofthemaximummarks).*

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

SemesterEndEvaluation(SEE):

- *SEEmarksforthepracticalcourseare50Marks.*
- *SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the Head of the Institute.*
- *The examination schedule and names of examiners are informed to the university before the conduction of the examination. These practical examinations are to be conducted between the schedule mentioned in the academic calendar of the University.*
- *Alllaboratoryexperimentsaretobeincludedforpracticalexamination.*
- *(Rubrics)Breakup of marks and the instructions printed on the cover page of the answer script tobestrictlyadheredtobytheexaminers.ORbasedonthecourserequirementevaluation*

Semester : III		
SocialConnect&Responsibility		
Course Code:	**MVJSCR307**	**CIE Marks: 100**
L: T:P:S	**0:0:2:1**	**SEE Marks: -**
Credits:	**1**	**Total :100**
Hours:	**12 Hrs Theory**	**SEE Duration: -**

Course Objectives: This course will enable the students to:

1. Provide a formal platform for students to communicate and connect to the surrounding.
2. create a responsible connection with the 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

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 the 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 student 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:

Part 1	
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.	4 Hrs
Part 2	
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.	4 Hrs
Part 3	
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.	4 Hrs
Part 4	
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	4 Hrs
Part 5	
Food walk: City's culinary practices, food lore, and indigenous materials of the region used in cooking – Objectives, Visit, case study, report, outcomes.	4 Hrs

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

CO1:Communicate and connect to the surrounding. CO2: Create a responsible connection with the society CO3:Involve in the community in general in which they work CO4:: Notice the needs and problems of the community and involve them in problem –solving CO5:Develop among themselves a sense of social & civic responsibility & utilize their knowledgein finding practical solutions to individual and community problems CO6:Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.
ACTIVITITES : Jamming session, open mic, and poetry: Platform to connect to others. Share the stories withothers. Share the experience of Social Connect. Exhibit the talent like playing instruments, singing, one-act play, art-painting, and fine art
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 socialconnect 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
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 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 Ofscheme and syllabus by Faculty
2	Heritage walk 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 individual to the concerned evaluation authority	Evaluation as per the rubrics Ofscheme 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 individual to the concerned evaluation authority	Evaluation as per the rubrics Ofscheme and syllabus by Faculty

4	Water conservation: & conservation techniques	May be individual or team	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 individual to the concerned evaluation authority	Evaluation as per the rubrics Ofscheme and 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 individual to the concerned evaluation authority	Evaluation as per the rubrics Ofscheme and syllabus by Faculty

Semester : III / IV / V / VI

NATIONAL SERVICE SCHEME(NSS)		
Course Code:	**MVJNSS 309/409/509/609**	**CIE Marks: 50**
L: T:P:S	**0:0:2:0**	**SEE Marks:**
Credits:	**1**	**Total :100**
Hours:	**24 Hrs Practical**	**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.

General Instructions - Pedagogy

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

1. Use innovative teaching methods along with lectures to help students build both theoretical and practical social and cultural skills.
2. Explain the importance of NSS activities today with real-life examples like cleanliness drives or blood donation camps.
3. Motivate and guide students to plan and carry out their own activities.
4. Give homework, grade assignments and quizzes, and keep records of students' progress in real-life field activities.
5. Encourage students to work in groups to improve their creativity and problem-solving skills.

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 No	**Topic**	**Group size**	**Location**	**Activity execution**	**Reporting**	**Evaluation 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 contribution in social and	May be individual or team	Women empowerment groups/ Consulting NGO's & Govt. Teams/ College campuses etc.	Group selection/proper consultation/Continuous monitoring/ information	Report should be submitted by individuals to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer

	economic issues.			board		
4.	Water conservation techniques – Role of different stake holders– Implementation.	May be individual or team	Villages/city Areas/ Grama panchayat/public associations/Government t 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 t 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 results and enhance their enrolment in Higher/ technical/ vocational education.	May be individual or team	Local government/ private/ aided schools/Government Schemes officers/ etc….	School 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
7.	Developing Sustainable Water management system for rural areas and implementation approaches.	May be individualorteam	Villages/City Areas/ Grama panchayat/public associations/Gover n ment Schemes officers/ campusetc….	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

8.	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.	May be individua l orteam	Villages/City Areas/ Grama panchayat/publi c associations/Gov ernment Schemes officers/ campus etc.	Group selection/pro per consultation/Con tinu 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
9.	Spreading public awareness under rural outreach programs. (minimum5programs). Socials connect and responsibilities.	May be individua l orteam	Villages /CityAreas / Grama panchayat/publi c associations/Gov ern ment Schemes officers/ campusetc….	Group selection/pro per 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
10.	Plantation and adoption of plants. Know your plants.	May be individua l orteam	Villages/CityAr eas/ Grama panchayat/publi c associations/Gov ern ment nt Schemes officers/ campusetc….	Place selection/proper consultation/Con tinu ous monitoring / Information board	Report should be submitted by individualsto the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
11.	Organize National integration and social harmonyevents /Workshops /Seminars.(Minim um 02 programs).	May be individu al orteam	Villages/CityAr eas/ Grama panchayat/publi c associations/Go vern ment Schemes officers/ campusetc….	Place selection/proper consultation/Con tinu 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

12.	Govt. school Rejuvenation and helping them to achieve good infrastructure.	May be individu al orteam	Villages/CityAr eas/ Grama panchayat/publi c associations/Go vern ment nt Schemes officers/ campusetc….	Place selection/proper consultation/Con tinu 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.
3. Government of India, NSS cell, Activities reports and its manual.

Semester : III / IV / V / VI

PHYSICAL EDUCATION (SPORTS & ATHLETICS)

Course Code:	**MVJPE309/409/509/609**	**CIE Marks: 50**
L: T:P:S	**0:0:2:0**	**SEE Marks:**
Credits:	**1**	**Total :100**
Hours:	**24 Hrs Practical**	**SEE Duration:**

CourseOutcomes(COs)	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**
CO1: Understand the importance of social responsibility and civic engagement	2	2	-	-	-	3	3	2	2	2	-
CO2: Develop leadership qualities and democratic attitudes	-	2	-	-	-	2	2	3	3	2	-
CO3: Work effectively as an individual and as a team in diverse fields of community	2	-	-	-	-	3	2	3	3	2	-
CO4: Acquire skills in mobilizing community participation and local resources	-	-	2	-	1	3	3	2	2	2	2
CO5: Understand and apply health, hygiene, and environmental conservation knowledge	-	-	1	-	1	3	3	2	-	-	-
CO6:Demonstrateethicalvalues, empathy, and compassion in social work	-	-	-	-	-	3	3	3	2	-	-

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.

Topics / Activities to be Covered (100Marks)

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	

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 maintainin lifestyle.

AssessmentDetails forCIE(bothCIE andSEE)

Weight age	**CIE– 100%**	
Participation of student in all the modules	50 Marks	• Implementationstrategiesoftheproject(P • The last report should be sig byPED,theHODandprincipal. • Atlastreportshould beevaluated bythe institute. • Finally,theconsolidatedmarkssheetshou to the Controller of Examinations offic
Final presentation / exhibition / Participation In competitions / practical on specific tasks Assigned to the students	50Marks	
Totalmarksforthecourseineachsemester	**100Marks**	

Marksscoredfor100bythestudentsshouldbeScaleto50marksineachsemester.

Studentsshouldpresenttheprogressoftheactivitiesasperthescheduleintheprescribedpracticalsessioninthefield.Thereshou progressinthevertical order for thebenefitof societyingeneral.

.

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 : III / IV / V / VI		
YOGA		
Course Code:	MVJYO309/409/509/609	**CIE Marks:100**
L: T:P:S	**0:0:2:0**	**SEE Marks: --**
Credits:	**0**	**Total :100**
Hours:	**24 Hrs Practical**	**SEE Duration: ---**

CourseObjectives:

- PromoteHolisticWellnessPracticeinStudents.
- DevelopPhysicalAwarenessandFlexibility.
- ImproveFocusandAcademicPerformance.
- EncourageHealthyLifestyleHabits.
- SupportmentalHealthandEmotionalbalance.
- MaintainphysicalBodyHealth.

1) TheHealthBenefitsofYoga:

Yogahelpswithaperson-centeredapproachtowell-beingoffering**physical, mental(cognitive),andspiritual(emotional)benefits**forstudents.Thesebenefitscan helpstudentscopewiththedemandsofacademicjourneys,improvetheiroverall health, and promote personal development.

- **KeyBenefitsofVariousYogaTechniques:**

- EnhancesPhysicalWell-being.
- BoostsMentalFocus.
- PromotesEmotionalStability.
- ReducesStressLevels.
- EncouragesInnerGrowth.

Itisalsousedasanadjunctherapytosupportrecoveryfromvariousphysical health conditions such as:

- ChronicPain.
- BackPain.
- Arthritis.
- CardiovascularDiseases.
- Asthma.
- ChronicFatigueSyndrome.

- MenstrualDisorders.
- DigestiveIssues.
- ThyroidImbalances.
- Migraineandheadache.

2) Coreobservationsonhowyogafunctionsasacomplementarymind-body interventiontosupportthepsychological,physiologicalandspiritualhealing processes associated with various health conditions.

PsychologicalBenefits:

- Stressreduction.
- Anxietyrelief.
- Traumahealing.
- Cognitiveandclarityfocus.
- EmotionalRegulation.
- Aidinmanagingdepression.

PhysiologicalBenefits:

- EnhanceBloodCirculation.
- BoostCardiovascularHealth.
- SupportsOverallGutFunction.
- PromotesThyroidFunction.
- Relieffrom Headaches.
- IncreasedEnergylevel.

Spiritual Benefits:

- CultivatinggratitudeandCompassion
- Self–realization
- BalanceandHarmony
- InnerPeace
- Senseofoneness.
- Mindfulness.

Module I -Discipline and Awareness Reflect Habits s Thoughts	
• **BasictheoryofYoga,YamassNiyamas** Yogadefinition,AimsandObjectives,importanceofyogainstudents. • **IntroductiontoYogaasana** Yogaasanameaning,principleandhealthbenefits. • **Ashtangayoga** Meaning,breathingtechniques. • **Fourpathsofyoga** Karmayoga,Bhakthiyoga,Rajayoga,Jnanayoga. • **Suryanamaskar** Suryanamaskarprayeranditsmeaning,benefitsandimportance. • **Yogaasanas** Asanasit'sneed,importance,nameandtechnique. **Sitting: -**Vajrasana, sukhasana **Standing:-** adasana,Ardhachakrasana **Proneline:-** Advasana,Bhujangasana **Supineline:-**Shavasana,Suptabaddhakonasana **Balancingposture:-**Vrikshasana, Garudasana	**6 h**
ModuleII-Buildingstrengthandfocus Finding out the obstacle	
• **Kriya Yoga** Tapas, Svadhyaya, Ishwarapranidhana • **Five Kleshas** Obstacles. • **Pranayama** Introduction to Pranayama. • **Pratyahara** Preparing mind for meditation, Breathe focus techniques.	**6 h**

• **Yoga asanas** Standing: -Virabhadrasana,Parshvakona Sitting: -Vajrasana, Paschimottanasana Prone Line: -Dhanurasana, Shalabhasana Supine Line: -Ananda Balasana, Supta Matsyendrasana Balancing: -Natarajasana (Dancer Pose)	
ModuleIII–Awarenessandinnerbalance **Finding how focused is the mind**	
• **Dharana :** Concentration • **Dhyana:** Meditation • **Swasthya,Smrithi,Sankalpa.** Toolofacademicexcellence. • ***Samyama*** Patanjali'sconceptofsamyama • **Yogasanas** **Standing**: - ArdhaChandrasana, Utkatasana **Sitting**: - Padmasana (or prep), Gomukhasana **ProneLine**:- AdhoMukhaSvanasana,Naukasana **SupineLine:-** SuptaBaddhaKonasana,Chakrasana **Balancing**: - Garudasana (Eagle Pose)	**6 h**
ModuleIV–integratingYogaindailyLife	
• **YamaniyamaAcharam** PracticeofethicalDiscipline(practicingnonviolence,truth,cleanliness) • **Ahara-ViharaSamyama** PracticedisciplineindietClifestyle. • **Asana-pranayamasadhana** Dailypracticeofasanasandpranayama • **Yogasanas** **Standing**: -PrasaritaPadottanasana,ParivrttaTrikonasana **Sitting**: -BaddhaKonasana,Marichyasana **ProneLine**: -Ustrasana(Camel),Makarasana(relaxation) **SupineLine**: -Sarvangasana,Shavasana **Balancing**: -Bakasana(Crow–optionalormodified)	**6 h**
Courseoutcomes 1. Identifyandreflectonpersonalhabitsandthoughts. 2. ExplainthebasictheoryofYoga,includingYamasCNiyama. 3. Understandthedefinition,aims,objectives,andimportanceofYoga,especially for students.	

4. EnhancephysicalandmentalstrengththroughadvancedYogasanas.
5. PracticeDharana(concentration)andDhyana(meditation)toimprovefocus.

CO/POMapping											
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1		2						3	2	2	
CO2	2						2	2			
CO3	2					2	2	3			
CO4					2		3	3			
CO5		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		
ADDITIONALMATHEMATICS-I		
Course Code:	**MVJMATDIP-I**	**CIE Marks: 100**
L: T:P:S	**2:0:0:0**	**SEE Marks: ---**
Credits:	**0**	**Total :100**
Hours:	**24 Hrs Theory**	**SEE Duration: ---**

CourseLearning Objectives:Thestudents willbeable to

To familiarize the important and introductory concepts of Differential calculus, Integral calculus, Vector differentiation, Probability, ordinary differential equations of first order,andanalyzethe engineering problems.

UNIT1	
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.	**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.	**5 Hrs.**
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. **Vector identities** - $div(\phi \vec{A})$, $curl(\phi \vec{A})$, $curl(grad(\phi))$, $div(curl \vec{A})$. Self study: Line integrals, Green's theorem, Gauss and stokes theorem.	**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.	**5 Hrs.**
UNIT 5	
Ordinary Differential Equations of First Order: Introduction – Formation of differential equation, solutions of first order and firstdegree differential equations: variable separable form, homogeneous, exact, linear differential equations. Some special first order equations: Bernoulli equation, Clairaut's equation	**5 Hrs.**

Self study: Applications of differential equations(ODE): Newton's law cooling.	

CourseOutcomes:Aftercompletingthe course, thestudentswillbeable to

CO1	Applytheknowledgeofcalculustosolveproblemsrelatedto polarcurvesand its Applications
CO2	Applytheconceptofintegrationandvariablestoevaluatemultipleintegrals and their usage in computing the area and volumes.
CO3	Illustratetheapplications ofmultivariatecalculustounderstandthesolenoidaland irrotationalvectorsandalsoexhibittheinterdependenceofline,surfaceandvolume integrals.
CO4	UnderstandthebasicConceptsofProbability
CO5	Recognizeandsolvefirst-orderordinarydifferentialequationsoccurringin different branches of engineering.

Text Books

1.	B.S.Grewal,"HigherEngineeringMathematics"KhannaPublishers,43rdEdition,2013.
2.	RamanaB.V.,"HigherEngineeringMathematics",TataMcGraw-Hill,2006.

CO - PO MAPPING

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

Semester : IV

Analysis and Design of Algorithms		
Course Code:	**MVJAI401**	**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 learn the methods for analyzing algorithms and evaluating their performance.
2. To demonstrate the efficiency of algorithms using asymptotic notations.
3. To solve problems using various algorithm design methods, including brute force, greedy, divide and conquer, decrease and conquer, transform and conquer, dynamic programming, backtracking, and branch and bound.
4. To learn the concepts of P and NP complexity classes.

Module-1	
INTRODUCTION: What is an Algorithm? Fundamentals of Algorithmic Problem Solving. FUNDAMENTALS OF THE ANALYSIS OF ALGORITHM EFFICIENCY: Analysis Framework, Asymptotic Notations and Basic Efficiency Classes, Mathematical Analysis of Non recursive Algorithms, Mathematical Analysis of Recursive Algorithms. BRUTE FORCE APPROACHES: Selection Sort and Bubble Sort, Sequential Search and Brute Force String Matching. Chapter 1 (Sections 1.1,1.2), Chapter 2(Sections 2.1,2.2,2.3,2.4), Chapter 3(Section 3.1,3.2)	8 hrs
Module-2	
BRUTE FORCE APPROACHES (contd..): Exhaustive Search (Travelling Salesman probem and Knapsack Problem). DECREASE-AND-CONQUER: Insertion Sort, Topological Sorting. DIVIDE AND CONQUER: Merge Sort, Quick Sort, Binary Tree Traversals, Multiplication of Large Integers and Strassen's Matrix Multiplication Chapter 3(Section 3.4), Chapter 4 (Sections 4.1,4.2), Chapter 5 (Section 5.1,5.2,5.3, 5.4)	8 hrs
Module-3	
TRANSFORM-AND-CONQUER: Balanced Search Trees, Heaps and Heapsort. SPACE-TIME TRADEOFFS: Sorting by Counting: Comparison counting sort, Input Enhancement in String Matching: Horspool's Algorithm. Chapter 6 (Sections 6.3,6.4), Chapter 7 (Sections 7.1,7.2)	8 hrs
Module-4	
DYNAMIC PROGRAMMING: Three basic examples, The Knapsack Problem and Memory Functions, Warshall's and Floyd's Algorithms. THE GREEDY METHOD: Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm, Huffman Trees and Codes. Chapter 8 (Sections 8.1,8.2,8.4), Chapter 9 (Sections 9.1,9.2,9.3,9.4)	8 hrs
Module-5	
LIMITATIONS OF ALGORITHMIC POWER: Decision Trees, P, NP, and NP-Complete Problems. COPING WITH LIMITATIONS OF ALGORITHMIC POWER: Backtracking (n-Queens problem, Subset- sum problem), Branch-and-Bound (Knapsack problem), Approximation algorithms for NP-Hard problems (Knapsack problem). Chapter 11 (Section 11.2, 11.3), Chapter 12 (Sections 12.1,12.2,12.3)	8 hrs

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

CO1: Apply Greedy and dynamic programming method to solve computational problem and backtracking using approximation methods.

CO2: Analyze the performance of the algorithm in terms of time complexity for asymptotic notational method and for various classes of problems such as P, NP hard and NP complete.

CO3:Compare and evaluate conquer approaches to solve computational problems.

CO4:Design a code by using modern tools (PyCharm, Visual Studio Code).

Textbooks

Introduction to the Design and Analysis of Algorithms, By Anany Levitin, 3rd Edition (Indian), 2017, Pearson.

