III SEMESTER

Semester: III			
Discrete Mathematical Structures and Probability			
Course Code:	**MVJ21MA31B**		**CIE Marks:50**
Credits:	**L:T:P:S:3:2:0:0**		**SEE Marks: 50**
Hours:	**30L+20T**		**SEE Duration: 3 Hrs**
Course Learning Objectives: The students will be able to			
1	Prepare for a background in abstraction, notation, and critical thinking for the mathematics most directly related to computer science.		
2	Understand and apply mathematical induction, combinatorics, discrete probability, sequence and recurrence, elementary number theory.		
3	Understand and apply probability distribution, sampling theory and joint probability distributions.		

UNIT-I	
Properties of the Integers: Mathematical Induction. **Principles of Counting**: Fundamental Principles of Counting, The Rules of Sum and Product, Permutations, Combinations – The Binomial and Multinomial Theorem, Combinations with Repetition. **Self-Study Topic:** The Well Ordering Principle. **Video Link**: 1. http://nptel.ac.in/courses.php?disciplineID=111	**10 Hrs**
UNIT-II	
The Principle of Inclusion and Exclusion: The Principle of Inclusion and Exclusion, Generalizations of the Principle. Derangements – Nothing is in its Right Place, Rook Polynomials. **Recurrence Relations:** First Order Linear Recurrence Relation, The Second Order Linear Homogeneous Recurrence Relation with Constant Coefficients. **Self-Study Topic:** Non-Homogeneous Recurrence Relation **Video Link**: 1. http://nptel.ac.in/courses.php?disciplineID=111	**10 Hrs**
UNIT-III	
Relations: Cartesian Products, Relations, Properties of Relations, Equivalence Relations Zero-One Matrices and Directed Graphs, Partial Orders – Hasse Diagrams and extreme	**10 Hrs**

elements. **Functions:** Plain and One to One, Onto Functions. The Pigeon-hole Principle, Function Composition, and Inverse Functions. **Self-Study Topic:** Lattice **Video Link**: 1. http://nptel.ac.in/courses.php?disciplineID=111	
UNIT-IV	
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. **Self-Study Topic:** Continuous Joint Probability Distribution. **Video Link**: 1. http://nptel.ac.in/courses.php?disciplineID=111	**10 Hrs**
UNIT-V	
Sampling Theory: Sampling, Sampling distributions, standard error, test of hypothesis for means and proportions, confidence limits for means, student's t-distributionand Chi-square distribution. **Coding Theory:**Coding of binary information and error detection. **Self-Study Topic:** Decoding and error detection. **Video Link**: 1. http://nptel.ac.in/courses.php?disciplineID=111	**10 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Demonstrate the application of discrete structures in different fields of computer Science.
CO2	Solve problems using recurrence relations and generating functions.
CO3	Solving logical problem using concepts of relations and functions.
CO4	Develop probability distribution of discrete, continuous random variables and joint probability distribution occurring in digital signal processing, information theory and Design engineering.
CO5	Demonstrate testing of hypothesis of sampling distributions.

Reference Books	
1.	Ralph P. Grimaldi: Discrete and Combinatorial Mathematics, 5th Edition, Pearson Education.2004.
2.	B.S. Grewal, "Higher Engineering Mathematics" Khanna Publishers, 43rd Edition, 2013.
3.	Ramana B. V., "Higher Engineering Mathematics", Tata Mc Graw-Hill, 2006.
4.	Kenneth H. Rosen: Discrete Mathematics and its Applications, 6thEdition, McGraw Hill, 2007

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	0	2	0	0	0	0	0	0	0	1
CO2	2	3	0	2	0	0	0	0	0	0	0	1
CO3	2	3	0	3	0	0	0	0	0	0	0	1
CO4	3	3	0	3	0	0	0	0	0	0	0	1
CO5	3	3	0	3	0	0	0	0	0	0	0	1

High-3, Medium-2, Low-1

Semester: III		
OBJECT ORIENTED PROGRAMMING		
Course Code: MVJ21AI32		**CIE Marks:100**
Credits: L:T:P:S:3:1:0:0		**SEE Marks: 100**
Hours: 40L+26T		**SEE Duration: 3 Hrs**

Course Learning Objectives: The students will be able to	
1	Identify the need for Java - an object oriented language. Set up Java JDK environment to create, debug and run simple Java programs.
2	Illustrate the use of classes and distinguish the usage of different types of Inheritance and constructors in real world.
3	Demonstrate the use of exceptions and to create multi-threaded programs
4	Illustrate the use of Collections with elements in Java program.
5	Develop Java Application using JDBC connectivity.

UNIT-I	
Prerequisites : Basic Knowledge about C or C++ **Introduction to Object Oriented Concepts and Java:** Java's Magic: the Byte code; Java Development Kit (JDK); The Java Buzz words, Object Oriented Programming - Two Paradigms, Abstraction, The Three OOP Principles and its advantages, Simple Java programs. Data types, variables and arrays, Operators, Control Statements. **Laboratory Sessions/ Experimental learning:** A professor in college will allow a student to be excused from the final exam if either of the following is true: • They have a 90% average or higher in the class and have missed 3 or less class lectures. • They have a 80% average or higher in the class and have not missed any class lectures. The program below will determine whether a student can get out of the exam or not. Rewrite the program so only one if statement is used. **Applications:** Arrays in mathematical vectors, matrices. **Video link / Additional online information (related to module if any):** • Differences between JVM vs JRE vs JDK in Java: https://www.youtube.com/watch?v=5Bp6GLU6HKE	**10 Hrs**
UNIT-II	
Classes, Inheritance, Packages and Interfaces: Classes fundamentals; Declaring objects; Assigning object reference variables; Introducing Methods, Constructors, this	**10 Hrs**

keyword, Finalize Method. Inheritance: Inheritance basics, using super, creating multi-level hierarchy, when constructors are called, method overriding, using abstract classes. Packages, Access Protection, Importing Packages, Interfaces. **Laboratory Sessions/ Experimental learning:** Write a program that calculates the number of buckets of paint to use for a room and the optimal number of cans to purchase. You need to ask the height of the room and the length and width of the room. The room is rectangular. You must paint the walls and the ceiling but not the floor. There are no windows or skylights. You can purchase the following size buckets of paint. • 5-liter bucket costs $15 each and covers 1500 square feet. • 1-liter bucket costs $4 and covers 300 square feet. **Applications:** Inheritance in Banking Sectors **Video link / Additional online information (related to module if any):** Types of Inheritance: https://www.youtube.com/watch?v=ZP27c7i5zpg	
UNIT-III	
Exception Handling and Multi-Threaded Programming: Exception Handling fundamentals, Exception Types, Uncaught Exceptions, Using try catch, Multiple catch clauses, Nested try statements, throw, throws, finally, Java's built-in exceptions, Programming Examples. **Multi-Threaded Programming**: The java thread model, Main thread, Creating Thread, Creating multiple threads, Using is Alive() and join(), Thread priorities, Synchronization; InterThread Communication - Bounded buffer problem. **Laboratory Sessions/ Experimental learning:** The Producer-Consumer problem describes two processes, the producer and the consumer, which share a common, fixed-size buffer used as a queue. The producer's job is to generate data, put it into the buffer, and start again.At the same time, the consumer is consuming the data (i.e. removing it from the buffer), one piece at a time. Make sure that the producer won't try to add data into the buffer if it's full and that the consumer won't try to remove data from an empty buffer. Write a java code to get the solution for this multi-process synchronization problem. **Applications:** Multithreads in Browsers, Servers **Video link / Additional online information (related to module if any):** Multithreading: https://www.youtube.com/watch?v=O_Ojfq-OIpM	**10 Hrs**
UNIT-IV	
The collections and Framework: Collections Overview, Recent Changes to Collections, The Collection Interfaces, The Collection Classes, Accessing a collection Via an Iterator,	**10 Hrs**

Storing User Defined Classes in Collections. **Java Lambda expressions:** Java Lambda expressions, Using Java Lambda expressions, Lambda expression vs method in java, Lambda expression in the array list. **Laboratory Sessions/ Experimental learning:** Write a Java program to iterate through all elements in a array list **.** Write a Java program to create a new array list, add some colors (string) and print out the collection **Applications:** Elements in group **Video link / Additional online information (related to module if any):** https://www.youtube.com/watch?v=Q_9vV3H-dt4	
UNIT-V	
JDBC: The Concept of JDBC; JDBC Driver Types; JDBC Packages; A Brief Overview of the JDBC process; Database Connection; Associating the JDBC/ODBC Bridge with the Database; Statement Objects; Result Set; Transaction Processing; Metadata, Data types; Exceptions. **Laboratory Sessions/ Experimental learning:** Develop Student Management System application with swings as the front end and database as the back end using JDBC connectivity. **Applications:** Scientific Applications, Financial Applications **Video link / Additional online information (related to module if any):** **Java JDBC :**https://www.youtube.com/watch?v=hEWBIJxrLBQ	**10 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Illustrate the Object Oriented Programming concepts and basic characteristics of Java.
CO2	Demonstrate the principles of classes, inheritance, packages and interfaces.
CO3	Experiment with exception handling Mechanisms and Create multi-threaded programs.
CO4	Interpret the need for advanced Java concepts like collections in developing modular and efficient programs.
CO5	Develop an application with Database using JDBC connectivity.

Reference Books	
1.	Herbert Schildt, Java The Complete Reference, 7 /9th Edition, Tata McGraw Hill, 2007.
2.	Jim Keogh: J2EE-The Complete Reference, McGraw Hill, 2007.
3.	Effective Java, Third Edition, Joshua Bloch, Addison-Wesley Professional,2017
4.	Richard Warburton**,** Java 8 Lambdas: Pragmatic Functional Programming Kindle Edition.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO/PSO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	-	-	-	-	-	-	-	-	3	2	-
CO2	3	3	1	-	-	-	-	-	-	-	-	3	2	-
CO3	3	3	1	2	-	-	-	-	-	1	-	3	2	3
CO4	3	3	3	3	-	-	-	2	2	2	-	3	2	-
CO5	3	3	3	3	-	-	2	2	3	2	-	3	2	3

High-3, Medium-2, Low-1

Semester: III		
OPERATING SYSTEMS		
Course Code: MVJ21AI33		**CIE Marks:100**
Credits: L:T:P:S:3:1:0:0		**SEE Marks: 100**
Hours: 40L+26T		**SEE Duration: 3 Hrs**

Course Learning Objectives: The students will be able to	
1	Introduce concepts and terminology used in OS.
2	Explain threading and multithreaded systems.
3	Illustrate process synchronization and concept of Deadlock.
4	Introduce Memory and Virtual memory management, File system and storage techniques.

UNIT-I	
Introduction: What operating systems do; Computer System organization; Computer System architecture; Operating System operations; 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; System boot. **Process Management**: Process concept; Process scheduling; Operations on processes; Inter process communication.	**8 Hrs**
UNIT-II	
Multi-threaded Programming: Overview; Multithreading models; Thread Libraries; Threading issues. Process Scheduling: Basic concepts; Scheduling Criteria; Scheduling Algorithms; Multiple-processor scheduling; Thread scheduling. **Process Synchronization**: Synchronization: The critical section problem; Peterson's solution; Synchronization hardware; Semaphores; Classical problems of synchronization; Monitors.	**8 Hrs**
UNIT-III	
Deadlocks : Deadlocks; System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock.	**8 Hrs**

Memory Management: Memory management strategies: Background; Swapping; Contiguous memory allocation; Paging; Structure of page table; Segmentation	
UNIT-IV	
Virtual Memory Management: Background; Demand paging; Copy-on-write; Page replacement; Allocation of frames; Thrashing. **File System, Implementation of File System**: File system: File concept; Access methods; Directory structure; File system mounting; File sharing; **Implementing File system**: File system structure; File system implementation; Directory implementation; Allocation methods; Free space management.	**8 Hrs**
UNIT-V	
Mass Storage Structure-Disk Structure-Disk Attachment-Disk Scheduling-Disk Management- Swap-Space Management. **Protection**: Domain of protection, Access matrix, Implementation of access matrix, Access control, Revocation of access rights, Capability- Based systems. Case Studies: **Windows, Unix, Linux, Android.**	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Illustrate the fundamental concepts of operating systems
CO2	Compare and illustrate various process scheduling algorithms.
CO3	Ability to recognize and resolve Deadlock problems, Memory Management techniques.
CO4	Apply appropriate memory and file management schemes.
CO5	Appreciate the need of access control and protection in Operating System and illustrate various disk scheduling algorithms.

Reference Books	
1.	Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Concepts 7th edition,Wiley-India, 2006
2.	D.M Dhamdhere, Operating Systems: A Concept Based Approach 3rd Ed, McGraw- Hill, 2013.
3.	Tanenbaum, A., "Modern Operating Systems", Prentice-Hall of India. 2004
4.	P.C.P. Bhatt, An Introduction to Operating Systems: Concepts and Practice 4th Edition

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

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Semester End Examination (SEE):

Total marks: 50+50=100

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CO3	3	2	3	-	-	-	-	-	-	-	-	-	3	-
CO4	3	2	3	-	-	-	-	-	-	-	-	-	2	2
CO5	3	2	3	-	-	-	-	-	-	-	-	-	2	-

High-3, Medium-2, Low-1

Semester: III		
DATA STRUCTURES AND APPLICATIONS & LAB		
Course Code: MVJ21AI34		**CIE Marks:50+50**
Credits: L:T:P: 3:0:1		**SEE Marks: 50 +50**
Hours:40 L+ 26 P		**SEE Duration: 03+03 Hours**

Course Learning Objectives: The students will be able to	
1	Identify the importance of data structures & memory allocation.
2	Perform operations on stacks and queues and its applications.
3	Apply the operations of linked list, Trees & Graphs in various applications.
4	Apply searching and sorting operations in real time applications.
5	Identify the importance of data structures & memory allocation.

UNIT-I	
Introduction: Data Structures, Classifications (Primitive &Non Primitive), Data structure Operations, Review of Arrays, Structures, Self-Referential Structures. Pointers and Dynamic Memory Allocation Functions. Representation of Linear Arrays in Memory, Dynamically allocated arrays. **Abstract Data Type, Array Operations:** Traversing, inserting, deleting, searching, and sorting, **Array ADT** :Multidimensional Arrays, Polynomials and Sparse Matrices. **Strings:** Basic Terminology, Storing, Operations and Pattern Matching algorithms. Programming Examples. **Laboratory Sessions/ Experimental learning:** **1.** Create an array of structure which has the following members Student name, Student USN, Marks1, Marks2, Marks3. Allocate memory to store 5 students details initially. When a new student details need to be entered or to be deleted in this array, dynamically change the array size. Write a program to implement this scenario and display the result. **2.** Find the bug for the following code and then Debug it int minval(int *A, int n) { int currmin;	**10 Hrs**

```
      for (int i=0; i<n; i++)
       if (A[i] <currmin)
currmin = A[i];
      return currmin;
    }
```

3. Compile the following code and debug it.

```
   #include <stdio.h>
   #include <string.h>
   struct student
  {
    int id;
    char name[30];
    float percentage;
  };
 int main()
{
    int i;
    struct student record1 = {1, "Raju", 90.5};
    struct student *ptr;
printf("Records of STUDENT1: \n");
printf("  Id is: %d \n", ptr->id);
printf("  Name is: %s \n", ptr->name);
printf("  Percentage is: %f \n\n", ptr->percentage);
     return 0;
```

} **Real Time Applications: System memory allocation** **Video link / Additional online information (related to module if any):** 1. https://nptel.ac.in/courses/106106130/ 2. https://nptel.ac.in/courses/106105085/ 3. https://nptel.ac.in/courses/106/106/106106127/ 4. https://www.coursera.org/lecture/data-structures/arrays-OsBSF	
UNIT-II	
Stacks: Definition, Stack Operations, Stack ADT, Array Representation of Stacks, Stacks using Dynamic Arrays, Stack Applications: Polish notation, Infix to postfix conversion, evaluation of postfix expression. **Recursion -** GCD, Tower of Hanoi. **Queues:** Definition, Array Representation, Queue Operations, Queue ADT, Circular Queues, Circular queues using Dynamic arrays, Dequeues, Priority Queues. Programming Examples. **Laboratory Sessions/ Experimental learning:** Design, Develop and Implement a menu driven Program in C for the following operations on DEQUEUE of Integers (Array Implementation of Queue with maximum size MAX) a. Insert an Element on to DEQUEUE b. Delete an Element from DEQUEUE c. Demonstrate Overflow and Underflow situations on DEQUEUE d. Display the status of DEQUEUE e. Exit Support the program with appropriate functions for each of the above operations **Real Time Applications: Game applications, Ticket booking applications (Eg: Train, restaurant etc)** **Video link / Additional online information (related to module if any):** 1.https://nptel.ac.in/courses/106106130/ 2. https://nptel.ac.in/courses/106102064/ 3. https://nptel.ac.in/courses/106105085/ 4.https://nptel.ac.in/courses/106/106/106106127/	**10 Hrs**
UNIT-III	
Linked Lists: Definition, Representation of linked lists in Memory, Memory allocation; Garbage Collection. Linked list operations: Traversing, Searching, Insertion, and Deletion. Doubly Linked lists, Circular linked lists, and header linked lists. Linked Stacks and Queues. Applications of Linked lists – Polynomials. Programming Examples	**10 Hrs**

Hashing: Hash Table organizations, Hashing Functions, Static and Dynamic Hashing.

Laboratory Sessions/ Experimental learning:

1.Design, Develop and Implement a Program in C for the following operations on Singly Circular Linked List (SCLL) with header nodes

a. Represent and Evaluate a Polynomial $P(x,y,z) = 6x^2 y^2 z-4yz^5 +3x^3 yz+2xy^5 z-2xyz^3$

b. Find the sum of two polynomials POLY1(x,y,z) and POLY2(x,y,z) and store the result in POLYSUM(x,y,z) Support the program with appropriate functions for each of the above operations

2. Debug the following code and explain the process

```
//Insert a value into an ordered linked list

void insert(lnode*&curr, int val) {

  if (curr == NULL)

curr = new lnode(val, NULL);

  else if (lnode->val>val)

curr = new lnode(val, curr->next);

  else {

curr = curr->next;

insert(curr, val);

  }

}
```

Real Time Applications: Music Player, Image Viewer, Web browser, Process Management, Mechanical field

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

1. https://nptel.ac.in/courses/106106130/
2. https://nptel.ac.in/courses/106102064/
3. https://nptel.ac.in/courses/106105085/

UNIT-IV

Trees: Terminology, Binary Trees, Properties of Binary trees, Array and linked	**10 Hrs**

Representation of Binary Trees, Binary Tree Traversals - Inorder, postorder, preorder; Additional Binary tree operations. Threaded binary trees, Binary Search Trees – Definition, Insertion, Deletion, Traversal, Searching, Application of Trees-Evaluation of Expression, AVL Trees, Splay Trees, B-Tree, Programming Examples **Laboratory Sessions/ Experimental learning:** Design, Develop and Implement a menu driven Program in C for the following operations on AVL Trees i) Construct an AVL tree by inserting the following elements in the given order. 63, 9, 19, 27, 18, 108, 99, 81. ii)searching for a node iii)Deleting a node **Real Time Applications:** Indexing in databases, Programming Languages, Computer chess games, Computer file system, Undo function in text editor, representing city region telephone network etc. **Video link:** • https://nptel.ac.in/courses/106102064/ • http://www.digimat.in/nptel/courses/video/106106127/L50.html • https://www.youtube.com/watch?v=ffgg_zmbaxw	
UNIT-V	
Graphs: Definitions, Terminologies, Matrix and Adjacency List Representation of Graphs, Elementary Graph operations, Traversal methods: Breadth First Search and Depth First Search, Topological Sort. **Sorting and Searching:** Quick sort, Insertion Sort, Radix sort, Merge Sort, Address Calculation Sort. **Laboratory Sessions/ Experimental learning:** Sort a given set of elements using the sorting Method which divides input array in two halves, calls itself for the two halves and then merges the two sorted halves" and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and 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. **Real Time Applications:** Graph Theory, E-Commerce websites, Google Maps, Facebook **Video link:**	**10 Hrs**

- https://www.youtube.com/watch?v=hk5rQs7TQ7E&feature=youtu.be
- **https://nptel.ac.in/courses/106/102/106102064/**

LABORATORY EXPERIMENTS

1. A courier company has number of items to be delivered to its intended customers through its salesman. The salesman visits the following cities to deliver the respective items. Write a C program,

Sl No	Cities	Number of items
1	Agra	25
2	Chennai	50
3	Kolkata	59
4	Mumbai	72
5	Delhi	12

a) To display name of cities where salesman has delivered maximum and minimum number of items

b) To search the number of items to be delivered of a user supplied city.

2. Implement Knuth-Morris- Pratt pattern matching algorithm using C program.
3. Design, Develop and Implement a menu driven Program in C with the listed operations for the data structure which follows Last In First Out (LIFO) order. (Use Array Implementation of specified DS with maximum size MAX).
   a. Push an Element
   b. Pop an Element
   c. Demonstrate how it can be used to check Palindrome
   d. Demonstrate Overflow and Underflow situations
   e. Display the status
   f. Exit

   Support the program with appropriate functions for each of the above operations.
4. Design, Develop and Implement a Program in C for converting an Infix Expression to Postfix Expression. Program should support for both parenthesized and free parenthesized expressions with the operators: +, -, *, /, % (Remainder), ^ (Power) and alphanumeric operands.
5. Design, Develop and Implement a menu driven Program in C for the following operations on Ring Buffer of Integers (Use Array Implementation)
   a. Insert an Element on to Ring Buffer
   b. Delete an Element from Ring Buffer
   c. Demonstrate Overflow and Underflow situations on Ring Buffer
   d. Display the status of Ring Buffer

e. Exit

Support the program with appropriate functions for each of the above operations

6. Design, Develop and Implement a menu driven Program in C for the following operations on Singly Linked List (SLL) of Student Data with the fields: USN, Name, 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
   e. Exit
7. Design, Develop and Implement a menu driven Program in C for the following operations on Doubly Linked List (DLL) of Employee Data with the fields: SSN, Name, Dept, Designation, Sal, 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
8. Design, Develop and Implement a menu driven C Program 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 recursively in inorder, pre order & post order

Search the BST for a given element (KEY) and report the appropriate message

9. Design, Develop and Implement 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
10. Develop a C program to sort a given set of n integer elements using Quick Sort method. Run the program for varied values of n and show the results of each iteration.
11. Given a File of N employee records with a set K of Keys(4-digit) which uniquely determine the records in file F. Assume that file F is maintained in memory by a Hash Table(HT) of m memory locations with L as the set of memory addresses (2- digit) of locations in HT. Let the keys in K and addresses in L are Integers. Design and 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.

Course Outcomes: After completing the course, the students will be able to	
CO1	Identify the necessity of data structure and its storage process.
CO2	Analyse the various operations performed on stack and queues for different applications.
CO3	Perform various operations on linked list for different applications**.**
CO4	Learn Trees and its applications.
CO5	Analyse the concepts of Graphs, searching, sorting & hashing in real time.

Reference Books	
1.	Ellis Horowitz and Sartaj Sahni, Fundamentals of Data Structures in C, 2nd Ed, Universities Press, 2014.
2.	Seymour Lipschutz, Data Structures Schaum's Outlines, Revised 1st Ed, McGraw Hill, 2014.
3.	Gilberg & Forouzan, Data Structures: A Pseudo-code approach with C, 2nd Ed, Cengage Learning,2014.
4.	Jean-Paul Tremblay & Paul G. Sorenson, An Introduction to Data Structures with Applications, 2nd Ed, McGraw Hill, 2013

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the self -study are 20 (2 presentations are be held for 10 marks each). The marks obtained in test, quiz and self -studies are added to get marks out of 100 and report CIE for 50 marks.

Laboratory- 50 Marks

The laboratory session is held every week as per the time table and the performance of the student is evaluated in every session. The average of the marks over number of weeks is considered for 30 marks. At the end of the semester a test is conducted for 10 marks. The students are encouraged to implement additional innovative experiments in the lab and are awarded 10 marks. Total marks for the laboratory is 50.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks are executed by means of an examination.

The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the complete syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

Laboratory- 50 Marks

CO-PO/PSO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	1	-	-	-	-	-	-	2	2	-
CO2	3	3	3	-	-	-	-	-	1	-	1	2	1	-
CO3	2	2	2	1	3	-	-	-	-	-	1	3	2	3
CO4	3	2	3	-	-	-	-	-	-	2	3	2	2	-
CO5	3	2	3	-	-	-	-	-	-	2	3	2	2	2

Experiment Conduction with proper results is evaluated for 40 marks and Viva is for 10 marks. Total SEE for laboratory is 50 marks.

High-3, Medium-2, Low-1

Semester: III		
ANALOG AND DIGITAL ELECTRONICS AND LAB		
Course Code: MVJ21AI35		**CIE Marks:50+50**
Credits: L:T:P: 3:0:1		**SEE Marks: 50 +50**
Hours:40 L+26P		**SEE Duration: 03+03 Hours**

Course Learning Objectives: The students will be able to	
1	Analyse the working of oscillators and use of regulators.
2	Make use of simplifying techniques in the design of combinational circuits.
3	Illustrate combinational and sequential digital circuits.
4	Demonstrate the use of flipflops and design registers and counters.
5	Design and test Analog-to-Digital and Digital-to-Analog conversion techniques.

UNIT-I	
Prerequisites : Basic analog Circuits **Metal Oxide Semiconductor Field Effect transistor(MOSFET):** Structure and I-V characteristics, MOSFET as a switch, MOSFET as an amplifier, CMOS and its applications. **Oscillators:** Basic working and applications of RC Phase shift oscillator, Wien Bridge oscillator, LC oscillator, Colpitt oscillator, Crystal Oscillator. **Linear Power Supplies:** Constituents of a Linear Power Supply, Designing Mains Transformer, Linear IC voltage regulators, Regulated Power Supply Parameters.	**8 Hrs**
UNIT-II	
Prerequisites: Digital Electronic Fundamentals **Karnaugh maps**: Minimum forms of switching functions, two and three variable Karnaugh maps, four variable karnaugh maps, Quine-McClusky Method: determination of prime implicants, The prime implicant chart, petricks method, simplification of incompletely specified functions, simplification using map-entered variables **Activity**: Writing and Analyzing C program for K-maps.	**8 Hrs**
UNIT-III	
Combinational Circuits: Multiplexer, Decoders, Adders, Subtractors, BCD arithmetic, carry look ahead adder, serial adder, ALU-Design and popular MSI chips, digital	**8 Hrs**

comparator, parity checker/generator, code converters, priority encoders, decoders/drivers for display devices, **Activity:** Designing a 32-bit ALU	
UNIT-IV	
Flip-Flops and Registers: **Flip Flops:** S-R,J-K,D and T flip flops,Edge-triggered JK FLIP-FLOPs **Registers:** Types of Registers, Serial In - Serial Out, Serial In - Parallel out, Parallel In - Serial Out, Parallel In - Parallel Out, Universal Shift Register, Applications of Shift Registers. **Counters:** Asynchronous Counters, Decoding Gates, Synchronous Counters, Changing the Counter Modulus, Decade Counters, Applications of Counters. **Activity:** Implementing 2 digit counters using seven segment display	**8 Hrs**
UNIT-V	
D/A Conversion and A/D Conversion: **Digital to analog converters**: weighted resistor/converter, R-2R Ladder D/A converter, specifications for D/A converters, examples of D/A converter lCs, sample and hold circuit. **Analog to digital converters:** quantization and encoding, parallel comparator A/D converter, successive approximation A/D converter, counting A/D converter, dual slope A/D converter, A/D converter using voltage to frequency and voltage to time conversion, specifications of A/D converters, example of A/D Converter ICs Activity: **Demonstration of CODEC which houses both ADC and DAC.**	**8 Hrs**
LABORATORY EXPERIMENTS	
1. Study of transistor phase shift oscillator and observe the effect of variation in R & C on oscillator frequency and compare with theoretical value. **2.** Design and test IC 723 voltage regulator **3.** Given a 4-variable logic expression, simplify it using Entered Variable Map and realize the simplified logic expression using 8:1 multiplexer IC. **4.** Design and implement a faster way3 to add binary numbers using carry look ahead adders. **5**. a) Realization and implementation of 2-bit comparator using logic gates. b) Implementation of 4-bit magnitude comparator using IC 7485. **6.** To design and construct basic flip-flops R-S ,J-K,J-K Master slave flip-flops using gates and verify their truth table	

7.	Implementation of SISO, SIPO, PISO and PIPO shift registers using Flip- flops
8.	Design and implementation of 3-bit synchronous up/down counter
9.	Design and implement a ring counter and Johnson counter using 4-bit shift register and demonstrate its working.
10.	Design and implement a mod-n (n<8) synchronous up counter using J-K Flip-Flop ICs and demonstrate its working.
11.	Design and implement an asynchronous counter using decade counter IC to count up from 0 to n (n<=9) and demonstrate on 7-segment display (using IC-7447).
12.	Design 4 bit r-2r ladder DAC using opamp.

