MVJCE CURRICULUM

FOR

COMPUTER SCIENCE & ENGINEERING(Scheme 2020)

III SEMESTER

Course Title	DATA STRUCTURES AND APPLICATIONS	**Semester**	03
Course Code	MVJ20CS32	**CIE**	50
Total No. of Contact Hours	50 L : T : P :: 40 : 10 : 0	**SEE**	50
No. of Contact Hours/week	4	**Total**	100
Credits	4	**Exam. Duration**	3 Hours

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

- Identify the importance of data structures & memory allocation.
- Perform operations on stacks and queues and its applications.
- Apply the operations of linked list, Trees & Graphs in various applications.
- Apply searching and sorting operations in real time applications.

Module-1	**RBT Level** L1,L2, L3	**Hours 10**

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;
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

Module-2	**RBT Level** L1,L2, L3	**Hours 10**

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/

Module-3	**RBT Level** L1,L2, L3	**Hours 10**

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

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) = 6x2 y 2 z-

4yz5 +3x3 yz+2xy5 z-2xyz3 b. Find the sum of two polynomials POLY1(x,y,z) and POLY2(x,y,z) and store the result in POLYSUM(x,y,z) Support the program with appropriate functions for each of the above operations

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/

Module-4	**RBT Level** L1,L2, L3	**Hours 10**

Trees: Terminology, Binary Trees, Properties of Binary trees, Array and linked 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 telehone 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

Module-5	**RBT Level** L1,L2, L3	**Hours 10**

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:

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

Course outcomes:

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.

Text/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	Reema Thareja, Data Structures using C, 3rd Ed, Oxford press, 2012.
4	Mark Allen Weiss, ―Data Structures and Algorithm Analysis in C‖, 2nd Edition, Pearson Education,1997.
5	Gilberg & Forouzan, Data Structures: A Pseudo-code approach with C, 2nd Ed, Cengage Learning,2014.
6	Jean-Paul Tremblay & Paul G. Sorenson, An Introduction to Data Structures with Applications, 2nd Ed, McGraw Hill, 2013
7	A M Tenenbaum, Data Structures using C, PHI, 1989
8	Robert Kruse, Data Structures and Program Design in C, 2nd Ed, PHI, 1996.
9	http://opendatastructures.org, https://donsheehy.github.io/datastructures

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

High-3, Medium-2, Low-1

Course Title	OBJECT ORIENTED PROGRAMMING	**Semester**	03
Course Code	MVJ20CS33	**CIE**	50

Total No. of Contact Hours	40 L: T : P :: 40 : 0 : 0	**SEE**	50
No. of Contact Hours/week	3	**Total**	100
Credits	3	**Exam. Duration**	3 Hours

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

- Identify the need for Java - an object oriented language. Set up Java JDK environment to create, debug and run simple Java programs.
- Illustrate the use of classes and distinguish the usage of different types of Inheritance and constructors in real world.
- Demonstrate the use of exceptions and to create multi-threaded programs
- Illustrate the use of Collections with elements in Java program.
- Develop Java Application using JDBC connectivity.

Module-1	**RBT Level** L1,L2, L3	**Hours 8**

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

Module-2	**RBT Level** L2, L3	**Hours 8**

Classes, Inheritance, Packages and Interfaces: Classes fundamentals; Declaring objects;

Assigning object reference variables; Introducing Methods, Constructors, this 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

Module-3	**RBT Level** L2,L3,L4	**Hours 8**

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 isAlive() 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

Module-4	**RBT Level** L3,L4, L6	**Hours 8**

The collections and Framework: Collections Overview, Recent Changes to Collections, The Collection Interfaces, The Collection Classes, Accessing a collection Via an Iterator, 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

Module-5	**RBT Level** L4,L5, L6	**Hours 8**

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; ResultSet; 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

Course outcomes:	
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.

Text/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.
5.	Mahesh Bhave and Sunil Patekar, "Programming with Java", First Edition, Pearson Education,2008, ISBN:9788131720806
6.	Rajkumar Buyya , S Thamarasi selvi, xingchen chu, Object oriented Programming with java, Tata McGraw Hill education private limited.
7.	E Balagurusamy, Programming with Java A primer, Tata McGraw Hill companies.

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

Course Title	OPERATING SYSTEMS	**Semester**	03
Course Code	MVJ20CS34	**CIE**	50
Total No. of Contact Hours	40 L : T : P :: 40 : 0 : 0	**SEE**	50
No. of Contact Hours/week	3	**Total**	100
Credits	3	**Exam. Duration**	3 Hours

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

- Introduce concepts and terminology used in OS.
- Explain threading and multithreaded systems.
- Illustrate process synchronization and concept of Deadlock.
- Introduce Memory and Virtual memory management, File system and storage techniques.