Reference books:

1. Computer Algorithms/C++, Ellis Horowitz, SatrajSahni and Rajasekaran, 2nd Edition, 2014, Universities Press.
2. Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, 3rd Edition, PHI.
3. Design and Analysis of Algorithms, S. Sridhar, Oxford (Higher Education)

CIE ASSESSMENT:

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

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**	**3**	**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 : IV		
ARTIFICIALINTELLIGENCE		
Course Code:	**MVJAI402**	**CIE Marks: 50**
L: T:P:S	**3:0:2:0**	**SEE Marks: 50**
Credits:	**4**	**Total :100**
Hours:	**40 Hrs Theory and 24 Hrs Practical**	**SEE Duration: 3 Hrs.**

Courseobjectives:

1. GainahistoricalperspectiveofAIandits foundations.
2. BecomefamiliarwithbasicprinciplesofAItowardproblemsolving\
3. Gettoknowapproachesofinference,perception,knowledgerepresentation,andlearning

Module-1	
Introduction: WhatisAI?FoundationsandHistoryofAI **IntelligentAgents:**Agentsand environment, Concept of Rationality, The nature of environment, The structure of agents. **Textbook1**:Chapter1-1.1,1.2, 1.3Chapter2- 2.1,2.2, 2.3, 2.4	**8 hrs**
Module-2	
Problem-solving: Problem-solving agents, Example problems, Searching for Solutions Uninformed Search Strategies: Breadth First search, Depth First Search, Iterative deepening depth first search; **Textbook1**:Chapter3-3.1, 3.2,3.3, 3.4	**8 hrs**
Module-3	
Informed Search Strategies: Heuristic functions, Greedy best first search, A*search. Heuristic Functions **Logical Agents**: Knowledge–based agents, The Wumpus world, Logic, Propositional logic, Reasoning patterns in Propositional Logic **Textbook1**:Chapter3-3.5,3.6 Chapter 4 –4.1, 4.2Chapter 7-7.1,7.2, 7.3, 7.4, 7.5	**8 hrs**
Module-4	
FirstOrderLogic:RepresentationRevisited,SyntaxandSemanticsofFirstOrderlogic,UsingFirstOrder logic. **Inference in First Order Logic** :Propositional Versus First Order Inference, Unification, Forward Chaining, Backward Chaining, Resolution Textbook1:Chapter8-8.1, 8.2, 8.3Chapter9-9.1, 9.2, 9.3, 9.4, 9.5	**8 hrs**
Module-5	
Uncertain Knowledge and Reasoning: Quantifying Uncertainty: Acting under Uncertainty, Basic Probability Notation, Inference using Full Joint Distributions, Independence, Baye's Rule and its use. Wumpus World Revisited **ExpertSystems:**Representingandusingdomainknowledge,ESshells.Explanation,knowledgeacquisition Text Book 1: Chapter 13-13.1, 13.2, 13.3, 13.4, 13.5, 13.6 Text Book2:Chapter 20	**8 hrs**

Sl.NO	Experiments
1	ImplementandDemonstrate DepthFirst Search Algorithmon WaterJugProblem
2	ImplementandDemonstrateBestFirstSearchAlgorithmonMissionaries-CannibalsProblemsusing Python
3	ImplementA*Search algorithm
4	ImplementAO*Search algorithm
5	Solve8-QueensProblemwithsuitableassumptions
6	ImplementationofTSPusingheuristicapproach
7	Implementationoftheproblemsolvingstrategies:eitherusingForwardChainingorBackward Chaining
8	ImplementresolutionprincipleonFOPLrelated problems
9	ImplementTic-Tac-ToegameusingPython

Courseoutcomes(CourseSkillSet):

Attheendofthecourse,thestudentwill beableto:

CO1:Applyknowledgeofagentarchitecture,searchingandreasoningtechniquesfordifferent applications.

CO2.ComparevariousSearchingandInferencingTechniques.

CO3.Developknowledgebasesentencesusingpropositionallogicandfirstorderlogic CO 4. Describe the concepts of quantifyinguncertainty.

CO5:UsetheconceptsofExpertSystemstobuildapplications.

Textbooks

1. StuartJ.Russell andPeterNorvig,ArtificialIntelligence,3rdEdition, Pearson,2015
2. ElaineRich,KevinKnight,ArtificialIntelligence,3rdedition,TataMcGrawHill,2013

Reference books:

1. GeorgeFLugar,ArtificialIntelligenceStructureandstrategiesforcomplex,PearsonEducation,5th Edition,2011
2. NilsJ.Nilsson,PrinciplesofArtificialIntelligence,Elsevier, 1980
3. SarojKaushik,ArtificialIntelligence,Cengagelearning,2014

AssessmentDetails(bothCIEandSEE)

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 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	3	2									
CO2											
CO3											
CO4											
CO5											

Semester : IV		
DATABASE MANAGEMENT SYSTEM		
Course Code:	**MVJAI403**	**CIE Marks: 50**
L: T:P:S	**3:0:2:0**	**SEE Marks: 50**
Credits:	**4**	**Total :100**
Hours:	**40 Hrs Theory and 24 Hrs Practical**	**SEE Duration: 3 Hrs.**

Course Objectives: This course will enable the students to:

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

Module-1	
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	8 hrs
Module-2	
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. Textbook 1: Ch 5.1 to 5.3, Ch 8.1 to 8.5; Ch 9.1 to 9.2 Textbook 2: 3.5	8 hrs
Module-3	

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. 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 14.1 to 14.7, Ch 6.1 to 6.5	8 hrs
Module-4	
SQL: Advanced Queries: More complex SQL retrieval queries, Specifying constraints as assertions and action triggers, Views in SQL. 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, Ch 20.1 to 20.6	8 Hrs
Module-5	
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	8 hrs
Practical Experiments	**24P**

1. Create a table called Employee & execute the following.

Employee(EMPNO,ENAME,JOB, MANAGER_NO, SAL, COMMISSION)

1. Create a user and grant all permissions to theuser.
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.
3. Add primary key constraint and not null constraint to the employee table.

Insert null values to the employee table and verify the result.

2. Create a table called Employee that contain attributes EMPNO,ENAME,JOB, MGR,SAL & 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.

3. 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
3. Find the Maximum age from employee table.

4. Find the Minimum age from employee table.
5. Find salaries of employee in Ascending Order.

Find grouped salaries of employees.

4. Create a row 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 & new Salary CUSTOMERS(ID,NAME,AGE,ADDRESS,SALARY)

5. Create cursor for Employee table & extract the values from the table. Declare the variables

,Open the cursor & extrct the values from the cursor. Close the cursor.

Employee(E_id, E_name, Age, Salary)

6. 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.

7. Install an Open Source NoSQL Data base MangoDB & perform basic CRUD(Create, Read,

Update & Delete) operations. Execute MangoDB basic Queries using CRUD operations.

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

CO1:Apply the concepts, models, operations, and techniques to query, manage, and optimize databases effectively for real-world applications.

CO2: Analyze the components, relationships, and constraints across database models, operations, and architectures to understand their inter dependencies and applications.

CO3: Construct and implement database systems by using concepts, architectures, models, and techniques to create efficient solutions for diverse applications.

CO4: Evaluate and validate the effectiveness, reliability, and scalability of database systems by critically assessing the application such as normalization, concurrency control, and transaction processing within real-world scenarios.

CO5: Design and develop innovative database systems using advanced tools, techniques, and technologies like mongodb to address modern data management challenges efficiently and effectively.

Textbooks

1. Fundamentals of Database Systems, Ramez Elmasri and Shamkant B. Navathe, 7th Edition, 2017, Pearson.

Database management systems, Ramakrishnan, and Gehrke, 3rd Edition, 2014, McGraw Hill

AssessmentDetails(bothCIEandSEE)

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

Semester : IV		
Analysis and Design of Algorithms lab		
Course Code:	**MVJAIL404**	**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 the students to:
To design and implement various algorithms in C/C++ programming using suitable development tools to address different computational challenges.
To apply diverse design strategies for effective problem-solving.
To Measure and compare the performance of different algorithms to determine their efficiency and suitability for specific tasks.

Sl No	Experiment List
1	Design and implement C/C++ Program to find Minimum Cost Spanning Tree of a given connected undirected graph using Kruskal's algorithm.
2	Design and implement C/C++ Program to find Minimum Cost Spanning Tree of a given connected undirected graph using Prim's algorithm.
3	Design and implement C/C++ Program to solve All-Pairs Shortest Paths problem using Floyd's algorithm. Design and implement C/C++ Program to find the transitive closure using Warshal's algorithm.
4	Design and implement C/C++ Program to find shortest paths from a given vertex in a weighted connected graph to other vertices using Dijkstra's algorithm.
5	Design and implement C/C++ Program to obtain the Topological ordering of vertices in a given digraph.
6	Design and implement C/C++ Program to solve 0/1 Knapsack problem using Dynamic Programming method.
7	Design and implement C/C++ Program to solve discrete Knapsack and continuous Knapsack problems using greedy approximation method.
8	Design and implement C/C++ Program to find a subset of a given set S = {sl , s2,.....,sn} of n positive integers whose sum is equal to a given positive integer d.
9	Design and implement C/C++ Program to sort a given set of n integer elements using Selection Sort method and compute its time complexity. Run the program for varied values of n> 5000 and record the time taken to sort. Plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.
10	Design and implement C/C++ Program to sort a given set of n integer elements using Quick Sort method and compute its time complexity. Run the program for varied values of n> 5000 and record the time taken to sort. Plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.

11	Design and implement C/C++ Program to sort a given set of n integer elements using Merge Sort method and compute its time complexity. Run the program for varied values of n> 5000, and record the time taken to sort. Plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.
12	Design and implement C/C++ Program for N Queen's problem using Backtracking.

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

CO1: Apply fundamental algorithmic techniques like divide-and-conquer, dynamic programming, greedy algorithms, backtracking, and branch-and-bound to solve computational problems.

CO2: Analyze the time and space complexity of algorithms using Big O notation and optimize algorithms to improve performance.

CO3: Evaluate different algorithmic approaches and select the most appropriate one based on problem constraints and efficiency.

CO4: Develop programs to solve computational problems be choosing appropriate design techniques to develop solutions for computational and complex problems.

CO5: Design and implement algorithms to solve real-world problems efficiently using programming languages such as Python, Java, or C++.

Assessment Details (both CIE and SEE)

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

Semester End Evaluation (SEE):

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.

Semester:IV		
Discrete Mathematics		
Course Code:	**MVJAI4051**	**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		
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 and 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, Isomorphism , 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.
	Text Books
2.	B.S. Grewal, "Higher Engineering Mathematics" Khanna Publishers, 43rd Edition, 2013.

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.

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 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	PO12
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 : IV		
METRICSPACES		
Course Code:	**MVJA I4052**	**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.**

Courseobjectives:

1. Provideinsight into thetheoryof sets
2. Learnbasicconceptsofmetricspaces
3. Understandtheconceptsofconnectedsetsandcompact spaces

Module-1:Theoryof Sets	
Finite and infinite sets, countable and uncountable sets, cardinality of sets, Schroder-Bernstein theorem, cantor's theorem, Order relation in cardinal numbers, Arithmetic ofcardinal numbers, Partially ordered set, Zorn's lemma and axioms of choice, various set-theoretic paradoxes. **(RBTLevels:L1,L2andL3)**	8 hrs
Module-2:ConceptsinMetricSpaces	
Definition and examples of metric spaces, Open spheres and Closed spheres, Neighborhoods, Open sets, Interior, Exterior and boundary points, Closed sets, Limit points and isolated points, Interior and closure of a set, Boundary of a set, Bounded sets, Distance between two sets, Diameter of a set. **(RBTLevels:L1,L2andL3)**	8 hrs
Module-3:CompleteMetricSpacesandContinuousFunctions	
Cauchy and Convergent sequences, Completeness of metric spaces, Cantor's intersection theorem, Dense sets and separable spaces, Nowhere dense sets and Baire's category theorem, continuous and uniformly continuous functions, Homeomorphism. Banach contraction principle. **(RBTLevels:L1,L2andL3)**	8 hrs
Module-4:Compactness	
Compactspaces,Sequentialcompactness,Bolzano-Weierstrassproperty,Compactnessandfinite	8 hrs

intersectionproperty,Heine-Boreltheorem,Totallyboundedset,equivalenceofcompactnessand sequential compactness. **(RBTLevels:L1,L2andL3)**	
Module-5:Connectedness	
Separated sets, Disconnected and connected sets, components, connected subsets of R, Continuous functions on connected sets. Local connectedness and arc-wise connectedness. **(RBT Levels: L1, L2 and L3)**	8 hrs

SuggestedLearningResources:

Books(Nameoftheauthor/TitleoftheBook/Nameofthepublisher/EditionandYear) Text Books

1. P.K.Jain &Khalil Ahamad,"*MetricSpaces"*.Narosa,2019.
2. MichealO;Searcoid,"Metricspaces".Springer-Verlag,2009.

ReferenceBooks:

1. SatishShirali&HarikishanL.Vasudeva,"*MetricSpaces"*,Springer-Verlag,2006.
2. E.T.Copson,"*Metricspaces"*,CambridgeUniversityPress, 1988.
3. P.R.Halmos,"*NaiveSetTheor*y".Springer, 1974.
4. S.Kumaresan,"*TopologyofMetricspaces",* 2nd edition,Narosa, 2011.

G.F.Simmons, "Introductionto Topologyand Modern Analysis".McGraw-Hill,2004

Courseoutcome(CourseSkill Set)

Attheendofthecourse,thestudentwillbeable to:

1. Explainbasicfactsaboutthecardinalityofasetandvariousset-theoreticparadoxes.
2. Applythe conceptsof openandclosed spheres andboundedsetstosolveproblems.
3. Demonstratestandardconceptsofmetricspacesandtheirproperties.

Identifythecontinuityof afunctiondefinedon metric spacesand homomorphism.

AssessmentDetails(bothCIEandSEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE, the minimum passing mark is 35% of the maximum marks (18 out of 50 marks). The student is declared as a pass in the course if he/she secures a minimumof40%(40marksout of100)inthe total oftheCIE (ContinuousInternal Evaluation)

andSEE(SemesterEnd Examination)taken together.

ContinuousInternalEvaluation:

- Thereare25marksfortheCIE'sAssignmentcomponentand25fortheInternalAssessment Test component.
- Each test shall be conducted for 25 marks. The first test will be administered after 40-50% of the coverage of the syllabus, and the second test will be administered after 85-90% of the coverage of the

syllabus. The average of the two tests shall be scaled down to 25 marks

- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The schedule for assignments shall be planned properly by the course teacher. The teacher should not conduct two assignments at the end of the semester if two assignments are planned. Each assignment shallbeconductedfor25marks.(Iftwoassignmentsareconductedthenthesumofthetwo assignmentsshallbescaleddownto25marks)

- ThefinalCIEmarksofthecourseoutof50willbethesumofthescale-downmarksof tests and assignment/s marks.

Internal AssessmentTestquestion paperis designed toattain thedifferentlevels of Bloom's taxonomy as per the outcome defined for the course.

Semester-EndExamination:

Theory SEE will be conducted by the University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. Thequestion paper will havetenquestions. Each questionissetfor20 marks.
2. Therewillbe2questionsfromeachmodule.Eachofthetwoquestionsunderamodule (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. Thestudentshavetoanswer 5fullquestions,selectingonefullquestion fromeachmodule.

Marksscoredshall beproportionallyreduced to50marks

CO-PO MAPPING

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

Semester : IV		
INTRODUCTION TO CONVEX OPTIMIZATION		
Course Code:	**MVJAI4053**	**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.**

Courseobjectives:*Theobjectivesofthecoursearetofecilitatethelearners to:*

- *Appreciate the importance of linear algebra in computer science and allied engineering science.*
- *Gain the knowledge of linear algebra tools and concepts to implememt them in their core domain.*
- *Improvetheirmathematicalthinkingandacquireskillsrequiredforsustained lifelong learning.*

Module-1:VECTORCALCULUS	
Functions of several variables, Differentiation and partial differentials, gradients of vector-valued functions, gradients of matrices, useful identities for computing gradients, linearization and multivariate Taylor series. **(RBTLevels:L1,L2andL3)**	8 hrs
Module-2:APPLICATIONSOFVECTORCALCULUS	
Backpropagationandautomaticdifferentiation,gradientsinadeepnetwork,TheGradient of Quadratic Cost, Descending the Gradient of Cost, The Gradient of MeanSquared Error. **(RBTLevels:L1,L2andL3)**	8 hrs
Module-3:ConvexOptimization-1	
Local and global optima, convex sets and functions separating hyperplanes, application of Hessian matrix in optimization, Optimization using gradient descent, Sequential search 3- point search and Fibonacci search. **(RBTLevels:L1,L2andL3)**	8 hrs
Module-4:ConvexOptimization-2	
Unconstrained optimization -Method of steepest ascent/descent, NR method, Gradient descent, Mini batch gradient descent,Stochastic gradient descent. **(RBTLevels:L1,L2andL3)**	8 hrs
Module-5:AdvancedOptimization	
Momentum-basedgradientdescentmethods:Adagrad,RMSpropandAdam. *Non-ConvexOptimization:ConvergencetoCriticalPoints,Saddle-Pointmethods.* **(RBTLevels:L1,L2andL3)**	8 hrs

Courseoutcome(CourseSkillSet)

Attheendofthecourse,thestudentwillbeableto:

1. *Applytheconceptsofvectorcalculustosolvethegivenproblem.*
2. *Applytheconceptsofpartialdifferentiationinmachinelearninganddeepneural networks.*
3. *Analyzetheconvexoptimizationalgorithmsandtheirimportanceincomputer science & engineering.*
4. *Applytheoptimizationalgorithmstosolvethe problem.*

Analyzetheadvancedoptimizationalgorithmsformachinelearning.

SuggestedLearningResources:

Books(Nameoftheauthor/TitleoftheBook/Nameofthepublisher/Editionand Year)

TextBooks:

1. *MathematicsforMachinelearning,MarcPeterDeisennroth,A.AldoFaisal,Cheng Soon Ong, 2020, Cambridge University Press.*
2. *S.Bubeck,ConvexOptimization:AlgorithmsandComplexity,Foundationsand Trends in Optimization, 2015.*
3. *S. Boyd, N. Parikh, and E. Chu," Distributed optimization and statistical learning via thealternatingdirectionmethodofmultipliers",FoundationsandTrendsinMachine Learning, Now Publishers Inc.*

ReferenceBooks:

1. *LinearAlgebraandOptimizationforMachineLearning,CharuC.Aggarwal, Springer, 2020.*
2. *A.Beck,First-OrderMethodsinOptimization,MOS-SIAMSeriesonOptimization, 2017.*

F. Bach, "Learning with Submodular Functions: A Convex Optimization Perspective",FoundationsandTrendsinMachineLearning,NowPublishersInc.