Course Outcomes: After completing the course, the students will be able to	
CO1	Design and analyze analog circuits using transistors, power supply, MOSFETS, regulator IC and opamp.
CO2	Simplify digital circuits using Karnaugh Map , POS and Quine-McClusky Methods
CO3	Explain construction and working of data processing circuits
CO4	Understanding the various types of latches and flip flops and building the registers and counters using flip flops.
CO5	Explain the basic principles of A/D and D/A conversion circuits and develop the same.

Reference Books	
1.	Anil K Maini, Varsha Agarwal, Electronic Devices and Circuits, Wiley, 2012.
2.	Charles H Roth and Larry L Kinney, Fundamentals of Logic design, Cengage Learning,2019.
3.	M. Morris Mani, Digital Design, 4th Edition, Pearson Prentice Hall, 2008.
4.	David A. Bell, Electronic Devices and Circuits, 5th Edition, Oxford University Press, 2008

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each).The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Laboratory- 50 Marks

The laboratory session is held every week as per the time table and the performance of the student is evaluated in every session. The average of the marks over number of weeks is considered for 30 marks. At the end of the semester a test is conducted for10 marks. The students are encouraged to implement additional innovative experiments in the lab and are awarded 10 marks. Total marks for the laboratory is 50.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks are executed by means of an examination.

The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO/PSO Mapping														
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**2**	**-**
CO2	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**2**	**-**
CO3	**3**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**2**	**-**
CO4	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**2**	**-**
CO5	**3**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**1**	**2**

High-3, Medium-2, Low-1

Semester: III		
UNIX SHELL PROGRAMMING (Theory)		
Course Code: MVJ21AEC37		**CIE Marks:100**
Credits: L:T:P:S:2:0:0:0		**SEE Marks: 100**
Hours: 40L		**SEE Duration: 3 Hrs**
Course Learning Objectives: The students will be able to		
1	**To help the students to understand effective use of Unix concepts, commands and terminology**	
2	**Identify, access, and evaluate UNIX file system.**	
3	**Understand UNIX command syntax and semantics.**	
4	**Ability to read and understand specifications, scripts and programs.**	

UNIT-I	
Introduction of UNIX - Introduction, History, Architecture, Experience the Unix environment, Basic commands ls, cat, cal, date, calendar, who, printf, tty, sty, uname, passwd, echo, tput, and bc.	**6 Hrs**
UNIT-II	
UNIX File System- The file, what's in a filename? The parent-child relationship, pwd, the Home directory, absolute pathnames, using absolute pathnames for a command, cd, mkdir, rmdir, Relative pathnames, The UNIX file system.	**6 Hrs**
UNIT-III	
Basic File Attributes - Is – l, the –d	**6 Hrs**

option, File Permissions, chmod, Security and File Permission, users and groups, security level, changing permission, user masks, changing ownership and group, File Attributes, More file attributes: hard link, symbolic link, umask, find.	
UNIT-IV	
Introduction to the Shell Scripting - Introduction to Shell Scripting, Shell Scripts, read, Command Line Arguments, Exit Status of a Command, The Logical Operators && and ||, exit, if, and case conditions, expr, sleep and wait, while, until, for, $, @, redirection. The here document, set, trap, Sample Validation and Data Entry Scripts.	**6 Hrs**
UNIT-V	
Introduction to UNIX System process: Mechanism of process creation. Parent and child process. The ps command with its options. Executing a command at a specified point of time: at command. Executing a command periodically: cron command and the crontab file Signals.	**6 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	**Know the basics of Unix concepts and commands.**
CO2	**Evaluate the UNIX file system.**
CO3	**Apply Changes in file system.**
CO4	**Understand scripts and programs.**

CO5	**Analyze Facility with UNIX system process**

Reference Books	
1.	**Unix Concepts & Applications 4rth Edition, Sumitabha Das, Tata McGraw Hill**
2.	**Unix Shell Programming, Yashwant Kanetkar**
3.	**Introduction to UNIX by M G Venkatesh Murthy**

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question

may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	-	-	-	-	-	-	-	-	-
CO2	2	2	3	-	-	-	-	-	-	-	-	-
CO3	3	2	3	-	-	-	-	-	-	-	-	-
CO4	3	2	3	-	-	-	-	-	-	-	-	-
CO5	3	2	3	-	-	-	-	-	-	-	-	-

High-3, Medium-2, Low-1

Semester: III		
Additional Mathematics-I **(Common to all branches)**		
Course Code:	**MVJ21MATDIP1**	**CIE Marks:50**
Credits:	**L:T:P:S: 4:0:0:0**	**SEE Marks: 50**
Hours:	**40L**	**SEE Duration: 3 Hrs**
Course Learning Objectives: The students will be able to		
1	To familiarize the important and introductory concepts of Differential calculus	
2	Aims to provide essential concepts integral calculus	
3	To gain knowledge of vector differentiation	
4	To learn basic study of probability	
5	Ordinary differential equations of first orderand analyze the engineering problems.	

UNIT-I	
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	**8 Hrs**

expansions- Illustrative examples. **Video Link**: 1. http://nptel.ac.in/courses.php?disciplineID=111	
UNIT-II	
IntegralCalculus: Statement of reduction formulae for the integrals of $\sin^n(x)$, $\cos^n(x)$, $\sin^n(x)\cos^n(n)$ and evaluation of these integrals with standard limits-problems. Double and triple integrals-Simple examples. **Video Link**: 1. http://nptel.ac.in/courses.php?disciplineID=111	**8 Hrs**
UNIT-III	
Vector Differentiation: ScalarandVectorpointfunctions,Gradient,Divergence,Curl,SolenoidalandIrrotationalvectorfields. **Vector identities**- $div(\phi \vec{A})$, $curl(\phi \vec{A})$, $curl(grad(\phi))$, $div(curl \vec{A})$. **Video Link**: 1. http://nptel.ac.in/courses.php?disciplineID=111	**8Hrs**
UNIT-IV	
Probability: Basic terminology, Sample space and events. Axioms of probability. Conditional probability – illustrative examples. Bayes theorem-examples. **Video Link**: 1. http://nptel.ac.in/courses.php?disciplineID=111	**8Hrs**
UNIT-V	
Ordinary Differential Equations of First Order: Introduction – Formation of differential equation, solutions of first order and first degree differential equations: variable separable form, homogeneous, exact, linear differential equations. **Video Link**: 1. http://nptel.ac.in/courses.php?disciplineID=111	**8Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply the knowledge of calculus to solve problems related to polar curves and its applications
CO2	Apply the concept of integration and variables to evaluate multiple integrals and their usage in computing the area and volumes.
CO3	Illustrate the applications of multivariate calculus to understand the solenoidal and irrotational

	vectors and also exhibit the inter dependence of line, surface and volume integrals.
CO4	Understand the basic Concepts of Probability
CO5	Recognize and solve first-order ordinary differential equations occurring in different branches of engineering.

Reference Books	
1.	B.S. Grewal,Higher Engineering Mathematics**,** Khanna Publishers,43rd Edition**,** 2013**,** .
2.	G. B. Gururajachar, Calculus and Linear Algebra, Academic Excellent Series Publication, 2018-19
3.	Chandrashekar K. S, Engineering Mathematics-I, Sudha Publications, 2010.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	0	2	0	0	0	0	0	0	1	1
CO2	3	3	0	2	0	0	0	0	0	0	1	1

CO3	3	3	0	3	0	0	0	0	0	0	1	1
CO4	2	2	0	3	0	0	0	0	0	0	1	1
CO5	2	2	0	2	0	0	0	0	0	0	0	1

High-3, Medium-2, Low-1

IV SEMESTER

B.E, IV SEMESTER, ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Semester: IV		
Operations Research, Numerical and Statistical Methods		
Course Code:	**MVJ21MA41B**	**CIE Marks:50**
Credits:	**L:T:P:S:2:2:0:0**	**SEE Marks: 50**
Hours:	**20L+20T**	**SEE Duration: 3 Hrs**
Course Learning Objectives: The students will be able to		
The purpose of this course is to make students well conversant with numerical methods to solve ordinary differential equations, sampling theory and Operational research emerging in science and engineering.		

UNIT-I	
Numerical Methods-1 Numerical solution of Ordinary Differential Equations of first order and first degree: Modified Euler's method, Taylor's series method, Runge-Kutta method of fourth order, Predictor and Corrector method: Milne's Method and Adams-Bashforth Method. **Self-Study Topic:** Euler's method.	**8Hrs**

Video Links: http://nptel.ac.in/courses.php?disciplineID=111	
UNIT-II	
Numerical Methods-2: Numerical solution of Ordinary Differential Equations of second order: Runge-Kutta method of fourth order, Predictor and Corrector method: Milne's Method and Adams Bash forth Method. **Calculus of Variations:** Variation of function and Functional, variational problems. Euler's equation, Geodesics. **Self-Study Topic:** Hanging Chain Problems. **Video Links:** http://nptel.ac.in/courses.php?disciplineID=111	**8 Hrs**
UNIT-III	
Operations Research-1 Introduction to Linear Programming Problem (LPP): Assumptions of LPP, Formulation of LPP and Graphical method various examples. The simplex method, Big M method and Two-Phase Method. **Self-Study Topic :**Dual simplex method. **Video Links:** http://nptel.ac.in/courses.php?disciplineID=111	**8 Hrs**
UNIT-IV	
Operations Research-2 **The transportation problem:** Initial Basic Feasible Solution (IBFS) by Northwest Corner Rule method, Matrix Minima Method, Vogel's Approximation Method, MODI method. **Game Theory:** The formulation of two persons, zero sum games; saddle point, maxmin and minmax principle, Solving simple games- a prototype example, Games with mixed strategies (ODD's method, Dominance method and Graphical method).	**8 Hrs**

Self-Study Topic: Matrix method **Video Links:** http://nptel.ac.in/courses.php?disciplineID=111	
UNIT-V	
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. **Self-Study Topic:** Fitting of the curves of the form$y = x^b$. **Video Links:** http://nptel.ac.in/courses.php?disciplineID=111	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Solve first and second order ordinary differential equation arising in flow problems using single step numerical methods.
CO2	Determine the extremals of functional and solve the simple problems of the Calculus of variations.
CO3	Solve the mathematical formulation of linear programming problem.
CO4	Solve the applications of transport problems and theory of games.
CO5	Fit a suitable curve by the method of least squares and determine the lines of regression for a set of statistical data.

Reference Books	
1.	B.S. Grewal, "Higher Engineering Mathematics" Khanna Publishers, 43rd Edition, 2013.
2.	S. D. Sharma, "Operations Research", Kedar Nath and Ram NathPublishers, Seventh Revised Edition 2014.
3.	Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley-India publishers,

	10thedition, 2014.
4.	Ramana B. V., "Higher Engineering Mathematics", Tata Mc Graw-Hill, 2006.
5.	Bali N. P. & Manish Goyal, "A text book of Engineering Mathematics", Laxmi Publications, 8th Edition

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three subdivisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	0	3	0	0	0	0	0	0	0	1
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CO3	3	3	0	2	0	0	0	0	0	0	0	1
CO4	2	3	0	3	0	0	0	0	0	0	0	1
CO5	3	3	0	3	0	0	0	0	0	0	0	1

High-3, Medium-2, Low-1

Semester: IV		
MICRO CONTROLLER AND EMBEDDED SYSTEMS		
Course Code: MVJ21AI 42		**CIE Marks:50+50**
Credits: L:T:P: 3:0:1		**SEE Marks: 50 +50**
Hours:40 L+ 26 P		**SEE Duration: 03+03 Hours**
Course Learning Objectives: The students will be able to		
1	Explain the fundamentals of ARM based system, basic hardware components, selection methods and attributes of an ARM Controller.	
2	Program ARM controller using the various instructions.	
3	Explain the fundamentals of Exception, Interrupt Handling and Memory Management Unit of ARM Controller.	
4	Identify the Embedded System Design applications.	
5	Explain the real time operating system for the embedded system design.	

UNIT-I	
Arm Embedded Systems ***Prerequisites:*** **ARM DESIGN PHILOSOPHY,ARM DATAFLOW MODEL** **Microprocessors versus Microcontrollers, ARM Embedded Systems**: The RISC design philosophy, The ARM Design Philosophy, Embedded System Hardware, Embedded System Software.	**8 Hrs**

ARM Processor Fundamentals: Registers, Current Program Status Register, Pipeline, Exceptions, Interrupts, and the Vector Table , Core Extensions **Activity:**1.Comparision of Microprocessor and Microcontroller hardware Model 2.Comparing the Microprocessor and Microcontroller Software Model	
UNIT-II	
ARM Instruction Set and Programming ***Prerequisites:* ARM INSTRUCTION SET,ARM ASSEMBLY PROGRAMMING** **Introduction to the ARM Instruction Set :**Data Processing Instructions , Programme Instructions, Software Interrupt Instructions, Program Status Register Instructions, Coprocessor Instructions, Loading Constants **ARM programming using Assembly language:** Writing Assembly code, Profiling and cycle counting, instruction scheduling **Activity:**1.Writing ARM Assembly program for Embedded System Applications	**8 Hrs**
UNIT-III	
Interrupt and Memory Management Unit: ***Prerequisites :*Interrupt, Exception, Memory Management unit** **Exception, Interrupt Handling :**Exception handling, Interrupts, Interrupt handling Schemes **Memory Management Unit :** The Memory Hierarchy and Cache Memory, Cache Architecture, Cache Policy, Moving from MPU to an MMU, How Virtual Memory Works, Details of ARM MMU **Activity:** 1) Use of External interrupt0 to turn ON/OFF led connected to Pin P1.25 of ARM Processor. 2) Use of Software Interrupt SWI instruction in programming. 3) Calculating physical memory address from logical address.	**8 Hrs**
UNIT-IV	
Prerequisites: Embedded systems ,Embedded Applications **Embedded System Components:** Embedded Vs General computing system, History of embedded systems, Classification of Embedded systems, Major applications areas of embedded systems, purpose of embedded systems Core of an Embedded System including all types of processor/controller, Memory, Sensors, Actuators, LED, 7 segment LED display, stepper motor, Keyboard, Push button switch, Communication Interface (on board and external types), Embedded firmware, Other system components.	**8 Hrs**

Activity: Case Study - Digital Clock, Battery operated Smartcard Reader	
UNIT-V	
Prerequisites: Real time operating system **Real Time Operating System (RTOS) based Embedded System Design:** Operating System basics, Types of operating systems, Task, process and threads (Only POSIX Threads with an example program), Thread pre-emption, Multiprocessing and Multitasking, Task Communication (without any program), Task synchronization issues – Racing and Deadlock, Concept of Binary and counting semaphores (Mutex example without any program), How to choose an RTOS **Activity:** **Case Study: Automated Meter Reading System (AMR) and Digital Camera, Real time concepts**	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Describe the architectural features and instructions of ARM microcontroller
CO2	Develop Assembly Programs in ARM for Embedded applications.
CO3	Describe the fundamentals of Exception, Interrupt Handling and Memory Management Unit of ARM Controller
CO4	Interface external devices and I/O with ARM microcontroller.
CO5	Demonstrate the need of real time operating system for embedded system applications

Reference Books	
1.	Andrew N Sloss, Dominic Symes and Chris Wright, ARM system developer's guide, Elsevier, Morgan Kaufman publishers, 2008.
2.	Shibu K V, "Introduction to Embedded Systems", Tata McGraw Hill Education, Private Limited, 2nd Edition.
3.	Raghunandan.G.H, Microcontroller (ARM) and Embedded System, Cengage learning Publication, 2019
4.	The Insider's Guide to the ARM7 Based Microcontrollers, Hitex Ltd., 1st edition, 2005.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the self -study are 20 (2 presentations are be held for 10 marks each). The marks obtained in test, quiz and self -studies are added to get marks out of 100 and report CIE for 50 marks.

Laboratory- 50 Marks

The laboratory session is held every week as per the time table and the performance of the student is evaluated in every session. The average of the marks over number of weeks is considered for 30 marks. At the end of the semester a test is conducted for 10 marks. The students are encouraged to implement additional innovative experiments in the lab and are awarded 10 marks. Total marks for the laboratory is 50.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks are executed by means of an examination.

The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the complete syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

Laboratory- 50 Marks

Experiment Conduction with proper results is evaluated for 40 marks and Viva is for 10 marks. Total SEE for laboratory is 50 marks.

CO-PO/PSO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2	1	-	-	-	-	-	-	-	-	2	-
CO2	3	2	1	3	3	2	-	-	2	-	1	-	1	1
CO3	3	2	1	3	-	2	-	-	2	-	-	-	2	-
CO4	3	3	2	3	3	2	-	-	2	2	2	-	1	2
CO5	3	2	3	3	3	2	-	-	2	2	2	2	1	1

High-3, Medium-2, Low-1

Semester: IV		
COMPUTER ORGANIZATION AND ARCHITECTURE		
Course Code: MVJ21AI43		**CIE Marks:100**
Credits: L:T:P:S:3:1:0:0		**SEE Marks: 100**
Hours: 40L+26T		**SEE Duration: 3 Hrs**
Course Learning Objectives: The students will be able to		
1	Learn the basic structure and operations of a computer.	
2	Learn the arithmetic and logic unit.	
3	Learn the different ways of communication with I/O devices & memories, memory hierarchies, cache memories and virtual memories.	
4	Understand & implement arithmetic process.	
5	Understand the processor and pipelining concepts.	
6	Understand parallelism and multi-core processors.	

UNIT-I	
Basic Structure of Computers: Basic Operational Concepts, Bus Structures, Performance –Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement. **Machine Instructions and Programs:** Memory Location and Addresses, Memory Operations, Instructions and Instruction Sequencing, Addressing Modes, Assembly	**8 Hrs**

Language, Basic Input and Output Operations, Stacks and Queues, Subroutines, Additional Instructions, Encoding of Machine Instructions. **Arithmetic:** Numbers, Arithmetic Operations and Characters, Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Positive Numbers, Signed Operand Multiplication, Fast Multiplication, Integer Division. **Text book 1: Chapter 1 – 1.1 to 1.9,Chapter2 – 2.1 to 2.10** **Text book 1: Chapter6 – 6.1 to 6.7** **Laboratory Sessions/ Experimental learning:** Study of peripherals, components of a Computer System **Applications:** Basic Computer Devices **Video link :** https://nptel.ac.in/courses/106105163/	
UNIT-II	
Input/output Organization: Accessing I/O Devices, Interrupts – Interrupt Hardware, Direct Memory Access, Buses, Interface Circuits, Standard I/O Interfaces – PCI Bus, SCSI Bus, USB **Text book 1: Chapter4 – 4.1 to 4.7** **Laboratory Sessions/ Experimental learning:** Design of ALU **Applications:** input /output operations **Videolink:**https://www.youtube.com/watch?v=RkAE4zE4uSE&list=PL13FD5F00C21BBC0B&index=11	**8 Hrs**
UNIT-III	
Memory: Basic Concepts, Semiconductor RAM Memories, Read Only Memories, Speed, Size, and Cost, Cache Memories – Types of cache ,Cache miss management Mapping Functions, Replacement Algorithms, Performance Considerations,(ARM Cache and Pentium cache). **Text book 1: Chapter5 – 5.1 to 5.4, 5.5** **Laboratory Sessions/ Experimental learning:** Design of Memory **Applications:** Different Types of Memory **Video link :** https://nptel.ac.in/courses/106105163/	**8 Hrs**
UNIT-IV	
Processor : A Basic MIPS implementation – Building a Data path – Control Implementation Scheme –Pipelining – Pipelined data path and control – Handling Data Hazards & Control Hazards –Exceptions. **Text book 2: Chapter 4**. **Laboratory Sessions:** Instruction scheduling **Applications:** Types of processor	**8 Hrs**

Video link: https://nptel.ac.in/courses/106106166/	
UNIT-V	
Parallelism: Parallel processing challenges –Flynn‘s classification – SISD, MIMD, SIMD, SPMD, and Vector Architectures - Hardware multithreading – Multi-core processors and other Shared Memory Multiprocessors - Introduction to Graphics Processing Units, Clusters, Warehouse Scale Computers and other Message-Passing Multiprocessors. **Text book 2: Chapter 6**. Laboratory Sessions : Process Scheduling **Applications:** Grid and Cloud Computing Video link: **https://nptel.ac.in/courses/106102114/**	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Explain the basic organization of a computer system.
CO2	Demonstrate functioning of different sub systems, such as processor, Input/output, and memory.
CO3	Design and analyses simple arithmetic and logical units.
CO4	Illustrate hardwired control and micro programmed control, pipelining, embedded and other Computing systems.
CO5	Design and analyses of simple Parallelism and Multithread.

Reference Books	
1.	Carl Hamacher, Zvonko Vranesic, SafwatZaky, Computer Organization, 5th Edition, Tata McGraw Hill, 2002. (Listed topics only from Chapters 1, 2, 4, 5, and 6).
2.	David A. Patterson and John L. Hennessy, Computer Organization and Design: The Hardware/Software Interface, Fifth Edition, Morgan Kaufmann / Elsevier, 2014.(Listed topics only from Chapters 4and 6).
3.	John P. Hayes, Computer Architecture and Organization, Third Edition, Tata McGraw Hill, 2012.
4.	John L. Hennessey and David A. Patterson, Computer Architecture – A Quantitative Approach‖, Morgan Kaufmann / Elsevier Publishers, Fifth Edition, 2012.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO/PSO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	-	-	-	-	-	-	-	1	2	-
CO2	3	3	2	2	-	-	-	-	-	-	-	1	2	-
CO3	3	3	3	2	-	-	-	-	-	-	-	1	2	-
CO4	3	3	2	2	-	-	-	-	-	-	-	1	2	-
CO5	3	3	3	2	-	-	-	-	-	-	-	1	1	2

High-3, Medium-2, Low-1

Semester: IV		
PYTHON PROGRAMMING AND LAB		
Course Code: MVJ21AI44		**CIE Marks:100**
Credits: L:T:P:S:3:1:0:0		**SEE Marks: 100**
Hours: 40L+26T		**SEE Duration: 3 Hrs**
Course Learning Objectives: The students will be able to		
1	Familiarize the students with the fundamentals and programming basics of Python Language	

UNIT-I	
Prerequisites : Knowledge of C Programming is required **Introduction to Python:** Features of python, Applications of python, Syntax, Comments, Indentations, Number types, Variables and Data Types, Operators, conditional statement, Loops in Python. **Python List:** Create Python List, Access Python List, Slicing a Python List, slicing and	**8 Hrs**

dicing, Reassigning a Python List (Mutable), Reassigning the whole Python list, Deleting list and elements, Multidimensional Lists, List Operations, Built-in List Functions.	
UNIT-II	
Python Tuple: Create a Python Tuple, Tuples Packing, Tuples Unpacking, Creating a tuple with a single item, Access Python Tuple, Slicing a Tuple, Deleting a Python Tuple, Reassigning Tuples, Tuple Functions Tuple Operations. **Python Dictionary:** Create a Dictionary, Dictionaries with mixed keys, Access a Python Dictionary, Delete Python Dictionary, In-Built Functions on a Python Dictionary, In-Built Methods on a Python Dictionary, Dictionary Operations.	**8 Hrs**
UNIT-III	
Python Function: User-Defined Functions in Python, Python Built-in Functions, Python Lambda Expressions, Recursion Function, Range function. **Python Method:** Introduction to Method, __init__(), Self Parameter, Functions vs Method, Magic Methods	**8 Hrs**
UNIT-IV	
Python Class: Introduction to Python Class, Defining a Python Class, Accessing Python Class Members Python Object Attributes Belonging to Python Class, Delete Python Class, Attribute, Inheritance, Multiple inheritance.	**8 Hrs**
UNIT-V	
File Handling In Python: Read and Write File, Open File, Close File, File Methods, Data Base connections.	**8 Hrs**

LABORATORY EXPERIMENTS

1. Write a Python program to encrypt the text using Caesar Cipher technique. Display the encrypted text. Prompt the user for input and the shift pattern.
2. Devise a Python program to implement the Rock-Paper-Scissor game.
3. Write a Python program to perform Jump Search for a given key and report success or failure. Prompt the user to enter the key and a list of numbers.
4. The celebrity problem is the problem of finding the celebrity among n people. A celebrity is someone who does not know anyone (including themselves) but is known by everyone. Write a Python program to solve the celebrity problem.
5. Write a Python program to construct a linked list. Prompt the user for input. Remove any duplicate numbers from the linked list.
6. Perform the following file operations using Python

a) Traverse a path and display all the files and subdirectories in each level till the deepest

level for a given path. Also, display the total number of files and subdirectories.

b) Read a file content and copy only the contents at odd lines into a new file.

7.Create a menu drive Python program with a dictionary for words and their meanings. Write functions to add a new entry (word: meaning), search for a particular word and retrieve meaning, given meaning find words with the same meaning, remove an entry, display all words sorted alphabetically.

8. Using Regular Expressions, develop a Python program to

a) Identify a word with a sequence of one upper case letter followed by lower case letters.

b) Find all the patterns of "1(0+)1" in a given string.

c) Match a word containing 'z' followed by one or more o's.

Prompt the user for input.

9. Devise a Python program to implement the Hangman Game.

10. Write a Python program to print all the Disarium numbers between 1 and 100

Any 10 experiments to be conducted

Course Outcomes: After completing the course, the students will be able to	
CO1	Understand data types (like character strings, integers, and real numbers)and the Operations that can be Applied to each data type.
CO2	Write programs that get input, perform calculations, and provide output (using Conditional logic, loops, Functions).
CO3	Write well designed and well documented programs that are easily maintainable
CO4	Analyze String Formatting Options.
CO5	Enjoy the art and science of computer files using python.