Module-1	RBT Level L1,L2, L3	Hours 8
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.		
Module-2	**RBT Level** L1,L2, L3	**Hours 8**
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.		
Module-3	**RBT Level** L1,L2, L3	**Hours 8**
Deadlocks : Deadlocks; System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock. **Memory Management**: Memory management strategies: Background; Swapping; Contiguous memory allocation; Paging; Structure of page table; Segmentation		
Module-4	**RBT Level** L1,L2, L3	**Hours 8**
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.		
Module-5	**RBT Level** L1,L2, L3	**Hours 8**
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.

Course outcomes:	
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.

Text/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,

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

High-3, Medium-2, Low-1

Course Title	COMPUTER ORGANIZATION AND ARCHITECTURE	**Semester**	03
Course Code	MVJ20CS35	**CIE**	50
Total No. of Contact Hours	40 L: T : P :: 40 : 0 :0	**SEE**	50

No. of Contact Hours/week	3	**Total**	100
Credits	3	**Exam. Duration**	3 Hours

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

- To learn the basic structure and operations of a computer.
- To learn the arithmetic and logic unit.
- To learn the different ways of communication with I/O devices & memories, memory hierarchies, cache memories and virtual memories.
- To understand & implement arithmetic process.
- To understand the processor and pipelining concepts.
- To understand parallelism and multi-core processors.

Module-1	**RBT Level** L1,L2,L3	**Hours 8**

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 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/

Module-2	**RBT Level** L1,L2,L3	**Hours 8**

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		
Module-3	**RBT Level** L1,L2,L3	**Hours 8**
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/		
Module-4	**RBT Level** L1,L2,L3	**Hours 8**
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 **Video link:** https://nptel.ac.in/courses/106106166/		
Module-5	**RBT Level** L1,L2,L3	**Hours 8**
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/		

Course outcomes:	
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.

Text/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.
5	http://vlabs.iitkgp.ac.in/coa/

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

High-3, Medium-2, Low-1

Course Title	PYTHON PROGRAMMING	**Semester**	03
Course Code	MVJ20CS36	**CIE**	50
Total No. of Contact Hours	40 L : T : P :: 40 : 0 : 0	**SEE**	50
No. of Contact Hours/week	3	**Total**	100
Credits	3	**Exam. Duration**	3 Hours

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

- Familiarize the students with the fundamentals and programming basics of Python Language

Module-1	**RBT Level** L2	**Hours 8**

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 dicing, Reassigning a Python List (Mutable), Reassigning the whole Python list, Deleting list and elements, Multidimensional Lists, List Operations, Built-in List Functions.

Module-2	**RBT Level** L2, L3	**Hours 8**

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.

Module-3	**RBT Level** L2, L3	**Hours 8**

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

Module-4	**RBT Level** L2, L3	**Hours 8**

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.

Module-5	**RBT Level** L2	**Hours 8**

File Handling In Python: Read and Write File, Open File, Close File, File Methods, Data Base connections.

Course outcomes:

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.

Text/Reference Books:	
1	Michael T. Goodrich, Roberto Tamassia, Michael H. GoldwasserData Structures and Algorithms in PythonJohn 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)

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

Course Title	DATA STRUCTURES AND APPLICATIONS LABORATORY	**Semester**	03
Course Code	MVJ20CSL37	**CIE**	50
Total No. of Contact Hours	40 L : T : P :: 10 : 0 : 30	**SEE**	50
No. of Contact Hours/week	3	**Total**	100
Credits	2	**Exam. Duration**	3 Hours

Course objective is to: ***This course will enable students to develop, implement, analyze and evaluation of***

- Linear data structures and their applications such as stacks, queues and lists,
- Non-Linear data structures and their applications such as Trees &Graphs
- Sorting and Hashing techniques.