WeblinksandVideoLectures(e-Resources):

- *https://ocw.mit.edu/courses/mathematics/18-06sc-linear-algebra-fall-2011/index.htm*
- *https://www.math.ucdavis.edu/~linear/linear.pdf*
- *https://www.coursera.org/learn/linear-algebra-machine-learning*
- *https://nptel.ac.in/syllabus/111106051/*
- *https://github.com/epfml/OptML_course*

https://www.youtube.com/playlist?list=PL4O4bXkI-fAeYrsBqTUYn2xMjJAqlFQzX

AssessmentDetails(bothCIEandSEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE, the minimum passing mark is 35% of the maximum marks (18 out of 50 marks). The student is declared as a pass in the course if he/she secures a minimum of 40% (40 marks out of 100) in the sum

total of the CIE (Continuous

InternalEvaluation)andSEE(SemesterEndExamination)takentogether.

ContinuousInternalEvaluation:

- *There are 25 marks for the CIE's Assignment component and 25 for the Internal Assessment Test component.*
- *Each test shall be conducted for 25 marks. The first test will be administered after 40- 50% of the coverage of the syllabus, and the second test will be administered after 85- 90% of the coverage of the syllabus. The average of the two tests shall be scaled down to 25 marks*
- *Any two assignment methods mentioned in the 22OB2.4, if an assignment is project- based then only one assignment for the course shall be planned. The schedule for assignmentsshallbeplannedproperlybythecourseteacher.Theteachershouldnot conduct two assignments at the end of the semester if two assignments are planned. Eachassignmentshallbeconductedfor25marks.(Iftwoassignmentsareconducted then the sum of the two assignments shall be scaled down to 25 marks)*
- *ThefinalCIEmarksofthecourseoutof50willbethesumofthescale-downmarksof testsandassignment/smarks.*

InternalAssessmentTest questionpaperisdesignedtoattainthedifferentlevelsof Bloom's taxonomy as per the outcome defined for the course.

Semester-EndExamination:

*TheorySEE willbe conductedbyUniversityas perthe scheduledtimetable, withcommon question papers for the course (***duration 03 hours).**

1. *Thequestionpaperwillhavetenquestions.Eachquestionissetfor20marks.*
2. *There will be 2 questions from each module. Each of the two questions under amodule(with a maximum of 3 sub-questions),* **should have a mix of topics** *under that module.*
3. *Thestudentshavetoanswer5fullquestions,selectingonefullquestionfromeach module.*

Marksscoredshallbeproportionallyreducedto50marks.

CO -PO MAPPING

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

Semester : IV		
ALGORITHMICGAMETHEORY		
Course Code:	**MVJAI 4054**	**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.**

Courseobjectives:

- Comprehendthebasicsofstrategicgamingandmixedstrategicequilibrium.
- Enablestudentstodevelopskillsonextensivegamingstrategies.
- Analyzeanddiscussvariousgamingmodels.
- Illustratesomereal-timesituations.

Module-1	
Introduction to Strategic Games: What is game theory? The theory of rational choice, Strategic games; Examples: The prisoner's dilemma, Bach or Stravinsky, Matching pennies; Nash equilibrium; Examples of Nash equilibrium; Best response functions;Dominated actions. **(RBTLevels:L1,L2andL3)**	8 hrs
Module-2	
Introduction;Strategicgamesinwhichplayersmayrandomize;MixedstrategyNash equilibrium; Dominated actions; Pure equilibrium when randomization is allowed. Illustration: Expert Diagnosis; Equilibrium in a single population. **(RBT Levels: L1, L2 and L3)**	8 hrs
Module-3	
Extensive games with perfect information; Strategies and outcomes; Nash equilibrium; Sub-game perfect equilibrium; Finding sub-game perfect equilibria of finite horizon games: Backward induction;Illustrations:Theultimatumgame,Stackelberg'smodelofduopoly. **(RBTLevels:L1,L2andL3)**	8 hrs
Module-4	
Bayesian Games**,** Motivational examples; General definitions; Two examples concerning information; Illustrations: Cournot's duopoly game with imperfect information, Providing a public good; Auctions: Auctions with an arbitrary distribution of valuations. **(RBTLevels:L1,L2andL3)**	8 hrs
Module-5	
CompetativeGames: Strictlycompetitivegamesand maximization. **Repeated games:** The main idea; Preferences; Repeated games; Finitely andinfinitely repeated Prisoner's dilemma; Strategies in an infinitely repeated Prisoner's dilemma; Nash equilibrium of an infinitely repeated Prisoner's dilemma, Nash equilibrium payoffs of an infinitelyrepeated Prisoner's dilemma. **(RBTLevels:L1,L2andL3)**	8 hrs

Courseoutcome(CourseSkill Set)

Attheendofthecourse,thestudentwillbeable to:

1. Interpretthebasicsofstrategicgamingand extensive games.
2. Analyzegamingstrategiesonreal-timeincidence.
3. Developthemodelsof gamingonreal-time incidence.

Applygametheoryin therealworld problems.

SuggestedLearningResources:

Books(Nameoftheauthor/TitleoftheBook/Nameofthepublisher/EditionandYear) Text Books:

1. **MartinOsborne:"AnIntroductiontoGameTheory",**OxfordUniversityPress,First Indian Edition, 2009, 7thimpression, ISBN – 0195128958.

ReferenceBooks:

1. **RogerB.Myerson:"AnalysisofConflictGameTheory",**Re-printEdition,Harvard University Press, 2008, ISBN – 978-0674341166.
2. **FrederickS.HillierandGeraldJ.Lieberman:"IntroductiontoOperationsResearch, Concepts and Cases",** 9thEdition; Tata McGraw Hill, 2010, ISBN – 0073376299.

JoelWatson:"AnIntroductiontoGameTheory"Strategy,2ndEdition,W.W.Norton &Company, 2007, ISBN – 9780393929348.

WeblinksandVideoLectures(e-Resources):

- http://nptel.ac.in/courses.php?disciplineID=111
- http://www.class-central.com/subject/math(MOOCs)
- http://academicearth.org/
- VTUe-ShikshanaProgram
- VTU EDUSAT Program.

AssessmentDetails(bothCIEandSEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE, the minimum passing mark is 35% of the maximum marks (18 out of 50 marks). The student is declared as a pass in the course if he/she secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous

InternalEvaluation)andSEE(SemesterEndExamination)takentogether.

ContinuousInternalEvaluation:

- *There are 25 marks for the CIE's Assignment component and 25 for the Internal Assessment Test component.*
- *Each test shall be conducted for 25 marks. The first test will be administered after 40- 50% of the coverage of the syllabus, and the second test will be administered after 85- 90% of the coverage of the syllabus. The average of the two tests shall be scaled down to 25 marks*
- *Any two assignment methods mentioned in the 22OB2.4, if an assignment is project- based then only one assignment for the course shall be planned. The schedule for*

assignmentsshallbeplannedproperlybythecourseteacher.Theteachershouldnot conduct two assignments at the end of the semester if two assignments are planned. Eachassignmentshallbeconductedfor25marks.(Iftwoassignmentsareconducted then the sum of the two assignments shall be scaled down to 25 marks)

- *ThefinalCIEmarksofthecourseoutof50willbethesumofthescale-downmarksof testsandassignment/smarks.*

InternalAssessmentTest questionpaperisdesignedtoattainthedifferentlevelsof Bloom's taxonomy as per the outcome defined for the course.

Semester-EndExamination:

*TheorySEE willbe conductedbyUniversityas perthe scheduledtimetable, withcommon question papers for the course (***duration 03 hours).**

4. *Thequestionpaperwillhavetenquestions.Eachquestionissetfor20marks.*
5. *There will be 2 questions from each module. Each of the two questions under amodule(with a maximum of 3 sub-questions),* **should have a mix of topics** *under that module.*
6. *Thestudentshavetoanswer5fullquestions,selectingonefullquestionfromeach module.*

Marksscoredshallbeproportionallyreducedto50marks.

CO -PO MAPPING

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

Semester : IV

BIOLOGY FOR ENGINEERS		
Course Code:	**MVJBI407**	**CIE Marks: 50**
L: T:P:S	**2:0:0:0**	**SEE Marks: 50**
Credits:	**2**	**Total :100**
Hours:	**24 Hrs Theory**	**SEE Duration: 2 Hrs.**

Course Objectives: This course will enable the students to:
To familiarize the students with the basic biological concepts and their engineering applications.
To enable the students with an understanding of biodesign principles to create novel devices and structures.
To provide the students 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	
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.	4Hrs
Module-2	
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.	5 Hrs
Module-3	
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	5Hrs
Module-4	
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 perflourocarbons (PFCs).	5Hrs
Module-5	
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.	5Hrs

Textbooks

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

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

CO1: Elucidate the basic biological concepts via relevant industrial applications and case studies.
CO2: Evaluate the principles of design and development, for exploring novel bioengineering projects.
CO3: Corroborate the concepts of biomimetics for specific requirements.
CO4: Think critically towards exploring innovative biobased solutions for socially relevant problems

CIE ASSESSMENT:

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

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 Code:	MVJUHV408	**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 Objectives: This course will enable the students to:

1. Appreciate the essential complementarily between "values and "skills" to ensure sustained happiness and prosperity which are the core aspirants of all human beings
2. Facilitate the development of holistic perspective among the 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 enriching interaction with nature

Module-1	
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 Aspirants, Method to fulfil the basic human Aspirants. Practical Session:Sharing about oneself(tutorial 1),Exploring Human Consciousness(tutorial 2),Exploring Natural Acceptance(tutotial 3)	**3Hrs**
Module-2	
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,Program to ensure self regulation and health Practical Session: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)	**3Hrs**
Module-3	
Review on harmony in the family-the basic unit of human Interaction , other feeling, justice in human-to-human relationship , understanding harmony in the society Harmony in the Family and society:Trust -the foundational value in the relationship , Repsect - as the right education , vision for the universal human order Practical session:exploring the feeling of trust (tutorial 7),Exploring the feeling of Respect(tutorial 8),Exploring system to fulfil human goal(tutorial 9)	**3Hrs**
Module-4	
Harmony in the Nature/Existence:Understanding Harmony in the Nature , Interconnection,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 Session:Exploring the four orders of Natures(Tutorial 10),Exploring Co-existence in Existence(Tutorial 11)	
Module-5	
Review on natural Acceptance of human values, Basics for Humanistic Education, Humanistic constitution and Universal Human order, Holistic Technologies, Production System and Management Models, Typical Case studies Implication of Holistic Understanding- a Look at professional Ethics: Definitiveness of Human Conduct, Competence in professional Ethics, Strategies for transition towards Value-based life and profession	**3 Hrs**

Textbooks
AICTE SIP UHV-I teaching materials, https://fdp-si.aicte.india.org/AicteSipUHV_download.php

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

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

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 announcethe 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

ADDITIONALMATHEMATICS-II		
Course Code:	**MVJMATDIP-II**	**CIE Marks: 100**
L: T:P:S	**2:0:0:0**	**SEE Marks: ---**
Credits:	**0**	**Total :100**
Hours:	**24 Hrs Theory**	**SEE Duration: ---**

Course Objectives: This course will enable the students to:
TofamiliarizetheimportanttoolsLinearAlgebra,differentialCalculus,Beta andGammafunctions,Three-dimensionalGeometryandhigherorderODE's and PDE's for analyzing the engineering problems.

Module-1	
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.	5 Hrs
Module-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
Module-3	
Analytical solid geometry: Introduction –Directional cosine and Directional ratio of a line, Equation of line in space-differentforms, Angle between twoline, shortest distance between twoline, plane and equation of plane in different forms and problems.	5 hrs
Module-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	5 hrs
Module-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.	5 hrs

Self-study: One dimensional heat and wave equations and solutions by the method of separable of variable	

Textbooks:

1. B.S.Grewal,"HigherEngineeringMathematics"KhannaPublishers,43rdEdition,2013.
2. RamanaB.V.,"HigherEngineeringMathematics",TataMcGraw-Hill,2006.

Course Outcomes: At the end of 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.

CIE ASSESSMENT:

- Two CIE Will be conducted for 50 marks each and average of two will be taken (A)
- Two Quizzes will be conducted along with CIE for 10 Marks Each and scaled to 15 marks each. Sum of two 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	-	2	-	-	-	-	-	-	1
CO2	3	3	-	2	-	-	-	-	-	-	1
CO3	3	3	-	3	-	-	-	-	-	-	-
CO4	2	2	-	3	-	-	-	-	-	-	1
CO5	2	2	-	2	-	-	-	-	-	-	-

Semester : V		
SOFTWARE ENGINEERING AND PROJECT MANAGEMENT		
Course Code:	**MVJAI501**	**CIE Marks: 50**

L: T:P:S	**3:0:0:0**	**SEE Marks: 50**
Credits:	**3**	**Total :100**
Hours:	**40 Hrs Theory**	**SEE Duration: 2 Hrs.**

Course Objectives: This course will enable the 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 ofsoftware 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	
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.	8 Hrs
Module-2	
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.	8 Hrs
Module-3	
Software Testing: A Strategic Approach to Software Testing, Strategic Issues, Test Strategies for Conventional Software, Test Strategies for Object -Oriented Software, Validation Testing, System Testing, The Art of Debugging. 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	8 hrs
Module-4	
Introduction to Project Management: Introduction, Project and Importance of Project Management, Contract Management, Activities Covered by Software Project Management, Plans, Methods and Methodologies, Some ways of categorizing Software Projects, Stakeholders, Setting Objectives, Business Case, Project Success and Failure, Management and Management Control, Project Management life cycle, Traditional versus Modern Project Management Practices.	8 hrs
Module-5	52
Activity Planning: Objectives of Activity Planning, When to Plan, Project Schedules, Sequencing	8 hrs

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.

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. Ian Sommerville: Software Engineering, 9th Edition, Pearson Education, 2012
5. Schaum's outline of theory and problems of software engineering, David A. Gustafson, McGraw-Hill's

O-PO MAPPING

Course Outcomes: At the end of the course,the 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 importance 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.

CIE ASSESSMENT:

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

CO4	**1**	**2**	**1**	**2**	**3**					**2**
CO5	**1**	**2**	**1**	**3**	**3**					**2**

Semester : V		
COMPUTER NETWORKS		
Course Code:	**MVJAI502**	**CIE Marks: 50**
L: T:P:S	**3:0:2:0**	**SEE Marks: 50**
Credits:	**4**	**Total :100**
Hours:	**40 Hrs Theory and 24 Hrs**	**SEE Duration: 2 Hrs.**

	Practical	

Course Objectives: This course will enable the 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	
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 and Wave division.	8 hrs
Module-2	
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	8 hrs
Module-3	
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.	8 hrs
Module-4	
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.	8 hrs
Module-5	
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.	8 hrs

LABORATORY EXPERIMENTS – 24hrs

1. Learn to use commands like tcpdump, netstat, ifconfig, lookup and trace route. Capture ping and trace route PDUs using a network protocol analyzer and examine. Screen effectiveness studies.
2. Write a program for error detecting code using CRC-CCITT (16- bits).
3. Write a program to find the shortest path between vertices using the Bellman-ford algorithm.
4. Applications using TCP and UDP sockets like: a) Chat b) File Transfer
5. Simulation of DNS using UDP sockets.
6. Write a code for simulating ARP /RARP protocols.
7. Implementation of Stop and Wait Protocol and Sliding Window Protocol.
8. Write a program for congestion control using leaky bucket algorithm.
9. Implement three nodes point – to- point networks with duplex links between them. Set the queue size, vary the bandwidth and find the number of packets dropped using NS 2 .
10. Simulate the transmission of ping messages/trace route over a network topology consisting of 6 nodes and find the number of packets dropped due to congestion using NS 2.
11. Simulate an Ethernet LAN using n nodes and set multiple traffic nodes and plot congestion window for different source / destination using NS 2.
12. Simulate simple ESS and with transmitting nodes in wireless LAN by simulation and determine the performance with respect to transmission of packets using NS 2

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.

Course Outcomes: At the end of the course,the 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.

CIE ASSESSMENT:

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)/3 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.

SEE ASSESSMENT:

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

Semester : V		
THEORY OF COMPUTATION		
Course Code:	**MVJAI503**	**CIE Marks: 50**
L: T:P:S	**4:0:0:0**	**SEE Marks: 50**
Credits:	**4**	**Total :100**
Hours:	**40 Hrs Theory**	**SEE Duration: 2 Hrs.**

Course Objectives: This course will enable the students to:
Acquiring knowledge of Automata Theory as the basis of all computer science languages design.
Understand the concept of Context Free Grammars and Languages.
Understand the concepts of Turing Machine and Chomskian Languages.
Acquire knowledge of Decidability.
Enrich the knowledge in various phases of compiler ant its use.

Module-1	
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	**8 hrs**
Module-2	
Regular Expressions: Regular languages: Regular Expressions – Finite Automata and Regular	**8 hrs**

Expression. Properties of regular expression, Applications of regular expression.	
Module-3	
Regular Languages: Properties of regular languages: Pumping lemma for regular languages – Closure properties of regular languages –Equivalence and Minimization of Finite Automata.	**8 hrs**
Module-4	
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 to CFG and CFG's to PDA	**8 hrs**
Module-5	
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 – Multi tape Turing Machines.	8 hrs

Textbooks:

1.Hopcroft J E, MotwaniR and Ullman J D, Introduction to Automata Theory, Languages and Computations, Second Edition, Pearson Education, 2012.

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

CO1: Analyze and design finite Automata for solving computational problems.

CO2: Design and implement regular expression, Analyze regular grammars, and optimize deterministic finite Automata

CO3: Analyze and prove the properties of regular languages using pumping lemma and closure properties.

CO4: Design and Analyze context- free languages, Parse trees and pushdown automata for efficient language recognition and processing

CO5: Design and implement optimized turing machines for complete computational problems.

CIE ASSESSMENT:

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

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

Semester : V		
DATA VISUALIZATION LAB		
Course Code:	**MVJAIL504**	**CIE Marks: 50**
L: T:P:S	**0:0:2:0**	**SEE Marks: 50**
Credits:	**1**	**Total :100**
Hours:	**24 Hrs of Practical**	**SEE Duration: 2 Hrs.**

Course Objectives: This course will enable the students to:

Effective use of Business Intelligence (BI) technology (Tableau) to apply data visualization.
To discern patterns and relationships in the data.
To build Dashboard applications.
To communicate the results clearly and concisely.
To be able to work with different formats of data sets.

24P

Sl No	List of Experiments
1	Understanding Data, what is data, where to find data, Foundations for building Data Visualizations, Creating Your First visualization?
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.
3	Tableau Calculations, Overview of SUM, AVR, and Aggregate features, Creating custom calculations and fields
4	Applying new data calculations to your visualizations, Formatting Visualizations, Formatting Tools and Menus, Formatting specific parts of the view
5	Editing and Formatting Axes, Manipulating Data in Tableau data, Pivoting Tableau data.
6	Structuring your data, Sorting and filtering Tableau data, Pivoting Tableau data.