Reference Books	
1.	Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser Data Structures and Algorithms in Python John Wiley & Sons, Incorporated.
2.	Frank Kane (2017) Hands-On Data Science and Python Machine Learning 1st Edition, Kindle Edition.
3.	Mark Smart,(2018), Introduction to Data Science with Python: Basics of Numpy and Pandas.

4.	VK Jain,Data Science & Analytics, Khanna Book Publishing ;edition (2018)

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO/PSO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	-	-	-	-	-	-	-	1	2	-
CO2	3	3	2	2	-	-	-	-	-	-	-	1	2	-
CO3	3	3	3	2	-	-	-	-	-	-	-	1	2	-
CO4	3	3	2	2	-	-	-	-	-	-	-	1	2	-
CO5	3	3	3	2	-	-	-	-	-	-	-	1	1	2

High-3, Medium-2, Low-1

Semester: IV		
DESIGN AND ANALYSIS OF ALGORITHMS AND LAB		
Course Code: MVJ21AI45		**CIE Marks:50+50**
Credits: L:T:P: 3:0:1		**SEE Marks: 50 +50**
Hours:40 L+ 26 P		**SEE Duration: 03+03 Hours**
Course Learning Objectives: The students will be able to		
1	Identify the importance of different asymptotic notation.	
2	Determine the complexity of recursive and non-recursive algorithms.	
3	Compare the efficiency of various design techniques like greedy method, backtracking etc.	
4	Apply appropriate method to solve a given problem.	

UNIT-I

Basic Concept of Algorithms: Introduction-What is an Algorithm, Algorithm Specification, Analysis Framework, Performance Analysis: Space complexity, Time complexity. Asymptotic Notations: Big-Oh notation (O), Omega notation (Ω), Theta notation (Θ), and Little-oh notation (o), Mathematical analysis of Non-Recursive and recursive Algorithms with Examples . Important Problem Types. Fundamental Data Structures. **Applications:** developing computational tools and bioinformatics software, Mathematics. **Video link / Additional online information (related to module if any):** • http://www.nptelvideos.com/video.php?id=1442 • https://nptel.ac.in/courses/106105085/	**10 Hrs**
UNIT-II	
Simple Design Techniques – Brute force : Selection sort, Bubble sort, Sequential Search and Brute-Force String Matching , Exhaustive search –Traveling Salesman problem, Knapsack problem , Assignment Problem. **Divide and Conquer:** General method, Binary search, Recurrence equation for divide and conquer, Finding the maximum and minimum, Merge sort, Quick sort, Strassen's matrix multiplication , Advantages and Disadvantages of divide and conquer. **Applications:** power distribution (electrical field), Online shopping and delivery (real time) **Video link / Additional online information (related to module if any):** • https://nptel.ac.in/courses/106102064/ • https://www.youtube.com/watch?v=MFfD57DTDQY	**10 Hrs**
UNIT-III	
Decrease and Conquer approach: Topological Sort, Decrease-by-a-Constant-Factor Algorithms: Josephus Problem. **Greedy Method**: General method, Coin Change Problem, Knapsack Problem, Job sequencing with deadlines. Minimum cost spanning trees: Prim's Algorithm, Kruskal's Algorithm. Single source shortest paths: Dijkstra's Algorithm. Huffman Trees and Codes. **Laboratory Sessions/ Experimental learning:** Solving real time problems using Greedy Technique. **Applications:** Optimization Problems. **Video link :**https://nptel.ac.in/courses/106/106/106106131/	**10 Hrs**
UNIT-IV	

Dynamic Programming: General method with Examples, Multistage Graphs. Transitive Closure: Warshall's Algorithm, All Pairs Shortest Paths: Floyd's Algorithm, Optimal Binary Search Trees, Knapsack problem, Bellman-Ford Algorithm , Travelling Sales Person problem , Reliability design. **Laboratory Sessions/ Experimental learning:** Solving real time problems using Dynamic Programming. **Applications:** Computer Networks. **Video link:**https://nptel.ac.in/courses/106/106/106106131/	**10 Hrs**
UNIT-V	
Backtracking: General method, N-Queens problem, Sum of subsets problem, Graph coloring, Hamiltonian cycles Programme and Bound: Assignment Problem, Travelling Sales Person problem, 0/1 Knapsack problem. **LC Programme and Bound solution :** FIFO Programme and Bound solution. NP-Complete and NP-Hard problems: Basic concepts, non-deterministic algorithms, P, NP, NP-Complete, and NP-Hard classes. **Laboratory Sessions/ Experimental learning:** Solving real time problems using Backtracking Technique. **Applications:** To solve puzzles such as crosswords, Sudoku etc. Video link: **https://nptel.ac.in/courses/106/106/106106131/**	**10 Hrs**

LABORATORY EXPERIMENTS

1. Create a Java class called Student with the following details as variables within it. (i) USN (ii) Name (iii) Branch (iv) Phone Write a Java program to create n Student objects and print the USN, Name, Branch, and Phone of these objects with suitable headings.
2. Write a Java program to read two integers a and b. Compute a/b and print, when b is not zero. Raise an exception when b is equal to zero.
3. Write a Java program that implements a multi-thread application that has three threads. First thread generates a random integer for every 1 second; second thread computes the square of the number and prints; third thread will print the value of cube of the number.
4. 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 non graph sheet. The elements can be read from a file or can be generated

using the random number generator. Demonstrate using Java how the divide-and-conquer method works along with its time complexity analysis: worst case, average case and best case.

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

Course Outcomes: After completing the course, the students will be able to	
CO1	Describe the need of algorithm and the notations used in design analysis.
CO2	Compare the efficiency of brute force, divide and conquer techniques for problem solving.
CO3	Ability to apply greedy algorithms, hashing and string matching algorithms.
CO4	Ability to design efficient algorithms using various design techniques.
CO5	Ability to apply the knowledge of complexity classes P, NP, and NP Complete and prove certain problems are NP-Complete.

Reference Books	
1.	Introduction to the Design and Analysis of Algorithms, AnanyLevitin:, 2rd Edition, 2009. Pearson.
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).
4.	http://jeffe.cs.illinois.edu/teaching/algorithms/

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

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Laboratory- 50 Marks

The laboratory session is held every week as per the time table and the performance of the student is evaluated in every session. The average of the marks over number of weeks is considered for 30 marks. At the end of the semester a test is conducted for 10 marks. The students are encouraged to implement additional innovative experiments in the lab and are awarded 10 marks. Total marks for the laboratory is 50.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks are executed by means of an examination.

The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the complete syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

Laboratory- 50 Marks

Experiment Conduction with proper results is evaluated for 40 marks and Viva is for 10 marks. Total SEE for laboratory is 50 marks.

High-3, Medium-2, Low-1

CO-PO/PSO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	--	--	--	1	--	--	--	--	--	--	2	2	-
CO2	2	3	--	--	2	--	--	--	--	--	--	--	2	-
CO3	3	3	2	2	--	--	--	--	--	--	--	2	2	2
CO4	3	3	3	--	--	--	--	--	1	--	--	2	3	2
CO5	2	2	2	1	3	--	--	--	--	--	--	3	3	3

Semester: IV		
C# AND .NET FRAMEWORK (Theory)		
Course Code: MVJ21AIA47		**CIE Marks:100**
Credits: L:T:P:S: 2:0:0:0		**SEE Marks: 100**
Hours: 40L		**SEE Duration: 3 Hrs**
Course Learning Objectives: The students will be able to		
1	**Understand the basics of C# and .NET**	

2	**Learn the variables and constants of C#**
3	**Know the object-oriented aspects and applications.**
4	**Learn the basic structure of .NET framework.**
5	**Learn to create a simple project of .NET Core**

UNIT-I	
Introduction to C# Part-I: Understanding C#, .NET, overview of C#, Variables, Data Types, Operators, Expressions, Branching, Looping, Methods, implicit and explicit casting.	**6 Hrs**
UNIT-II	
Part-II: Constants, Arrays, Array Class, Array List, String, String Builder, Structure, Enumerations, boxing and unboxing.	**6 Hrs**
UNIT-III	
Object Oriented Concepts-I:Class, Objects, Constructors and its types, inheritance, properties, indexers, index overloading, polymorphism	**6 Hrs**
UNIT-IV	
Object Oriented Concepts-II: Sealed class and methods, interface, abstract class, abstract and interface, operator overloading, delegates, events, errors and exception, Threading.	**6 Hrs**
UNIT-V	
Introduction to .NET FRAMEWORK: Assemblies, Versoning, Attributes, reflection, viewing meta data, remoting, security in .NET, Environment Setup of .NET Core and create a small project.	**6 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Able to explain how C# fits into the .NET platform
CO2	Describe the utilization of variables and constants of C#
CO3	Use the implementation of object-oriented aspects in applications.
CO4	Analyze and Set up Environment of .NET Core.
CO5	Evaluate and create a simple project application

Reference Books	
1.	Herbert Schildt, "The Complete Reference: C# 4.0", Tata McGraw Hill, 2012
2.	Christian Nagel et al. "Professional C# 2012 with .NET 4.5", Wiley India, 2012.
3.	Andrew Troelsen , "Pro C# 2010 and the .NET 4 Platform, Fifth edition, A Press, 2010.
4.	Ian Griffiths, Matthew Adams, Jesse Liberty, "Programming C# 4.0", Sixth Edition, O"Reilly, 2010.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	2	1	-	-	-	-	-	-	-	-
CO2	3	2	1	3	3	2	-	-	2	-	1	-
CO3	3	2	1	3	-	2	-	-	2	-	-	-
CO4	3	3	2	3	3	2	-	-	2	2	2	-
CO5	3	2	3	3	3	2	-	-	2	2	2	2

High-3, Medium-2, Low-1

Semester: IV

Additional Mathematics-II (Common to all branches)		
Course Code:	**MVJ21MATDIP2**	**CIE Marks:50**
Credits:	**L:T:P:S: 4:0:0:0**	**SEE Marks: 50**
Hours:	**40L**	**SEE Duration: 3 Hrs**

Course Learning Objectives: The students will be able to	
1	To familiarize the important concepts of linear algebra.
2	Aims to provide essential concepts differential calculus, beta and gamma functions.
3	Introductory concepts of three-dimensional geometry along with methods to solve them.
4	Linear differential equations
5	Formation of partial differential equations.

UNIT-I	
Linear Algebra: Introduction - Rank of matrix by elementary row operations - Echelon form. Consistency of system of linear equations - Gauss elimination method. Eigen values and Eigen vectors of a square matrix. Diagonalization of a square matrix of order two. **Self study**: Application of Cayley-Hamilton theorem (without proof) to compute the inverse of a matrix-Examples. **Video Link**: 1. http://nptel.ac.in/courses.php?disciplineID=111	**8 Hrs**
UNIT-II	
Differential calculus: Indeterminate forms: L-Hospital rule (without proof), Total derivatives, and Composite functions. Maxima and minima for a function of two variables. **Beta and Gamma functions:** Beta and Gamma functions, Relation between Beta and Gamma function-simple problems. **Self study**: Curve tracing. **Video Link**: 1. http://nptel.ac.in/courses.php?disciplineID=111	**8Hrs**
UNIT-III	
Analytical solid geometry: Introduction –Directional cosine and Directional ratio of a line, Equation of line in space- different forms, Angle between two line, shortest distance between two line, plane and equation of plane in different forms and problems.	**8Hrs**

Self study: Volume tetrahedron. **Video Link**: 1. http://nptel.ac.in/courses.php?disciplineID=111	
UNIT-IV	
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 , and Euler –Cauchy equation. **Self study**: Method of variation of parameters **Video Link**: 1. http://nptel.ac.in/courses.php?disciplineID=111	**8 Hrs**
UNIT-V	
Partial differential equation: Introduction- Classification of partial differential equations, formation of partial differential equations. Method of elimination of arbitrary constants and functions. Solutions of non-homogeneous partial differential equations by direct integration. Solution of Lagrange's linear PDE. **Self study:** One dimensional heat and wave equations and solutions by the method of separable of variable **Video Link**: 1. http://nptel.ac.in/courses.php?disciplineID=111	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Make use of matrix theory for solving system of linear equations and compute eigen values and eigenvectors 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.
Reference Books	

1.	B.S. Grewal,Higher Engineering Mathematics**,** Khanna Publishers,43rd Edition**,** 2013**,** .
2.	G. B. Gururajachar, Calculus and Linear Algebra, Academic Excellent Series Publication, 2018-19
3.	Chandrashekar K. S, Engineering Mathematics-I, Sudha Publications, 2010.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO Mapping

CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	0	2	0	0	0	0	0	0	1	1
CO2	3	3	0	2	0	0	0	0	0	0	1	1
CO3	3	3	0	3	0	0	0	0	0	0	0	1
CO4	2	2	0	3	0	0	0	0	0	0	1	1
CO5	2	2	0	2	0	0	0	0	0	0	0	1

High-3, Medium-2, Low-1

V SEMESTER

Semester: V		
SOFTWARE ENGINEERING &PROJECT MANAGEMENT		
Course Code: MVJ21SPM51		**CIE Marks:100**
Credits: L:T:P:S:3:1:0:0		**SEE Marks: 100**
Hours: 40L+26T		**SEE Duration: 3 Hrs**

Course Learning Objectives: The students will be able to	
1	Describe the importance of management and functions of a manager.
2	Explain the process of planning and organizing.
3	Understand principles, concept, methods and techniques of the software engineering approach to producing quality software (particularly for large, complex systems).
4	Impart skills in the design and implementation of efficient software across disciplines.
5	Gather knowledge on various maintenance methods.

UNIT-I	
Management: importance of management, definition, management functions, roles of a manager, levels of management, managerial skills, management and administration, management –a science or art, management – a profession, professional management v/s family management. Development of management thought; Early classical approaches, Neo classical approaches, modern approaches. **Application:** Enterprises **Video Link:** https://www.youtube.com/watch?v=mub7Z8Fl3ZU	**8 Hrs**
UNIT-II	
Planning: Nature, Importance of planning, forms, types of plans, steps in planning, limitations of planning, making planning effective, planning skills, strategic planning in Indian industry. **Organizing:** Organization Meaning, process of organizing, span of management	**8 Hrs**

principles of organizing, Departmentation, organization structure, committees, teams. **Application:** Industry **Video Link:** https://www.youtube.com/watch?v=pCUs3UKwYpc	
UNIT-III	
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; User requirements, System requirements, requirement validation and software requirement specification document. Prototyping - Basic concepts of formal specification techniques. **Laboratory Sessions/ Experimental learning:** To write the SRS for the given real time application using report writing tools. **Applications:** In Software development process. **Video link / Additional online information:** https://nptel.ac.in/courses/106105182/	**8 Hrs**
UNIT-IV	
SOFTWARE DESIGN: Fundamental design concepts and principles; Design characteristics; System Models - Context, Behavioral, Data and, Object models, Architectural design- System structuring, Control models; Structured design; Object-oriented analysis and design; User interface design; Design for reuse; Design patterns; **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. **Video link / Additional online information:** https://www.coursera.org/lecture/client-needs-and-software-requirements/3-2-4-use-cases-bZNCr	**8 Hrs**
UNIT-V	
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. **Software evolution:** Software maintenance; Characteristics of maintainable software; Reengineering; Legacy systems; Software reuse. **Laboratory Sessions/ Experimental learning:** Using Selenium IDE write a test suite containing minimum 4 test cases.	**8 Hrs**

Applications: In Software development process. **Video link / Additional online information:** https://www.youtube.com/watch?v=T3q6QcCQZQg	

Course Outcomes: After completing the course, the students will be able to	
CO1	Describe the importance of management and functions of a manager.
CO2	Explain the process of planning and principles of organizing
CO3	Comprehend software development life cycle and Prepare SRS document for a project
CO4	Apply software design and development techniques
CO5	Identify verification and validation methods in a software engineering project.

Reference Books	
1.	Management and Entrepreneurship , N V R Naidu ,T Krishna Rao 4th reprint.
2.	Law relating to Intellectual Property rights , B. L. Wadhera, 5th edition,Universal Law Publishing, 2011
3.	Ian Sommerville, "Software Engineering", 9th Edition, Addison- Wesley, 2011
4.	Principles of Management, P C Tripathi, P N Reddy, 5th edition, TataMcGraw Hill, 2012
5.	Rajib Mall, “Fundamentals of Software Engineering”, PHI Publication, 3rd edition, 2009

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom’s taxonomy level.

CO-PO/PSO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	2	2	-	-	-	2	-	-	-
CO2	2	-	-	-	-	2	2	-	-	-	2	-	-	-
CO3	2	-	-	-	-	2	2	-	-	-	2	-	-	2
CO4	2	-	-	-	-	2	-	-	2	-	2	-	-	-
CO5	2	-	-	-	-	2	-	2	-	-	2	-	1	-

High-3, Medium-2, Low-1

Semester: V		
DATA COMMUNICATION & COMPUTER NETWORKS		
Course Code:MVJ21AI52		**CIE Marks:100**
Credits: L:T:P:S:3:1:0:0		**SEE Marks: 100**
Hours: 40L+T		**SEE Duration: 3 Hrs**
Course Learning Objectives: The students will be able to		
1	Introduce the fundamental concepts and types of computer networks.	
2	Demonstrate the TCP/IP and OSI models with merits and demerits.	
3	Understand the difference between all communication protocols.	

UNIT-I	
Data Communications: Components – Direction of Data flow – Networks – Components and Categories – Types of Connections – Topologies –Protocols and Standards – ISO / OSI model, Example Networks such as ATM, Frame Relay, ISDN Physical layer: Transmission modes, Multiplexing, Transmission Media, Switching, Circuit Switched Networks, Datagram Networks, Virtual Circuit Networks. **Video link / Additional online information (related to module if any):** http://www.nptelvideos.in/2012/11/computer-networks.html	**10 Hrs**
UNIT-II	
Data link layer: Introduction, Framing, and Error – Detection and Correction – Parity – LRC – CRC Hamming code, Flow and Error Control, Noiseless Channels, Noisy Channels, HDLC, Point to Point Protocols. 111 Medium Access sub layer: ALOHA, CSMA/CD, LAN – Ethernet IEEE 802.3, IEEE 802.5 – IEEE 802.11, Random access, Controlled access, Channelization. **Video link / Additional online information (related to module if any):** http://www.nptelvideos.in/2012/11/computer-networks.html	**10 Hrs**

UNIT-III	
Network layer: Logical Addressing, Internetworking, Tunneling, Address mapping, ICMP, IGMP, Forwarding, Uni-Cast Routing Protocols, Multicast Routing Protocols. **Video link / Additional online information (related to module if any):** http://www.nptelvideos.in/2012/11/computer-networks.html	**10 Hrs**
UNIT-IV	
Transport Layer: Process to Process Delivery, UDP and TCP protocols, Data Traffic, Congestion, Congestion Control, QoS, Integrated Services, Differentiated Services, QoS in Switched Networks. **Video link:** http://www.nptelvideos.in/2012/11/computer-networks.html	**10 Hrs**
UNIT-V	
Application Layer: Domain name space, DNS in internet, electronic mail, SMTP, FTP, WWW, HTTP, SNMP. Video link: **http://www.nptelvideos.in/2012/11/computer-networks.html**	**10 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Interpret the basics of Computer Networks and Various Protocols.
CO2	Generalize functionalities and services of each layer of OSI model.
CO3	Explains the concept of data framing and error control mechanisms
CO4	Compares Different routing protocols
CO5	Identify the concepts of network security, Mobile and adhoc networks

Reference Books	
1.	Data Communications and Networking, Behrouz A. Forouzan , Fourth Edition TMH,2006.
2.	Computer Networks, Andrew S Tanenbaum, 4th Edition. Pearson Education, PHI.
3.	An Engineering Approach to Computer Networks, S. Keshav, 2 nd Edition, Pearson Education.
4.	Understanding communications and Networks, 3 rd Edition, W.A. Shay, Cengage Learning.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2

assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO/PSO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	1	-	-	-	-	-	-	2	-	-
CO2	3	3	3	-	-	-	-	-	1	-	1	2	1	-
CO3	2	2	2	1	3	-	-	-	-	-	1	3	-	1
CO4	3	2	3	-	-	-	-	-	-	2	3	2	-	-
CO5	3	2	3	-	-	-	-	-	-	2	3	2	2	-

High-3, Medium-2, Low-1

Semester: V		
DATABASE MANAGEMENT SYSTEMS AND LAB		
Course Code: MVJ21AI53		**CIE Marks:50+50**
Credits: L:T:P: 3:0:1		**SEE Marks: 50 +50**
Hours:40 L+ 26 P		**SEE Duration: 03+03 Hours**
Course Learning Objectives: The students will be able to		
1	Provide a strong foundation in database concepts, technology, and practice.	
2	Practice SQL programming through a variety of database problems.	
3	Demonstrate the use of concurrency and transactions in database.	
4	Design and build database applications for real world problems.	
5	Provide a strong foundation in database concepts, technology, and practice.	

UNIT-I	
Introduction to Databases: Introduction; An example; characteristics of the database approach; actors on the scene; workers behind the scene; advantages of using the DBMS approach; A brief history of database Applications; when Not to use a DBMS. **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. **Modelling using Entities and Relationships:** Entity types, Entity sets, attributes, roles, and structural constraints, Weak entity types, ER diagrams, examples. **Laboratory Sessions/ Experimental learning:** Draw ER diagram for database applications(logical database design). **Applications:** Library Management system, Banking, Universities and colleges, credit card transactions, social media sites, Telecommunications, Finance, Military, online shopping, Human Resource Management, Manufacturing, Airline Reservation systems.	**10 Hrs**

Video link / Additional online information (related to module if any): • https://nptel.ac.in/courses/106106093/ • https://nptel.ac.in/courses/106105175/ • https://www.youtube.com/watch?v=WSNqcYqByFk	
UNIT-II	
Relational Model: Relational Model Concepts, Relational Model Constraints and relational database schemas, Update operations, dealing with constraint violations. **Relational Algebra:** Unary and Binary relational operations, additional relational operations (aggregate, grouping, etc.) Examples of Queries in relational algebra. **Mapping Conceptual Design into a Logical Design:** Relational Database Design using ER-to-Relational mapping. **SQL:** SQL data definition and data types, specifying constraints in SQL, retrieval queries in SQL, INSERT, DELETE, and UPDATE statements in SQL. **Laboratory Sessions/ Experimental learning:** programs to perform set operations, arithmetic operations, joins, selection, projection, create tables for real world db applications and insert values to it. **Applications:** RDBMS, enterprise level software solution(except light weight web applications) **Video link / Additional online information (related to module if any):** • https://nptel.ac.in/courses/106106093/ • https://nptel.ac.in/courses/106105175/ • https://www.youtube.com/watch?v=gGGHjYbQMvw • https://www.youtube.com/watch?v=nc1yivH1Yac • https://www.youtube.com/watch?v=64szTfLNu3o	**10 Hrs**
UNIT-III	
SQL: Advances Queries: More complex SQL retrieval queries, Specifying constraints as assertions and action triggers, Views in SQL, Schema change statements in SQL. **Database Application Development:** Accessing databases from applications, An introduction to JDBC, JDBC classes and interfaces, SQLJ, Stored procedures, Embedded SQL**.** **Laboratory Sessions/ Experimental learning:** Mini-projects to develop connections between front end and backend(database) using JDBC. Write SQL queries for the given schema.	**10 Hrs**

Applications: Java Programming, In Server to reduce network traffic and to provide security(Stored procedure) **Video link / Additional online information (related to module if any):** • https://www.youtube.com/watch?v=64szTfLNu3o • https://www.digimat.in/nptel/courses/video/106105175/L11.html • https://www.youtube.com/watch?v=sjzlr0EsZL4 • https://nptel.ac.in/courses/106106093/ • https://nptel.ac.in/courses/106105175/	
UNIT-IV	
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. Dependency theory - functional dependencies, Armstrong's axioms for FD's, closure of a set of FD's, minimal covers. **Laboratory Sessions/ Experimental learning:** Draw schema diagram which satisfy all forms of normalization for all db real world application **Applications:** to optimize database design **Video link / Additional online information (related to module if any):** • https://nptel.ac.in/courses/106106093/ • https://nptel.ac.in/courses/106105175/ • https://www.youtube.com/watch?v=YD8dhOmuVnY	**10 Hrs**
UNIT-V	
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. **Concurrency Control in Databases:** Two-phase locking techniques for Concurrency control, Concurrency control based on Timestamp ordering. **Introduction to Database Recovery Protocols:** Recovery Concepts, NO-UNDO/REDO recovery based on Deferred update, Recovery techniques based on immediate update, Shadow paging,	**10 Hrs**

File Organizations and Indexes: Introduction, Hashing techniques, Indexing, Structures for Files. **Laboratory Sessions/ Experimental learning:** Develop banking and other financial applications. **Applications:** Systems that manage sales order entry, airline reservations, payroll, employee records, manufacturing, and shipping. Operating system(deadlock) **Video link / Additional online information (related to module if any):** • https://nptel.ac.in/courses/106106093/ • https://nptel.ac.in/courses/106105175/ • https://www.youtube.com/watch?v=5ammL5KU4mo	

LABORATORY EXPERIMENTS

1. Creation of a database and writing SQL queries to retrieve information from the database.

2. Performing Insertion, Deletion, Modifying, Altering, Updating and Viewing records based on conditions.

3. Creation of Views, Synonyms, Sequence, Indexes, Save point.

4. Creating an Employee database to set various constraints.

5. Creating relationship between the databases.

6. Study of PL/SQL block.

7. Write a PL/SQL block to satisfy some conditions by accepting input from the user.

8. Write a PL/SQL block that handles all types of exceptions.

9. Creation of Procedures.

10. Creation of database triggers and functions

11. Mini project (Application Development using Oracle/ Mysql)

a) Inventory Control System.

b) Material Requirement Processing.

c) Hospital Management System.

d) Railway Reservation System.

e) Personal Information System.

f) Web Based User Identification System.

g) Timetable Management System.

h) Hotel Management System

Course Outcomes: After completing the course, the students will be able to	
CO1	Identify, analyse and define database objects, enforce integrity constraints on a database using RDBMS.
CO2	Use Structured Query Language (SQL) for database manipulation.
CO3	Design and build simple database systems.
CO4	Apply the concepts of Normalization and design database which possess no anomalies.
CO5	Develop application to interact with databases.

Reference Books

1. Fundamentals of Database Systems, RamezElmasri and Shamkant B. Navathe, 7th Edition, 2017, Pearson
2. Database management systems, Ramakrishnan, and Gehrke, 3rd Edition, 2014, McGraw Hill
3. SilberschatzKorthand Sudharshan, Database System Concepts, 6th Edition, McGrawHill, 2013.
4. Database Principles Fundamentals of Design, Implementation and Management, Cengage Learning 2012.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the self -study are 20 (2 presentations are be held for 10 marks each). The marks obtained in test, quiz and self -studies are added to get marks out of 100 and report CIE for 50 marks.

Laboratory- 50 Marks

The laboratory session is held every week as per the time table and the performance of the student is evaluated in every session. The average of the marks over number of weeks is considered for 30 marks. At the end of the semester a test is conducted for 10 marks. The students are encouraged to implement additional innovative experiments in the lab and are awarded 10 marks. Total marks for the laboratory is 50.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks are executed by means of an examination.