7	Advanced Visualization Tools: Using Filters, Using the Detail panel, using the Size panels, customizing filters, Using and 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
9	Tableau file types, publishing to Tableau Online, Sharing your visualizations, printing, and Exporting
10	Creating custom charts, cyclical data and circular area charts, Dual Axis charts.

Course Outcomes: At the end of the course, the student 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.

Reference Books:
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 Assessment:
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 MAPPING

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

Semester : V		
COMPUTER VISION		
Course Code:	**MVJAI5051**	**CIE Marks: 50**

L: T:P:S	**3:0:0:0**	**SEE Marks: 50**
Credits:	**3**	**Total :100**
Hours:	**40 Hrs Theory**	**SEE Duration: 2 Hrs.**

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 modelling, stochastic optimization etc.
2.Applications range from Biometrics, Medical diagnosis, document processing, mining of visual content,to surveillance, advanced rendering.

Module-1	
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	8 hrs
Module-2	
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	8 hrs
Module-3	
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	8 hrs
Module-4	
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	8 hrs
Module-5	
Object recognition and shape representation: alignment, appearance-based methods, invariants, image eigenspaces	8 hrs

Textbooks:
1.Computer Vision: Algorithms and Applications, R. Szeliski, Springer, 2011
2.Introductory techniques for 3D computer vision, E. Trucco and A. Verri, PrenticeHall,1998

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

CIE ASSESSMENT:
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

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

Semester : V		
Information Theory and Coding		
Course Code:	**MVJAI5052**	**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. Explain concept of Dependent & Independent Source, measure of information, Entropy, Rate of information and Order of a source		

2 Represent the information using Shannon Encoding, Shannon Fano, Prefix and Huffman Encoding Algorithms
3. Model the continuous and discrete communication channels using input, output and joint probabilities

4. Determine a codeword comprising of the check bits computed using Linear Block codes, cyclic codes & convolutional codes
5. Design the encoding and decoding circuits for Linear Block codes, cyclic codes, convolutional codes, BCH and Golay codes.

Module-1: Information Theory	
Information Theory: Introduction, Measure of information, Information content of message, Average Information content of symbols in Long Independent sequences, Average Information content of symbols in Long dependent sequences, Markov Statistical Model for Information Sources, Entropy and Information rate of Mark off Sources (Section 4.1, 4.2 of Text 1)	8 hrs
Module-2: Source Coding	
Source Coding: Encoding of the Source Output, Shannon's Encoding Algorithm (Sections 4.3, 4.3.1 of Text 1), Shannon Fano Encoding Algorithm (Section 2.15 of Reference Book 4) Source coding theorem, Prefix Codes, Kraft McMillan Inequality property KMI, Huffinan codes (Section 2.2 of Text 2)	8 hrs
Module-3: Information Channels:	
Information Channels: Communication Channels, Discrete Communication channels Channel Matrix, Joint probabilty Matrix, Binary Symmetric Channel, System Entropies. (Section 4.4, 4.5, 4.51,4.5.2 of Text 1) Mutual Information, Channel Capacity, Channel Capacity of Binary Symmetric Channel, (Section 2.5, 2.6 of Text 2) Binary Erasure Channel, Muroga's Theorem (Section 2.27, 2.28 of Reference Book4)	8 hrs
Module-4:ErrorControl Coding	
Error Control Coding: Introduction, Examples of Error control coding, methods of Controlling Errors, Types of Errors, types of Codes, Linear Block Codes: matrix description of Linear Block Codes, Error detection & Correction capabilities ofLinear Block Codes, Single error correction Hamming code, Table lookup Decoding using Standard Array. Binary Cyclic Codes: Algebraic Structure of Cyclic Codes, Encoding using an (n-k) Bit Shift register, Syndrome Calculation, Error Detection and Correction (Sections 9.1, 9.2,9.3,9.3.1,9.3.2,9.3.3 of Text 1)	8 hrs
Module-5:ConvolutionCodes	
Convolution Codes: Convolution Encoder, Time domain approach, Transform domain approach, Code Tree, Trellis and State Diagram, The Viterbi Algorithm) (Section 8.5-Articles 1,2 and 3, 8.6-Article 1of Text 2)	8 hrs
Course outcomes: CO1: Overview of probability theory, significance of "information" with respect to information theory. CO2: Derive equations of entropy, mutual information and channel capacity for all kinds of channels. CO3: Implement various types of source coding algorithms and analyse their performance. CO4: Explain various methods of generating and detecting different types of error correcting codes. CO5: Design linear block codes and cyclic codes (encoding and decoding).	
Textbooks: 1. Digitaland AnalogCommunicationSystems,K.SamShanmugam,JohnWtleyIndiaPvtLtd,1996	

2. DigitalCommunication,SimonHaykin,JohnWtleyIndiaPvtLtd,2008

Reference Books:
1. Digital Conummications- Fundamentals andApplications, Bernard Sklar, SecondEdition, Pearson Education, 2016, ISBN: 9780134724058
2.InformationTheory and Coding,HariBhat,GaneshRao,Cengage,2017
3.ErrorCorrectionCoding, ToddKMoon,Wiley Std.Edition, 2006

CIE ASSESSMENT:

CIEisbasedonquizzes,tests,assignments/seminarsandanyotherformofevaluation.Generally,therewill be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests

Quizzes/minitests(4marks)

Mini Project / Case Studies (8 Marks) Activities/Experimentationsrelatedtocourses(8 Marks)

SEE ASSESSMENT:

- QuestionpaperfortheSEEconsistsoftwopartsi.e.PartAandPartB.PartAiscompulsoryandconsists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.
- Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions,eachcarrying16marks.Studentshavetoanswerfivefullquestions.Onequestionmustbeset fromeachunit.Thedurationofexamination is3 hours.

CO-PO MAPPING

CO/PO	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	2	2	2	3					2	3
CO4	2	2	2	2	2					2	3
CO5	1	2	3	2	2					2	3

Semester : V		
Nonlinear Control Techniques		
Course Code:	**MVJAI5053**	**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
To introduce the need and concept of nonlinear system.

- To Identify and describe key characteristics of non-linear systems• Apply analytical and numerical techniques to detect and study limit cycles in various systems.
- To Define Lyapunov stability and its importance in analyzing the behavior of nonlinear systems.
- To Understand the Centre Manifold Theorem and its significance in simplifying the analysis of nonlinear systems.
- To Design stabilizing controllers based on exact feedback linearization and other methods.

\	
Introduction-Characteristicsofnonlinearsystems-Classificationofequilibriumpoints-analysisof systems with piecewise constant inputs using phase plane analysis.	8 hrs
Module-2	
periodicorbits-limitcycles-Poincare-BendixsoncriterionBendixson criterion.Existenceand uniquenessof solutions,Lipschitz condition.	8 hrs
Module-3	
StabilityofNonlinearSystems-Lyapunovstability-localstability-locallinearizationandstabilityin the small- Direct method of Lyapunov - generation of Lyapunov function for linear and nonlinear systems – variable gradient method	8 hrs
Module-4	
Centremanifoldtheorem-regionofattraction-FeedbackControlandFeedbackStabilisation- Analysis of feedback systems- Circle Criterion – Popov Criterion.	8 hrs
Module-5:ConvolutionCodes	
Feedback linearization- Design via linearization- stabilization - regulation via integral control-gain scheduling. Exact Feedback Linearization - Input state linearization - input output linearization - state feedback control - stabilization - tracking - integral control.	8 hrs
Course outcomes: CO1: LearnfundamentalsofAnalyzing behaviors andphenomenainnonlinearsystems. CO2: Identifyandanalyzeperiodicsolutions invarioustypes ofnonlinear systems . CO3: Understandthe conceptsoflocalstabilityandstabilityinthe small . CO4: Applythe CentreManifoldTheorem to analyzethelocal behaviorofnonlinear systems . CO5: Evaluatethelimitationsandbenefitsof linearization-basedcontrol design .	
Textbooks: 1. AlbertoIsidori,“NonlinearControlSystems:AnIntroduction”,Springer-Verlag 2. HassanKKhalil,NonlinearSystems,Prentice- HallInternational(UK),2002 3. Jean-JacquesE.SlotineandWeipingLi,“Applied NonlinearControl”,Prentice-Hall,NJ, 1991 Reference Books: 1. M.Vidyasagar,“NonlinearSystemsAnalysis”,Prentice-Hall,India,1991,2.Shankar Sastry, “Nonlinear System Analysis, Stability and Control”, Springer, 1999	
CIE ASSESSMENT: CIEisbasedonquizzes,tests,assignments/seminarsandanyotherformofevaluation.Generally,therewill be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests Quizzes/minitests(4marks) Mini Project / Case Studies (8 Marks) Activities/Experimentationsrelatedtocourses(8 Marks)	
SEE ASSESSMENT: - QuestionpaperfortheSEEconsistsoftwopartsi.e.PartAandPartB.PartAiscompulsoryandconsists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the	

whole syllabus.

- Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions,eachcarrying16marks.Studentshavetoanswerfivefullquestions.Onequestionmustbeset fromeachunit.Thedurationofexamination is3 hours.

CO-PO MAPPING

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

Semester : V		
Distributed Systems		
Course Code:	**MVJAI5054**	**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:
1. Understand the goals and challenges of distributed systems
2. Describe the architecture of RPC/RMI, distributed file systems and name services
3. Learn clock synchronization algorithms to monitor and order the events, mutual exclusion, election and consensus algorithms.
4. Study the fundamental concepts and algorithms related to distributed transactions and replication.

Module-1	
CHARACTERIZATION OF DISTRIBUTED SYSTEMS: Introduction, Focus on resource sharing, Challenges. REMOTE INVOCATION: Introduction, Request-reply protocols, Remote procedure call, Introduction to Remote Method Invocation. Textbook: Chapter- 1.1,1.4,1.5, 5.1-5.5	8 hrs
Module-2	
DISTRIBUTED FILE SYSTEMS: Introduction, File service architecture. NAME SERVICES: Introduction, Name services and the Domain Name System, Directory services. Textbook: Chapter- 12.1,12.2, 13.1-13.3	8 hrs
Module-3	
TIME AND GLOBAL STATES: Introduction, Clocks, events and process states, Synchronizing Physical clocks, Logical time and logical clocks, Global states Textbook: Chapter- 14.1-14.5	8 hrs
Module-4	
COORDINATION AND AGREEMENT: Introduction, Distributed mutual exclusion, Elections, Coordination and agreement in group communication, Consensus and related problems. Textbook: Chapter -15.1-15.5	8 hrs
Module-5	

DISTRIBUTED TRANSACTIONS: Introduction, Flat and nested distributed transactions, Atomic commit protocols, Concurrency control in distributed transactions, Distributed deadlocks, Transaction recovery. REPLICATION: Introduction. Textbook: Chapter -17.1-17.6, 18.1	8 hrs

Course outcomes: After completing the course, the students will be able to :
CO1: Identify the goals and challenges of distributed systems
CO2: Describe the architecture of distributed file systems and name services.
CO3: Apply clock synchronization algorithms to monitor and order the events.
CO4: Analyze the performance of mutual exclusion, election and consensus algorithms.
CO5: Illustrate the fundamental concepts and algorithms related to distributed transactions and replication.

Textbooks:
1. GeorgeCoulouris,JeanDollimoreandTimKindberg:DistributedSystems –Conceptsand Design, 5th Edition, Pearson Publications, 2009

Reference Books:
1. TAndrewSTanenbaum:DistributedOperatingSystems,3rdedition,Pearsonpublication, 2007
2. AjayD.KshemkalyaniandMukeshSinghal,DistributedComputing:Principles,Algorithms and Systems, Cambridge University Press, 2008
3. SunitaMahajan,SeemaShan,DistributedComputing,OxfordUniversityPress,2015

CIE ASSESSMENT:
CIEisbasedonquizzes,tests,assignments/seminarsandanyotherformofevaluation.Generally,therewill be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests

Quizzes/minitests(4marks)

Mini Project / Case Studies (8 Marks) Activities/Experimentationsrelatedtocourses(8 Marks)

SEE ASSESSMENT:
- QuestionpaperfortheSEEconsistsoftwopartsi.e.PartAandPartB.PartAiscompulsoryandconsists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.
- Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions,eachcarrying16marks.Studentshavetoanswerfivefullquestions.Onequestionmustbeset fromeachunit.Thedurationofexamination is3 hours.

CO-PO MAPPING

CO/PO	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	2	2	2	3					2	3
CO4	2	2	2	2	2					2	3
CO5	1	2	3	2	2					2	3

SEMESTER:V		
INNOVATION&ENTREPRENEURSHIP		
Course Code:	**MVJIE5055**	**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.**
CourseLearningObjectives:Thestudentswillbeableto		
1	Inspired;developentrepreneurialmindset andattributes;entrepreneurialskillsetsfor venturecreationandintrapreneurial leadership	
2	Applytheprocess ofproblem-opportunityidentificationandfeasibility assessmentby developingamacroperspectiveoftherealmarket,industries,domains,andcustomerswhile using design thinking principles to refine and pivot their venture idea.	
3	AnalyzeCustomerandMarketsegmentation,estimateMarketsize,anddevelopand validateCustomerPersona.	
4	InitiateSolutiondesign,developMVP,anddetermineProduct-Marketfitprototypes.	
5	Craftinitial Businessplan,Developgo-to-marketstrategies applystorytellingskillsin presentingapersuasiveand defensibleVenturePitch.	
MODULE-I		

EntrepreneurshipFundamentals&Context Meaning and concept, attributes and mindset of entrepreneurial and intrapreneurial leadership,rolemodelsineachandtheirroleineconomicdevelopment.Gamifiedrole 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**
MODULE-II	
Problem&CustomerIdentification: 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. **CoreTeachingTool:**SeveraltypesofactivitiesincludingClass,game,GenAI,'Get outofthebuilding',andVentureActivities.	**8Hrs**
MODULE-III	
Solutiondesign&Prototyping: UnderstandingCustomerJobs-to-be-doneandcrafting innovative solution design to map to customers' needs and create a strong value proposition.DevelopingProblem-solutionfititeratively.Understandingprototypingand MVP. Developing a feasibility prototype with differentiating values, features, and benefits. Initial testing for proof-of-concept and iteration on the prototype. **CoreTeachingTool:** VentureActivity,nocode Innovationtools,Classactivity	**8Hrs**
MODULE-IV	
OpportunityAssessmentandSizing,Business&FinancialModel: Assessrelative market position via competition analysis, sizing the market, and assessing the scope and potential scale of the opportunity. **CoreTeachingTool**:ClassandVentureActivity Introduction to Business model and types, Lean approach, 9 block lean canvas model, riskiestassumptionstoBusinessmodels.ImportanceofBuild–Measure–Leanapproach. Businessplanning:componentsofBusinessplan-Salesplan,Peopleplan,andfinancialplan.	**8Hrs**

MODULE-V	
Go-to-MarketPlan,ScaleOutlook,andVenturePitch Readiness: Financial Planning: Types of costs, preparing a financial plan for profitability using a financialtemplate, understandingthebasicsof Uniteconomics,and analyzingfinancial performance.IntroductiontoMarketingandSales,SelectingtheRightChannel,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:** FounderCaseStudies–SamaandSecurely Share;Classactivity 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. **CoreTeachingTool**:Experttalks;Cases;Classactivityanddiscussions;VentureActivities	**8Hrs**

CO	CourseOutcomes
CO1	UnderstandEntrepreneurialSkillsetandMindset
CO2	Understandandanalyzeindustryproblemsand Enhance customerperson asbasedon market/otherfeedback
CO3	UnderstandanddevelopMVPs
CO4	UnderstandandapplyBusinessmodelsandBusinessplanning.
CO5	Developago-to-marketstrategyandbuildaPersuasivesales pitch

Textbooks

1. RobertD.Hisrich,MichaelP.Peters,DeanA.Shepherd,SabyasachiSinha(2020). Entrepreneurship, McGrawHill, 11th Edition.
2.Ries,E.(2011).TheLeanStartup:HowToday'sEntrepreneursUseContinuous Innovation to Create Radically Successful Businesses. Crown Business
3.Osterwalder,A.,&Pigneur,Y.(2010).BusinessModelGeneration:AHandbookfor Visionaries, Game Changers, and Challengers. John Wiley & Sons.
4.ChowdhryAjay,(2023)JustAspire:NotesonTechnology,Entrepreneurshipand theFuture.

5.SimonSinek(2011)StartwithWhy,PenguinBooks limited.

6.BrownTim(2019)ChangebyDesignRevised&Updated:HowDesignThinking Transforms Organizations and Inspires Innovation, Harper Business
7.NamitaThapar(2022)TheDolphinandtheShark:StoriesonEntrepreneurship,Penguin Books Limited.

References

1.CollinsJim,PorrasJerry,(2004)BuilttoLast:SuccessfulHabitsofVisionary Companies
2.BurlingtonBo,(2016)SmallGiants:CompaniesThatChoosetoBeGreatInsteadofBig

3.SarasD.Sarasvathy,(2008)Effectuation:ElementsofEntrepreneurialExpertise,Elgar Publishing Ltd

WebResources

Learning resource- IgniteX Course Wadhwani platform (Includes 200+ components of customcreatedmodularcontent+500+componentsofthemostrelevantcuratedcontent)

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

MAPPINGOFCOsANDPOs:

CO/ POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11
CO1	**2**	**2**	**2**						**2**		
CO2			**2**	**2**	**2**						
CO3			**2**		**2**	**2**			**2**		
CO4			**2**		**2**				**2**		
CO5			**2**			**2**	**2**	**2**		**2**	

Semester : V		
Essence of Research Methodology and IPR		
Course Code:	**MVJRMI507**	**CIE Marks: 50**
L: T:P:S	**3:0:0:0**	**SEE Marks: 50**
Credits:	**3**	**Total :100**
Hours:	**40 Hrs Theory**	**SEE Duration: 2 Hrs.**

Course Objectives: This course will enable the students to:

1.Give an overview of the research methodology and explain the technique of defining research problem.

2. Explain various research designs and their characteristics.

3.Explain the details of sampling designs, measurement and scaling techniques and also different methods of data collections.