The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the complete syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

Laboratory- 50 Marks

Experiment Conduction with proper results is evaluated for 40 marks and Viva is for 10 marks. Total SEE for laboratory is 50 marks.

CO-PO/PSO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	3	3	2	3	-	-	-	1	-	-	2	2	-
CO2	3	3	3	2	2	-	-	-	1	-	-	2	1	-
CO3	3	3	3	2	2	-	-	-	1	-	-	2	2	2

CO4	2	3	3	2	2	-	-	-	1	-	-	2	2	3
CO5	2	3	3	3	3	-	-	-	2	-	-	2	-	1

High-3, Medium-2, Low-1

Semester: V		
ARTIFICIAL INTELLIGENCE AND LAB		
Course Code: MVJ21AI54		**CIE Marks:50+50**
Credits: L:T:P: 3:0:1		**SEE Marks: 50 +50**
Hours:40 L+ 26 P		**SEE Duration: 03+03 Hours**
Course Learning Objectives: The students will be able to		
1	Understand fundamental concepts in Artificial Intelligence.	
2	Understand the problem solving techniques and knowledge representation.	
3	Design intelligent components or programs to meet desired needs.	
4	Implement, and evaluate a computer-based intelligent systems.	
5	Understand fundamental concepts in Artificial Intelligence.	

UNIT-I	
Introduction: AI problems, foundation of AI and history of AI, Intelligent agents: Agents and Environments, The concept of rationality, The nature of environments, Structure of agents, Problem solving agents, Problem formulation. **Video link / Additional online information (related to module if any):** http://nptel.ac.in/courses/106106126/	**8 Hrs**
UNIT-II	
Knowledge Representation & Reasons: Knowledge – Based Agents, The Wumpus world. **Propositional Logic:** Reasoning patterns in propositional logic - Resolution, Forward & Backward Chaining. **Inference in First order logic:** Propositional vs. first order inference, Unification & lifting, Forward chaining, Backward chaining, Resolution. **Video link / Additional online information (related to module if any):** http://nptel.ac.in/video.php?subjectId=106105079	**8 Hrs**
UNIT-III	
Searching: Searching for solutions, uniformed search strategies – Breadth first search, depth first search, Depth limited search, Iterative deepening depth first search bi-direction search, Comparing uninformed search strategies. Search with partial information (Heuristic search), Greedy best first search, A* search, Memory bounded heuristic search, Heuristic functions. **Local search Algorithms:** Hill climbing, Simulated annealing search, Local beam search, Genetic algorithms. **Video link / Additional online information (related to module if any):**https://www.youtube.com/watch?v=6hmIKIWBVSI	**8 Hrs**
UNIT-IV	
Constrain satisfaction problems: Backtracking search for CSPs local search for constraint satisfaction problems. **Game Playing:** Games, Minimax algorithm, Optimal decisions in multiplayer games, Alpha-Beta pruning, Evaluation functions, Cutting of search. **Video link / Additional online information (related to module if any):**https://nptel.ac.in/courses/106/106/106106158/	**8 Hrs**
UNIT-V	
Planning: Classical planning problem, Language of planning problems, Expressiveness and extension, planning with state – space search, Forward state spare search, Backward state space search, Heuristics for state space search, Partial order planning Graphs,	**8 Hrs**

Planning graphs **Learning:** what is learning, Forms of learning, Inductive learning, Learning Decision Trees. **Video link / Additional online information (related to module if any):** https://www.youtube.com/watch?v=3C6ZLS-gfXU	

LABORATORY EXPERIMENTS

1. Programming in C or Matlab to implement fuzzy logic application for autonomous robot system.
2. Programming in C/Matlab to implement simulated annealing/genetic algorithm for solving inverse kinematic problems
3. Programming in C/Matlab to solve traveling salesman problem using ant colony optimization algorithm
4. Write program using Visual Prolog to create an expert system.
5. Write program for obstacle avoidance in mobile robots using any one algorithm
6. Implement A* algorithm to Solve 8-puzzle problem (Assume any initial configuration and define goal configuration clearly)
7. Define the operators for controlling domestic robot; use these operators to plan an activity to be executed by the robot. For example, transferring two/three objects one over the other from one place to another. Use Means-Ends analysis with all the steps revealed
8. Solving real time planning and scheduling problems using software like Witness/Pro-model

Course Outcomes: After completing the course, the students will be able to	
CO1	Recognize the various types and working units of an expert systems.
CO2	Interpret the logic behind the building of knowledge base and knowledge representation.
CO3	Deploy Searching Techniques to design intelligent agents
CO4	Choose various Constraint Satisfaction Problem, Game Playing techniques to use in various intelligent system designs.
CO5	Apply suitable learning methodology while designing systems based on their applications.

Reference Books	
1.	Stuart Russel, Peter Norvig, (2009), Artificial Intelligence – A Modern Approach,3rd Edition, Pearson Education.
2.	E.Rich and K.Knight, (2008), Artificial Intelligence , 3rd Edition, Tata McGraw Hill.

3.	Patterson, (2009), Artificial Intelligence and Expert Systems, 2nd Edition, PHI.
4.	Ivan Bratka, (2000), PROLOG Programming for Artificial Intelligence. 3rdEdition – Pearson Education.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the self -study are 20 (2 presentations are be held for 10 marks each). The marks obtained in test, quiz and self -studies are added to get marks out of 100 and report CIE for 50 marks.

Laboratory- 50 Marks

The laboratory session is held every week as per the time table and the performance of the student is evaluated in every session. The average of the marks over number of weeks is considered for 30 marks. At the end of the semester a test is conducted for 10 marks. The students are encouraged to implement additional innovative experiments in the lab and are awarded 10 marks. Total marks for the laboratory is 50.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks are executed by means of an examination.

The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the complete syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

Laboratory- 50 Marks

Experiment Conduction with proper results is evaluated for 40 marks and Viva is for 10 marks. Total SEE for laboratory is 50 marks.

CO-PO/PSO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	-	1	1	2	-	-	-	-	-	1	-
CO2	3	3	3	3	2	-	-	-	-	-	-	-	-	-
CO3	1	-	-	1	1	-	2	3	3	3	3	-	2	-
CO4	3	3	2	2	2	-	-	-	-	-	-	3	-	-
CO5	3	3	3	3	3	2	-	-	3	3	3	3	2	1

High-3, Medium-2, Low-1

Semester: V **Professional Elective I**		
Artificial Neural Network		
Course Code:MVJ21AI551		**CIE Marks:100**
Credits: L:T:P:S:3:1:0:0		**SEE Marks: 100**
Hours: 40L		**SEE Duration: 3 Hrs**
Course Learning Objectives: The students will be able to		
1	Understand the role of neural networks in engineering, artificial intelligence, and cognitive modelling.	
2	Understand the concepts and techniques of neural networks through the study of important neural network models.	
3	Evaluate whether neural networks are appropriate to a particular application.	

4	Apply neural networks to particular application.
5	Analyze the steps needed to improve performance of the selected neural network.

UNIT-I	
Introduction: Biological Neuron- Artificial Neural Model- Types of activation functions- **Architecture:** Feedforward and Feedback, Convex Sets, Convex Hull and Linear Separability, Non-Linear Separable Problem. XOR Problem, Multilayer Networks. **Learning:** Learning Algorithms, Error correction and Gradient Descent Rules, Learning objective of TLNs, Perceptron Learning Algorithm, Perceptron Convergence Theorem.	**8 Hrs**
UNIT-II	
Supervised Learning: Perceptron learning and Non Separable sets, a.-Least Mean Square Learning, MSE Error surface, Steepest Descent Search, JL-LMS approximate to gradient descent, Application of LMS to Noise Cancelling, Multi-layered Network Architecture, Back propagation Learning Algorithm, Practical consideration of BP algorithm.	**8 Hrs**
UNIT-III	
Support Vector Machines and Radial Basis Function: Learning from Examples, Statistical Learning Theory, Support Vector Machines, SVM application to Image Classification, Radial Basis Function Regularization theory, Generalized RBF Networks, Learning in RBFNs, RBF application to face recognition.	**8 Hrs**
UNIT-IV	
Attractor Neural Networks: Associative Learning Attractor Associative Memory, Linear Associative memory, Hopfield Network, application of Hopfield Network, Brain State in a Box neural Network, Simulated Annealing, Boltzmann Machine, Bidirectional Associative Memory.	**8 Hrs**
UNIT-V	
Self-organization Feature Map: Maximal Eigenvector Filtering, Extracting Principal Components, Generalized Learning Laws, Vector Quantization, Self organization Feature Maps, Application of SOM,	**8 Hrs**

Growing Neural Gas.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Understand the role of neural networks in engineering, artificial intelligence, and cognitive modelling.
CO2	Understand the concepts and techniques of neural networks through the study of important neural network models.
CO3	Evaluate whether neural networks are appropriate to a particular application.
CO4	Apply neural networks to particular application.
CO5	Analyze the steps needed to improve performance of the selected neural network.

Reference Books	
1.	Neural Networks A Classroom Approach- Satish Kumar, McGraw Hill Education (India) Pvt. Ltd, Second Edition.
2.	Introduction to Artificial Neural Systems
3.	Artificial Neural Networks

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO/PSO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	-	3	-	-	-	-	-	-	1	-	2
CO2	3	3	1	-	-	-	-	-	-	-	-	1	1	3
CO3	3	3	1	-	-	-	-	-	-	-	-	1	1	2
CO4	3	3	1	-	-	-	-	-	-	-	-	1	-	2
CO5	3	3	1	-	-	-	-	-	-	-	-	2	1	1

High-3, Medium-2, Low-1

Semester: V Professional Elective I		
COMPILER DESIGN		
Course Code:MVJ21AI552		**CIE Marks:100**
Credits: L:T:P:S:3:1:0:0		**SEE Marks: 100**
Hours: 40L+26T		**SEE Duration: 3 Hrs**
Course Learning Objectives: The students will be able to		
1	Learn the various parsing techniques and different levels of translation.	
2	Learn how to obtain specific object code from source language.	
3	Learn how to optimize the code and schedule for optimal performance.	

UNIT-I

FRONT END OF COMPILERS: The Structure of Compiler – Lexical Analysis: Role of Lexical Analyzer, Specification and Recognition of Tokens, Syntax Analysis: Top Down Parsing, Bottom up Parsing, LR Parsers: SLR, CLR, and LALR. **Video Links :**https://www.youtube.com/watch?v=yxnbvS2t_QA	**8 Hrs**
UNIT-II	
INTERMEDIATE CODE GENERATION: Syntax Directed Definitions, Evaluation Orders for Syntax Directed Definitions, Syntax Directed Translation Schemes, Intermediate Languages: Syntax Tree, Three Address Code, Postfix Code, Declarations, Translation of Expressions, Type Checking, Back Patching. **Video Links:** https://www.youtube.com/watch?v=EpAzj7zXrbk	**8 Hrs**
UNIT-III	
RUNTIME AND OBJECT CODE GENERATION: Storage Organization, Stack Allocation Space, Access to Non-local Data on the Stack, Heap Management - Issues in Code Generation - Design of Code Generator - Register Allocation and Assignment – Instruction Selection by Tree Rewriting – Optimal Code Generation for Expressions – Dynamic Programming Code Generation. **Video Links:** https://www.youtube.com/watch?v=lRvaRhPsqOo	**8 Hrs**
UNIT-IV	
CODE OPTIMIZATION: Basic Blocks and Flow Graphs – Optimization of Basic Blocks – Principal Sources of Optimizations – Data Flow Analysis – Constant Propagation – Partial Redundancy Elimination – Peephole Optimizations. **Video Links**: https://nptel.ac.in/courses/106/108/106108113/	**8 Hrs**
UNIT-V	
SCHEDULING AND OPTIMIZING FOR PARALLELISM: Code Scheduling Constraints – Basic Block Scheduling – Global Code Scheduling - Basic Concepts in Parallelization – Parallelizing Matrix Multiplication – Iteration Spaces – Affine Array Indexes. **Video Links**: https://www.youtube.com/watch?v=-yMWgtTeQgY	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Design compiler phases from language specification.
CO2	Design code generators for the specified machine.
CO3	Analyze Object Code Generation techniques.
CO4	Apply the various optimization techniques.
CO5	Understand the Optimizing for Parallelism

Reference Books	
1.	Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, ―Compilers: Principles, Techniques and Tools‖, Second Edition, Pearson Education, 2009.
2.	Randy Allen, Ken Kennedy, ―Optimizing Compilers for Modern Architectures: A Dependence based Approach‖, Morgan Kaufmann Publishers, 2002.
3.	Keith D Cooper and Linda Torczon, ―Engineering a Compiler‖, Morgan Kaufmann Publishers Elsevier Science, 2004

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO/PSO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	1	2	-	-	-	-	-	-	-	2	1	-
CO2	3	3	2	3	1	-	-	-	-	-	-	2	2	2
CO3	3	3	2	3	1	-	-	-	-	-	-	2	3	-
CO4	3	3	2	3	2	-	-	-	-	-	-	2	3	-
CO5	3	3	2	3	2	-	-	-	-	-	-	2	3	1

High-3, Medium-2, Low-1

Semester: V Professional Elective I		
CRYPTOGRAPHY AND NETWORK SECURITY		
Course Code:MVJ21AI553		**CIE Marks:100**
Credits: L:T:P:S:3:1:0:0		**SEE Marks: 100**
Hours: 40L		**SEE Duration: 3 Hrs**
Course Learning Objectives: The students will be able to		
1	Acquire fundamental knowledge on the concepts of finite fields and number theory.	
2	To gain various block cipher and stream cipher models.	
3	Describe the principles of public key cryptosystems, hash functions and digital signature.	
4	Learn the various malicious attacks and firewall applications.	
5	To develop various security protocols for web and email applications	

UNIT-I	
INTRODUCTION & NUMBER THEORY: Services, Mechanisms and attacks- Classical Encryption techniques (Symmetric cipher model, substitution techniques, transposition techniques. finite fields and number theory: Groups, Rings, Fields-Modular arithmetic- Euclid's algorithm-Finite fields- Polynomial Arithmetic –Prime numbers- Fermat's and Euler's theorem- Testing for primality -The Chinese remainder theorem. **Applications:** Developing cryptographic algorithms **Video link / Additional online information (related to module if any):** https://www.cc.gatech.edu/~echow/ipcc/hpc-course/ https://nptel.ac.in/courses/111/103/111103020/	**8 Hrs**
UNIT-II	
BLOCK CIPHERS & PUBLIC KEY CRYPTOGRAPHY: Data Encryption Standard-Block cipher principles-block cipher modes of operation-Advanced Encryption Standard (AES)-Blowfish-RC5 algorithm. Public key cryptography: Principles of public key cryptosystems-The RSA algorithm-Key management - Diffie Hellman Key exchange-Elliptic curve arithmetic-Elliptic curve cryptography. **Applications:** Online transactions **Video link / Additional online information (related to module if any):** http://www.infocobuild.com/education/audio-video-courses/computer-science/IntroductionToCryptography-Ruhr/lecture-08.html https://www.comparitech.com/blog/information-security/diffie-hellman-key-exchange/	**8 Hrs**
UNIT-III	
HASH FUNCTIONS AND DIGITAL SIGNATURES: Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC – MD5 - SHA - HMAC – CMAC - Digital signature and authentication protocols – DSS – EIGamal. **Applications:** Cyber forensic **Video link / Additional online information (related to module if any):** https://www.educba.com/md5-alogrithm/ https://www.tutorialspoint.com/cryptography/cryptography_digital_signatures.htm	**8 Hrs**
UNIT-IV	
SECURITY PRACTICE & SYSTEM SECURITY: Authentication applications – Kerberos – X.509 Authentication services - Internet Firewalls for Trusted System: Roles of Firewalls – Firewall related terminology- Types of Firewalls - Firewall designs - SET for E-Commerce Transactions. Intruder – Intrusion detection system – Virus and related threats – Countermeasures.	**8 Hrs**

Applications: Antivirus / Malware detecting software **Video link / Additional online information (related to module if any):** https://www.simplilearn.com/what-is-kerberos-article https://searchsecurity.techtarget.com/feature/The-five-different-types-of-firewalls	
UNIT-V	
E-MAIL & IP SECURITY: E-mail Security: Security Services for E-mail-attacks possible through E-mail - establishing keys privacy-authentication of the source-Message Integrity-Non-repudiation-Pretty Good Privacy-S/MIME. IPSecurity: Overview of IPSec - IP and IPv6-Authentication Header-Internet Key Exchange (Phases of IKE, ISAKMP/IKE Encoding). **Applications:** Email and Banking applications **Video link / Additional online information (related to module if any):** https://www.barracuda.com/glossary/email-security https://www.youtube.com/watch?v=ubHZQrECeew	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Implement number theory for various identified attacks.
CO2	Design and develop the public key cryptographic algorithms.
CO3	Develop the digital signature and hashing algorithms
CO4	Design a firewall for detecting malicious attacks.
CO5	Design the protocols for improving security on email, web and IP.

Reference Books	
1.	William Stallings, Cryptography and Network Security, 6th Edition, Pearson Education, March 2013.
2.	Charlie Kaufman, Radia Perlman and Mike Speciner, “Network Security”, Prentice Hall of India, 2002.
3.	Behrouz A. Ferouzan, “Cryptography & Network Security”, Tata Mc Graw Hill, 2007.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO/PSO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	-	-	-	-	-	1	-	2	-	-	2	3
CO2	3	2	2	1	-	-	-	-	-	2	-	1	2	2
CO3	2	3	1	3	-	1	1	1	-	1	-	2	2	1
CO4	3	2	2	1	-	2	-	-	-	-	2	1	2	2
CO5	2	2	3	3	-	1	2	1	2	-	1	2	2	2

High-3, Medium-2, Low-1

Semester: V Professional Elective I		
VIRTUAL REALITY		
Course Code:MVJ21AI554		**CIE Marks:100**
Credits: L:T:P:S:3:1:0:0		**SEE Marks: 100**
Hours: 40L		**SEE Duration: 3 Hrs**
Course Learning Objectives: The students will be able to		
1	Explain understanding of this technology, underlying principles, its potential and limits and to learn about the criteria for defining useful applications.	
2	Illustrate process of creating virtual environments.	

UNIT-I

Introduction : The three I's of virtual reality, commercial VR technology and the five classic components of a VR system. Input Devices : (Trackers, Navigation, and Gesture Interfaces): Three dimensional position trackers, navigation and manipulation, interfaces and gesture interfaces **Video Links :** https://www.youtube.com/watch?v=DCQYBHz7RDs	**8 Hrs**
UNIT-II	
Output Devices: Graphics displays, sound displays & haptic feedback. **Video Links:** https://www.youtube.com/watch?v=wwcd0h5d0Vs	**8 Hrs**
UNIT-III	
Modeling : Geometric modeling, kinematics modeling, physical modeling, behaviour modeling, model management. **Video Links:**https://www.youtube.com/watch?v=0IgOapAtauM	**8 Hrs**
UNIT-IV	
Human Factors: Methodology and terminology, user performance studies, VR health and safety issues. **Video Links**: https://www.youtube.com/watch?v=_RU-XjaKWbg	**8 Hrs**
UNIT-V	
Applications: Medical applications, military applications, robotics applications. **Video Links**: https://www.youtube.com/watch?v=rYWJdZ5qg6M&list=PLbRMhDVUMngcdUbBySzyzcPiFTYWr4rV_	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Illustrate technology, underlying principles, its potential and limits and to learn about the criteria for defining useful applications.
CO2	Explain process of creating virtual environments
CO3	Analyse & Design a system or process to meet given specifications with realistic engineering constraints.
CO4	Identify problem statements and function as a member of an engineering design team.
CO5	Utilize technical resources

Reference Books

1.	Virtual Reality Technology, Second Edition, Gregory C. Burdea & Philippe Coiffet, John Wiley & Sons.
2.	Jason Jerald. 2015. The VR Book: Human-Centred Design for Virtual Reality. Association for Computing Machinery and Morgan & Claypool, New York, NY, USA.
3.	Learning Virtual Reality: Developing Immersive Experiences and Applications for Desktop, Web, and Mobile, Tony Parisi, O'Reilly Media; 1 edition, 2015.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO/PSO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	1	2	-	-	-	-	-	-	-	2	1	-
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CO3	3	3	2	3	1	-	-	-	-	-	-	2	3	-

CO4	3	3	2	3	2	-	-	-	-	-	-	2	3	-
CO5	3	3	2	3	2	-	-	-	-	-	-	2	3	1

High-3, Medium-2, Low-1

Semester: V **Professional Elective I**		
DIGITAL IMAGE PROCESSING		
Course Code:MVJ21AI555		**CIE Marks:100**
Credits: L:T:P:S:3:1:0:0		**SEE Marks: 100**
Hours: 40L+26T		**SEE Duration: 3 Hrs**
Course Learning Objectives: The students will be able to		
1	Describe the fundamentals of digital image processing.	
2	Understand image formation and the role human visual system plays in perception of gray and color image data.	

3	Apply image processing techniques in both the spatial and frequency (Fourier) domains.
4	Design and evaluate image analysis techniques
5	Conduct independent study and analysis of image Enhancement and restoration techniques

UNIT-I	
Digital Image Fundamentals: What is Digital Image Processing?, Origins of Digital Image Processing, Examples of fields that use DIP, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Elements of Visual Perception, Image Sensing and Acquisition. **(Text: Chapter 1and Chapter 2: Sections 2.1to 2.2, 2.6.2)**	**8 Hrs**
UNIT-II	
Image Enhancement in the Spatial Domain: Image Sampling and Quantization, Some Basic Relationships Between Pixels, Linear and Nonlinear Operations. Some Basic Intensity Transformation Functions, Histogram Processing, Fundamentals of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters (Text:Chapter2: Sections 2.3 to 2.62, Chapter3: Sections3.2 to3.6),	**8 Hrs**
UNIT-III	
Frequency Domain: Preliminary Concepts, The Discrete Fourier Transform (DFT) of Two Variables, Properties of the 2-DDFT, Filtering in the Frequency Domain, Image Smoothing and Image Sharpening Using Frequency Domain Filters, Selective Filtering. (Text: Cbapter4: Sections 4.2, 4.5 to 4.10),	**8 Hrs**
UNIT-IV	
Restoration: Noise models, Restoration in the Presence of Noise Only using Spatial Filtering and Frequency Domain Filtering, Linear, Position-Invariant degradations Estimating the Degradation Function, Inverse Filtering, Minimum Mean Square Error(Wiener) Filtering, Constrained Least Squares Filtering. (Text: Chapter 5: Sections 5.2, to 5.9)	**8 Hrs**
UNIT-V	
Morphological Image Processing: Preliminaries, Erosion and Dilation, Opening and Closing. **Image Processing:** Color Fundamentals, Color Models, Pseudo color Image Processing. (Text: Chapter 6: Sections 6.1 to 6.3 Chapter 9: Sedions9.1 to 9.3)	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Describe the fundamentals of digital image processing.
CO2	Understand image formation and the role human visual system plays in perception of gray and color image data.
CO3	Apply image processing techniques in both the spatial and frequency (Fourier) domains.
CO4	Design and evaluate image analysis techniques
CO5	Conduct independent study and analysis of image Enhancement and restoration techniques

Reference Books	
1.	Digital Image Processing- Rafel C Gonzalez and Richard E. Woods, PHI 3rd Edition 2010.
2.	Digital Image Processing- S.Jayaraman
3.	Fundamentals of Digital Image Processing- A K. Jain
4.	Image Processing analysis and Machine vision with Mind Tap by Milan Sonka and Roger Boile

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO/PSO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	1	2	-	-	-	-	-	-	-	2	1	-
CO2	3	3	2	3	1	-	-	-	-	-	-	2	2	2
CO3	3	3	2	3	1	-	-	-	-	-	-	2	3	-
CO4	3	3	2	3	2	-	-	-	-	-	-	2	3	-
CO5	3	3	2	3	2	-	-	-	-	-	-	2	3	1

High-3, Medium-2, Low-1

Semester: V		
ENVIRONMENTALSTUDIES		
Course Code: MVJ21CV56		**CIE Marks: 50**
Credits: L:T:P: 1:0:0		**SEE Marks: 50**
Hours: 15 L		**SEE Duration: 2 Hrs.**
Course Learning Objectives: The students will be able 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.

UNIT-I	
Introduction to environmental studies, Multidisciplinary nature of environmental studies; Scope and importance; Concept of sustainability and sustainable development. **Ecosystems (Structure and Function):** Forest, Desert, Rivers, Ocean **Biodiversity:** Types, Hot spots; Threats and Conservation of biodiversity, Deforestation**.** Video link:https://nptel.ac.in/courses/127/106/127106004/	**3 Hrs**
UNIT-II	
AdvancesinEnergySystems(Merits,Demerits,GlobalStatusandApplications):Hydrogen,Solar,Tidal and Wind. **Natural Resource Management (Concept and case-study):** Disaster Management, Sustainable Mining and Carbon Trading. Video link: https://nptel.ac.in/courses/121/106/121106014/	**3 Hrs**
UNIT-III	
Environmental Pollution: Surface and Ground Water Pollution, Noise pollution, Soil Pollution and Air Pollution. **Waste Management & Public Health Aspects:** Bio-medical Waste, Solid waste, Hazardous waste and E-waste. Video link: • https://nptel.ac.in/courses/122/106/122106030/ • https://nptel.ac.in/courses/105/103/105103205/ • https://nptel.ac.in/courses/120/108/120108005/ • https://nptel.ac.in/courses/105/105/105105160/	**3 Hrs**
UNIT-IV	
Global Environmental Concerns (Concept, policies, and case-studies): Global Warming, Climate Change, Acid Rain, Ozone Depletion and Fluoride problem in drinking water. Video link: • https://nptel.ac.in/courses/122/106/122106030/ • https://nptel.ac.in/courses/120108004/ • https://onlinecourses.nptel.ac.in/noc19_ge23/preview	**3 Hrs**
UNIT-V	

Latest Developments in Environmental Pollution Mitigation Tools(Concept and Applications): G.I.S. & Remote Sensing, Environment Impact Assessment, Environmental Management Systems. Video link: • https://nptel.ac.in/courses/105/102/105102015/ • https://nptel.ac.in/courses/120/108/120108004/	**3 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Describe the principles of ecology and environmental issues that apply to air, land, and water issues on a global scale.
CO2	Develop critical thinking and/or observation skills, and apply them to the analysis of a problem or question related to the environment.
CO3	Demonstrate ecology knowledge of a complex relationship between biotic and Abiotic components.
CO4	Apply their ecological knowledge to illustrate and graph a problem
CO5	Describe the realities that managers face when dealing with complex issues.

Reference Books	
1.	Principals of Environmental Science and Engineering, Raman Siva kumar, Cengage learning, Singapur, 2nd Edition, 2005.
2.	Environmental Science – working with the Earth G.Tyler Miller Jr. Thomson Brooks /Cole, 11th Edition, 2006
3.	Textbook of Environmental and Ecology, Pratiba Singh, Anoop Singh &PiyushMalaviya , ACME Learning Pvt. Ltd. New Delhi, 1st Edition.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE for 50 marks executed by way of tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 40 marks and assignment is evaluated for 10 marks. The three tests are conducted for 40 marks each and the average of all the tests are calculated for 40. The marks for the assignments are 10 (2 assignments for 5 marks each). The marks obtained in test and assignment are added and report CIE for 50 marks.

Semester End Examination (SEE):

SEE for 50 marks are executed by means of an examination. The Question paper contains objective type questions for 100 marks covering the entire syllabus having same complexity in terms of COs and Bloom's taxonomy level.

Total marks: 50+50=100

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	3	1	-	2	2	1	1	-	2	1
CO2	3	3	2	1	-	1	2	-	1	1	2	1
CO3	3	3	2	1	-	2	2	-	1	1	2	1
CO4	3	3	2	2	-	2	2	-	1	1	2	1

High-3, Medium-2, Low-1

Semester: V		
RESEARCH METHODOLOGY & IPR		
Course Code:MVJ21AEC57		**CIE Marks:100**
Credits: L:T:P:S:3:1:0:0		**SEE Marks: 100**
Hours: 40L+26T		**SEE Duration: 3 Hrs**
Course Learning Objectives: The students will be able to		
1	Give an overview of the research methodology and explain the technique of defining a 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.

UNIT-I	
Research Methodology: Introduction, Meaning of Research, Objectives of Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Research Process, Criteria of Good Research, Problems Encountered by Researchers in India. **Video link / Additional online information:** https://youtu.be/9IJscfF_irU https://youtu.be/IZLn9_PA_4s	**8 Hrs**
UNIT-II	
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 **Video link / Additional online information:** https://youtu.be/Yzfl3rtF0SM https://youtu.be/gpgzj1U7BYA	**8 Hrs**
UNIT-III	
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. **Video link / Additional online information:**	**8 Hrs**

https://youtu.be/GVmQpGn-Zuo https://youtu.be/NVr0OqeAdjw https://youtu.be/HYj4Ght1_qs	
UNIT-IV	
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 **Video link / Additional online information :** • https://youtu.be/IEP3swFeauE • https://www.youtube.com/watch?v=8oNGkvuRP60&ab_channel=NPTEL-NOCIITM	**8 Hrs**
UNIT-V	
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, The Geographical Indications of Goods (Registration and Protection) Act1999, Copyright Act,1957,The Protection 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, Competing Rationales for Protection of IPRs, 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**

Course Outcomes: After completing the course, the students will be able to	
CO1	To give an overview of the research methodology and explain the technique of defining a research problem
CO2	To explain various research designs and their characteristics
CO3	To explain the details of sampling designs, measurement and scaling techniques and also different methods of data collections
CO4	To explain several parametric tests of hypotheses
CO5	To discuss leading International Instruments concerning Intellectual Property Rights.

Reference Books	
1.	Research Methodology: Methods and Techniques, C.R. Kothari, Gaurav Garg, 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 Dog Publishing, 2005

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the

entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO/PSO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	-	3	-	-	-	-	-	-	1	-	2
CO2	3	3	1	-	-	-	-	-	-	-	-	1	1	3
CO3	3	3	1	-	-	-	-	-	-	-	-	1	1	2
CO4	3	3	1	-	-	-	-	-	-	-	-	1	-	2
CO5	3	3	1	-	-	-	-	-	-	-	-	2	1	1

High-3, Medium-2, Low-1

Semester: V		
UNIVERSAL HUMAN VALUES		
Course Code:MVJ21UHVI58		**CIE Marks: 50**
Credits: L:T:P: 2:0:0		**SEE Marks: 50**
Hours: 30L		**SEE Duration: 3 Hrs.**
Course Learning Objectives: The students will be able to		
1	Appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.	

2	Facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
3	Highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature.

UNIT-I	
Introduction to Value Education: Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education), Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Happiness and Prosperity – Current Scenario, Method to Fulfill the Basic Human Aspirations. **Practical Sessions**: (1) Sharing about Oneself (2) Exploring Human Consciousness (3) Exploring Natural Acceptance Video link: • https://www.youtube.com/watch?v=85XCw8SU084 • https://www.youtube.com/watch?v=E1STJoXCXUU&list=PLWDeKF97v9SP_Kt6jqzA3pZ3yA7g_OAQz • https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw	**6Hrs**
UNIT-II	
Harmony in the Human Being: Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health. **Practical Sessions**: (4) Exploring the difference of Needs of Self and Body (5) Exploring Sources of Imagination in the Self (6) Exploring Harmony of Self with the Body Video link: • https://www.youtube.com/watch?v=GpuZo495F24 • https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw	**6Hrs**
UNIT-III	
Harmony in the Family and Society: Harmony in the Family – the Basic Unit of Human	**6 Hrs**

Interaction, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to-Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order. **Practical Sessions**: (7) Exploring the Feeling of Trust (8) Exploring the Feeling of Respect (9) Exploring Systems to fulfill Human Goal Video link: • https://www.youtube.com/watch?v=F2KVW4WNnS • https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw	
UNIT-IV	
Harmony in the Nature/Existence: Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfillment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence. **Practical Sessions**: (10) Exploring the Four Orders of Nature (11) Exploring Co-existence in Existence Video link: • https://www.youtube.com/watch?v=1HR-QB2mCF0 • https://www.youtube.com/watch?v=lfN8q0xUSpw • https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw	**6 Hrs**
UNIT-V	
Implications of the Holistic Understanding – a Look at Professional Ethics: Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics, Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession **Practical Sessions**: (12) Exploring Ethical Human Conduct (13) Exploring Humanistic Models in Education (14) Exploring Steps of Transition towards Universal Human Order Video link: • https://www.youtube.com/watch?v=BikdYub6RY0 • https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw	**6 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Explore themselves, get comfortable with each other and with the teacher

CO2	Enlist their desires and the desires are not vague.
CO3	Restate that the natural acceptance (intention) is always for living in harmony, only competence is lacking
CO4	Differentiate between the characteristics and activities of different orders and study the mutual fulfillment among them
CO5	Present sustainable solutions to the problems in society and nature

Reference Books	
1.	AICTE SIP UHV-I Teaching Material, https://fdp-si.aicte india.org/ AicteSipUHV _download.php
2.	A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
3.	Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2
4.	Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010

Continuous Internal Evaluation (CIE):

CIE for 50 marks is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

Total marks: 50+50=100

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		1				2	2	3	2	1	2	1
CO2		1				2	2	3	2	1	2	1
CO3		1				2	2	3	2	1	2	1
CO4		1				2	2	3	2	1	2	1
CO5		1				2	2	3	2	1	2	1

High-3, Medium-2, Low-1

VI SEMESTER

PROJECT MANAGEMENT and OOMD			
Course Code	**MVJ22CS61**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2:2:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Learning Objectives

CLO 1. Outline software engineering principles and activities involved in building large software programs. Identify ethical and professional issues and explain why they are of concern to Software Engineers.

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

CLO 3. Infer the fundamentals of object oriented concepts, differentiate system models, use UML diagrams and apply design patterns.5

CLO 4. Explain the role of DevOps in Agile Implementation.

CLO 5. Discuss various types of software testing practices and software evolution processes. CLO 6. Recognize the importance Project Management with its methods and methodologies.

CLO 7. Identify software quality parameters and quantify software using measurements and metrics. List software quality standards and outline the practices involved

Teaching-Learning Process (General Instructions)

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

1. Lecturer method (L) need not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the

class, which promotes critical thinking.

5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem with different circuits/logic and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

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**(Textbook: 5 Sec 2.4)** and UML diagrams

Textbook 3: Chapter 1,2,3

Building the Analysis Models: Requirement Analysis, Analysis Model Approaches, Data modeling Concepts, Object Oriented Analysis, Scenario-Based Modeling, Flow-Oriented Modeling, class Based Modeling, Creating a Behavioral Model.

Textbook 1: Chapter 8: 8.1 to 8.8

Teaching-Learning Process	Chalk and board, Active Learning, Problem based learning

Module-2

Process Overview: Process Overview, System Conception and Domain Analysis: Process Overview: Development stages; Development life Cycle; System Conception: Devising a system concept; elaborating a concept; preparing a problem statement. Domain Analysis: Overview of analysis; Domain Class model: Domain state model; Domain interaction model; Iterating the analysis.

Text Book-2:Chapter- 10,11,and 12

Teaching-Learning Process	Chalk and board, Active Learning, Demonstration

Module3

Use Cae on Banking System, Health Care , ATM , LMS,

Textbook 1: Chapter 13: 13.1 to 13.7

Agile Methodology & DevOps: Before Agile – Waterfall, Agile Development,

Self-Learning Section:

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.

Textbook 4: Chapter 2: 2.1 to 2.9

Teaching-Learning Process	Chalk and board, Active Learning, Demonstration

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.

Textbook 3: Chapter 1: 1.1 to 1.17

Teaching-Learning Process	Chalk and board, Active Learning, Demonstration

Module-5

Activity Planning:

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

Apple's iPhone develeopment

NASA's Mars Rover Mission

Textbook 3: Chapter 6: 6.1 to 6.16

Software Quality:

Introduction, The place of software quality in project planning, Importance of software quality, software

quality models, ISO 9126, quality management systems, process capability models, techniques to enhance software quality, quality plans.

Textbook 3: Chapter 13: (13.1 to 13.6 , 13.9, 13.11, 13.14),

Teaching-Learning Process	Chalk and board, Active Learning, Demonstration

Course Outcomes

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

CO 1. Understand the activities involved in software engineering and analyze the role of variousprocess models

CO 2. Explain the basics of object-oriented concepts and build a suitable class model using modelling techniques

CO 3. Describe various software testing methods and to understand the importance of agilemethodology and DevOps

CO 4. Illustrate the role of project planning and quality management in software developmentCO 5. Understand the importance of activity planning and different planning models

Assessment Details (both CIE and SEE)

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). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

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

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marksand will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper has to be designed to attain the different levels of Bloom'staxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common questionpapers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks. Marks scoredshall be proportionally reduced to 50 marks
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

Suggested Learning Resources:

Textbooks

1. Roger S. Pressman: Software Engineering-A Practitioners approach, 7th Edition, Tata McGrawHill.
2. 12 Grady Booch et. al.: Object-Oriented Analysis and Design with Applications,3rd Edition,Pearson Education,2007.
3. 13Michael Blaha, James Rumbaugh: Object Oriented Modelling and Design with UML, 2nd Edition, Pearson Education, 2005.

3. Bob Hughes, Mike Cotterell, Rajib Mall: Software Project Management, 6th Edition, McGraw Hill Education, 2018.
4. Deepak Gaikwad, Viral Thakkar, DevOps Tools From Practitioner's Viewpoint, Wiley.
5. Ian Sommerville: Software Engineering, 9th Edition, Pearson Education, 2012.

Reference:

1. Pankaj Jalote: An Integrated Approach to Software Engineering, Wiley India.

Weblinks and Video Lectures (e-Resources):

1. https://onlinecourses.nptel.ac.in/noc20_cs68/preview
2. https://www.youtube.com/watch?v=WxkP5KR_Emk&list=PLrjkTql3jnm9b5nr-ggx7Pt1G4UAHeFlJ
3. http://elearning.vtu.ac.in/econtent/CSE.php
4. http://elearning.vtu.ac.in/econtent/courses/video/CSE/15CS42.html
5. https://nptel.ac.in/courses/128/106/128106012/ (DevOps)

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

Case study, Field visit

CO-PO/PSO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	-	1	1	2	-	-	-	-	-	1	-
CO2	3	3	3	3	2	-	-	-	-	-	-	-	-	-
CO3	1	-	-	1	1	-	2	3	3	3	3	-	2	-
CO4	3	3	2	2	2	-	-	-	-	-	-	3	-	-
CO5	3	3	3	3	3	2	-	-	3	3	3	3	2	1

High-3, Medium-2, Low-1

Semester: VI		
MACHINE LEARNING AND LAB		
Course Code: MVJ21AI62		**CIE Marks:50+50**
Credits: L:T:P: 3:0:1		**SEE Marks: 50 +50**
Hours:40 L+ 26 P		**SEE Duration: 03+03 Hours**

Course Learning Objectives: The students will be able to	
1	Define machine learning and problems relevant to machine learning.
2	Differentiate supervised, unsupervised and reinforcement learning.
3	Apply neural networks, Bayes classifier and k nearest neighbor, for problems appear in machine learning.
4	Perform statistical analysis of machine learning techniques.
5	Define machine learning and problems relevant to machine learning.

UNIT-I	
Introduction: Well posed learning problems, Designing a Learning system, Perspective and Issues in Machine Learning. **Concept Learning:** Concept learning task, Concept learning as search, Find-S algorithm, Version space, Candidate Elimination algorithm, Inductive Bias. **Laboratory Sessions/ Experimental learning:** To understand purpose, give real time dataset(problem) and ask to students to solve in class room. **Video link / Additional online information (related to module if any):** • https://www.youtube.com/watch?v=rQ3oi9g8alY • https://www.youtube.com/watch?v=h0e2HAPTGF4	**10 Hrs**
UNIT-II	
Decision Tree Learning Decision tree representation, Appropriate problems for decision tree learning, Basic decision tree learning algorithm, hypothesis space search in decision tree learning, Inductive bias in decision tree learning, Issues in decision tree learning. **Laboratory Sessions/ Experimental learning:** Ask students to design a Decision Tree using freely available dataset or problem in classroom. **Video link / Additional online information (related to module if any):** • https://www.youtube.com/watch?v=qDcl-FRnwSU • https://www.youtube.com/watch?v=FuJVLsZYkuE	**10 Hrs**
UNIT-III	

Bayesian Learning and Evaluating Hypotheses **Bayesian Learning:** Introduction, Bayes theorem, Bayes theorem and concept learning, MDL principle, Naive Bayes classifier, Bayesian belief networks, EM algorithm. **Evaluating Hypotheses**: Estimating hypothesis accuracy, Basics of sampling theorem, General approach for deriving confidence intervals, Difference in error of two hypothesis **Laboratory Sessions/ Experimental learning:** Ask the students to build Bayes Belief Networks for real time problem in class room. **Video link / Additional online information (related to module if any):** • https://www.youtube.com/watch?v=480a_2jRdK0 • https://www.youtube.com/watch?v=E3l26bTdtxI	**10 Hrs**
UNIT-IV	
Artificial Neural Networks and Instance based Learning **Artificial Neural Networks:** Introduction, Neural Network representation, Appropriate problems, Perceptrons, Back propagation algorithm. Instanced Based Learning: Introduction, k-nearest neighbor learning, locally weighted regression. **Laboratory Sessions/ Experimental learning:** Give real time problem and ask students to design an ANN using perceptrons. **Video link:** • https://www.youtube.com/watch?v=xbYgKoG4x2g&list=PL53BE265CE4A6C056. • https://www.youtube.com/watch?v=BRMS3T11Cdw&list=PL3pGy4HtqwD2a57wl7Cl7tmfxfk7JWJ9Y	**10 Hrs**
UNIT-V	
Reinforcement Learning and Deep Learning : Reinforcement Learning: Introduction, Learning Task, Q Learning. **Deep Learning**: Introduction to Deep Learning-Reasons to go Deep Learning, Introduction to Convolution Networks ,Restricted Boltzmann Machines, Deep Belief Nets, Recurrent Nets. **Video link:** • https://www.youtube.com/watch?v=TIlDzLZPyhY&list=PLyqSpQzTE6M_FwzHFAyf4LSkz_IjMyjD9 • https://www.youtube.com/watch?v=iOh7QUZGyiU&list=PLqYmG7hTraZDNJre23vqCGIVpfZ_K2RZs	**10 Hrs**

LABORATORY 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 and show the output for test cases. Develop an interactive program by Compareing the result by implementing LIST THEN ELIMINATE algorithm.
2. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm. Output a description of the set of all hypotheses consistent with the training examples.
3. Demonstrate Pre processing (Data Cleaning, Integration and Transformation) activity on suitable data: For example: Identify and Delete Rows that Contain Duplicate Data by considering an appropriate dataset. Identify and Delete Columns That Contain a Single Value by considering an appropriate dataset
4. 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. Demonstrate the working of the Random forest algorithm. Use an appropriate data set for building and apply this knowledge to classify a new sample
6. 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 naive Bayesian Classifier model to perform this task. Calculate the accuracy, precision, and recall for your data set.
8. Construct aBayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set.
9. Demonstrate the working of EM algorithm to cluster a set of data stored in a .CSV file.
10. Demonstrate the working of SVM classifier for a suitable data set

Web Link and Video Lectures(Self Learning)

- https://www.youtube.com/watch?v=rurs7cdT5cc
- https://www.youtube.com/watch?v=jQerVWxOGMc
- https://www.youtube.com/watch?v=X-wAtdGS5No
- https://www.youtube.com/watch?v=Db-tV8JJ3ZQ
- https://www.youtube.com/watch?v=Yb7vcX0inbM

Course Outcomes: After completing the course, the students will be able to	
CO1	Identify the issues in machine learning and Algorithms for solving it.
CO2	Explain theory of probability and statistics related to machine learning.
CO3	Investigate concept learning, ANN, Bayes classifier, k nearest neighbor, Q, Learning.
CO4	Identify the difference between Machine Learning and Deep Learning and using scenario

CO5	Explain the concepts of Q learning and deep learning

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.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the self -study are 20 (2 presentations are be held for 10 marks each). The marks obtained in test, quiz and self -studies are added to get marks out of 100 and report CIE for 50 marks.

Laboratory- 50 Marks

The laboratory session is held every week as per the time table and the performance of the student is evaluated in every session. The average of the marks over number of weeks is considered for 30 marks. At the end of the semester a test is conducted for 10 marks. The students are encouraged to implement additional innovative experiments in the lab and are awarded 10 marks. Total marks for the laboratory is 50.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks are executed by means of an examination.

The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the complete syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

Laboratory- 50 Marks

Experiment Conduction with proper results is evaluated for 40 marks and Viva is for 10 marks. Total SEE for laboratory is 50 marks.

CO-PO/PSO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	1	-	-	-	-	-	-	2	-	-
CO2	3	3	3	-	-	-	-	-	1	-	1	2	1	-
CO3	2	2	2	1	3	-	-	-	-	-	1	3	-	1
CO4	3	2	3	-	-	-	-	-	-	2	3	2	-	-
CO5	3	2	3	-	-	-	-	-	-	2	3	2	2	-

High-3, Medium-2, Low-1

Semester: VI		
WEB TECHNOLOGIES AND LAB		
Course Code: MVJ21AI 63		**CIE Marks:50+50**
Credits: L:T:P: 3:0:1		**SEE Marks: 50 +50**
Hours:40 L+ 26 P		**SEE Duration: 03+03 Hours**

Course Learning Objectives: The students will be able to	
1	To understand different Internet Technologies.
2	To learn java-specific web services architecture
3	To understand the SQL and JDBC
4	To learn the AJAX and JSON
5	To understand different Internet Technologies.

UNIT-I	
Website Basics, HTML5, CSS 3, Web 2.0: Web Essentials: Clients, Servers and Communication ,The Internet, Basic Internet protocols, World wide web, HTTP Request Message , HTTP Response Message, Web Clients, Web Servers, HTML5 : Tables, Lists, Image, HTML5 control elements , Semantic elements , Drag and Drop, Audio, Video controls, CSS3: Inline, embedded and external style sheets, Rule cascading, Inheritance, Backgrounds, Border Images, Colours, Shadows, Text, Transformations **Laboratory Sessions/ Experimental learning:** **1.** Design HTML form for keeping student record. **2.** Write a HTML code to generate following output. Create an html page with following specifications a. Title should be about my college b. Put the image in the background c. Place your College name at the top of the page in large text followed by address in smaller size d. Add names of courses offered each in a different color, style and typeface e. Add scrolling text with a message of your choice **Video link / Additional online information:** • https://www.youtube.com/watch?v=QEtWL4lWlL4 • https://www.youtube.com/watch?v=JsbxB2l7QGY&list=PLVlQHNRLflP_hIZuBNjr6rZzqa2HZFkny • https://www.youtube.com/watch?v=h_RftxdJTzs	**10 Hrs**

UNIT-II	
Client side Programming: An Introduction to java Script, JavaScript DOM Model, Date and Object, Regular Expression, Exception Handling, Validation, Built-in Objects, Event Handling, DHTML with JavaScript, JSON introduction, Syntax, Function Files, Http Request, SQL. **Laboratory Sessions/ Experimental learning:** **1.** Write a JavaScript to design a simple calculator to perform the following operations: sum, product, difference and quotient. **2.** Write a JavaScript code that displays text "TEXT-GROWING" with increasing font size in the interval of 100ms in RED COLOR, when the font size reaches 50pt it displays "TEXT-SHRINKING" in BLUE color. Then the font size decreases to 5pt. **Video link / Additional online information:** • https://www.youtube.com/watch?v=uDwSnnhl1Ng&list=PLsyeobzWxl7qtP8Lo9TReqUMkiOp446cV https://www.youtube.com/watch?v=zPTY1hKq3SU&list=PLVlQHNRLflP-ByWEVjCZAj79kJdshKQwu	**10 Hrs**
UNIT-III	
Server Side Programming: Java Servlet Architecture, Servlet Life Cycle, Form GET and POST actions, Session handling, Installing and Configuring Apache Tomcat Web Server, Database Connectivity: JDBC perspectives, JDBC Program Example, JSP: Understanding Java server page, JSP Standard Tag Library (JSTL), Creating HTML form using JSP Code. **Laboratory Sessions/ Experimental learning:** **1.** Assume four users user1, user2, user3 and user4 having the passwords pwd1, pwd2, pwd3 and pwd4 respectively. Write a servlet for doing the following. a. Create a Cookie and add these four user id's and passwords to this Cookie. b. Read the user id and passwords entered in the Login form and authenticate with the values available in the cookies. **2.** Write a JSP which insert the details of the 3 or 4users who register with the web site by using registration form. Authenticate the user when he submits the login form using the user name and password from the database. **Video link / Additional online information:** • https://www.youtube.com/watch?v=7TOmdDJc14s&list=PLsyeobzWxl7pUPF2xjjJiG4BKC9x_GY46 • https://www.youtube.com/watch?v=xve6QEgIR-0&list=PL0zysOflRCel5BSXoslpfDawe8FyyOSZb • https://www.youtube.com/watch?v=0pzR2FGTEhk	**10 Hrs**

UNIT-IV	
PHP: Introduction to PHP, PHP using PHP, Variables, Program Control, Built-in Functions, Form Validation, Basic command with PHP examples, Connection to server, creating Database, Selecting Database, Listing Database, listing table names Creating a table, Inserting data, deleting data and tables, altering tables. **Laboratory Sessions/ Experimental learning:** 1. Write a PHP program to keep track of the number of visitors visiting the web page and to display this count of visitors, with proper headings. 2. Write a PHP program to display a digital clock which displays the current time of the server. 3. Write a PHP program to sort the student records which are stored in the database using selection sort. 4. Design an XML document to store information about a student in an engineering college affiliated to VTU. The information must include USN, Name, and Name of the College, Branch, Year of Joining, and email id. Make up sample data for 3 students. Create a CSS style sheet and use it to display the document. **Video link / Additional online information :** • https://www.youtube.com/watch?v=itRkLa2kq6w • https://www.youtube.com/watch?v=KJHYdkKtafU https://www.youtube.com/watch?v=G_CFRAdbXfI&list=PL_RGaFnxSHWrjkpK2zD4TWKWMWVfeYK-b	**10 Hrs**
UNIT-V	
AJAX: Ajax client server architecture, Xml HTTP request object, Call back methods. Advanced JavaScript and jQuery, JavaScript Pseudo-Classes, jQuery Foundations, Web Services: Introduction, Java web services Basics, Creating, Publishing, Testing and Describing a web services, Database driven web service from an application. **Laboratory Sessions/ Experimental learning:** 1. Creating simple application to access data base using JDBC Formatting HTML with CSS. 2. Write a Program for manipulating Databases and SQL with real time application. 3. Write a Java applet to display the Application Program screen i.e. calculator and other. **Video link / Additional online information** • https://www.youtube.com/watch?v=qk9MWbyRlhE • https://www.youtube.com/watch?v=0pzR2FGTEhk • https://www.youtube.com/watch?v=HgvIox6ehkM	**10 Hrs**

LABORATORY EXPERIMENTS
1. Create a web page with the following. a. Cascading style sheets. b. Embedded style sheets. c. Inline style sheets. Use our college information(Department of CSE) for the web pages. **2.** Design HTML form for keeping student record and validate it using Java script. **3.** Write an HTML program to design an entry form of student details and send it to store at database server like SQL, Oracle or MS Access. 4. Write a JavaScript code that displays text "TEXT-GROWING" with increasing font size in the interval of 100ms in RED COLOR, when the font size reaches 50pt it displays "TEXT-SHRINKING" in BLUE color. Then the font size decreases to 5pt. 5. Assume four users user1, user2, user3 and user4 having the passwords pwd1, pwd2, pwd3 and pwd4 respectively. Write a servlet for doing the following. i. Create a Cookie and add these four user id's and passwords to this Cookie. ii. Read the user id and passwords entered in the Login form and authenticate with the values available in the cookies. 6. Write a JSP which insert the details of the 3 or 4 users who register with the web site by using registration form. Authenticate the user when he submits the login form using the user name and password from the database. 7. Validate the form using PHP regular expression. PHP stores a form data in to database 8. Write a PHP program to display a digital clock which displays the current time of the server. 9. Creating simple application to access data base using JDBC Formatting HTML with CSS. 10. Write a Program for manipulating Databases and SQL with real time application

Course Outcomes: After completing the course, the students will be able to	
CO1	Construct a basic website using HTML and Cascading Style Sheets.
CO2	Build dynamic web page with validation using Java Script objects and by applying different event handling mechanism.
CO3	Develop server side programs using Servlets and JSP.
CO4	Construct simple web pages in PHP and to represent data in XML format.
CO5	Use AJAX and web services to develop interactive web applications.

Reference Books	
1.	Deitel and Deitel and Nieto,Internet and World Wide Web, How to Program, Prentice Hall, 5th Edition, 2011.
2.	Randy Connolly, Ricardo Hoar, "Fundamentals of Web Development", 1stEdition, Pearson Education India. (ISBN:978-9332575271)
3.	Stephen Wynkoop and John Burke ―Running a Perfect Website‖, QUE, 2nd Edition,1999
4.	Chris Bates, Web Programming – Building Intranet Applications, 3rd Edition, Wiley Publications, 2009.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the self -study are 20 (2 presentations are be held for 10 marks each). The marks obtained in test, quiz and self -studies are added to get marks out of 100 and report CIE for 50 marks.

Laboratory- 50 Marks

The laboratory session is held every week as per the time table and the performance of the student is evaluated in every session. The average of the marks over number of weeks is considered for 30 marks. At the end of the semester a test is conducted for 10 marks. The students are encouraged to implement additional innovative experiments in the lab and are awarded 10 marks. Total marks for the laboratory is 50.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks are executed by means of an examination.

The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the complete syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a

maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

Laboratory- 50 Marks

Experiment Conduction with proper results is evaluated for 40 marks and Viva is for 10 marks. Total SEE for laboratory is 50 marks.