4.Explain several parametric tests of hypotheses

5.Discuss leading International Instruments concerning Intellectual Property Rights

Module-1	
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, Problems Encountered by Researchers in India.	8 hrs
Module-2	
Research Design: Meaning of Research Design, Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental Designs, Important Experimental Designs. Reviewing the literature: Place of the literature review in research, bringing clarity and focus to research problem, improving research methodology, broadening knowledge base in research area, enabling contextual findings, Review of the literature, searching the existing literature, reviewing the selected literature, developing a theoretical framework, developing a conceptual framework, writing about the literature reviewed	8 hrs
Module-3	
Design of Sample Surveys: Design of Sampling: Introduction, Sample Design, Sampling and Non-sampling Errors, Sample Survey versus Census Survey, Types of Sampling Designs. Measurement and Scaling: Qualitative and Quantitative Data, Classifications of Measurement Scales, Goodness of Measurement Scales, Sources of Error in Measurement, Techniques of Developing Measurement Tools, Scaling, Scale Classification Bases, Scaling Technics, Multidimensional Scaling, Deciding the Scale. Data Collection: Introduction, Experimental and Surveys, Collection of Primary Data, Collection of Secondary Data.	8 hrs

Module-4	
Testing of Hypotheses: Hypothesis, Basic Concepts Concerning Testing of Hypotheses, Testing of Hypothesis, Test Statistics and Critical Region, Critical Value and Decision Rule, Procedure for Hypothesis Testing, Hypothesis Testing for Mean, Proportion, Variance, for Difference of Two Mean, for Difference of Two Proportions, for Difference of Two Variances, P-Value approach, Power of Test, Limitations of the Tests of Hypothesis	8 hrs
Module-5	
Intellectual Property: The Concept, Intellectual Property System in India, Development of TRIPS Complied Regime in India, Patents Act, 1970, Trade Mark Act, 1999,The Designs Act, 2000,TheGeographical Indications of Goods (Registration and Protection) Act1999, Copyright Act,1957,TheProtection of Plant Varieties and Farmers' Rights Act, 2001,The Semi-Conductor Integrated Circuits Layout Design Act, 2000, Trade Secrets, Utility Models, IPR and Biodiversity, The Convention on Biological Diversity (CBD) 1992, Co, Leading International Instruments Concerning IPR, World Intellectual Property Organisation (WIPO),WIPO and WTO, Paris Convention for the Protection of Industrial Property, National Treatment, Right of Priority, Common Rules, Patents, Marks, Industrial Designs, Trade Names, Indications of Source, Unfair Competition, Patent Cooperation Treaty (PCT), Advantages of PCT Filing, Berne Convention for the Protection of Literary and Artistic Works, Basic Principles, Duration of Protection, Trade Related Aspects of Intellectual Property Rights(TRIPS) Agreement, Covered under TRIPS Agreement, Features of the Agreement, Protection of Intellectual Property under TRIPS, Copyright and Related Rights, Trademarks, Geographical indications, Industrial Designs, Patents, Patentable Subject Matter, Rights Conferred, Exceptions, Term of protection, Conditions on Patent Applicants, Process Patents, Other Use without Authorization of the Right Holder, Layout-Designs of Integrated Circuits, Protection of Undisclosed Information, Enforcement of Intellectual Property Rights, UNSECO.	8 hrs
Textbooks: 1.Research Methodology: Methods and Techniques, C.R. Kothari, GauravGarg, New Age International, 4th Edition, 2018 2. Study Material (For the topic Intellectual Property under module 5) Professional Programme Intellectual Property Rights, Law and Practice, The Institute of Company Secretaries of India, Statutory Body Under an Act of Parliament, September 2013. 3.Research Methods: the concise knowledge base, Trochim, Atomic DogPublishing,2005.	
Course outcomes: At the end of the course, the students will be able to CO1: overview of the research methodology and explain the technique of defining a research problem. CO2: explain various research designs and their characteristics CO3: explain the details of sampling designs, measurement and scaling techniques and also different methods of data collections CO4: explain several parametric tests of hypotheses CO5: discuss leading International Instruments concerning Intellectual Property Rights	
CIE ASSESSMENT: 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	
SEE ASSESSMENT: 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	-	1	2	2	-	-	1	1	1
CO2	3	2	3	2	2	2	-	1	1	1	-
CO3	1	2	3	3	2	2	-	1	1	1	-
CO4	1	2	3	3	3	2	-	1	1	-	1
CO5	1	1	1	2	2	1	-	-	-	-	-

Semester : V		
Environmental Studies		
Course Code:	**MVJENV508**	**CIE Marks: 50**
L: T:P:S	**3:0:0:0**	**SEE Marks: 50**
Credits:	**3**	**Total :100**
Hours:	**40 Hrs Theory**	**SEE Duration: 2 Hrs.**

Course Objectives: This course will enable the students to:
1.Relate interdisciplinary approach to complex environmental problems using basic tools of the natural and social sciences including geo-systems, biology, chemistry, economics, political science and international processes.
2.Study drinking water quality standards and to illustrate qualitative analysis of water.
3.Critically evaluate the science and policy ramifications of diverse energy portfolios on air and water quality, climate, weapons proliferation, and societal stability.

Module-1

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, Hotspots; Threats and	8 hrs

Conservation of biodiversity, Deforestation.	
Module-2	
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.	8 hrs
Module-3	
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.	8 hrs
Module-4	
Global Environmental Concerns (Concept, policies, and case-studies): Global Warming, Climate Change, Acid Rain, Ozone Depletion and Fluoride problem in drinking water.	8 hrs
Module-5	
Latest Developments in Environmental Pollution Mitigation Tools (Concept and Applications): G.I.S.& Remote Sensing, Environment Impact Assessment, Environmental Management Systems.	8 hrs

Textbooks:

1.Raman Siva kumar, "Principals of Environmental Science and Engineering", 2ndEdition, Cengage learning, Singapur.
2.G. Tyler Miller, "Environmental Science – working with the Earth", 11thEdition, Jr. Thomson Brooks /Cole publications, California
3.Pratiba Singh, Anoop Singh & Piyush Malaviya, "Environmental and Ecology", 1st Edition, ACME Learning Pvt. Ltd. New Delhi.

Course outcomes: At the end of 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.

CIE ASSESSMENT:

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

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

Semester : VI		
NATURAL LANGUAGE PROCESSING		
Course Code:	**MVJAI601**	**CIE Marks: 50**
L: T:P:S	**3:0:2:0**	**SEE Marks: 50**
Credits:	**4**	**Total :100**
Hours:	**40 Hrs Theory and 24 Hrs Practical**	**SEE Duration: 3 Hrs.**

Course objectives: The students will be able to

1. Understand the concept of natural language processing, its challenges, and applications.
2. Understand the concepts of words form using morphology analysis.
3. Acquire the knowledge of syntax and semantics related to natural languages and implement them.
4. Ability to design and analyze various NLP algorithms.
5. Understand and apply knowledge of machine learning techniques used in NLP.

Module-1: Introduction to NLP	
Introduction: Origin of Natural Language Processing (NLP), Challenges of NLP, NLP Applications, Processing Indian Languages.	8 hrs
Module-2: Words, Word Forms and Parsing	
Morphologyfundamentals; MorphologyParadigms; FiniteStateMachine BasedMorphology; Automatic Morphology Learning; Named Entities.	8 hrs

Parsing: Definite clause grammars; shift-reduce parsing; chart parsing' Shallow Parsing, Statistical Parsing, Maximum Entropy Models; Random Fields, Scope Ambiguity and Attachment Ambiguity resolution, Approaches to discourse, generation.	
Module-3: Language Modeling and Part of Speech Tagging	
Language Modeling and Part of Speech Tagging: Markov models, N-grams, estimating the probability of a word, and smoothing, Parts-of-speech, examples, and its usage	8 hrs
Module-4: : Machine Translation	
Machine Translation: Need of MT, Problems of Machine Translation, MT Approaches, Direct Machine Translations, Rule-Based Machine Translation, Knowledge Based MT System, Statistical Machine Translation. **Video-link:** https://www.youtube.com/watch?v=2XUhKpH0p4M&list=PLeo1K3hjS3uuvuAXhYjV2lMEShq2UYSwX&index=12	8 hrs
Module-5: : Meaning and Other Applications	
Meaning:LexicalKnowledgeNetworks,WorldNetTheory;SemanticRoles;WordSense Disambiguation; WSD and Multilinguality; Metaphors. OtherApplications:SentimentAnalysis;TextEntailment;QuestionAnsweringinMultilingual Setting; NLP in Information Retrieval, Cross-Lingual IR. Text-classification. **Video-link:** https://www.youtube.com/watch?v=ZeoqOybAzdc&list=PLeo1K3hjS3uuvuAXhYjV2lMEShq2UYS wX&index=26	8 hrs

Laboratory Experiments – 24P

Sl.NO	Experiments
1	Createacorpusofminimumfivefileswithminimumof5sentencesineachfile,searchfor agivenpatternusingregularexpressionfromthecorpusandlistallthesentencesthathave thesearchedpatternbyhighlightingthefirstoccurrenceofthepatter foreachsentenceand also print the name of the file each sentence belongs to
2	WriteaprogramthattakesaDFAand astringasaninputandchecksforthevalidityofthe string
3	WriteaprogramthattakesanNFAandastringasaninputandchecksforthevalidityof the string using DFS/BFS strategy.
4	ExploreNLTK/Spacyand anyotherequivalent toolsof thefollowing fundamentals: a) Performsentenceandwordtokenization b) Removestop wordsinatext. c) Removepunctuation. d) Tagthe words in agiven text using POS tagger. e) Stemmingand Lemmatization.

5	Writeaprogram forpredicting next word in thesequenceusing n-grams.
6	Writeaprogramtocreateandreadaninputfile,performbasiccleanupoperationsonthe text in the file like removing HTML tags. URLs, remove the duplicate texts. perform spellingcorrectionandremovetheadditionalspaces.Finallywritethe cleanedtextinto an output file.
7	Writeaprogramtoreadaninputfile,deletetheoddnumbersintextsandreplacetheeven numbers with their equivalent words. Finally write the updated test into an output file.
8	WriteaprogramthattakesCFGforalanguageandasentencebelongstoalanguageasan input and generates parse tree for the same using various parsers available in NLTK and Spacy.
9	Writeaprogram toExtractnames, emails,andphonenumbersfromatext.
10	Writeaprogramtoretrievetheinformationfromatextfileusingverb/nounkeywordsasa search query.

Course Outcomes:

CO1: Analyzenaturallanguage text.

CO2: Definetheimportanceofnatural languageprocessing.

CO3: Understandandapply theconceptsoftextmining.

CO4: Illustrateinformationretrieval techniques.

CO5: EvaluatevariousNLP algorithms.

SuggestedLearningResources:

Textbooks:

1. JurafskyD.andMartinH.J, Speech,andLanguageProcessing:An IntroductiontoNaturalLanguageProcessing,ComputationalLinguistics and Speech Recognition, Prentice Hall (2014), 2nd ed.

2.Manning D. C. and Schütze H., Foundations of Statistical Natural LanguageProcessingMITPress(1999)1sted. Reference Books: (Name of the author/Title of the Book/ Name of the publisher/Edition andYear)

ReferenceBooks:

1.DaleR.,MoislH.andSomersH.,HandbookofNaturalLanguage Processing, CRC Press (2010), 2nd ed.

2.BirdS.,KleinE.andLoperE.,NaturalLanguageProcessingwith Python, Oreilly Publication (2009), 2nd ed.

CIE ASSESSMENT:
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.

SEE ASSESSMENT:
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	3	3	3	1	–	2	2	1	1	–	2
CO2	3	3	2	1	–	2	2	–	1	1	2
CO3	3	3	2	1	–	2	2	–	1	1	2
CO4	3	3	2	2	–	2	2	–	1	1	2
CO5	3	3	2	2	–	2	2	–	1	1	2

Semester : VI

MACHINE LEARNING

Course Code:	**MVJAI602**	**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.**	

Courseobjectiveisto:*Thiscoursewillenablestudentsto*

1. Understandmachinelearningandproblemsrelevanttomachinelearning.
2. Differentiatesupervised,unsupervisedandreinforcementlearning.
3. Applydata-preprocessingmethodssuchasdatacleaning,transformation,reduction,andscaling.
4. Applyvariousregressionandclassificationtechniquesandevaluatethem.
5. Performstatisticalanalysisofmachinelearningtechniques.

UnderstandANNconceptsandapplythemonvariousdatasetstounderstandhowit's working.

Module-1	
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. Show Data Visualization problem examples using MATLAB.	8 hrs
Module-2	
Regression: Linear Regression, Multiple Linear Regression and Polynomial Regression, Evaluating Regression Model's Performance (RMSE, Mean Absolute Error, Correlation, RSquare), Regularization Methods Classification: Need and Applications of Classification, Logistic Regression, Decision tree. Case study of classification and regression algorithms using MATLAB.	8 hrs
Module-3	
Classification (Contd..): 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.) Clustering: Need and Applications of Clustering, Partitioned methods, Hierarchical methods, Density- based methods. Case study of classification and clustering algorithms using MATLAB.	8 hrs
Module-4	
Association Rules Learning: Need and Application of Association Rules Learning, Basic concepts of Association Rule Mining, Naïve algorithm, Apriori algorithm.	8 hrs
Module-5	
Artificial Neural Networks: Introduction, Neural Network representation, Appropriate problems, Perceptron, Backpropagation algorithm.	8 hrs

Courseoutcomes:

CO1 IdentifytheissuesinmachinelearningandAlgorithmsforsolving it.

CO2 Evaluatetheprobabilityandstatisticsrelatedtomachinelearning.

CO3 Investigateandapplyconceptlearning ofallMachineLeaningAlgorithms.

CO4 IdentifythedifferencebetweentherealtimeapplicationofMachineLearningandDeep Learning using real time scenarios.

CO5 Understandandapplytheconceptsofdeeplearning.

Textbooks:

1.TomM.Mitchell,MachineLearning,IndiaEdition2013,McGrawHillEducation.
2.AlpaydinE.,IntroductiontoMachineLearning,MITPress(2014)3rdEdition.
3.VijayvargiaAbhishek,MachineLearningwithPython,BPBPublication(2018)

ReferenceBooks:

1.TrevorHastie,RobertTibshirani,JeromeFriedman,hTheElementsofStatistical Learning, 2nd edition, springer series in statistics.

CIE ASSESSMENT:
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

SEE ASSESSMENT:
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	1	-	2	2	1	1	-	2
CO2	3	3	2	1	-	1	2	-	1	1	2
CO3	3	3	2	1	-	2	2	-	1	1	2
CO4	3	3	2	2	-	2	2	-	1	1	2
CO5	3	3	2	2	-	2	2	-	1	1	2

Semester : VI		
Human-centered AI		
Course Code:	**MVJAI6031**	**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.Understand the history of AI and responsible AI.

2.Understand and analyse HCAI framework and how it is human-centred.

3. Understand different types of recommender systems and its application in HCAI.

4. Understand explainable AI and to analyse its societal impact.

5. Understand AI ethics and designing its moral agents.

Module-1	
Introduction to HCAI: Brief history of social control of technology from WWII until the present time, The current wave of legislation and ethical guidelines for AI, AI Ethics challenges, Brief introduction to the notion of Trustworthy AI, Responsible AI, Human-Centred AI, The background of Artificial Intelligence (AI), Basic notions: Autonomy, Adaptability, Interaction, Who or what is responsible for decisions and actions by AI systems?, What is Human-Centred Artificial Intelligence (HCAI)?, The United Nation's Sustainable Development Goals, What makes HCAI different from AI: Process, Product, The basic concepts of HCAI	8 hrs
Module-2	
HCAI framework and Design Metaphors: Motivation behind the HCAI Framework, rising above the levels of automation, Defining Reliable, Safe and Trustworthy systems, Two-dimensional	8 hrs

HCAI Framework, what is Human-Centred Design? Design guidelines and examples, Design metaphors: Intelligent Agents and Supertools, Teammates and Tele-bots, Assured autonomy and control centres, Social Robots and active appliances	
Module-3	
Short Introduction to recommender systems: Content-Based Recommendation, Collaborative Filtering, Hybrid Approaches, Model- vs Memory-Based, Item- vs User-Based, Evolution of Recommender Systems.	8 hrs
Module-4	
Explainable AI: Explainable AI: Current state and some thought for the future A Journey towards Explainable AI and its Societal Implications, the need of interpreting AI systems, Understanding Interpretability and Explainability, Traditional interpretable models, Explaining the black box, Model-specific algorithms, Model- agnostic algorithms, Counterfactual explanations, evaluating explanation methods, Enhancing human-AI collaboration.	8 hrs
Module-5	
AI ethics and responsible AI: A high-level overview of AI Ethics, Ethical decision-making, Ethical theories, Ethics in practice, implementing ethical reasoning, Responsible research and innovation, The ART of AI: Accountability, Responsibility, Transparency, Approaches to ethical reasoning by AI, designing artificial moral agents, implementing ethical deliberation, Levels of ethical behaviour, The ethical status of AI systems, Ensuring Responsible AI in practiceApplications: Network Storage, Google Apps and Microsoft office online	8 hrs

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

CO1 Understand the history of AI and responsible AI.
CO2 Understand HCAI framework and analyse how it is human-centred.
CO3 Understand different types of recommender systems and its application in HCAI.
CO4 Understand explainable AI and its societal impact.
CO5 Apply and analyse different approaches of ethical AI.

Textbooks / Reference Books:

1. Shneiderman, Ben, Human-Centered AI (Oxford, 2022; online edn, Oxford Academic, 17 Fe 2022), https://doi.org/10.1093/oso/9780192845290.001.0001, accessed 4 June 2024.
2. Virginia Dignum, Responsible Artificial Intelligence, Springer Cham, https://doi.org/10.1007/978-3-030-30371-6.

CIE ASSESSMENT:

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

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

Semester : VI		
CLOUD COMPUTING		
Course Code:	**MVJAI6032**	**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.Understand the fundamental ideas behind Cloud Computing, the evolution of the paradigm, its applicability; benefits, as well as current and future challenges.

2.Understand and apply the basic ideas and principles in data center design; cloud management techniques and cloud software deployment considerations;.

3.Understand and analyze the different CPU, memory and I/O virtualization techniques that serve in offering software, computation and storage services on the cloud; Software Defined Networks (SDN) and Software Defined Storage (SDS);.

4.Understand and analyze cloud storage technologies and relevant distributed file systems, NoSQL databases and object storage;.

5.Analyze and create the variety of programming models and develop working experience in several of them .