CO-PO/PSO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	-	3	-	-	-	-	-	-	1	-	2
CO2	3	3	1	-	-	-	-	-	-	-	-	1	1	3
CO3	3	3	1	-	-	-	-	-	-	-	-	1	1	2
CO4	3	3	1	-	-	-	-	-	-	-	-	1	-	2
CO5	3	3	1	-	-	-	-	-	-	-	-	2	1	1

High-3, Medium-2, Low-1

Semester: VI Open Elective I		
CLOUD COMPUTING		
Course Code:MVJ21AI641		**CIE Marks:100**
Credits: L:T:P:S:3:1:0:0		**SEE Marks: 100**
Hours: 40L+26T		**SEE Duration: 3 Hrs**

Course Learning Objectives: The students will be able to	
1	To understand the fundamental ideas behind Cloud Computing, the evolution of the paradigm, its applicability; benefits, as well as current and future challenges;
2	To introduce the basic ideas and principles in data center design; cloud management techniques and cloud software deployment considerations;
3	To discuss 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	To introduce cloud storage technologies and relevant distributed file systems, NoSQL databases and object storage;
5	To discuss the variety of programming models and develop working experience in several of them.

UNIT-I	
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 **Video link / Additional online information :** https://www.youtube.com/watch?v=PW-V-72MJNY	**10 Hrs**
UNIT-II	
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,	**10 Hrs**

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) **Video link / Additional online information :** https://www.youtube.com/watch?v=ifZh5SJAujA	
UNIT-III	
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 **Video link / Additional online information :** https://www.youtube.com/watch?v=7m3f-P-WWbg	**10 Hrs**
UNIT-IV	
Platform and Software as a Service**:** Technologies and Tools for Cloud Computing- Aneka Cloud Platform- Aneka Resource Provisioning Service- Hybrid Cloud Implementation – Comet Cloud 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 **Video link / Additional online information :** https://www.youtube.com/watch?v=3KJjKY8k9Lk	**10 Hrs**

UNIT-V	
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 **Video link / Additional online information :** **https://www.youtube.com/watch?v=uj2Sb7b_Do0**	**10 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Recall the recent history of cloud computing, illustrating its motivation and evolution.
CO2	List some of 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	Define SLAs and SLOs and illustrate their importance in Cloud Computing.
CO5	List some of the common cloud providers and their associated cloud stacks and recall popular cloud use case scenarios.

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.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be

more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO/PSO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	-	1	1	2	-	-	-	-	-	1	-
CO2	3	3	3	3	2	-	-	-	-	-	-	-	-	-
CO3	1	-	-	1	1	-	2	3	3	3	3	-	2	-
CO4	3	3	2	2	2	-	-	-	-	-	-	3	-	-
CO5	3	3	3	3	3	2	-	-	3	3	3	3	2	1

High-3, Medium-2, Low-1

Semester: VI Open Elective I		
FOUNDATION OF DATA SCIENCE		
Course Code: MVJ21AI642		**CIE Marks:100**
Credits: L:T:P:S:3:1:0:0		**SEE Marks: 100**
Hours: 40L+26T		**SEE Duration: 3 Hrs**
Course Learning Objectives: The students will be able to		
1	To provide strong foundation for data science and application area related to information technology and understand the underlying core concepts and emerging technologies in data science	

UNIT-I	
INTRODUCTION TO DATA SCIENCE: Definition – Big Data and Data Science Hype – Why data science – Getting Past the Hype – The Current Landscape – Who is Data Scientist? - Data Science Process Overview – Defining goals – Retrieving data – Data preparation – Data exploration – Data modeling – Presentation. **Video Links :** https://www.youtube.com/watch?v=KMj49syT8JM&list=PLyqSpQzTE6M-sBjDcT21Gpnj8grR2fDgc	**10 Hrs**
UNIT-II	
BIG DATA: Problems when handling large data – General techniques for handling large data – Case study – Steps in big data – Distributing data storage and processing with Frameworks – Case study. **Video Links:** https://nptel.ac.in/courses/106/101/106101163/	**10 Hrs**
UNIT-III	
MACHINE LEARNING: Machine learning – Modeling Process – Training model – Validating model – Predicting new observations –Supervised learning algorithms – Unsupervised learning algorithms. **Video Links:** https://nptel.ac.in/courses/106/101/106101163/	**10 Hrs**
UNIT-IV	
DEEP LEARNING: Introduction – Deep Feedforward Networks – Regularization – Optimization of Deep Learning – Convolutional Networks – Recurrent and Recursive Nets – Applications of Deep Learning. **Video Links**: https://nptel.ac.in/courses/106/101/106101163/	**10 Hrs**
UNIT-V	
DATA VISUALIZATION : Introduction to data visualization – Data visualization	**10 Hrs**

options – Filters – MapReduce – Dashboard development tools – Creating an interactive dashboard with dc.js-summary. **Video Links**: https://nptel.ac.in/courses/106/101/106101163/	

Course Outcomes: After completing the course, the students will be able to	
CO1	Explore the fundamental concepts of data science.
CO2	Understand data analysis techniques for applications handling large data
CO3	Understand various machine learning algorithms used in data science process
CO4	Visualize and present the inference using various tools
CO5	Learn to think through the ethics surrounding privacy, data sharing and algorithmic decision-making

Reference Books	
1.	Introducing Data Science, Davy Cielen, Arno D. B. Meysman, Mohamed Ali, Manning Publications Co., 1st edition, 2016
2.	An Introduction to Statistical Learning: with Applications in R, Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, Springer, 1st edition, 2013
3.	Deep Learning, Ian Goodfellow, Yoshua Bengio, Aaron Courville, MIT Press, 1st edition, 2016
4.	Ethics and Data Science, D J Patil, Hilary Mason, Mike Loukides, O' Reilly, 1st edition, 2018

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO/PSO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	1	2	-	-	-	-	-	-	-	2	1	-
CO2	3	3	2	3	1	-	-	-	-	-	-	2	2	2
CO3	3	3	2	3	1	-	-	-	-	-	-	2	3	-
CO4	3	3	2	3	2	-	-	-	-	-	-	2	3	-
CO5	3	3	2	3	2	-	-	-	-	-	-	2	3	1

High-3, Medium-2, Low-1

Semester: VI		
Open Elective I		
INTRODUCTION TO DRONES		
Course Code:MVJ21AI643		**CIE Marks:100**
Credits: L:T:P:S:3:1:0:0		**SEE Marks: 100**
Hours: 40L+26T		**SEE Duration: 3 Hrs**
Course Learning Objectives: The students will be able to		
1	To make the students to understand the basic concepts of UAV systems design.	

UNIT-I	
INTRODUCTION TO UAV: History of UAV –classification – Introduction to Unmanned Aircraft Systems--models and prototypes – System Composition-applications. **Video Links :** https://www.digimat.in/nptel/courses/video/101104073/L01.html	**8 Hrs**
UNIT-II	
THE DESIGN OF UAV SYSTEMS : Introduction to Design and Selection of the System- Aerodynamics and Airframe Configurations- Characteristics of Aircraft Types- Design Standards and Regulatory Aspects-UK,USA and Europe- Design for Stealth--control surfaces-specifications. **Video Links:** https://www.digimat.in/nptel/courses/video/101104083/L01.html	**8 Hrs**
UNIT-III	
AVIONICS HARDWARE : Autopilot – AGL-pressure sensors-servos-accelerometer –gyros-actuators- power supply- processor, integration, installation, configuration, and testing. **Video Links:**https://nptel.ac.in/courses/101/104/101104083/	**8 Hrs**
UNIT-IV	
COMMUNICATION PAYLOADS AND CONTROLS: Payloads-Telemetry-tracking-Aerial photography-controls-PID feedback-radio control frequency range –modems-memory system-simulation-ground test-analysis-trouble shooting. **Video Links**: https://nptel.ac.in/courses/101/108/101108047/	**8 Hrs**
UNIT-V	
THE DEVELOPMENT OF UAV SYSTEMS :Waypoints navigation-ground control software-System Ground Testing- System In-flight Testing- Future Prospects and Challenges-Case Studies – Mini and Micro UAVs. Video Links**:https://nptel.ac.in/courses/101/104/101104073/**	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Ability to design UAV system
CO2	Prepare preliminary design requirements for an unmanned aerial vehicle.
CO3	Perform system testing for unmanned aerial vehicles
CO4	Integrate various systems of unmanned aerial vehicle.
CO5	Design micro aerial vehicle systems by considering practical limitations.

Reference Books	
1.	Paul G Fahlstrom, Thomas J Gleason, "Introduction to UAV Systems", UAV Systems, Inc, 1998
2.	Reg Austin "Unmanned Aircraft Systems UAV design, development and deployment", Wiley, 2010.
3.	Dr. Armand J. Chaput, "Design of Unmanned Air Vehicle Systems", Lockheed Martin Aeronautics Company, 2001
4.	Kimon P. Valavanis, "Advances in Unmanned Aerial Vehicles: State of the Art and the Road to Autonomy", Springer, 2007

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO/PSO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	2	3	3	-	-	-	-	-	-	3	2	-
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CO3	3	3	2	3	2	-	-	-	-	-	-	2	3	-
CO4	3	3	2	3	2	-	-	-	-	-	-	2	3	2
CO5	3	3	2	3	3	-	-	-	-	-	-	2	3	3

High-3, Medium-2, Low-1

Semester: VI Open Elective I		
JAVA PROGRAMMING		
Course Code:MVJ21AI643		**CIE Marks:100**
Credits: L:T:P:S:3:1:0:0		**SEE Marks: 100**
Hours: 40L+26T		**SEE Duration: 3 Hrs**

Course Learning Objectives: The students will be able to	
1	Learn fundamental features of object oriented language and JAVA
2	Set up Java JDK environment to create, debug and run simple Java programs
3	Learn object oriented concepts using programming examples
4	Study the concepts of importing of packages and exception handling mechanism.
5	Discuss the String Handling examples with Object Oriented concepts

UNIT-I	
An Overview of Java: Object-Oriented Programming, A First Simple Program, A Second Short Program, Two Control Statements, Using Blocks of Code, Lexical Issues, The Java Class Libraries, Data Types, Variables, and Arrays: Java Is a Strongly Typed Language, The Primitive Types, Integers, Floating-Point Types, Characters, Booleans, A Closer Look at Literals, Variables, Type Conversion and Casting, Automatic Type Promotion in Expressions, Arrays, A Few Words About Strings Text book 1: Ch 2, Ch 3	**8 Hrs**
UNIT-II	
Operators: Arithmetic Operators, The Bitwise Operators, Relational Operators, Boolean Logical Operators, The Assignment Operator, The ? Operator, Operator Precedence, Using Parentheses, Control Statements: Java's Selection Statements, Iteration Statements, Jump Statements. Text book 1: Ch 4, Ch 5	**8 Hrs**
UNIT-III	
Introducing Classes: Class Fundamentals, Declaring Objects, Assigning Object Reference Variables, Introducing Methods, Constructors, The this Keyword, Garbage Collection, The finalize( ) Method, A Stack Class, A Closer Look at Methods and Classes: Overloading Methods, Using Objects as Parameters, A Closer Look at Argument Passing, Returning Objects, Recursion, Introducing Access Control, Understanding static, Introducing final, Arrays Revisited, Inheritance: Inheritance, Using super, Creating a Multilevel Hierarchy, When Constructors Are Called, Method Overriding, Dynamic Method Dispatch, Using Abstract	**8 Hrs**

Classes, Using final with Inheritance, The Object Class. Text book 1: Ch 6, Ch 7.1-7.9, Ch 8.	
UNIT-IV	
Packages and Interfaces: Packages, Access Protection, Importing Packages, Interfaces, Exception Handling: 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, Using Exceptions. Text book 1: Ch 9, Ch 10	**8 Hrs**
UNIT-V	
Enumerations, Type Wrappers, I/O, Applets, and Other Topics: I/O Basics, Reading Console Input, Writing Console Output, The PrintWriter Class, Reading and Writing Files, Applet Fundamentals, The transient and volatile Modifiers, Using instance of, strict fp, Native Methods, Using assert, Static Import, Invoking Overloaded Constructors Through this( ), String Handling: The String Constructors, String Length, Special String Operations, Character Extraction, String Comparison, Searching Strings, Modifying a String, Data Conversion Using value Of( ), Changing the Case of Characters Within a String , Additional String Methods, String Buffer, String Builder. Text book 1: Ch 12.1,12.2, Ch 13, Ch 15	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Explain the object-oriented concepts and JAVA.
CO2	Develop computer programs to solve real world problems in Java
CO3	Develop simple GUI interfaces for a computer program to interact with users

Reference Books	
1.	Herbert Schildt, Java The Complete Reference, 7th Edition, Tata McGraw Hill, 2007. (Chapters 2, 3, 4, 5, 6,7, 8, 9,10, 12,13,15)
2.	Mahesh Bhave and Sunil Patekar, "Programming with Java", First Edition, Pearson Education,2008, ISBN:9788131720806.
3.	Rajkumar Buyya,S Thamarasi selvi, xingchen chu, Object oriented Programming with java, Tata McGraw Hill education private limited.
4.	E Balagurusamy, Programming with Java A primer, Tata McGraw Hill companies.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be

more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO/PSO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	2	3	3	-	-	-	-	-	-	2	2	-
CO2	3	3	2	3	3	-	-	-	-	-	-	2	2	2
CO3	3	3	2	3	2	-	-	-	-	-	-	2	3	-
CO4	3	3	2	3	2	-	-	-	-	-	-	2	3	-
CO5	3	3	2	3	3	-	-	-	-	-	-	2	3	1

High-3, Medium-2, Low-1

Semester: VI Open Elective I		
ETHICAL HACKING		
Course Code:MVJ21AI644		**CIE Marks:100**
Credits: L:T:P:S:3:1:0:0		**SEE Marks: 100**
Hours: 40L+26T		**SEE Duration: 3 Hrs**

Course Learning Objectives: The students will be able to	
1	Understand Ethical Hacking.
2	Identify how intruders escalate privileges and what steps can be taken to secure a system.
3	Introduce and demonstrate hacking tools for penetration testing purposes only.

UNIT-I	
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 Cyber laws – 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. **Video link / Additional online information (related to module if any):** https://www.youtube.com/watch?v=a1xQq60EtJc	**10 Hrs**
UNIT-II	
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 A 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. **Applications**: Understand the network protocols and port scanning techniques using Kali linux **Video link / Additional online information (related to module if any):** https://www.digimat.in/nptel/courses/video/106106178/L34.html	**10 Hrs**
UNIT-III	
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	**10 Hrs**

Content-Type Attacks. Web Application Security Vulnerabilities: Overview of Top Web Application Security Vulnerabilities – SQL Injection Vulnerabilities – Cross-Site Scripting Vulnerabilities. VoIP Attacks **Applications**: Familiarizing with different types of attacks such as sniffing, spoofing etc **Video link / Additional online information (related to module if any):** https://nptel.ac.in/courses/106/106/106106199/	
UNIT-IV	
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 **Applications:** Exploiting buffer overflow vulnerabilities **Video link / Additional online information (related to module if any):** https://www.youtube.com/watch?v=9dd3M2a4LKI	**10 Hrs**
UNIT-V	
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. **Applications:** Understand the protection mechanism to prevent against various server attacks. **Video link / Additional online information (related to module if any):** https://nptel.ac.in/noc/courses/noc15/SEM1/noc15-cs03/	**10 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Understand the Ethics Of Ethical Hacking.
CO2	Identify the Social Engineering Attacks.
CO3	Recognize and Detect Types of Attacks.
CO4	Manage Instrumented Fuzzying Tools and Techniques.
CO5	Collect Malware and Initial Analysis.

Reference Books	
1.	Allen Harper, Shon Harris, Jonathan Ness, Chris Eagle, Gideon Lenkey, Terron Williams, ―Gray Hat Hacking The Ethical Hackers Handbook‖, 3rd Edition, 2011
2.	Sharma Pankaj, ―Hacking‖, APH Publishing, 2005
3.	Rajat Khare, ―Network Security and Ethical Hacking‖, Luniver Press, 2006.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO/PSO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	-	-	-	-	1	-	-	-	3	2	-
CO2	3	3	1	-	-	-	-	2	-	1	-	3	2	-
CO3	3	3	1	2	-	-	-	-	-	1	-	3	-	2
CO4	3	3	3	3	-	3	2	2	2	2	-	3	2	-
CO5	3	3	3	3	-	3	2	2	3	2	-	3	2	-

High-3, Medium-2, Low-1

Semester: VI		
ANGULAR JS AND NODE JS (Theory & Lab)		
Course Code: MVJ21AEC66		**CIE Marks:100**
Credits: L:T:P:S: 2:0:0:0		**SEE Marks: 100**
Hours: 40L		**SEE Duration: 3 Hrs**

Course Learning Objectives: The students will be able to	
1	**To learn the basics of Angular JS.**
2	**To understand the Angular JS Modules**
3	**To implement Forms, inputs and Services**
4	**To implement Directives and Databases**
5	**To understand basics of Node JS.**

UNIT-I	
Introduction To Angular JS: Introduction – Features – Angular JS Model-View-Controller – Expression - Directives and Controllers.	**6Hrs**
UNIT-II	
Angular JS Modules: Arrays –Working with ng-model – Working with Forms – Form Validation – Error Handling with Forms – Nested Forms with ng-form – Other Form Controls.	**6Hrs**
UNIT-III	
Directives& Building Databases: Part I- Filters – Using Filters in Controllers and Services – Angular JS Services – Internal Angular JS Services – Custom Angular JS Services	**6Hrs**
UNIT-IV	
Directives& Building Databases: Part-II- Directives – Alternatives to Custom Directives – Understanding the Basic options – Interacting with Server – HTTP Services – Building Database, Front End and BackEnd	**6Hrs**
UNIT-V	
Introduction to NODE .JS:	**6Hrs**

Introduction –Using the Terminals – Editors –Building a Webserver with Node – The HTTP Module – Views and Layouts.	

Course Outcomes: After completing the course, the students will be able to	
CO1	**Describe the features of Angular JS.**
CO2	**Recognize the form validations and controls.**
CO3	**Implement Directives and Controllers**
CO4	**Evaluate and create database for simple application.**
CO5	**Plan and build webservers with node using Node .JS.**

Reference Books	
1	**Adam Freeman - ProAngular JS, Apress, First Edition, 2014.**
2	**ShyamSeshadri, Brad Green –"AngularJS: Up and Running: Enhanced Productivity with Structured Web Apps", Apress, O'Reilly Media, Inc.**
3.	**AgusKurniawan–"AngularJS Programming by Example", First Edition, PE Press, 2014.**
4.	**Brad Dayley, "Learning Angular JS", Addison-Wesley Professional, First Edition, 2014.**

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks

each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
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CO3	2	2	2	1	3	-	-	-	-	-	1	3
CO4	3	2	3	2	1	-	-	-	-	2	3	2
CO5	3	2	3	1	-	-	-	-	-	2	3	2

High-3, Medium-2, Low-1

VII SEMESTER

Semester: VII		
FOUNDATION OF DATA SCIENCE		
Course Code: MVJ21AI71		**CIE Marks:100**
Credits: L:T:P:S:3:1:0:0		**SEE Marks: 100**
Hours: 40L+26T		**SEE Duration: 3 Hrs**
Course Learning Objectives: The students will be able to		
1	To provide strong foundation for data science and application area related to information technology and understand the underlying core concepts and emerging technologies in data science	

UNIT-I	
INTRODUCTION TO DATA SCIENCE: Definition – Big Data and Data Science Hype – Why data science – Getting Past the Hype – The Current Landscape – Who is Data Scientist? - Data Science Process Overview – Defining goals – Retrieving data – Data preparation – Data exploration – Data modeling – Presentation. **Video Links :** https://www.youtube.com/watch?v=KMj49syT8JM&list=PLyqSpQzTE6M-sBjDcT21Gpnj8grR2fDgc	**10 Hrs**
UNIT-II	
BIG DATA: Problems when handling large data – General techniques for handling large data – Case study – Steps in big data – Distributing data storage and processing with Frameworks – Case study. **Video Links:** https://nptel.ac.in/courses/106/101/106101163/	**10 Hrs**
UNIT-III	
MACHINE LEARNING: Machine learning – Modeling Process – Training model – Validating model – Predicting new observations –Supervised learning algorithms – Unsupervised learning algorithms. **Video Links:**https://nptel.ac.in/courses/106/101/106101163/	**10 Hrs**
UNIT-IV	
DEEP LEARNING: Introduction – Deep Feed forward Networks – Regularization –	**10 Hrs**

Optimization of Deep Learning – Convolutional Networks – Recurrent and Recursive Nets – Applications of Deep Learning. **Video Links**: https://nptel.ac.in/courses/106/101/106101163/	
UNIT-V	
DATA VISUALIZATION : Introduction to data visualization – Data visualization options – Filters – MapReduce – Dashboard development tools – Creating an interactive dashboard with dc.js-summary. **Video Links**: https://nptel.ac.in/courses/106/101/106101163/	**10 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Explore the fundamental concepts of data science.
CO2	Understand data analysis techniques for applications handling large data
CO3	Understand various machine learning algorithms used in data science process
CO4	Visualize and present the inference using various tools
CO5	Learn to think through the ethics surrounding privacy, data sharing and algorithmic decision-making

Reference Books	
1.	Introducing Data Science, Davy Cielen, Arno D. B. Meysman, Mohamed Ali, Manning Publications Co., 1st edition, 2016
2.	An Introduction to Statistical Learning: with Applications in R, Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, Springer, 1st edition, 2013
3.	Deep Learning, Ian Goodfellow, Yoshua Bengio, Aaron Courville, MIT Press, 1st edition, 2016
4.	Ethics and Data Science, D J Patil, Hilary Mason, Mike Loukides, O' Reilly, 1st edition, 2018

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2

assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

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CO4	3	3	2	3	2	-	-	-	-	-	-	2	3	-
CO5	3	3	2	3	2	-	-	-	-	-	-	2	3	1

High-3, Medium-2, Low-1

Semester: VII		
COMPUTER VISION **Professional Elective II**		
Course Code: MVJ21AI721		**CIE Marks:100**
Credits: L:T:P:S:3:0:0:0		**SEE Marks: 100**
Hours: 40L		**SEE Duration: 3 Hrs**
Course Learning Objectives: The students will be able to		
1	This course will enable students to Computer Vision focuses on development of algorithms and techniques to analyze and interpret the visible world around us. This requires understanding of the fundamental concepts related to multi-dimensional signal processing, feature extraction, pattern analysis visual geometric modeling, stochastic optimization etc. Knowledge of these concepts is necessary in this field, to explore and contribute to research and further developments in the field of computer vision. Applications range from Biometrics, Medical diagnosis, document processing, mining of visual content, to surveillance, advanced rendering etc.	

UNIT-I	
Digital Image Formation and low-level processing Overview and State-of-the-art, Fundamentals of Image Formation, Transformation: Orthogonal, Euclidean, Affine, Projective, etc; Fourier Transform, Convolution and Filtering, Image Enhancement, Restoration, Histogram Processing	**8Hrs**
UNIT-II	
Depth estimation and Multi-camera views Perspective, Binocular Stereopsis: Camera and Epipolar Geometry; Homography, Rectification, DLT, RANSAC, 3-D reconstruction framework; Auto-calibration.	**8Hrs**
UNIT-III	
Feature Extraction Edges - Canny, LOG, DOG; Line detectors (Hough Transform), Corners - Harris and Hessian Affine, Orientation Histogram, SIFT, SURF, HOG, GLOH, Scale-Space Analysis- Image Pyramids and Gaussian derivative filters, Gabor Filters and DWT.	**8Hrs**
UNIT-IV	
Image Segmentation	**8Hrs**

Region Growing, Edge Based approaches to segmentation, Graph-Cut, Mean-Shift, MRFs, Texture Segmentation; Object detection.	
UNIT-V	
Pattern Analysis Clustering: K-Means, K-Medoids, Mixture of Gaussians, Classification: Discriminant Function, Supervised, Un-supervised, Semi-supervised; Classifiers: Bayes, KNN, ANN models; Dimensionality Reduction: PCA, LDA, ICA; Non-parametric methods.	**8Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Understand the concepts of Digital Image Processing.
CO2	Analyse Homography and stereopsis.
CO3	Analyse Edges and Hough Transforms.
CO4	Demonstrate the ideas of image Segmentation.
CO5	Implement the concepts of Pattern Analysis.

Reference Books	
1.	Richard Szeliski, Computer Vision: Algorithms and Applications, Springer-Verlag London Limited 2011.
2.	Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education, 2003.
3.	Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, March 2004.
4.	K. Fukunaga; Introduction to Statistical Pattern Recognition, Second Edition, Academic Press, Morgan Kaufmann, 1990.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding

up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**2**	**1**	**1**	**-**	**1**	**1**	**2**	**-**	**-**	**-**	**-**	**-**
CO2	**3**	**3**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO3	**1**	**-**	**-**	**1**	**1**	**-**	**2**	**3**	**3**	**3**	**-**	**-**
CO4	**3**	**3**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**3**	**3**
CO5	**3**	**3**	**3**	**3**	**3**	**2**	**-**	**-**	**3**	**3**	**3**	**3**

High-3, Medium-2, Low-1

Semester: VII Professional Elective II		
INFORMATION RETRIEVAL		
Course Code:MVJ21AI722		**CIE Marks:100**
Credits: L:T:P:S:3:1:0:0		**SEE Marks: 100**
Hours: 40L+26T		**SEE Duration: 3 Hrs**

Course Learning Objectives: The students will be able to	
1	To understand the basics of Information Retrieval.
2	To understand machine learning techniques for text classification and clustering.
3	To understand various search engine system operations.
4	To learn different techniques of recommender system

UNIT-I	
INTRODUCTION: Information Retrieval – Early Developments – The IR Problem – The Users Task – Information versus Data Retrieval – The IR System – The Software Architecture of the IR System – The Retrieval and Ranking Processes – The Web – The e-Publishing Era – How the web changed Search – Practical Issues on the Web – How People Search – Search Interfaces Today – Visualization in Search Interfaces. **Video link / Additional online information (related to module if any):** https://www.youtube.com/watch?v=fFxpSmyICwI	**8 Hrs**
UNIT-II	
MODELING AND RETRIEVAL EVALUATION: Basic IR Models – Boolean Model – TF-IDF (Term Frequency/Inverse Document Frequency) Weighting – Vector Model – Probabilistic Model – Latent Semantic Indexing Model – Neural Network Model – Retrieval Evaluation – Retrieval Metrics – Precision and Recall – Reference Collection – User-based Evaluation – Relevance Feedback and Query Expansion – Explicit Relevance Feedback. **Video link / Additional online information (related to module if any):** **https://www.youtube.com/watch?v=m0oiAOgSQFw**	**8 Hrs**
UNIT-III	

TEXT CLASSIFICATION AND CLUSTERING: A Characterization of Text Classification – Unsupervised Algorithms: Clustering – Naïve Text Classification – Supervised Algorithms – Decision Tree – k-NN Classifier – SVM Classifier – Feature Selection or Dimensionality Reduction – Evaluation metrics – Accuracy and Error – Organizing the classes – Indexing and Searching – Inverted Indexes – Sequential Searching – Multi-dimensional Indexing. **Video link / Additional online information (related to module if any):** https://www.youtube.com/watch?v=vuc93jbO2Dw	**8 Hrs**
UNIT-IV	
WEB RETRIEVAL AND WEB CRAWLING: The Web – Search Engine Architectures – Cluster based Architecture – Distributed Architectures – Search Engine Ranking – Link based Ranking – Simple Ranking Functions – Learning to Rank – Evaluations — Search Engine Ranking – Search Engine User Interaction – Browsing – Applications of a Web Crawler – Taxonomy – Architecture and Implementation – Scheduling Algorithms – Evaluation. **Video link / Additional online information (related to module if any):** **https://www.youtube.com/watch?v=JjywDlY1OJk**	**8 Hrs**
UNIT-V	
RECOMMENDER SYSTEM: Recommender Systems Functions – Data and Knowledge Sources – Recommendation Techniques – Basics of Content-based Recommender Systems – High Level Architecture – Advantages and Drawbacks of Content-based Filtering – Collaborative Filtering – Matrix factorization models – Neighborhood models. **Video link / Additional online information (related to module if any):** **https://www.youtube.com/watch?v=1JRrCEgiyHM**	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Use an open source search engine framework and explore its capabilities
CO2	Evaluate Boolean Model
CO3	Apply appropriate method of classification or clustering.
CO4	Design and implement innovative features in a search engine.
CO5	Design and implement a recommender system.