Module-1	
Introduction to Cloud Computing: Cloud Computing in a Nutshell, Roots of Cloud Computing, Layers and Types of Clouds, Desired Features of a Cloud, Cloud Infrastructure Management, Infrastructure as a Service Providers, Platform as a Service Providers, Challenges and Risks, Broad Approaches to Migrating into the Cloud, The Seven-Step Model of Migration into a Cloud Applications: Microsoft Azure, Amazon Web Services	8 hrs
Module-2	
Integration as a Service' Paradigm for the Cloud Era: An Introduction, The Onset of Knowledge Era, The Evolution of SaaS , The Challenges of SaaS Paradigm, Approaching the SaaS Integration Enigma, New Integration Scenarios, The Integration Methodologies, SaaS Integration Products and Platforms , SaaS Integration Services, Businesses-to-Business Integration (B2Bi) Services, A Framework of Sensor- Cloud Integration, SaaS Integration Appliances, Issues for Enterprise Applications on the Cloud, Transition Challenges, Enterprise Cloud Technology and Market Evolution, Business Drivers Toward a Marketplace for Enterprise Cloud Computing, The Cloud Supply Chain Laboratory Sessions/ Experimental learning: 1. Installation and Configuration of Hadoop. Applications: PAAS (Facebook, Google App Engine)	8 hrs
Module-3	
Virtual Machines Provisioning and Migration Services: Introduction and Inspiration- Background and Related Work-Virtual Machines Provisioning and Manageability- Virtual Machine Migration Services- VM Provisioning and Migration in Action– Provisioning in the Cloud Context- The Anatomy of Cloud Infrastructures-Distributed Management of Virtual Infrastructures - Scheduling Techniques for Advance Reservation of Capacity- Capacity Management to meet SLA Commitments- RVWS Design and Cluster as a Service: The Logical Design Laboratory Sessions/ Experimental learning: Implementation of Para-Virtualization using VM Ware 's Workstation/ Oracle 's Virtual Box and Guest O.S Applications: Hardware Virtualization, Operating system Virtualization, Server Virtualization, Storage Virtualization	8 hrs
Module-4	
Platform and Software as a Service: Technologies and Tools for Cloud Computing- Aneka Cloud Platform- Aneka Resource Provisioning Service- Hybrid Cloud Implementation – Comet Cloud	8 hrs

Architecture- Autonomic Behavior of Comet Cloud- Overview of Comet Cloud-based Applications- Implementation and Evaluation- Workflow Management Systems and Clouds- Architecture of Workflow Management Systems - Utilizing Clouds for Workflow Execution- Case Study: Evolutionary Multi objective Optimizations- Visionary thoughts for Practitioners Laboratory Sessions/ Experimental learning: Create an application (Ex: Word Count) using Hadoop Map/Reduce. Applications: Schedule book	
Module-5	
MapReduce Programming Model and Implementations: MapReduce Programming Model- Major MapReduce Implementations for the Cloud- The Basic Principles of Cloud Computing-A Model for Federated Cloud Computing- Traditional Approaches to SLO Management- Types of SLA- Life Cycle of SLA- SLA Management in Cloud- Automated Policy-based Management- The Current State of Data Security in the Cloud-Data Privacy and Security Issues-Producer Consumer Relationship-Cloud Service Life Cycle Laboratory Sessions/ Experimental learning: Create your resume in a neat format using google and zoho cloud Programs on PaaS Applications: Network Storage, Google Apps and Microsoft office online	8 hrs

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

CO1 Recall the recent history of cloud computing, illustrating its motivation and evolution.
CO2 Analyze the enabling technologies in cloud computing and discuss their significance.
CO3 Articulate the economic benefits as well as issues/risks of the cloud paradigm for businesses as well as cloud providers.
CO4 Understand SLAs and SLOs and analyze their importance in Cloud Computing.
CO5 Recall some of the common cloud providers and their associated cloud stacks and compare popular cloud use case scenarios.

Textbooks / Reference Books:

1. Cloud Computing, Principles and Paradigms, Rajkumar Buyya, James Broberg, Wiley Publication.
2. Dan C Marinescu: Cloud Computing Theory and Practice. Elsevier (MK) 2013

CIE ASSESSMENT:

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

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

Semester : VI		
BLOCKCHAINTECHNOLOGY		
Course Code:	**MVJAI6033**	**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. Familiarise the functional/operational aspects of cryptocurrency ecosystem.
2. Understand emerging abstract models for Blockchain Technology.
3. Understand how blockchain 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	
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. Applications: Telecommunications, finance, universities Video link / Additional online information (related to module if any): https://coincentral.com/byzantine-generals-problem/ https://www.tutorialspoint.com/distributed_dbms/distributed_dbms_databases.htm https://blockonomi.com/merkle-tree/	8 hrs
Module-2	
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. Applications: Government, healthcare.	8 hrs
Module-3	
Distributed Consensus: Nakamoto consensus, Proof of Work, Proof of Stake, Proof of Burn, Difficulty Level, Sybil Attack, Energy utilization and alternate. Applications: Decentralized Applications, Encrypted messaging applications Video link / Additional online information (related to module if any): https://blockonomi.com/nakamoto-consensus/ https://cointelegraph.com/explained/proof-of-work-explained	8 hrs
Module-4	
Cryptocurrency: History, Distributed Ledger, Bitcoin protocols - Mining strategy and rewards, Ethereum - Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Sidechain, Namecoin. Applications: Peer - to - peer payment application. Video link / Additional online information (related to module if any): https://blockgeeks.com/guides/smart-contracts/	8 hrs
Module-5	
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.Video link / Additional online information (related to module if any): https://www.water-io.com/iot-vs-wot https://www.talend.com/resources/iot-cloud-architecture	8 hrs

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
3 Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System.
4 DR. Gavin Wood, “ETHEREUM: A Secure Decentralized Transaction Ledger,”Yellow paper.2014. 5

Nicola Atzei, Massimo Bartoletti, and Tiziana Cimoli, A survey of attacks on Ethereum smart contracts

Course outcomes: Students will able to

CO1 Basic Cryptography functions, digital signature, public key cryptosystems, zero- knowledge proof systems.
CO2 Policies and applications of Blockchain in Distributed databases.
CO3 Explain the Nakamoto consensus, List and describe differences between proof-of- work and proof-of-stake consensus.
CO4 Design, build, and deploy smart contracts and distributed applications.
CO5 Cryptocurrency governance, regulations and applications.

CIE ASSESSMENT:

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)/3 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	2	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	2
CO3	3	3	1	-	2	-	1	-	-	-	-
CO4	3	3	3	2	3	-	-	1	-	-	-
CO5	3	2	-	-	2	-	-	2	-	-	-

Semester : VI		
Time Series Analysis		
Course Code:	**MVJAI6034**	**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.Understand the characteristics of time series data and their applications in different domains.
2.Learn various time series models and techniques for analyzing and forecasting time series data.
3.Develop skills in model identification, estimation, and diagnostic checking.
4.Apply time series analysis methods to real-world data sets using statistical software.
5.Interpret and communicate results obtained from time series analysis effectively.

Module-1	
Introduction to Time Series Analysis: Time series data definition, Qualities of time series information, Time series analysis applications, Time Series Elements, and (partially) Decomposition	8 hrs
Module-2	
Stationarity and Time Series Components: Seasonality, cyclical elements, and trends, Methods of decomposition: multiplicative and additive models, The meaning of stationarity	8 hrs
Module-3	
Time Series Modeling Autocorrelation function (ACF) and partial autocorrelation function (PACF): Models of moving averages (MAs), Models of Autoregressive (AR) ARIMA models, or autoregressive integrated moving averages, Model Determination and Approximation (In part)	8 hrs
Module-4	
Forecasting and Model Evaluation: Jenkins-Box technique, Model selection standards: BIC and AIC, estimating parameters and fitting models, Methods for Diagnostic Checking and Forecasting	8 hrs
Module-5	
Advanced Topics and Applications: SARIMA models (seasonal ARIMA models), Transfer function models, extended memory functions, Uses and Examples, Examine and Combine	8 hrs

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

CO1 Showcase your ability to analyze time series data using relevant statistical approaches such as decomposition, trend analysis, and seasonal adjustment.
CO2 Use several time series models, including as ARIMA, SARIMA, and exponential smoothing, to reliably estimate future values and assess the uncertainty of such projections.
CO3 Evaluate the stationarity of time series data and apply the appropriate modifications to accomplish it.
CO4 Implement time series models with statistical software such as R or Python, and effectively analyze the findings.
CO5 Utilize time series analysis techniques to analyze real-world datasets from a variety of fields, including environmental sciences, finance, and economics, and make intelligible findings to aid in decision-making.

Textbooks:

1. "Time Series Analysis and Its Applications: With R Examples" by Robert H. Shumway and David S. Stoffer ISBN: 978-3319524511.
2. "Time Series Analysis: Forecasting and Control" by George E.P. Box, Gwilym M. Jenkins, Gregory C. Reinsel, and Greta M. Ljung ISBN: 978-1118675021.

Reference Books:

1."The Analysis of Time Series: An Introduction" by Chris Chatfield ISBN: 978- 1584883173
2. "Time Series: Theory and Methods" by Peter J. Brockwell and Richard A. Davis ISBN: 978-1441903198
3. “Time Series Analysis: With Applications in R" by Jonathan D. Cryer and Kung- Sik Chan ISBN: 978-0387759586.

CIE ASSESSMENT:

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

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											
CO2											
CO3											
CO4											
CO5											

Semester : VI		
INTRODUCTION TO DATA STRUCTURES		
Course Code:	**MVJAI6041**	**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. 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	
Introduction : Data Structures definition , classification of data structures , Arrays – Definition, Declaration , Types of arrays, Structures , Pointers. Textbook 2 : chapter 2	8 hrs
Module-2	
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. Textbook 2 : chapter 3	8 hrs
Module-3	
Linked List -Linked-list and its types- singly linked lists- doubly-linked lists- circular linked lists, Applications of Linear Data Structures. Textbook 1 : Chapter3:3.2.1, 3.2.2, 3	8 hrs
Module-4	
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. Textbook 1 : Chapter4:4	8 hrs
Module-5	
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. 44 Textbook 1 : Chapter9: 9.1-9.3,9.5 , Chapter 5	8 hrs

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.

Course outcomes: At the end of the course, the students will be able to
CO1 Evaluate the performance and efficiency of different operations on arrays, stacks, queues, and circular queues.
CO2 Understand the different types of linked list.
CO3 Implement basic operations on trees.
CO4 Demonstrate the representation and traversal techniques of graphs and their applications.
CO5 Use the concepts of Hashing.

CIE ASSESSMENT:
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)/3 for 50 marks

SEE ASSESSMENT:
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	1	3	3	-	-	-	1	-	-
CO2	2	2	2	3	2	-	-	-	1	-	-
CO3	2	2	2	3	2	-	-	-	1	-	--
CO4	3	2	2	3	2	-	-	-	1	-	-
CO5	3	2	2	3	2	-	-	-	1	-	-

Semester : VI		
FUNDAMENTALS OF OPERATING SYSTEMS		
Course Code:	**MVJAI6042**	**CIE Marks: 50**
L: T:P:S	**3:0:0:0**	**SEE Marks: 50**
Credits:	**3**	**Total :100**
Hours:	**40 Hrs Theory**	**SEE Duration: 2 Hrs.**

Course Objectives: This course will enable the 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. Outline the features of files and file management systems.

Module-1	
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. Textbook 1: Chapter 1: 1.1-1.4	8 hrs
Module-2	
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. Textbook 1: Chapter 2: 2.1- 2.8, Chapter 3: 3.1-3.6	8 hrs

Module-3	
Deadlocks: what is Deadlock, Deadlock Characteristics, resource management, conditions of deadlock – Handling Deadlocks, deadlock avoidance, Deadlock Detection, Deadlock Recovery. Textbook 1: Chapter 8: 8.3 to 8.8	8 hrs
Module-4	
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. Textbook1: Chapter 3:3.3, Chapter 9: 9.1, 9.2	8 hrs
Module-5	
File and Database Systems: File concept, Access methods, Data Hierarchy, Directory Structure, File Protection, File System Structure. File access control. Textbook 1: Chapter 14:14.2- 14.	8 hrs

Textbooks:

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

Course outcomes: At the end of the course, the students will be able 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. Outline the features of files and file management system

CIE ASSESSMENT:

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)/3 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	-	2	-	-	-	-	1	-	-	-
CO2	3	3	1	2	-	-	-	1	-	-	-
CO3	3	2	-	2	-	-	-	1	-	-	-
CO4	3	2	2	1	-	-	-	1	-	-	-

CO5	3	1	2	-	-	-	-	1	1	-	-

Semester : VI		
MOBILE APPLICATION DEVELOPMENT		
Course Code:	**MVJAI6043**	**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. Understand system requirements for mobile applications.
2. Generate suitable design using specific mobile development frameworks. Implement the design using specific mobile development frameworks.
3. Deploy the mobile applications in marketplace for distribution.

Module-1	
Introduction: Introduction to mobile application - Market values for mobile applications System requirements for mobile application, Mobile application development architecture. Video link / Additional online information (related to module if any): https://www.tutorialspoint.com/android/ Online	8 hrs
Module-2	
Designing Applications using Android: Developing user interfaces -Layout -Input Controls and Events- Menus - Dialogs, Notifications and Toasts Applications: Design a Simple Calculator App Video link / Additional online information (related to module if any): http://www.androidhive.info/	8 hrs
Module-3	
Multimedia & Services: Lifecycle of a Service - Managing Services,GPS API Playing audio, video. Video link / Additional online information (related to module if any): https://nptel.ac.in/courses/106/106/106106147/	8 hrs
Module-4	
Technology I,Android:Introduction Establishing the development environment Android architecture Activities and views Interacting with UI Persisting data using SQLite Packaging and deployment. Video link / Additional online information (related to module if any): http://developer.android.com/develop/index.htm	8 hrs
Module-5	
Technology II IOS: Introduction to Objective C IOS features UI implementation Touch frameworks Data persistence using Core Data and SQLite.	8 hrs

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

Course outcomes: At the end of the course, the students will be able to
CO1:Demonstrate knowledge on basics of mobile application
CO2:Understand the framework of mobile application and design simple interfaces
CO3:Create an application using multimedia components.
CO4:Develop and deploy application with server side connectivity
CO5:Understand basic concepts of IOS

CIE ASSESSMENT:
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

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**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO2	**3**	**2**	**3**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**
CO3	**3**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO4	**3**	**2**	**3**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**
CO5	**3**	**2**	**3**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**

Semester : VI			
INTRODUCTION TO AI			
Course Code:	**MVJAI6044**	**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. 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.
4. Design different learning algorithms for improving the performance of AI systems.
5. Implement projects using different AI learning techniques.

Module-1	
What is artificial intelligence, Problems, Problem Spaces and search, Heuristic search technique. Textbook 1,2	8 hrs
Module-2	
Knowledge Representation Issues, Using Predicate Logic, Representing knowledge using Rules. Textbook 1 :Chapter 3,4	8 hrs

Module-3	
Symbolic Reasoning under Uncertainty, Statistical reasoning, Weak Slot and Filter Structures Textbook 1 : Chapter 5,6,7	8 hrs
Module-4	
Strong slot-and-filler structures, Game Playing. Application: Designing Smart Games. Textbook 1 : Chapter 8,9,10	8 hrs
Module-5	
Learning, Expert Systems. TextBook1: Ch 17 and 20 RBT: L1, L2	8 hrs

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.

Course outcomes: At the end of the course, the students will be able to
CO1 Identify the AI based problems.
CO2 Apply techniques to solve problems
CO3 Define learning and explain various learning techniques.
CO4 Discuss expert systems CO5 Implement projects using different AI learning techniques.

CIE ASSESSMENT:

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

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	2	-	-	-	-	1	1	2	-	-	-
CO2	2	-	-	-	-	1	1	2	-	-	-
CO3	2	2	2	2	-	1	1	2	2	1	-
CO4	2	2	2	2	-	1	1	2	2	1	-

CO5	2	-	-	-	-	1	1	2	-	-	-

Semester : VI		
MACHINE LEARNING LAB		
Course Code:	**MVJAIL606**	**CIE Marks: 50**
L: T:P:S	**0:0:2:0**	**SEE Marks: 50**
Credits:	**1**	**Total :100**
Hours:	**24 Hrs of Practical**	**SEE Duration: 3 Hrs.**

Course Objectives: This course will enable the students to:
Make use of Data sets in implementing the machine learning algorithms Implement the machine learning concepts and algorithms in any suitable language of choice.

Sl No	List of Experiments
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	Implement and demonstrate the Candidate Elimination algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CS
3	Develop a program to demonstrate the prediction of values of a given dataset using Linear regression
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.
5	Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.
6	Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
7	Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
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
9	Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same dataset for clustering using k- Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program
10	Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem
11	Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graph.

Course Outcomes: At the end of the course, the student will be able to
CO1 Preprocess raw data for machine learning algorithms. to implement andevaluate linear regression models.
CO2 Implement and evaluate logistic regression models.
CO3 Implement and evaluate KNN models for both classification and regression tasks. To implement and evaluate SVM models with different kernels.

CO4 Perform dimensionality reduction using PCA and understand its impact on the dataset. to implement and evaluate K-Means clustering and determine the optimal number of clusters. CO5 To implement and evaluate ensemble methods and understand their advantages over individual models.
Reference Books: 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. 2. R Programming for Data Science by Roger D. Peng (References) 3. The Art of R Programming by Norman Matloff Cengage Learning India.

Semester: VI		
INDIANKNOWLEDGE SYSTEMS		
Course Code:	**MVJIKK608**	**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.**

CourseLearningObjectives: Thestudentswillbeableto	
1	TofacilitatethestudentswiththeconceptsofIndiantraditionalknowledgeandtomake them understand the Importance of roots of knowledge system.
2	Tomakethestudentsunderstandthetraditionalknowledgeandanalyseitandapplyit to their day-to-day life.

Unit-I	**05Hrs**
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	**05Hrs**
Traditional Knowledge in Humanities and Sciences: Lingistics, Number and measurements-Mathematics,Chemistry,Physics,Art,Astronomy,Astrology,Crafts andTrade in India and Engineering and Technology.	
Unit-III	**05Hrs**
TraditionalKnowledgeinProfessionaldomain: Townplanningandarchitecture-Construction,Health,wellnessandPsychology-Medicine,Agriculture,Governanceandpublic administration, United Nations Sustainable development goals.	

CourseOutcomes:Aftercompletingthecourse,thestudentswillbeableto	
CO1:	ProvideanoverviewoftheconceptoftheIndianKnowledgeSystemanditsimportance.
CO2:	Appreciatetheneedfor and importance ofprotectingtraditionalknowledge.
CO3:	RecognizetherelevanceofTraditionalknowledgeindifferentdomains.
CO4:	EstablishthesignificanceofIndianKnowledgesystemsinthecontemporaryworld.

ReferenceBooks	
1	**IntroductiontoIndianKnowledgeSystem-conceptsandapplications**,BMahadevan, VinayakRajatBhat,NagendraPavanaRN,2022,PHILearningPrivateLtd,ISBN-978-93- 91818-21-0
	TraditionalKnowledgeSysteminIndia,AmitJha,2009,AtlanticPublishersandDistributors (P)Ltd.,ISBN-13:978-8126912230,
2	**KnowledgeTraditionsandPracticesofIndia**,KapilKapoor,AvadeshKumarSingh,Vol.1, 2005,DKPrintWorld(P)Ltd.,ISBN81-246-0334,
	SuggestedWebLinks:
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 announcethe 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.

CO-POMapping											
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

Semester : VII			
Deep Learning and Reinforcement Learning			
Course Code:	**MVJAI701**	**CIE Marks: 50**	
L: T:P:S	**3:0:0:0**	**SEE Marks: 50**	
Credits:	**4**	**Total :100**	
Hours:	**40 Hrs Theory**	**SEE Duration: 3 Hrs.**	
Course Objectives: This course will enable the 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: Introduction			
Introduction: History of Deep Learning, McCulloch Pitts Neuron, Multilayer Perceptrons (MLPs), Representation Power of MLPs, Sigmoid Neurons, Feed Forward Neural Networks, Back propagation. Activation Functions & Parameters: Gradient Descent (GD), Momentum Based GD, Nesterov Accelerated GD, Stochastic GD, Principal Component Analysis and its interpretations, Singular Value Decomposition, Parameters/s Hyper-parameters			8 Hrs
Module-2: Auto-Encoders & Regularization			
Auto encoders and relation to PCA, Regularization in auto encoders, Denoising auto encoders, Sparse auto encoders, Regularization: Bias Variance Tradeoff, L2 regularization, Early stopping, Dataset augmentation, Encoder Decoder Models, Attention Mechanism, Attention over images, Batch Normalization			8 hrs
Module-3: Deep Learning Model			

Deep Learning Models:Introduction to CNNs, Architecture, Convolution/pooling layers, CNN Applications, LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet. Introduction to RNNs KNN, Back propagation through time (BPTT), Vanishing and Exploding Gradients, Truncated BPTT, GRU, LSTMs,Deep Learning Applications:Image Processing, Natural Language Processing, Speech recognition, VideoAnalytics	8 hrs
Module-4: INTRODUCTION AND MULTI ARMED BANDITS	
Reinforcement Learning Primitives: Introduction,Basics of RL, Defining RL Framework, Probability Basics: Probability Axioms,Random Variables, Probability Mass Function, Probability Density Function, CumulativeDistribution Function and Expectation. Introduction to Agents, Intelligent Agents– ProblemSolving – Searching, Logical Agents.	8 hrs
Module-5: FINITE MARKOV DECISION PROCESS	
Finite Markov Decision Process:Basics, The Agent-Environment Interface, Goals and Rewards, Returns and Episodes, Unified Notation for Episodic and Continuing Tasks, Policies and Value Functions, Optimal Policies and optimal Value Functions, Optimality and Approximation. DYNAMIC PROGRAMMING Dynamic Programming:Definition, Policy Evaluation (Prediction), Policy Improvement, Policy Iteration, Value Iteration, Asynchronous dynamic programming, Generalized Policy Iteration, Efficiency of dynamic programming.	8 hrs

Laboratory Experiments – 24P

Sl.NO	Experiments
1	Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.
2	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.
3	Writea programto 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 Python ML library classes/API.
4	Write a program to implement Continuous Bag of Words Model using KNN Algorithm (using Python).
5	Build an image classification model to detect if the person has cancer or not.
6	Build a chatbot to identify the context the user is asking and then provide it with the relevantanswer.

7	Implement a Human Face Recognition Model and determine the accuracy in detecting the boundingboxes of the human face
8	Build a model that takes an image as input and determines whether the image contains a picture of adog or a cat.
9	Implement Q-learning algorithm to navigate a grid world and learn an optimal policy.
10	Implement Asynchronous dynamic programming in python.

Course outcomes: At the end of the course, the students will be able to
CO1: Understand the fundamentals of deep learning and the main research activities in this field.
CO2: Remember architectures and optimization methods for deep neural network training.
CO3: Implement, apply, and test relevant learning algorithms in TensorFlow.
CO4: Understand the fundamentals of Reinforcement learning.
CO5: Understand the finite markov decision process.

Text Books:

1. YoshuaBengioand IanJ.GoodfellowandAaron Courville,"DeepLearning",MITPress,2015.
2. Miguel Morales, Grokking Deep Reinforcement Learning, Manning Publications, 2020.

Reference Books:
1. RichardS.SuttonandAndrewG.Barto,Reinforcementlearning:AnIntroduction, Second Edition, MIT Press, 2019.
2. Keng, Wah Loon, Graesser, Laura, Foundations of Deep Reinforcement Learning: Theory and Practice in Python, Addison Wesley Data & Analytics Series, 2020. 4. Francois Chollet, Deep Learning with Python, Manning Publications, 2018.

CIE ASSESSMENT:
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.

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

Semester : VII		
Machine learning II		
Course Code:	**MVJAI702**	**CIE Marks: 50**
L: T:P:S	**3:0:2:0**	**SEE Marks: 50**
Credits:	**4**	**Total :100**
Hours:	**40 Hrs Theory**	**SEE Duration: 3 Hrs.**

Course Objectives: This course will enable the students to:
- Understand eigenvalues, eigenvectors, and their significance in linear algebra and concepts related to singular value decomposition (SVD)
- Understanding Bayesian Approaches
- Understand the theoretical foundations of machine learning and how learning algorithms adapt based on observed errors.
- Understand the motivation behind using genetic algorithms (GAs) for solving complex problems and Understand the basics of reinforcement learning (RL).
- Explore how prior knowledge can enhance learning

Module-1: Matrix Analysis	
Matrix Analysis: Eigen analysis, Rank Analysis, and Spectral Graph Theory, Probability: Exponential family of distribution, Sufficient Statistics, Overview of Statistical Estimation: MLE, MAP, and Bayes Principle Machine Learning Theory:Foundational Aspects of Learning, PAC Learning, VC Dimension, Learnability ,Structural and Empirical Risk ,Minimizing Risk: Minimizing the VC dimension, Minimal Complexity Machines, Data Augmentation	8 Hrs
Module-2: Bayesian learning	
Introduction, Bayes theorem, Bayes theorem and concept learning, Maximum Likelihood and least squared error hypotheses, maximum likelihood hypotheses for predicting probabilities, minimum description length principle, Bayes optimal classifier, Gibs algorithm, Naïve Bayes classifier, an example: learning to classify text, Bayesian belief networks, the EM algorithm.	8 hrs
Module-3: Computational learning theory and	

Instance-Based Learning	
Computational learning theory – Introduction, probably learning an approximately correct hypothesis, sample complexity for finite hypothesis space, sample complexity for infinite hypothesis spaces, the mistake bound model of learning. Instance-Based Learning- Introduction, k-nearest neighbour algorithm, locally weighted regression, radial basis functions, case- based reasoning, remarks on lazy and eager learning.	8 hrs
Module-4: Genetic Algorithms	
Genetic Algorithms – Motivation, Genetic algorithms, an illustrative example, hypothesis space search, genetic programming, models of evolution and learning, parallelizing genetic algorithms. Learning Sets of Rules – Introduction, sequential covering algorithms, learning rule sets: summary, learning First-Order rules, learning sets of First-Order rules: FOIL, Induction as inverted deduction, inverting resolution. Reinforcement Learning – Introduction, the learning task, Q–learning, non-deterministic, rewards and actions, temporal difference learning, generalizing from examples, relationship to dynamic programming.	8 hrs
Module-5: Analytical Learning	
Analytical Learning-1- Introduction, learning with perfect domain theories: PROLOG-EBG, remarks on explanation-based learning, explanation-based learning of search control knowledge. Analytical Learning-2- Using prior knowledge to alter the search objective, using prior knowledge to augment search operators. Combining Inductive and Analytical Learning – Motivation, inductive-analytical approaches to learning, using prior knowledge to initialize the hypothesis.	8 hrs

Laboratory Experiments: 24P

1. The probability that it is Friday and that a student is absent is 3%. Since there are 5 school days in a week, the probability that it is Friday is 20%. What is theprobability that a student is absent given that today is Friday? Apply Baye's rule in python to get the result. (Ans: 15%)
2. Extract the data from database using python.
3. Implement k-nearest neighbours classification using python
4. Given the following data, which specify classifications for nine Combinations of VAR1 and VAR2 predict a classification for a case where VAR1=0.906 and VAR2=0.606, using the result of k-means clustering with 3 means (i.e., 3 centroids).
5. The following training examples map descriptions of individuals onto high, medium and low credit-worthiness.Input attributes are (from left to right) income, recreation, job, status, age-group, home-owner. Find the unconditional probability of 'golf' and the conditional probability of 'single' given

'medRisk' in the dataset.

6. Implement linear regression using python.
7. Implement naive baye's theorem to classify the English text
8. Implement an algorithm to demonstrate the significance of genetic algorithm.
9. Implement the finite words classification system using Back-propagation algorithm.

10. Carry out the performance analysis of classification algorithms on a specific dataset.

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

CO1: Understand the theoretical foundations of machine learning.
CO2: Understand the foundations of Bayesian inference.
CO3: Understand a very broad collection of machine learning algorithms and problems .
CO4: Explore a practical example to see how GAs work.
CO5: Determining how to use explanations to guide search processes .

Textbooks and References:
1."Matrix Analysis for Statistics" by James R. Schott.
2. https://archive.org/details/BolstadWilliamM.CurranJamesMIntroductionToBayesianStatistics2016Wiley
3. An Introduction to Genetic Algorithms By Melanie Mitchell
4. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" by Aurélien Géron.

CIE ASSESSMENT:
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.

SEE ASSESSMENT:THEORY – 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	3	2	2	2	1	2	_	-	-	-	2
CO2	3	2	2	2	1	2	-	-	-	-	2
CO3	3	2	2	2	1	2	-	-	-	-	2
CO4	3	2	3	2	1	2	-	-	-	-	2
CO5	3	2	2	2	1	2	-	-	1	1	2

Semester : VII		
Data Security and Privacy		
Course Code:	**MVJAI703**	**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. Understand the fundamentals of database systems, data analysis, and security, including data storage and representation, exploratory data analysis, authentication and authorization, and database security measures to protect data from unauthorized access and threats.
2. Understand and implement techniques for protecting individual privacy and anonymity in data.
3. Understand fundamentals of Differential Privacy (DP), including its formalism, mechanisms, and properties, and to learn how to apply DP concepts.
4. Understand various adversarial attacks on AI/ML systems, including poisoning, evasion, and backdoor attacks.
5. Understand the fundamental concepts and principles of privacy, legal and ethical issues in computer security.

.

Module-1: Fundamentals of Data Privacy & Security	
Databases and Exploratory Data Analysis,Data Representation and Storage, Authentication and Authorization,Database Security	8Hrs
Module-2: Anonymization	
Linkage and re-identification attacks, k-anonymity, l-diversity, t-closeness, Implementing anonymization. Anonymizing complex data, Privacy and anonymity in mobile environments.	8 hrs
Module-3: Differential Privacy (DP)	
Formalism and interpretation of DP, Fundamental DP mechanisms and properties Interactive and non-interactive DP, DP for complex data, Local Differential Privacy (LDP)	8 hrs
Module-4: Security and Privacy in AI and Machine Learning (AI/ML)	
Adversary modeling in AI/ML, Poisoning, evasion, and backdoor attacks, Test-time attacks: Model inversion, model stealing, membership inference, adversarial examples. Architectures and algorithms for privacy-preserving machine learning.	8 hrs
Module-5: Privacy, Legal and Ethical Issue:	
Privacy: Privacy Concepts, Privacy Principles and Policies, Authentication and Privacy, Data Mining, Privacy on the Web, E-Mail Security, Impacts on Emerging Technologies. Legal and Ethical Issues in Computer Security: Protecting Programs and Data, Information and the Law,	8 hrs

Rights of Employees and employers, Redress for Software Failures, Computer Crime, Ethical Issues in Computer Security.	

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

CO1 design, implement, and secure database systems, perform exploratory data analysis, and ensure data privacy and security through authentication, authorization, and database security measures.

CO2 design and implement privacy-preserving data analysis techniques, including anonymization, differential privacy, and secure data sharing, to protect individual privacy and anonymity in various data settings.

CO3 apply the principles of Differential Privacy to design and analyze privacy-preserving algorithms and systems, ensuring robust privacy guarantees for individual data in various applications.

CO4 Identify, analyze, and develop countermeasures against various adversarial attacks on AI/ML systems, including data poisoning, evasion, and backdoor attacks, to ensure the security and robustness of machine learning models.

CO5 Evaluate the privacy, legal, and ethical implications of computer security practices and technologies, and design solutions that balance security with individual privacy rights and ethical considerations.

Textbooks:

1. DataPrivacyandSecuritybySalomon,David,Springer,2003.(Module III)
2. SecurityinComputingbyCharlesPfleeger,ShariLawrencePfleeger,5thEdition,PHI,2015. (Module IV)

ReferenceBooks:

1. InformationSecurity:PrinciplesandPractice byMarkStamp,WileyInterScience,2011.
2. ComputerSecurity:ArtandSciencebyMattBishop,FirstEdition,Addison Wesley,2002.

CIE ASSESSMENT:

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

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	2	2	2	-	-	-	-	1	2	2	2
CO2	2	2	2	-	-	1	-	1	2	2	2
CO3	2	2	2	2	1	1	-	1	2	2	2
CO4	1	2	2	2	1	1	-	1	2	2	2
CO5	1	2	2	1	1	1	2	1	2	2	2

Semester : VII		
IOT ANALYTICS		
Course Code:	**MVJAI7041**	**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:
The course provides a detailed description of IoT analytics and the integration of big datainto IoT. The course also has a detailed description on the toolsthat can be used for analytics.

Module-1	
Introduction, IoT data and big data, challenges of IOT analytics applications, IOT analytics lifecycle andtechniques, conclusions. IoT, Cloud and Big Data Integration for IoT Analytics troduction, cloud based IOT platforms, data analytics for the IOT, Data collection using low power, Lawrence radios, WAZIUP software platform, iKaaS software platform.	8 Hrs
Module-2	
Introduction, VITAL architecture for IoT Analytics, VITAL development environment, Development Examples. Open-Source Framework Introduction, Architecture for IoT Analytics-as-a-Service, Sensing - as-a-Service Infrastructure Anatomy, Scheduling, Metering and Service Delivery, Sensing - as-a-Service Example, From Sensing - as-a-Service to IoT Analytics- as-a-Service.	8 hrs
Module-3	
Introduction, Related Work, Semantic Analytics, Tools and Platforms, A Practical Use Cases.	8 hrs
Module-4	
Data Analytics in Smart Buildings Introduction, Addressing Energy Efficiency in Smart Buildings, A proposal of a general architecture for management systems of smart buildings, IoT based system for Energy Efficiency in Smart Buildings, Evaluation and Results.	8 hrs
Module-5	
Introduction, Cloud based IoT Analytics, Cloud based city platform, new challenges towards Edge based solutions, Edge based IoT Analytics, Use case of Edge based data analytics.	8 hrs

Textbooks:
1. John Soldatos (Editor), Building Blocks for IoT Analytics Internet of Things Analytics, River Publishers Series in Signal, Image and Speech Processing.

Course Outcome: The students will be able to
CO1:Interpret the impact and challenges posed by IoT networks leading to new architectural models
CO2:Compare and Contrast the deployment of smart objects and technologies to connect them to network
CO3: Appraise the role of IoT protocols for efficient network communication
CO4:Elaborate the need for Data Analytics and security in IoT
CO5: Illustrate different sensor technologies for sensing real world entities and identify the application of IoT in Industry

CIE ASSESSMENT:

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

SEE ASSESSMENT:
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						3
CO2	2	1	2	2	2						3
CO3	1	1	2	2	3						2
CO4	2	2	2	2	3						1
CO5	1	1	3	3	3						2

Semester : VII		
BUSINESS ANALYTICS		
Course Code:	**MVJAI7042**	**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. Provide solutions, assessments, and validation to a broad range of situations by eliciting, planning,monitoring, and analyzing enterprise requirements.
2. Work as a professional maintaining high standards of practice, making ethical/legal judgments and decisions, and sustaining professional standing through a commitment to life-long learning.
3. Demonstrate effective use of written, verbal, and non-verbal communication, employing relevant knowledge, skills, and judgment in a business setting.

Module-1	
Analytics and Data Science – Analytics Life Cycle – Types of Analytics – Business Problem	8hrs

Definition – Data Collection – Data Preparation – Hypothesis Generation – Modeling – Validation and Evaluation – Interpretation – Deployment and Iteration.	
Module-2	
Data Warehouses and Data Mart – Knowledge Management -Types of Decisions – Decision Making Process – Decision Support Systems – Business Intelligence -OLAP – Analytic function.	8 hrs
Module-3	
Human Resources – Planning and Recruitment – Training and Development – Supply chain network – Planning Demand, Inventory and Supply – Logistics – Analytics applications in HR & Supply Chain – Applying HR Analytics to make a prediction of the demand for hourly employees for a year. Pedagogy Chalk and Board, Problem-based learning.	8 hrs
Module-4	
Marketing Strategy, Marketing Mix, Customer Behaviour -selling Process – Sales Planning - Analytics applications in Marketing and Sales – predictive analytics for customers' behaviour in marketing and sales.	8 hrs
Module-5	
DSS- Executive and enterprise support- Automated decision support - Web analytics- Datamining- Applied artificial intelligence - Visual analysis: Data concepts – Data Dashboards -Data exploration & visualization – Scorecards	8 hrs

Textbooks:

1.R. Evans James, Business Analytics, 2nd Edition, Pearson, 2017
2.R N Prasad, Seema Acharya, Fundamentals of Business Analytics, 2nd Edition, Wiley, 2016
3.Philip Kotler and Kevin Keller, Marketing Management, 15th edition, PHI, 2016
4.VSP RAO, Human Resource Management, 3rd Edition, Excel Books, 2010.
5.Mahadevan B, "Operations Management -Theory and Practice",3rd Edition, Pearson Education,2018.
6.Umesh R Hodeghatta and Umesha Nayak, Business Analytics Using R - A

CIE ASSESSMENT:

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
.