Reference Books	
1.	Ricardo Baeza-Yates and Berthier Ribeiro-Neto, ―Modern Information Retrieval: The Concepts and Technology behind Search, Second Edition, ACM Press Books, 2011.
2.	Ricci, F, Rokach, L. Shapira, B.Kantor, ―Recommender Systems Handbook, First Edition,

	2011.
3.	C. Manning, P. Raghavan, and H. Schütze, ―Introduction to Information Retrieval, Cambridge University Press, 2008.
4.	Stefan Buettcher, Charles L. A. Clarke and Gordon V. Cormack, ―Information Retrieval: Implementing and Evaluating Search Engines, The MIT Press, 2010.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO/PSO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	-	-	-	-	-	1	-	2	-	-	2	3
CO2	3	2	2	1	-	-	-	-	-	2	-	1	2	2
CO3	2	3	1	3	-	1	1	1	-	1	-	2	2	1
CO4	3	2	2	1	-	2	-	-	-	-	2	1	2	2
CO5	2	2	3	3	-	1	2	1	2	-	1	2	2	2

High-3, Medium-2, Low-1

Semester: VII Professional Elective II		
HIGH PERFORMANCE COMPUTING		
Course Code:MVJ21AI723		**CIE Marks:100**
Credits: L:T:P:S:3:1:0:0		**SEE Marks: 100**
Hours: 40L+26T		**SEE Duration: 3 Hrs**

Course Learning Objectives: The students will be able to	
1	Improve the system performance
2	Learn various distributed and parallel computing architecture
3	Learn different computing technologies

UNIT-I	
Grid Computing: Data & Computational Grids, Grid Architectures And Its Relations To Various Distributed Technologies. Autonomic Computing, Examples Of The Grid Computing Efforts (Ibm). **Video link** : https://www.youtube.com/watch?v=GlobK-eWDSo	**8 Hrs**
UNIT-II	
Cluster Setup & Its Advantages, Performance Models & Simulations; Networking Protocols & I/O, Messaging Systems. Process Scheduling, Load Sharing And Balancing; Distributed Shared Memory, Parallel I/O. **Video link** : https://www.youtube.com/watch?v=9J4uXnSDias	**8 Hrs**
UNIT-III	
Example Cluster System – Beowlf; Cluster Operating Systems: Compas And Nanos Pervasive Computing Concepts & Scenarios; Hardware & Software; Human – Machine Interface. **Video link** : https://www.youtube.com/watch?v=GlobK-eWDSo	**8 Hrs**
UNIT-IV	
Device Connectivity; Java for Pervasive Devices; Application Examples **Video link** : https://www.youtube.com/watch?v=bS6XqjBO99Q	**8 Hrs**
UNIT-V	
Classical Vs Quantum Logic Gates; One, Two & Three Qubit Quantum Gates; Fredkin & Toffoli Gates; Quantum Circuits; Quantum Algorithms. Videolink**:https://nptel.ac.in/courses/115/101/115101092/**	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Understanding the concepts in grid computing
CO2	Ability to set up cluster and run parallel applications
CO3	Ability to understand the cluster projects and cluster OS
CO4	Understanding the concepts of pervasive computing
CO5	Understanding the concepts of quantum computing

Reference Books	
1.	"Selected Topics In Advanced Computing" Edited By Dr. P. Padmanabham And Dr. M.B. Srinivas, 2005 Pearson Education.
2.	J. Burkhardt et.al: 'pervasive computing' Pearson Education
3.	Marivesar:' Approaching quantum computing', Pearson Education
4.	Raj kumar Buyya:'High performance cluster computing', Pearson Education

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO/PSO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	-	-	-	-	-	-	-	-	-	2	2
CO3	3	3	3	-	-	-	-	-	-	-	-	-	1	3
CO4	3	3	3	-	-	-	-	-	-	-	-	-	1	2
CO5	2	2	2	-	-	-	-	-	-	-	-	-	2	-

High-3, Medium-2, Low-1

Semester: VII Professional Elective II		
BIG DATA ANALYTICS		
Course Code:MVJ21AI724		**CIE Marks:100**
Credits: L:T:P:S:3:1:0:0		**SEE Marks: 100**
Hours: 40L+26T		**SEE Duration: 3 Hrs**

Course Learning Objectives: The students will be able 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 the optimized business decisions in solving complex real-world problems

UNIT-I	
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. **Video link** : https://www.digimat.in/nptel/courses/video/106104189/L01.html	**8 Hrs**
UNIT-II	
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**
UNIT-III	
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**
UNIT-IV	
UNDERSTANDING MAP REDUCE FUNDAMENTALS :Map Reduce Framework: Exploring the features of Map Reduce, Working of Map Reduce, Exploring Map and Reduce Functions,	**8 Hrs**

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**	
UNIT-V	
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. **Videolink: https://www.youtube.com/watch?v=qr_awo5vz0g**	**8 Hrs**

Course Outcomes: After completing 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 querying the bigdata 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

Reference Books	
1.	Seema Acharya, Subhashini Chellappan,―BigData and Analytics, Wiley Publications,2nd Edition, 2014 DT Editorial Services,―BigData, DreamTechPress, 2nd Edition, 2015.
2.	TomWhite, ―Hadoop: The Definitive Guide, O'Reilly, 3rd Edition, 2012.
3.	Big Data Black Book, Dreamtech publications , 1st Edition, 2017.
4.	Michael Minelli, Michele Chambers, Ambiga Dhiraj, ―BigData, BigAnalytics: Emerging Business Intelligence and Analytic Trends for Today's Business, Wiley CIO Series, 1st Edition, 2013.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2

assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO/PSO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2		-	-	-	-	-	-	-	-	-	2	-
CO2	2	2		-	-	-	-	-	-	-	-	-	2	2
CO3	2	3	2	2	-	-	-	-	-	-	-	-	1	3
CO4	1	2	3	-	-	-	-	-	-	-	-	-	1	2
CO5	1	2	2	2	-	-	-	-	-	-	-	-	2	-

High-3, Medium-2, Low-1

Semester: VII Professional Elective II		
PERVASIVE COMPUTING		
Course Code:MVJ21AI725		**CIE Marks:100**
Credits: L:T:P:S:3:1:0:0		**SEE Marks: 100**
Hours: 40L+26T		**SEE Duration: 3 Hrs**
Course Learning Objectives: The students will be able to		
1	Understand an insight into future developments in the field of pervasive computing.	
2	Provide an in-depth knowledge on pervasive computing and wireless networking.	
3	Describe the variety of pervasive services and applications.	

UNIT-I	
Pervasive Computing : Evolution of Pervasive Computing - Decentralization continues - Applied Pervasive computing - Pervasive computing principles - Pervasive Information Technology - Smart Cards - Smart Labels. **Video link** : https://www.youtube.com/watch?v=bS6XqjBO99Q	**8 Hrs**
UNIT-II	
Embedded Controls: Smart sensors and Actuators - Smart Appliances - Appliances and Home Networking -Automotive Computing. Operating Systems: Windows CE -Palm OS - Symbian EPOC - Java Card - Windows for Smart Cards. Video link **: http://digimat.in/nptel/courses/video/108108147/L01.html**	**8 Hrs**
UNIT-III	
Middleware Components: Programming Consumer Devices - Smart Card Programming - Messaging Components - Database Components. Security: The importance of security - Cryptographic patterns and methods Cryptographic Tools-Secure socket layer **Video link** : https://www.digimat.in/nptel/courses/video/117108048/L01.html	**8 Hrs**
UNIT-IV	
Gateways, Device Management and Synchronization :Connectivity Gateway - Wireless Gateway - Transcoding - Residential Gateway - Architecture and components of Web Application Servers - Web Sphere Application Server Web Sphere Everyplace Suite - Oracle Portal-to-Go - Tasks of Device Management Systems - Tivoli Device Support Infrastructure - User Profiles and Directory Services - Synchronization - The Challenge of Synchronizing Data - Industry Data Synchronization Standards -Today's Synchronization Solution	**8 Hrs**

Video link **:https://www.digimat.in/nptel/courses/video/106105183/L40.html**	
UNIT-V	
Portals and Access Services: Internet Portals-Wireless Portal - Broadcasting Portal - Home Services - Communication Services - Home Automation - Energy Services - Security Services - Remote Home Healthcare Services - Travel and Business Services - Consumer Services Video link: https://www.youtube.com/watch?v=oxMdDsud5vg	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Describe the principles of pervasive technology.
CO2	Identify the functionalities of operating systems and middleware
CO3	Analyze the device management and synchronization techniques.
CO4	Explain the various gateways
CO5	Choose the appropriate techniques to develop various pervasive applications.

Reference Books	
1.	Asoke K Talukder, Roopa R Yavagal, "Mobile computing: Technology, Applications and Service Creation", Second Edition, Tata McGraw-Hill Publishing Company Limited, 2017, ISBN 978-0070144576
2.	UweHansmann, LotharMerk, Martin S. Nicklous, Thomas Stober, "Pervasive Computing Handbook",Second edition, Springer, 2003, ISBN 978-3-642-05525-6.
3.	MinyiGuo, Jingyu Zhou, Feilong Tang, Yao Shen, "Pervasive Computing: Concepts, Technologies and Applications", CRC Press,2016, ISBN 9781466596276.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO/PSO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2		-	-	-	-	-	-	-	-	-	2	-
CO2	2	2		-	-	-	-	-	-	-	-	-	2	2
CO3	2	3	2	2	-	-	-	-	-	-	-	-	1	3
CO4	1	2	3	-	-	-	-	-	-	-	-	-	1	2
CO5	1	2	2	2	-	-	-	-	-	-	-	-	2	-

High-3, Medium-2, Low-1

Semester: VII Professional Elective III		
NATURAL LANGUAGE PROCESSING		
Course Code:MVJ21AI731		**CIE Marks:100**
Credits: L:T:P:S:3:1:0:0		**SEE Marks: 100**
Hours: 40L+26T		**SEE Duration: 3 Hrs**
Course Learning Objectives: The students will be able to		
1	Learn the fundamentals of natural language processing	
2	Understand the use of CFG and PCFG in NLP	
3	Understand the role of semantics of sentences and pragmatics	
4	Gain knowledge in automated Natural Language Generation and Machine Translation	

UNIT-I	
INTRODUCTION: Origins and challenges of NLP – Language Modelling: Grammar-based LM, Statistical LM –Regular Expressions, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance values of real symmetric matrices: Jacobi and Givens method. **Laboratory Session**: Word Analysis **Applications:** Text to Speech conversion **Video link** :https://nptel.ac.in/courses/106/105/106105158/	**8 Hrs**
UNIT-II	
WORD LEVEL AND SYNTACTIC ANALYSIS: N grams Models of Syntax - Counting Words - Unsmoothed N grams-Smoothing-Back off Deleted Interpolation – Entropy – English Word Classes - Tag sets for English-Part of Speech Tagging-Rule Based Part of Speech Tagging - Stochastic Part of Speech Tagging - Transformation-Based Tagging -Issues in PoS tagging – Hidden Markov and Maximum Entropy models. **Laboratory Session**: Morphological Analyzer for a given word **Applications**: Speech to text conversion Video link **:https://nptel.ac.in/courses/106/105/106105158/**	**8 Hrs**
UNIT-III	
CONTEXT FREE GRAMMARS**:** Context-Free Grammars, Grammar rules for English, Tree banks, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing, Ambiguity,	**8 Hrs**

Dynamic Programming parsing – Shallow parsing Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs – Feature structures, Unification of feature structures **Laboratory Sessions**: Chunking for a given sentence **Applications**: Compiler **Video link** :https://www.youtube.com/watch?v=6b40kKe2SFg	
UNIT-IV	
SEMANTICS AND PRAGMATICS: Representing Meaning - Meaning Structure of Language, - First Order Predicate Calculus-Representing Linguistically Relevant Concepts –SyntaxDriven Semantic Analysis - Semantic Attachments –Syntax Driven Analyzer- Robust Analysis – Lexemes and Their Senses - Internal Structure - Word Sense Disambiguation -Information Retrieval. **Laboratory Session**: Pragmatic Analysis of a given sentence **Applications**: Sentiment Analysis Video link **:https://www.coursera.org/lecture/human-language/pragmatics-E8VXH**	**8 Hrs**
UNIT-V	
LANGUAGE GENERATION AND DISCOURSEANALYSIS: Discourse segmentation, Coherence – Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm – Co reference Resolution – Resources: Porter Stemmer, Lemmatize, Penn Treebank, Brill's Tagger, Word Net, Prop Bank, Frame Net, Brown Corpus, and British National Corpus (BNC). **Laboratory Session**: Sentiment analysis on movie database **Applications**: Sentiment analysis Videolink**:https://www.coursera.org/lecture/text-mining-analytics/5-6-how-to-do-sentiment-analysis-with-sentiwordnet-5RwtX**	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	To tag a given text with basic Language features.
CO2	To design an innovative application using NLP components
CO3	To implement a rule-based system to tackle morphology/syntax of a language
CO4	To design a tag set to be used for statistical processing for real-time applications
CO5	To compare the use of different statistical approaches for different types of NLP applications

Reference Books	
1.	Daniel Jurafsky, James H. Martin—Speech and Language Processing: An Introduction to Natural

	Language Processing, Computational Linguistics and Speech, Pearson Publication, 2014.
2.	C. Manning and H. Schutze, "Foundations of Statistical Natural Language Processing", MITPress. Cambridge, MA:1999
3.	Steven Bird, Ewan Klein and Edward Loper, ―Natural Language Processing with Python, First Edition, OReilly Media, 2009.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

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Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO/PSO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	-	-	-	-	-	-	-	-	-	2	2
CO3	3	3	3	-	-	-	-	-	-	-	-	-	1	3
CO4	3	3	3	-	-	-	-	-	-	-	-	-	1	2
CO5	2	2	2	-	-	-	-	-	-	-	-	-	2	-

High-3, Medium-2, Low-1

Semester: VII		
Professional Elective III		
HEALTHCARE ANALYTICS		
Course Code:MVJ21AI732		**CIE Marks:100**
Credits: L:T:P:S:3:1:0:0		**SEE Marks: 100**
Hours: 40L+26T		**SEE Duration: 3 Hrs**

Course Learning Objectives: The students will be able to

1	Understand the health data formats, health care policy and standards
2	Learn the significance and need of data analysis and data visualization
3	Understand the health data management frameworks
4	Learn the use of machine learning and deep learning algorithms in healthcare
5	Apply healthcare analytics for critical care applications

UNIT-I	
INTRODUCTION TO HEALTHCARE ANALYSIS :Overview - History of Healthcare Analysis Parameters on medical care systems- Health care policy- Standardized code sets – Data Formats – Machine Learning Foundations: Tree Like reasoning , Probabilistic reasoning and Bayes Theorem, Weighted sum approach. **Video link** :https://www.digimat.in/nptel/courses/video/110104095/L01.html	**8 Hrs**
UNIT-II	
ANALYTICS ON MACHINE LEARNING : Machine Learning Pipeline – Pre-processing – Visualization – Feature Selection – Training model parameter – Evaluation model : Sensitivity , Specificity , PPV ,NPV, FPR ,Accuracy , ROC , Precision Recall Curves , Valued target variables –Python: Variables and types, Data Structures and containers , Pandas Data Frame :Operations – Scikit –Learn : Pre-processing , Feature Selection. Video link **:https://www.digimat.in/nptel/courses/video/106105152/L01.html**	**8 Hrs**
UNIT-III	
HEALTH CARE MANAGEMENT: IOT- Smart Sensors – Migration of Healthcare Relational database to NoSQL Cloud Database – Decision Support System – Matrix block Cipher System – Semantic Framework Analysis – Histogram bin Shifting and Rc6 Encryption – Clinical Prediction Models – Visual Analytics for Healthcare.	**8 Hrs**

Video link : https://www.digimat.in/nptel/courses/video/110104095/L41.html	
UNIT-IV	
HEALTHCARE AND DEEP LEARNING: Introduction on Deep Learning – DFF network CNN- RNN for Sequences – Biomedical Image and Signal Analysis – Natural Language Processing and Data Mining for Clinical Data – Mobile Imaging and Analytics – Clinical Decision Support System. Video link **:https://www.youtube.com/watch?v=W3_yaf3HvHU**	**8 Hrs**
UNIT-V	
CASE STUDIES: Predicting Mortality for cardiology Practice –Smart Ambulance System using IOT –Hospital Acquired Conditions (HAC) program- Healthcare and Emerging Technologies – ECG Data Analysis. Videolink: **https://www.youtube.com/watch?v=UvQFH5RGOnU**	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Use machine learning and deep learning algorithms for health data analysis
CO2	Apply the data management techniques for healthcare data
CO3	Evaluate the need of healthcare data analysis in e-healthcare, telemedicine and other critical care applications
CO4	Design health data analytics for real time applications
CO5	Design emergency care system using health data analysis

Reference Books	
1.	Chandan K.Reddy, Charu C. Aggarwal, "Health Care data Analysis", First edition, CRC, 2015.
2.	Vikas Kumar, "Health Care Analysis Made Simple", Packt Publishing, 2018.
3.	Nilanjan Dey, Amira Ashour , Simon James Fong, Chintan Bhatl, "Health Care Data Analysis and Management, First Edition, Academic Press, 2018.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

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more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO/PSO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2		-	-	-	-	-	-	-	-	-	2	-
CO2	2	2		-	-	-	-	-	-	-	-	-	2	2
CO3	2	3	2	2	-	-	-	-	-	-	-	-	1	3
CO4	1	2	3	-	-	-	-	-	-	-	-	-	1	2
CO5	1	2	2	2	-	-	-	-	-	-	-	-	2	-

High-3, Medium-2, Low-1

Semester: VII Professional Elective III		
PATTERN RECOGNITION		
Course Code:MVJ21AI732		**CIE Marks:100**
Credits: L:T:P:S:3:1:0:0		**SEE Marks: 100**
Hours: 40L+26T		**SEE Duration: 3 Hrs**

Course Learning Objectives: The students will be able to	
1	Identify areas where Pattern Recognition and Machine Learning can offer a solution.
2	Describe the strength and limitations of some techniques used in computational Machine Learning for classification, regression and density estimation problems
3	Describe genetic algorithms, validation methods and sampling techniques
4	Describe and model data to solve problems in regression and classification
5	Implement learning algorithms for supervised tasks.

UNIT-I	
Introduction: Importance of pattern recognition, Features, Feature Vectors, and Classifiers, Supervised, Unsupervised, and Semi-supervised learning, Introduction to Bayes Decision Theory, Discriminant Functions and Decision Surfaces, Gaussian PDF and Bayesian Classification for Normal Distributions. L1, L2	**8 Hrs**
UNIT-II	
Data Transformation and Dimensionality Reduction: Introduction, Basis Vectors, The Karhunen Loeve (KL) Transformation, Singular Value Decomposition, Independent Component Analysis (Introduction only). Nonlinear Dimensionality Reduction, Kernel PCA. L1, L2	**8 Hrs**
UNIT-III	
Estimation of Unknown Probability Density Functions: Maximum Likelihood Parameter Estimation, Maximum a Posteriori Probability estimation, Bayesian Interference, Maximum Entropy Estimation, Mixture Models, Naive-Bayes Classifier, The Nearest Neighbor Rule. L1, L2, L3	**8 Hrs**
UNIT-IV	
Linear Classifiers: Introduction, Linear Discriminant Functions and Decision Hyperplanes, The Perceptron	**8 Hrs**

Algorithm, Mean Square Error Estimate, Stochastic Approximation of LMS Algorithm, Sum of Error Estimate. L1, L2, L3	
UNIT-V	
Nonlinear Classifiers: The XOR Problem, The two Layer Perceptron, Three Layer Perceptron, Back propagation Algorithm, Basic Concepts of Clustering, Introduction to Clustering , Proximity Measures. L1, L2, L3	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Identify areas where Pattern Recognition and Machine Learning can offer a solution.
CO2	Describe the strength and limitations of some techniques used in computational Machine Learning for classification, regression and density estimation problems
CO3	Describe genetic algorithms, validation methods and sampling techniques
CO4	Describe and model data to solve problems in regression and classification
CO5	Implement learning algorithms for supervised tasks.

Reference Books	
1.	Pattern Recognition: Sergios Theodoridis, Konstantinos Koutroumbas, Elsevier India Pvt. Ltd (Pap Back), 4th edition
2.	The Elements of Statistical Learning: Trevor Hastie
3.	Pattern Classification: Richard O. Duda
4.	Pattern Recognition and Image Analysis Earl Gose: Richard Johnsonbaugh

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

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Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and

CO-PO/PSO Mapping														
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CO2	2	2		-	-	-	-	-	-	-	-	-	2	2
CO3	2	3	2	2	-	-	-	-	-	-	-	-	1	3
CO4	1	2	3	-	-	-	-	-	-	-	-	-	1	2
CO5	1	2	2	2	-	-	-	-	-	-	-	-	2	-

Bloom's taxonomy level.

High-3, Medium-2, Low-1

Semester: VII Professional Elective III		
VISION SYSTEMS AND ROBOTICS		
Course Code:MVJ21AI734		**CIE Marks:100**
Credits: L:T:P:S:3:1:0:0		**SEE Marks: 100**
Hours: 40L+26T		**SEE Duration: 3 Hrs**
Course Learning Objectives: The students will be able to		
1	Learn the basics of robotics.	
2	Understand the robot end effectors.	
3	Learn the techniques used in robot mechanics.	
4	Learn the fundamentals of machine vision systems and robot programming.	
5	Learn the basics of robotics.	

UNIT-I	
BASICS OF ROBOTICS: Introduction- Basic components of robot-Laws of robotics- classification of robot-work space – accuracy resolution –repeatability of robot. Power transmission system: Rotary to rotary motion, Rotary to linear motion, Harmonics drives.	**8 Hrs**
UNIT-II	
ROBOT END EFFECTORS : Robot End effectors: Introduction- types of End effectors- Tools as end effectors - Drive system for grippers - Mechanical gripper- types of gripper mechanism- gripper force analysis and gripper design - other types of gripper- special purpose grippers.	**8 Hrs**
UNIT-III	
ROBOT MECHANICS : Robot kinematics: Introduction- Matrix representation- rigid motion & homogeneous transformation- forward & inverse kinematics- trajectory planning. Robot Dynamics: Introduction - Manipulator dynamics – Lagrange - Euler formulation- Newton - Euler formulation.	**8 Hrs**
UNIT-IV	
MACHINE VISION FUNDAMENTALS : Machine vision: image acquisition, digital images- sampling and quantization-levels of computation Feature extraction-windowing technique- segmentation- Thresholding- edge detection- binary morphology - grey morphology - Camera calibration – Stereo Reconstruction.	**8 Hrs**
UNIT-V	
V ROBOT PROGRAMMING: Robot Languages- Classification of robot language-Computer	**8 Hrs**

control and robot software-Val system and Languages- VAL language commands- motion control, hand control, program control, pick and place applications - palletizing applications using VAL, Robot welding application using VAL program- Rapid Language - basic commands Virtual robotics - VAL-II and AML – applications of robots	

Course Outcomes: After completing the course, the students will be able to	
CO1	Able to know the basics of robotics.
CO2	Able to understand the concepts of robot end effectors.
CO3	Obtain forward, reverse kinematics and dynamics model of the industrial robot arm
CO4	Develop the vision algorithms.
CO5	Understand the robot programming and applications of robots.

Reference Books	
1.	Carsten Steger, Markus Ulrich, Christian Wiedemann, Machine Vision Algorithms and Applications, Second edition, Weinheim, WILEY-VCH, 2018
2.	John J. Craig, Introduction to Robotics - Mechanics and Control, 3 rd Edition, Pearson Education Inc, 2013.
3.	S.K. Saha, Introduction to Robotics, 4 th Edition, Tata McGraw Hill Education, 2011.
4.	Ashitava Ghoshal, Robotics-Fundamental Concepts and Analysis, Oxford University Press, Sixth impression, 2010.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

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Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the

entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

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

High-3, Medium-2, Low-1

Semester: VII Professional Elective III		
DEEP LEARNING TECHNIQUES		
Course Code:MVJ21AI734		**CIE Marks:100**
Credits: L:T:P:S:3:1:0:0		**SEE Marks: 100**
Hours: 40L+26T		**SEE Duration: 3 Hrs**

Course Learning Objectives: The students will be able 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

UNIT-I	
DEEP NETWORKS: Machine Learning Basics: Learning Algorithms – Supervised and Unsupervised learning – Feed forward Deep networks – regularization – Optimization for training Deep models. **Video link** :http://www.deeplearning.net	**8 Hrs**
UNIT-II	
CONVOLUTIONAL NETWORKS AND SEQUENCE MODELLING : Convolutional Networks – Convolution operation – Motivation Pooling – Basic Convolution function – Algorithms – Recurrent and recursive nets : Recurrent neural networks – Bidirectional RNN – Recursive Neural networks – Auto regressive networks – Long term dependencies – Temporal dependencies – Approximate search **Video link** :www.cs.toronto.edu/~fritz/absps/imagenet.pdf	**8 Hrs**
UNIT-III	
PROBABILISTIC MODELS AND AUTO ENCODERS : Structured Probabilistic models : Challenges of unstructured modelling – using graphs to describe model structure – Learning about dependencies – inference – Deep learning approach – Monte carlo models – Linear Factor models and Auto encoders **Video link** :https://www.youtube.com/watch?v=wPz3MPl5jvY	**8 Hrs**
UNIT-IV	
DEEP GENERATIVE MODELS : Restricted Boltzmann Machines – Deep Belief networks – Deep Boltzmann machine – Convolutional Boltzmann machine	**8 Hrs**

Video link :https://www.youtube.com/watch?v=W3_yaf3HvHU	
UNIT-V	
APPLICATIONS: Speech, Audio and Music processing – Language modelling and Natural language processing – information retrieval – object recognition and computer vision – Multi modal and multi task learning Videolink: http://www.deeplearning.net	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Use feed forward deep networks
CO2	Apply convolutional networks and sequence modelling for problem solving
CO3	Use probabilistic models and auto encoders
CO4	Use deep generative models for problem solving
CO5	Apply the deep learning techniques

Reference Books	
1.	Yoshua Bengio and Ian J.Goodfellow and Aaron Courville, "Deep Learning", MIT Press, 2015
2.	Li Deng, Dong Yu, "Deep Learning: Methods and Applications", now publishers, 2014

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

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Semester End Examination (SEE):

Total marks: 50+50=100

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entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO/PSO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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CO3	2	3	3	2	-	-	-	-	-	-	-	-	1	3
CO4	2	2	1	-	-	-	-	-	-	-	-	-	1	2
CO5	3	1	2	2	-	-	-	-	-	-	-	1	2	-

High-3, Medium-2, Low-1

Semester: VII Open Elective III		
GAME DESIGN & DEVELOPMENT		
Course Code: MVJ21AI741		**CIE Marks:100**
Credits: L:T:P:S:3:0:0:0		**SEE Marks: 100**
Hours: 40L		**SEE Duration: 3 Hrs**

Course Learning Objectives: The students will be able to	
1	Understand the concepts of Game design and development.
2	Learn the processes, mechanics and issues in Game Design.
3	Be exposed to the Core architectures of Game Programming.
4	Know about Game programming platforms, frame works and engines. Learn to develop games.

UNIT-I	
3D Transformations, Quaternions, 3D Modeling and Rendering, Ray Tracing, Shader Models, Lighting, Color, Texturing, Camera and Projections, Culling and Clipping, Character Animation, Physics-based Simulation, Scene Graphs.	**8 Hrs**
UNIT-II	
Game engine architecture, Engine support systems, Resources and File systems, Game loop and real-time simulation, Human Interface devices, Collision and rigid body dynamics, Game profiling.	**8 Hrs**
UNIT-III	
Application layer, Game logic, Game views, managing memory, controlling the main loop, loading and caching game data, User Interface management, Game event management	**8Hrs**
UNIT-IV	
2D and 3D Game development using Flash, DirectX, Java, Python, Game engines - Unity. DX Studio.	**8Hrs**
UNIT-V	
Developing 2D and 3D interactive games using DirectX or Python – Isometric and Tile Based Games, Puzzle games, Single Player games, Multi Player games.	**8Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Discuss the concepts of Game design and development.
CO2	Design the processes, and use mechanics for game development.
CO3	Explain the Core architectures of Game Programming

CO4	Use Game programming platforms, frame works and engines.
CO5	Create interactive Games

Reference Books	
1.	Mike Mc Shaffrfy and David Graham, "Game Coding Complete", Fourth Edition, Cengage Learning, PTR, 2012
2.	Jason Gregory, "Game Engine Architecture", CRC Press / A K Peters, 2009
3.	David H. Eberly, "3D Game Engine Design, Second Edition: A Practical Approach to Real-Time Computer Graphics" 2 nd Editions, Morgan Kaufmann, 2006.
4.	Ernest Adams and Andrew Rollings, "Fundamentals of Game Design", 2 nd Edition Prentice Hall / New Riders, 2009.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

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Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO2	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO3	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO4	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
C05	**2**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

High-3, Medium-2, Low-1

Semester: VII Open Elective III		
COMPUTER GRAPHICS		
Course Code: MVJ21AI741		**CIE Marks:100**
Credits: L:T:P:S:3:0:0:0		**SEE Marks: 100**
Hours: 40L		**SEE Duration: 3 Hrs**

Course Learning Objectives: The students will be able to	
1	Understand the two dimensional graphics and their transformations
2	Gain knowledge about graphics hardware devices and software used.
3	Appreciate illumination and color models.
4	Understand the three dimensional graphics and their transformations.
5	Be familiar with understand clipping techniques.

UNIT-I	
Survey of computer graphics, Overview of graphics systems – Video display devices, Raster scan systems, Random scan systems, Graphics monitors and Workstations, Input devices, Hard copy Devices, Graphics Software; Output primitives – points and lines, line drawing algorithms, loading the frame buffer, line function; circle and ellipse generating algorithms; Pixel addressing and object geometry, filled area primitives.	**8 Hrs**
UNIT-II	
Two dimensional geometric transformations – Matrix representations and homogeneous coordinates, composite transformations; Two dimensional viewing – viewing pipeline, viewing coordinate reference frame; widow-to-viewport coordinate transformation, Two dimensional viewing functions; clipping operations – point, line, and polygon clipping algorithms.	**8 Hrs**
UNIT-III	
Three dimensional concepts; Three dimensional object representations – Polygon surfaces- Polygon tables- Plane equations – Polygon meshes; Curved Lines and surfaces, Quadratic surfaces; Blobby objects; Spline representations – Bezier curves and surfaces - B-Spline curves and surfaces. **TRANSFORMATION AND VIEWING:** Three dimensional geometric and modeling transformations – Translation, Rotation, Scaling, composite transformations; Three dimensional viewing – viewing pipeline, viewing coordinates, Projections, Clipping; Visible surface detection methods	**8 Hrs**
UNIT-IV	

Light sources – basic illumination models – halftone patterns and dithering techniques; Properties of light – Standard primaries and chromaticity diagram; Intuitive colour concepts – RGB colour model – YIQ colour model – CMY colour model – HSV colour model – HLS colour model; Colour selection.	**8Hrs**
UNIT-V	
Design of Animation sequences – animation function – raster animation – key frame systems – motion specification –morphing – tweening. **COMPUTER GRAPHICS REALISM:** Tiling the plane – Recursively defined curves – Koch curves – C curves – Dragons – space filling curves – fractals – Grammar based models – fractals – turtle graphics – ray tracing.	**8Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Design two dimensional graphics
CO2	Apply two dimensional transformations.
CO3	Design three dimensional graphics.
CO4	Apply three dimensional transformations.
CO5	Design animation sequences.

Reference Books	
1.	John F. Hughes, Andries Van Dam, Morgan Mc Guire ,David F. Sklar , James D. Foley, Steven K. Feiner and Kurt Akeley ,"Computer Graphics: Principles and Practice", , 3rd Edition, Addison- Wesley Professional,2013. (UNIT I, II, III, IV)
2.	Donald Hearn and Pauline Baker M, "Computer Graphics", Prentice Hall, New Delhi, 2007 (UNIT V).
3.	Donald Hearn and M. Pauline Baker, Warren Carithers,"Computer Graphics With Open GL", 4th Edition, Pearson Education, 2010.
4.	Hill F S Jr., "Computer Graphics", Maxwell Macmillan" , 1990.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

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each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**1**											
CO2	**1**		**2**	**2**			**1**			**2**	**2**	
CO3	**1**							**2**	**2**	**2**	**1**	
CO4	**1**	**2**				**2**						**2**

High-3, Medium-2, Low-1

Semester: VII Open Elective III		
INTRODUCTION TO HUMAN COMPUTER INTERACTION		
Course Code:MVJ21AI742		**CIE Marks:100**
Credits: L:T:P:S:3:1:0:0		**SEE Marks: 100**
Hours: 40L+26T		**SEE Duration: 3 Hrs**

Course Learning Objectives: The students will be able to	
1	Learn the foundations of Human Computer Interaction.
2	Be familiar with the design technologies for individuals and persons with disabilities.
3	Be aware of mobile HCI.
4	Learn the guidelines for user interface.
5	Learn the foundations of Human Computer Interaction.

UNIT-I	
FOUNDATIONS OF HCI : The Human: I/O channels – Memory – Reasoning and problem solving; The computer: Devices – Memory – processing and networks; Interaction: Models – frameworks – Ergonomics – styles – elements – interactivity- Paradigms. **Video link / Additional online information (related to module if any):** https://www.youtube.com/watch?v=WW1g3UT2zww	**8 Hrs**
UNIT-II	
DESIGN & SOFTWARE PROCESS : Interactive Design basics – process – scenarios – navigation – screen design – Iteration and prototyping. HCI in software process – software life cycle – usability engineering – Prototyping in practice – design rationale. Design rules – principles, standards, guidelines, rules. Evaluation Techniques – Universal Design. **Video link / Additional online information (related to module if any):** https://www.youtube.com/watch?v=dNgK8CXzMSw	**8 Hrs**
UNIT-III	
MODELS& THEORIES: HCI Models: Cognitive models: Socio-Organizational issues and stakeholder requirements –Communication and collaboration models-Hypertext, Multimedia and WWW. **Video link / Additional online information (related to module if any):**	**8 Hrs**

https://www.youtube.com/watch?v=axKhU701LxU	
UNIT-IV	
MOBILE HCI: Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools. – Case Studies **Video link / Additional online information (related to module if any):** https://www.youtube.com/watch?v=o5bPWsfYkQo	**8 Hrs**
UNIT-V	
WEB INTERFACE DESIGN: Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow – Case Studies. **Video link / Additional online information (related to module if any):** https://www.youtube.com/watch?v=QJ9ygdD2sIY	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Design effective dialog for HCI.
CO2	Design effective HCI for individuals and persons with disabilities.
CO3	Assess the importance of user feedback.
CO4	Explain the HCI implications for designing multimedia/ ecommerce/ e-learning Web sites.
CO5	Develop meaningful user interface.

Reference Books	
1.	Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, ―Human Computer Interaction, 3rd Edition, Pearson Education, 2004 (UNIT I, II & III)
2.	Brian Fling, ―Mobile Design and Development, First Edition, O‘Reilly Media Inc., 2009 (UNIT – IV)
3.	Bill Scott and Theresa Neil, ―Designing Web Interfaces, First Edition, O‘Reilly, 2009. (UNIT-V)

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be

more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO/PSO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	-	-	-	-	-	-	-	-	-	-	2	-
CO2	2	2	-	-	-	-	-	-	-	-	-	-	2	2
CO3	2	3	3	2	-	-	-	-	-	-	-	-	1	3
CO4	2	2	1	-	-	-	-	-	-	-	-	-	1	2
CO5	3	1	2	2	-	-	-	-	-	-	-	1	2	-

High-3, Medium-2, Low-1

Semester: VII Open Elective III		
MOBILE APPLICATION DEVELOPMENT		
Course Code:MVJ21AI743		**CIE Marks:100**
Credits: L:T:P:S:3:1:0:0		**SEE Marks: 100**
Hours: 40L+26T		**SEE Duration: 3 Hrs**

Course Learning Objectives: The students will be able to	
1	Demonstrate their understanding of the fundamentals of Android operating systems
2	Demonstrate their skills of using Android software development tools
3	Demonstrate their ability to develop software with reasonable complexity on mobile platform
4	Demonstrate their understanding of the fundamentals of Android operating systems

UNIT-I	
Introduction to Android Operating System: Android OS design and Features – Android development framework, SDK features, Installing and running applications on Eclipse platform, Creating AVDs, Types of Android applications, Best practices in Android programming, Android tools. Android application components – Android Manifest file, Externalizing resources like values, themes, layouts, Menus etc, Android Application Lifecycle – Activities, Activity lifecycle, activity states, monitoring state changes **Video link / Additional online information (related to module if any):** https://www.youtube.com/watch?v=deq8mkt_cxQ	**8 Hrs**
UNIT-II	
Android User Interface: Measurements – Device and pixel density independent measuring units Layouts – Linear, Relative, Grid and Table Layouts User Interface (UI) Components – Editable and non editable Text Views, Buttons, Radio and Toggle Buttons, Checkboxes, Spinners, Dialog and pickers Event Handling – Handling clicks or changes of various UI components Fragments – Creating fragments, Lifecycle of fragments, Fragment states, Adding fragments to Activity, adding, removing and replacing fragments with fragment transactions, interfacing between fragments and Activities, Multi-screen Activities **Applications:** Design a Simple Calculator App **Video link / Additional online information (related to module if any):** https://www.youtube.com/watch?v=PJ3RdfJ4Np8	**8 Hrs**
UNIT-III	

Intents and Broadcasts: Intent – Using intents to launch Activities, Explicitly starting new Activity, Implicit Intents, Passing data to Intents, Getting results from Activities, Native Actions, using Intent to dial a number or to send SMS Broadcast Receivers – Using Intent filters to service implicit Intents, Resolving Intent filters, finding and using Intents received within an Activity Notifications – Creating and Displaying notifications, Displaying Toast. **Video link / Additional online information (related to module if any):** https://nptel.ac.in/courses/106/106/106106147/	**8 Hrs**
UNIT-IV	
Persistent Storage: Files – Using application specific folders and files, creating files, reading data from files, listing contents of a directory Shared Preferences – Creating shared preferences, saving and retrieving data using Shared Preference Database – Introduction to SQLite database, creating and opening a database, creating tables, inserting retrieving and deleting data, Registering Content Providers, Using content Providers (insert, delete, retrieve and update) **Video link / Additional online information (related to module if any):** http://developer.android.com/develop/index.htm	**8 Hrs**
UNIT-V	
Advanced Topics: Alarms – Creating and using alarms Using Internet Resources – Connecting to internet resource, using download manager Location Based Services – Finding Current Location and showing location on the Map, updating location **Video link / Additional online information (related to module if any):** https://www.codeschool.com/learn/ios	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Understand the fundamentals of Android operating systems
CO2	Understand various layouts and designing UI.
CO3	Understand major Android components intents, broadcasting and notifications.
CO4	Understand basic concepts of SQLite database.
CO5	Understand how to utilize Location based services.

Reference Books	
1.	Charlie Collins, Michael Galpin and Matthias Kappler, “Android in Practice”, DreamTech, 2012
2.	David Mark, Jack Nutting, Jeff LaMarche and Frederic Olsson, “Beginning iOS 6 Development: Exploring the iOS SDK”, Apress, 2013.
3.	Google Developer Training, "Android Developer Fundamentals Course – Concept Reference”, Google Developer Training Team, 2017.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO/PSO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	-	-	-	-	-	-	-	-	3	1	-
CO2	3	3	1	-	-	-	-	-	-	-	-	3	3	-
CO3	3	3	1	2	-	-	-	-	-	1	-	3	1	-
CO4	3	3	3	3	-	-	-	2	2	2	-	3	2	2
CO5	3	3	3	3	-	-	2	2	3	2	-	3	1	-

High-3, Medium-2, Low-1

Semester: VII Open Elective III		
QUANTUM COMPUTING		
Course Code:MVJ21AI744		**CIE Marks:100**
Credits: L:T:P:S:3:1:0:0		**SEE Marks: 100**
Hours: 40L+26T		**SEE Duration: 3 Hrs**

Course Learning Objectives: The students will be able to	
1	To understand the building blocks of a quantum computer.
2	To understand the principles, quantum information and limitation of quantum operations formalizing
3	To understand the quantum error and its correction.

UNIT-I	
FUNDAMENTAL CONCEPTS: Global Perspectives, Quantum Bits, Quantum Computation, Quantum Algorithms, Quantum Information, Postulates of Quantum Mechanisms. **Video Links :** https://www.youtube.com/watch?v=3yoyVCAQH4M	**8 Hrs**
UNIT-II	
QUANTUM COMPUTATION : Quantum Circuits – Quantum algorithms, Single Orbit operations, Control Operations, Measurement, Universal Quantum Gates, Simulation of Quantum Systems, Quantum Fourier transform, Phase estimation, Applications, Quantum search algorithms – Quantum counting – Speeding up the solution of NP – complete problems – Quantum Search for an unstructured database. **Video Links:** https://www.youtube.com/watch?v=OlatlIaqPj8	**8 Hrs**
UNIT-III	
QUANTUM COMPUTERS : Guiding Principles, Conditions for Quantum Computation, Harmonic Oscillator Quantum Computer, Optical Photon Quantum Computer – Optical cavity Quantum electrodynamics, Ion traps, Nuclear Magnetic resonance. **Video Links:** https://www.youtube.com/watch?v=Nq4YZtINNAQ	**8 Hrs**
UNIT-IV	
QUANTUM INFORMATIONS: Quantum noise and Quantum Operations – Classical Noise and Markov Processes, Quantum Operations, Examples of Quantum noise and Quantum Operations – Applications of Quantum operations, Limitations of the Quantum operations formalism, Distance Measures for Quantum information. **Video Links**: https://nptel.ac.in/courses/115/101/115101092/	**8 Hrs**
UNIT-V	
QUANTUM ERROR CORRECTION :Introduction, Shor code, Theory of Quantum Error – Correction, Constructing Quantum Codes, Stabilizer codes, Fault – Tolerant Quantum Computation, Entropy and information – Shannon Entropy, Basic properties of Entropy, Von Neumann, Strong Sub Additivity, Data Compression, Entanglement as a physical resource. Video Links**:https://www.digimat.in/nptel/courses/video/115101092/L23.html**	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Define and explain basic concepts in Quantum computing.
CO2	Demonstrate applications of Quantum computing.
CO3	Explain principles in the design of Quantum Computers

CO4	Discuss applications and limitations of Quantum operations
CO5	Explain theory and concepts in Quantum error correction.

Reference Books	
1.	Micheal A. Nielsen and Issac L. Chiang, "Quantum Computation and Quantum Information", Cambridge University Press, Fint South Asian Edition, 2002
2.	Bennett C.H., Bernstein E., Brassard G., Vazirani U., The strengths and weaknesses of quantum computation. SIAM Journal on Computing.
3.	Mika Hiravensalo, "Quantum computing" II edition, ACM computing classification, Springer-2004

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO/PSO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	2	3	3	-	-	-	-	-	-	2	2	-
CO2	3	3	2	3	3	-	-	-	-	-	-	2	2	2
CO3	3	3	2	3	2	-	-	-	-	-	-	2	3	-
CO4	3	3	2	3	2	-	-	-	-	-	-	2	3	-
CO5	3	3	2	3	3	-	-	-	-	-	-	2	3	1

High-3, Medium-2, Low-1

Semester: VII		
PROJECT PHASE – 1 (Theory)		
Course Code: MVJ21AIPR75		**CIE Marks:100**
Credits: L:T:P:S:3:0:0:0		**SEE Marks: 100**
Hours: 40L		**SEE Duration: 3 Hrs**

Course Learning Objectives: The students will be able to	
1	To support independent learning.
2	To develop interactive, communication, organization, time management, and presentation skills.
3	To impart flexibility and adaptability
4	To expand intellectual capacity, credibility, judgment, intuition.
5	To train students to present the topic of project work in a seminar without any fear, face audience confidently, enhance communication skill, involve in group discussion to present and exchange ideas

Project Work Phase - I
Each student of the project batch shall involve in carrying out the project work jointly in constant consultation with internal guide, co-guide, and external guide and prepare the project report as per the norms avoiding plagiarism.

Course Outcomes: After completing the course, the students will be able to	
CO1	Describe the project and be able to defend it.
CO2	Learn to use modern tools and techniques
CO3	Develop skills to work in a team to achieve common goal. Develop skills of project management and finance.
CO4	Develop skills of self-learning, evaluate their learning and take appropriate actions to improve it.
CO5	Prepare them for life-long learning to face the challenges and support the technological changes to meet the societal needs.

Scheme of Evaluation
Internal Marks: The Internal marks (50 marks) evaluation shall be based on Phase wise completion of the project work, Project report, Presentation and Demonstration of the actual/model/prototype of the project.

CIE Marks Breakup for Major Project during VII Semester :

Relevance of the Topic	10 Marks
Report	20 Marks
Evaluation by Guide	25 Marks
Presentation	30 Marks
Viva- Voce	15 Marks
Total	100 Marks

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**2**	**2**	**2**	**3**	**3**	**2**	**1**	**1**	**2**	**1**	**1**	**2**
CO2	**2**	**2**	**2**	**3**	**3**	**2**	**1**	**1**	**2**	**1**	**2**	**2**
CO3	**2**	**2**	**2**	**3**	**3**	**2**	**1**	**1**	**2**	**1**	**2**	**2**
CO4	**2**	**2**	**2**	**3**	**3**	**2**	**1**	**1**	**2**	**1**	**2**	**2**
CO5	**2**	**2**	**2**	**3**	**3**	**2**	**1**	**1**	**2**	**1**	**2**	**2**

High-3, Medium-2, Low-1

VIII SEMESTER

Semester: VIII		
PROJECT PHASE – 2 (Theory)		
Course Code: MVJ21AIP81		**CIE Marks:100**
Credits: L:T:P:S:3:0:0:0		**SEE Marks: 100**
Hours: 40L		**SEE Duration: 3 Hrs**

Course Learning Objectives: The students will be able to	
1	To support independent learning
2	To develop interactive, communication, organization, time management, and presentation skills
3	To impart flexibility and adaptability.
4	To inspire independent and team working.
5	To expand intellectual capacity, credibility, judgment, intuition.
6	To adhere to punctuality, setting and meeting deadlines.
7	To instill responsibilities to oneself and others
8	To train students to present the topic of project work in a seminar without any fear, face audience confidently, enhance communication skill, involve in group discussion to present and exchange ideas.

Project Work Phase - II:
Each student of the project batch shall involve in carrying out the project work jointly in constant consultation with internal guide, co-guide, and external guide and prepare the project report as per the norms avoiding plagiarism.

Course Outcomes: After completing the course, the students will be able to	
CO1	Describe the project and be able to defend it.Develop critical thinking and problem solving skills
CO2	Learn to use modern tools and techniques. Communicate effectively and to present ideas clearly and coherently both in written and oral forms.
CO3	Develop skills to work in a team to achieve common goal. Develop skills of project management and finance.
CO4	Develop skills of self-learning, evaluate their learning and take appropriate actions to improve it.
CO5	Prepare them for life-long learning to face the challenges and support the technological changes to meet the societal needs.

Scheme of Evaluation :
Internal Marks: The Internal marks (50 marks) evaluation shall be based on Phase wise completion of the project work, Project report, Presentation and Demonstration of the actual/model/prototype of the project. Semester End Examination: SEE marks for the project (50 marks) shall be based on Project report, Presentation and Demonstration of the actual/model/prototype of the project, as per the norms by the examiners appointed

CIE Marks Breakup for Major Project during VIII Semester :

Seminar on Project and Demonstration	20 Marks
Report	10 Marks
Evaluation by Guide	15 Marks
Co-curricular Activities	05 Marks
Total	**50 Marks**

Breakup for SEE Marks for Major Project

Project Report , Presentation, Demonstration and Quality of Work	30 Marks
Viva- Voce	25 Marks
Total	**50 Marks**

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**2**	**2**	**2**	**3**	**3**	**2**	**1**	**1**	**2**	**1**	**1**	**2**
CO2	**2**	**2**	**2**	**3**	**3**	**2**	**1**	**1**	**2**	**1**	**2**	**2**
CO3	**2**	**2**	**2**	**3**	**3**	**2**	**1**	**1**	**2**	**1**	**2**	**2**
CO4	**2**	**2**	**2**	**3**	**3**	**2**	**1**	**1**	**2**	**1**	**2**	**2**
CO5	**2**	**2**	**2**	**3**	**3**	**2**	**1**	**1**	**2**	**1**	**2**	**2**

High-3, Medium-2, Low-1

Semester: VIII		
INTERNSHIP (Theory)		
Course Code: MVJ21AIINT82		**CIE Marks:100**
Credits: L:T:P:S:3:0:0:0		**SEE Marks: 100**
Hours: 40L		**SEE Duration: 3 Hrs**

Course Learning Objectives: The students will be able to	
1	To get the field exposure and experience
2	To apply the theoretical concept in field application
3	To prepare the comparison statement of difference activities

Internship:
This shall be carried out by students in industry set-up related to the laboratories/research organizations/project management consulting firms/QS and QA organizations/ planning and design offices/Professional organizations and other avenues related to the computer science and engineering domain in consultation and approval of internship guide/HOD /internship committees of the institutions

Course Outcomes: After completing the course, the students will be able to	
CO1	Develop skills to work in a team to achieve common goal. Develop skills of project management and finance.
CO2	Develop skills of self-learning, evaluate their learning and take appropriate actions to improve it.
CO3	Prepare them for life-long learning to face the challenges and support the technological changes to meet the societal needs.

Scheme of Evaluation :
Marks: The marks (100 marks) evaluation shall be based on final presentation of the activities undertaken during the internship, to a panel comprising internship guide, a senior faculty from the department and head of the department. Each student should submit the internship report at the end of semester with internship certificate. Semester End Examination: Viva-Voce examination shall be conducted by a panel of examiners consisting of internship supervisor, a senior faculty from the department and head of the department.

Marks Breakup for Industry Training Evaluation:

Evaluation by the supervisor under whom the training was carried out	25 Marks
Evaluation by i) Relevance of the Industrial Internship	10 Marks
ii) Report	25 Marks
iii) Evaluation	40 Marks
Total	**100 Marks**

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**2**	**2**	**2**	**3**	**3**	**2**	**1**	**1**	**2**	**1**	**1**	**2**
CO2	**2**	**2**	**2**	**3**	**3**	**2**	**1**	**1**	**2**	**1**	**2**	**2**
CO3	**2**	**2**	**2**	**3**	**3**	**2**	**1**	**1**	**2**	**1**	**2**	**2**
CO4	**2**	**2**	**2**	**3**	**3**	**2**	**1**	**1**	**2**	**1**	**2**	**2**
CO5	**2**	**2**	**2**	**3**	**3**	**2**	**1**	**1**	**2**	**1**	**2**	**2**

High-3, Medium-2, Low-1

Semester: VIII		
TECHNICAL SEMINAR		
Course Code: MVJ21AIS83		**CIE Marks:100**
Credits: L:T:P:S:3:0:0:0		**SEE Marks: 100**
Hours: 40L		**SEE Duration: 3 Hrs**
Course Learning Objectives: The students will be able to		
1	To inculcate self-learning, face audience confidently, enhance communication skill, involve in group discussion and present and exchange ideas.	

Seminar:

Each student, under the guidance of a Faculty, is required to choose, preferably, a recent topic of his/her interest relevant to the course of specialization. Carryout literature survey; organize the Course topics in a systematic order.

- Conduct literature survey in the domain area to find appropriate topic.
- Prepare the synopsis report with own sentences in a standard format.
- Learn to use MS word, MS power point, MS equation and Drawing tools or any such facilities in the preparation of report and presentation.
- Present the seminar topic orally and/or through power point slides.
- Communicate effectively to answer the queries and involve in debate/discussion.

The participants shall take part in discussion to foster friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident

Course Outcomes: After completing the course, the students will be able to	
CO1	Develop knowledge in the field of Computer Science and Engineering and other disciplines through independent learning and collaborative study.
CO2	Identify and discuss the current, real-time issues and challenges in engineering & technology. Develop written and oral communication skills
CO3	Explore concepts in larger diverse social and academic contexts.
CO4	Apply principles of ethics and respect in interaction with others.
CO5	Develop the skills to enable life-long learning

Scheme of Evaluation :

Marks: The marks (100 marks) evaluation shall be based on final presentation, to a panel comprising seminar guide, a senior faculty from the department and head of the department. Each student should submit the Seminar report at the end of semester.

Semester End Examination: Viva-Voce examination shall be conducted by a panel of examiners consisting of seminar supervisor, a senior faculty from the department and head of the department.

Marks Breakup for Seminar :

Relevance of the Topic	10 Marks
Report	20 Marks
Presentation	50 Marks
Viva- Voce	20 Marks
Total	**100 Marks**

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**2**	**2**	**2**	**3**	**3**	**2**	**1**	**1**	**2**	**1**	**1**	**2**
CO2	**2**	**2**	**2**	**3**	**3**	**2**	**1**	**1**	**2**	**1**	**2**	**2**
CO3	**2**	**2**	**2**	**3**	**3**	**2**	**1**	**1**	**2**	**1**	**2**	**2**
CO4	**2**	**2**	**2**	**3**	**3**	**2**	**1**	**1**	**2**	**1**	**2**	**2**
CO5	**2**	**2**	**2**	**3**	**3**	**2**	**1**	**1**	**2**	**1**	**2**	**2**

High-3, Medium-2, Low-1