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

Semester : VII		
SOFT COMPUTING		
Course Code:	**MVJAI7043**	**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. Understand the fundamentals of soft computing, including machine learning and computational intelligence, and equip them with the knowledge and skills to apply soft computing techniques to real-world problems, such as sales forecast prediction using back propagation networks.
2. Understanding of artificial neural networks (ANNs), including their architecture, training, and applications, to enable them to design and implement ANNs to solve real-life problems, including natural language processing.
3. Analyze the principles and concepts of fuzzy logic, enabling them to design and apply fuzzy inference systems and controllers to solve real-world problems, including those that involve uncertainty and ambiguity.
4. Analyze the fundamental concepts and procedures of Genetic Algorithms (GA), including encoding, initialization, selection, and genetic operators, to enable them to design and apply GA to solve optimization and search problems.
5. Analyze the principles and applications of computational intelligence paradigms, including swarm intelligence and particle swarm optimization, to enable them to design and apply these techniques to solve

complex optimization and search problems.	
Module-1	
INTRODUCTION TO SOFT COMPUTING: Evolution of Computing, Concept of computing systems. Soft Computing Constituents, From Conventional AI to Computational Intelligence, Machine Learning Basics, Some applications of soft computing techniques Real Time Applications: Framework for predicting analytics on sales forecast using back propagation network	8hrs
Module-2	
NEURAL NETWORKS: Biological neurons and it's working, Simulation of biological neurons to problem solving. Architecture-: Single Layer and Multilayer -Feed Forward Networks-Training and Learning methods, Applications of ANNs to solve some real-life problems. Real Time Applications: Natural Language processing using artificial neural networks.	8 hrs
Module-3	
FUZZY LOGIC: Introduction to Fuzzy logic, Fuzzy Sets, Membership Functions, Operations on Fuzzy sets, Fuzzy Rules and Fuzzification and Defuzzification, Fuzzy Inference Systems, Fuzzy logic controller design, Some applications of Fuzzy logic. Real Time Applications: • Traffic Simulation System Based on Fuzzy Logic • Fuzzy logic rule based medical diagnosis system. Video link: • https://onlinecourses.nptel.ac.in/noc20_ma48/ https://nptel.ac.in/courses/111/102/111102130/	8 hrs
Module-4	
Basic Concepts – Working Principle – Procedures of GA – Flow Chart of GA - Genetic Representation: (Encoding) Initialization and Selection – Genetic Operators: Encoding,	8 hrs
Module-5	
COMPUTATIONAL INTELLIGENCE: Computational Intelligence Paradigms, Swarm Intelligence Techniques, Basic Particle Swarm Optimization, Applications. Real Time Applications: Hybrid Computational Intelligence Systems for Real World Applications Video link: https://nptel.ac.in/courses/106/106/106106126/	8 hrs
Course outcomes: At the end of the course, the students will be able to CO1 Apply soft computing techniques, including machine learning and computational intelligence, to solve real-world problems, such as sales forecast prediction, and develop effective solutions using back propagation networks and other soft computing methods. CO2 Design, train, and deploy artificial neural networks (ANNs) to solve complex real-life problems, including natural language processing, and develop practical solutions using ANN architectures and algorithms. CO3 Analyze and apply fuzzy logic principles to develop fuzzy inference systems andcontrollers that effectively solve real-world problems, handling uncertainty and ambiguity in areas like control systems, decision-making, and expert systems. CO4 Analyze and apply Genetic Algorithm (GA) concepts and procedures to design and implement effective solutions for optimization and search problems, leveraging encoding, initialization, selection, and genetic operators to drive efficient problem-solving.	

CO5 Analyze and apply computational intelligence paradigms, including swarm intelligence and particle swarm optimization, to develop innovative solutions for complex optimization and search problems, leveraging the collective intelligence of swarm systems to drive efficient problem-solving.

Text / Reference Books:

1 Fuzzy Logic: A Practical approach, F. Martin, Mc neill, and Ellen Thro, AP Professional,2000.
2 Fuzzy Logic with Engineering Applications (3rd Edn.), Timothy J. Ross, Willey, 2010.
3 Foundations of Neural Networks, Fuzzy Systems, and Knowledge Engineering, Nikola K.Kasabov, MIT Press, 1998.
4 An Introduction to Genetic Algorithms, Melanie Mitchell, MIT Press, 2000.
5 Genetic Algorithms In Search, Optimization And Machine Learning, David E. Goldberg,Pearson Education,
2002.
6 Soft Computing, D. K. Pratihar, Narosa, 2008.
7 Neuro-Fuzzy and soft Computing, J.-S. R. Jang, C.-T. Sun, and E. Mizutani, PHI Learning,2009.
8 Practical Genetic Algorithms, Randy L. Haupt and sue Ellen Haupt, John Willey & Sons,2002.
9 Real World Applications of Computational Intelligence, Mircea Gh. Negoita, Bernd Reusch,Part of the Studies in Fuzziness and Soft Computing book series (STUDFUZZ, volume 179)

CIE ASSESSMENT:

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

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

Semester : VII		
BIG DATA ANALYTICS		
Course Code:	**MVJAI7044**	**CIE Marks: 50**
L: T:P:S	**3:0:0:0**	**SEE Marks: 50**
Credits:	**3**	**Total :100**
Hours:	**40 Hrs Theory**	**SEE Duration: 3Hrs.**

Course Objectives: This course will enable the students to:
1. The scope and essentiality of Big Data and Business Analytics.
2. The technologies used to store, manage, and analyze big data in a Hadoop ecosystem.
3. The techniques and principles in big data analytics with scalability and streaming capability.
4. The hypothesis on optimized business decisions in solving complex real-world problems.

Module-1	
INTRODUCTION TO BIG DATA: Characteristics of Data,Evolution of Big Data,Definition of Big Data,Challenges with Big Data, Traditional Business Intelligence (BI) versus Big Data. Big data analytics: Classification of Analytics, Importance and challenges facing big data, Terminologies Used in Big Data Environments, The Big Data Technology Landscape,industry examples of big data Video link : https://www.digimat.in/nptel/courses/video/106104189/L01.html	8hrs
Module-2	
INTRODUCTION TO HADOOP: Introducing Hadoop, RDBMS versus Hadoop,Distributed Computing Challenges, History and overview of Hadoop, Use Case of Hadoop,Hadoop Distributors,Processing Data with Hadoop, Interacting with Hadoop Ecosystem Video link: https://www.digimat.in/nptel/courses/video/106104189/L04.html	8 hrs
Module-3	
THE HADOOP DISTRIBUTED FILESYSTEM: Hadoop Distributed File System (HDFS): The Design of HDFS, HDFS Concepts, Basic Filesystem Operations, Hadoop Filesystems. The Java Interface- Reading Data from a Hadoop URL, Reading Data Using the Filesystem API, Writing Data. Data Flow- Anatomy of a File Read, Anatomy of a File Write, Limitations. Video link: https://www.digimat.in/nptel/courses/video/106104189/L04.html	8 hrs
Module-4	
UNDERSTANDING MAP REDUCE FUNDAMENTALS: Map Reduce Framework: Exploring the features of Map Reduce, Working of Map Reduce, Exploring Map and Reduce Functions, Techniques to optimize Map Reduce jobs, Uses of Map Reduce. Controlling MapReduce Execution with Input Format, Reading Data with custom Record Reader, -Reader, Writer, Combiner, Partitioners, Map Reduce Phases,Developing simple MapReduce Application. Video link: https://www.digimat.in/nptel/courses/video/106104189/L06.html	8 hrs
Module-5	
INTRODUCTION TO PIG: Introducing Pig: Pig architecture, Benefits, Installing Pig, Properties of Pig, Running Pig, Getting started with Pig Latin, working with operators in Pig, Working with functions in Pig. Video link: https://www.youtube.com/watch?v=qr_awo5vz0g	8 hrs

Course outcomes: At the end of the course, the students will be able to
CO1 Explain the evolution of big data with its characteristics and challenges with traditional business

intelligence.
CO2 Explain the big data technologies used to process and query the big data in Hadoop, MapReduce and Pig.
CO3 Make use of appropriate components for processing, scheduling, and knowledge extraction from large volumes in distributed Hadoop Ecosystem.
CO4 Develop a Map Reduce application for optimizing the jobs.
CO5 Develop applications for handling huge volume of data using Pig Latin.

Textbooks:
1 Seema Acharya, Subhashini Chellappan,F—BigData and Analytics,Wiley Publications,2nd Edition, 2014
DT Editorial Services,—BigData, Dream Tech Press,2nd Edition,2015.
2 Tom White,—Hadoop:The Definitive Guide,O'Reilly,3 rd Edition,2012.
3 Big Data Black Book, dream tech publications, 1st Edition, 2017.

Reference Books:
1 Michael Minelli, Michele Chambers,Ambiga Dhiraj, —Big Data,Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Business, Wiley CIO Series, 1stEdition,2013.
2 Rajiv Sabherwal, Irma Becerra- Fernandez, —Business Intelligence –Practice, Technologies and Management, John Wiley, 1st Edition,2011.
3 Arvind Sathi, —Big Data Analytics: Disruptive Technologies for Changing the Game, IBM Corporation, 1st Edition,2012.

CIE ASSESSMENT:
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

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

Semester : VII			
INTRODUCTION TO DBMS			
Course Code:	**MVJAI7051**	**CIE Marks: 50**	
L: T:P:S	**3:0:0:0**	**SEE Marks: 50**	
Credits:	**3**	**Total :100**	
Hours:	**40 Hrs Theory**	**SEE Duration: 2 Hrs.**	

Course Objectives: This course will enable the students to:

- To learn the fundamentals of data models.
- To conceptualize and depict a database system using ER diagram.
- To make a study of SQL and relational database design.
- To understand the internal storage structures using different file and indexing techniques which will help in physical DB design.
- To know the fundamental concepts of transaction processing- concurrency control techniques and recovery procedure.

Module-1	
INTRODUCTIONAND CONCEPTUALMODELING: Introduction to File and Database systems- Database system structure – Data Models – Introduction to Network and Hierarchical Models – ER model – Relational Model – Relational Algebra.	
Module-2	
RELATIONAL MODEL: SQL – Data definition- Queries in SQL- Updates- Views – Integrity and Security – Relational Database design – Functional dependencies and Normalization for Relational Databases (up to BCNF).	8 hrs
Module-3	
NON-RELATIONAL MODEL: 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	8 hrs
Module-4	
DATA STORAGE AND QUERY PROCESSING: Record storage and Primary file organization- Secondary storage Devices- Operations on FilesHeap File- Sorted Files- Hashing Techniques –	8 hrs

Index Structure for files –Different types of Indexes- B-Tree - B+ Tree – Query Processing.	
Module-5	
TRANSACTION MANAGEMENT: Transaction management -Transaction Processing – Introduction- Need for Concurrency control- Desirable properties of Transaction- Schedule and Recoverability- Serializability and Schedules – Concurrency Control – Types of Locks- Two Phases locking- Deadlock- Time stamp-based concurrency control – Recovery Techniques – Concepts- Immediate Update- Deferred Update - Shadow Paging	8 hrs
Textbooks: 1 Abraham Silberschatz, Henry F. Korth and S. Sudarshan- "Database System Concepts", Seventh Edition, McGraw-Hill, 202	
Course outcomes: At the end of the course, the students will be able to CO1 To learn the fundamentals of data models CO2 To conceptualize and depict a database system using ER diagram. CO3 To make a study of SQL and relational database design. CO4 To understand the internal storage structures using different file and indexing techniques which will help in physical DB design. CO5 To know the fundamental concepts of transaction processing- concurrency control techniques and recovery procedure	
CIE ASSESSMENT: 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)/3 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	**3**	**2**	**2**	**1**	**2**						**1**
CO2	**3**		**2**	**2**	**2**						**1**
CO3	**3**	**1**	**2**	**1**	**3**						**1**
CO4	**3**	**2**	**2**	**2**	**3**						**2**
CO5	**3**	**2**	**3**	**1**	**3**						**1**

Semester : VII		
INTRODUCTION TO ALGORITHMS		
Course Code:	**MVJAI7052**	**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. 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	
Module 1: The Role of Algorithms in Computing: Algorithms, kinds of problems are solved by algorithms, Algorithms as a technology, Efficiency, Data structures, Technique, Hard problems Textbook 1: Chapter 1	8 Hrs
Module-2	
Module 2: Getting Started Insertion sort, Analyzing algorithms, Analysis of insertion sort, Worst-case and average-case analysis, Designing algorithms Textbook 1:Chapter 2,3	8 hrs
Module-3	
Module 3: Growth of Functions Growth of Functions, Asymptotic notation, Comparison of functions, Standard notations and common functions, Functional iteration Textbook 1: Chapter 4,5,6	8 hrs
Module-4	
Module 4: Recurrences The substitution method, The recursion-tree method, The master method, Proof of the master theorem, The proof for exact powers Textbook 1 Chapter 7,8,9	8 hrs
Module-5	
Module 5: Probabilistic Analysis and Randomized Algorithms The hiring problem, Indicator random variables, Randomized algorithms, Probabilistic analysis and further uses of indicator random variables Textbook 1: Chapter 10,11	8 hrs

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.
Links: https://archive.nptel.a

Course outcomes: At the end of the course, the students will be able to
CO1 Explain the basic algorithm and its characteristics

CO2 Understanding of sorting algorithm
CO3 Analysis of algorithm and performance
CO4 Illustrate Recurrence algorithms
CO5 Probablilistic Analysis and randomized algorithms.

CIE ASSESSMENT:
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

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

Semester : VII		
SOFTWARE ENGINEERING		
Course Code:	MVJAI7053	CIE Marks: 50
L: T:P:S	3:0:0:0	SEE Marks: 50

Credits:	3	Total :100
Hours:	40 Hrs Theory	SEE Duration: 2 Hrs.

Course Objectives: This course will enable the students to:

1. Understand principles, concepts, methods, and techniques of the software engineering approach to producing quality software (particularly for large, complex systems).
2. Impart skills in the design and implementation of efficient software systems across disciplines.
3. Familiarize engineering practices and standards used in developing software products and components. Gather knowledge on various software testing, maintenance method

Module-1	
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. Laboratory Sessions/ Experimental learning: To write the SRS for the given real time application using report writing tools. Applications: In Software development process.	8 Hrs
Module-2	
Software Design Fundamental design concepts and principles; Design characteristics; System Models - Context, Behavioral, Data and, Object models. Laboratory Sessions/ Experimental learning: Draw a class diagram, object diagram, Use case diagram, Sequence diagram and activity diagram for the given real time application using rational rose tool. Applications: In Software development process.	8 hrs
Module-3	
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. Laboratory Sessions/ Experimental learning: Using Selenium IDE write a test suite containing minimum 4 test cases. Applications: In Software development process.	8 hrs
Module-4	
Component Based Software Engineering Engineering of Component-Based Systems; The CBSE Process; Domain Engineering; Component- Based Development; Classifying and Retrieving Components; Economics of CBSE Laboratory Sessions/ Experimental learning: Create a project using MS projects for any real time scenario. Applications: In Software development process.	8 hrs
Module-5	
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; Laboratory Sessions/ Experimental learning: Estimation of test coverage metrics using manual test metrics. Applications: In Software development process.	8 hrs

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
3. Rajib Mall, “Fundamentals of Software Engineering”, PHI Publication, 3rd edition, 2009
4. PankajJalote: An Integrated Approach to Software Engineering, Wiley India.

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

CO1 Comprehend software development life cycle and Prepare SRS document for a project
CO2 Apply software design and development techniques
CO3 Identify verification and validation methods in a software engineering project

CO4 Apply on Component based software development process.
CO5 Involve in continuous learning to solve issues of process and software product using the advanced CASE tools and techniques

CIE ASSESSMENT:

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

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

Semester : VII		
ETHICAL HACKING		
Course Code:	**MVJAI7054**	**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. Learn the skills to become responsible and effective ethical hackers, navigating the ethical and legal landscape of cybersecurity.
2. Understand various types of attacks, including social engineering, physical penetration, and insider attacks, to understand how to identify vulnerabilities, conduct simulated attacks, and develop effective defenses to protect organizations from these threats.
3. Apply the knowledge and skills to identify and mitigate various web application security threats, including content-type attacks, web application security vulnerabilities, and VoIP attacks, to protect their organization's digital assets from exploitation.
4. Analyze advanced reverse engineering techniques, including ethical reverse engineering, source code analysis, and fuzzing, to identify and mitigate software vulnerabilities, particularly browser- based vulnerabilities, and develop effective mitigation strategies.
5. Analyze the reverse engineer malware, using techniques such as honeynet technology, deobfuscation, and reverse engineering, to understand malware behavior and develop effective countermeasures.

Module-1

Ethics Of Ethical Hacking: Why you need to Understand Your Enemy's Tactics? Recognizing The Gray Areas in Security – Vulnerability Assessment – Penetration Testing. Ethical Hacking and the Legal System: Understanding Individual Cyberlaws – 18 USC Section 1029, 1030, 2510 – Digital Millennium Copyright Act (DMCA) – Cyber Security Enhancement Act 2002. Proper and Ethical Disclosure: CERT's Current Process – Full Disclosure Policy – Organization for Internet Safety Applications: In-class activity to understand the penetration testing methodologies.	8 Hrs
Module-2	
Social Engineering Attacks: How A Social Engineering Attack Works? – Conducting A Social Engineering Attack – Common Attacks used in Penetration Testing – Defending Against Social Engineering Attacks. Physical Penetration Attacks: Why Physical Penetration is important – Conducting a Physical Penetration – Common Ways into A Building. Insider Attacks: Why Simulating an Insider Attack is Important – Conducting an Insider Attack – Defending against Insider Attack.	8 hrs
Module-3	
Understanding and Detecting Content-Type Attacks: How do Content-Type Attacks work? - Which File Formats are Being Exploited Today? - Tools to Detect Malicious PDF Files – Tools to test your Protections against Content-Type Attacks – How to protect your Environment from Content-Type Attacks. Web Application Security Vulnerabilities: Overview of Top Web Application Security Vulnerabilities – SQL Injection Vulnerabilities – Cross-Site Scripting Vulnerabilities. VoIP Attacks.	8 hrs
Module-4	
Passive Analysis: Ethical Reverse Engineering – Why Bother with Reverse Engineering? – Source Code Analysis. Advanced Reverse Engineering: Overview of Software Development Process – Instrumentation Tools – Fuzzing – Instrumented Fuzzying Tools and Techniques. Finding New Browser Based Vulnerabilities. Mitigation Alternatives.	8 hrs
Module-5	
Collecting Malware and Initial Analysis: Malware – Latest Trends in Honeynet Technology – Catching Malware – Initial Analysis of Malware. Hacking Malware: Trends in Malware – DeObfuscating Malware – Reverse Engineering Malware.	8 hrs

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

CO1 Conduct ethical hacking and penetration testing, identifying vulnerabilities and weaknesses, while adhering to ethical standards and legal frameworks to protect digital assets and organizations.
CO2 Design and implement effective defenses against various types of attacks, including social engineering,
physical penetration, and insider attacks, to protect organizations from potential threats and vulnerabilities.
CO3 Identify and mitigate web application security threats, including content-type attacks, vulnerabilities, and VoIP attacks, to ensure the security and integrity of their organization's digital assets.
CO4 Utilize advanced reverse engineering techniques to identify and mitigate software vulnerabilities, developing effective strategies to enhance browser security and protect against exploitation.
CO5 Develop effective countermeasures to detect, prevent, and respond to malware threats, enhancing their organization's overall cybersecurity posture.

Textbooks:

1 Stuart McClure, Joel Scambray and Goerge Kurtz, Hacking Exposed 7: Network Security Secrets & Solutions, Tata Mc Graw Hill Publishers, 2010.
2 Bensmith, and Brian Komer, Microsoft Windows Security Resource Kit, Prentice Hall of India, 2010.

Reference Books:

1. Rafay Baloch, “A Beginners Guide to Ethical Hacking”.

2. Allen Harper, Shon Harris, Jonathan Ness, Chris Eagle, “Gray Hat Hacking The Ethical Hackers Handbook”, 3rd Edition, McGraw-Hill Osborne Media paperback(January 27, 2011)

CIE ASSESSMENT:

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

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