<table>
<tr><th>Sl No</th><th>Experiment Name</th><th>RBT Level</th><th>Hours</th></tr>
<tr><td>1</td><td>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,
<table>
<tr><td>S.No</td><td>Cities</td><td>Number of items</td></tr>
<tr><td>1</td><td>Agra</td><td>25</td></tr>
<tr><td>2</td><td>Chennai</td><td>50</td></tr>
<tr><td>3</td><td>Kolkata</td><td>59</td></tr>
<tr><td>4</td><td>Mumbai</td><td>72</td></tr>
<tr><td>5</td><td>Delhi</td><td>12</td></tr>
</table>
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.</td><td>L3</td><td>3</td></tr>
<tr><td>2</td><td>Implement Knuth-Morris- Pratt pattern matching algorithm using C program.</td><td>L3</td><td>3</td></tr>
<tr><td>3</td><td>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</td><td>L3</td><td>3</td></tr>
<tr><td>4</td><td>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</td><td>L3</td><td>3</td></tr>
</table>

	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	**L3**	**3**
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	**L3**	**3**
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	**L3**	**3**
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.	**L3**	**3**

	b) Traverse the BST recursively in inorder, preorder & postorder c) 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	**L3**	**3**
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.	**L3**	**3**
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.	**L3**	**3**

Course outcomes:	
CO1	Analyze and Compare various linear data structures.
CO2	Code, debug and demonstrate the working nature of different types of data structures and the applications.
CO3	Implement, analyse and evaluate the searching and sorting algorithms.
CO4	Choose the appropriate data structure for solving real world problems.

CO-PO/PSO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2

CO1	3	3	2	-	3	3	-	-	3	-	3	2	1	-
CO2	3	3	2	-	3	3	-	-	3	-	3	2	1	2
CO3	3	3	2	-	3	3	-	-	3	-	3	2	2	3
CO4	3	3	2	-	3	3	-	-	3	-	3	2	2	2

High-3, Medium-2, Low-1

Course Title	PYTHON PROGRAMMING LABORATORY	**Semester**	03
Course Code	MVJ20CSL37	**CIE**	50
Total No. of Contact Hours	40 L : T : P :: 10 : 0 : 30	**SEE**	50
No. of Contact Hours/week	3	**Total**	100
Credits	2	**Exam. Duration**	3 Hours

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

- Solve computer software problems by writing customized programs in an efficient way using python Language.

Sl No	**Experiment Name**	**RBT Level**	**Hours**
1	Python Program to Print the Fibonacci sequence.	**L3**	**3**
2	Python Program to Multiply Two Matrices	**L3**	**3**
3	Python Program To Display Powers of 2 Using Anonymous Function.	**L3**	**3**
4	Python Program to Make a Simple Calculator	**L3**	**3**
5	Python Program to Find Sum of Natural Numbers Using Recursion	**L3**	**3**
6	Python Program to Sort Words in Alphabetic	**L3**	**3**
7	Python Program to Find the sum of list elements	**L3**	**3**
8	Demonstrate using python programming to Read and write into a file	**L3**	**3**
9	Implement a Sequential Search using Python.	**L3**	**3**
10	Explore String Functions using Python.	**L3**	**3**
11	Simulate elliptical orbits in Pygame	**L3**	**3**
12	Simulate bouncing ball using Pygame	**L3**	**3**

Course outcomes:	
CO1	Implement Python programs with conditionals and loops.
CO2	Represent compound data using Python lists, tuples, dictionaries.
CO3	Use functions for structuring Python programs.
CO4	Read and write data from/to files in Python.

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

High-3, Medium-2, Low-1

IV SEMESTER

Course Title	ANALYSIS AND DESIGN OF ALGORITHMS	**Semester**	04
Course Code	MVJ20CS42	**CIE**	50
Total No. of Contact Hours	50 L : T : P :: 40 : 10 : 0	**SEE**	50
No. of Contact Hours/week	4	**Total**	100
Credits	4	**Exam. Duration**	3 Hours

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

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

Module-1	**RBT Level** L1,L2 , L3	**Hours 10**

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/

Module-2	**RBT Level** L2 , L3	**Hours 10**

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

Module-3	**RBT Level** L2,L3 , L4	**Hours 10**

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/

Module-4	**RBT Level** L3,L4 , L6	**Hours 10**

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/

Module-5	**RBT Level** L4,L5 ,L6	**Hours 10**

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/	
Course outcomes:	
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.

Text/Reference Books:	
1	Introduction to the Design and Analysis of Algorithms, Anany Levitin:, 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/
5	Computer Algorithms/C++, Ellis Horowitz, Satraj Sahni and Rajasekaran, 2nd Edition, 2014, Universities Press.

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

High-3, Medium-2, Low-1

Course Title	SOFTWARE ENGINEERING	**Semester**	04
Course Code	MVJ20CS43	**CIE**	50

Total No. of Contact Hours	40 L : T : P :: 40 : 0 : 0	**SEE**	50
No. of Contact Hours/week	3	**Total**	100
Credits	3	**Exam. Duration**	3 Hours

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

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

Module-1	**RBT Level** L1,L2, L3	**Hours 8**

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/

Module-2	**RBT Level** L1,L2, L3	**Hours 8**

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

Module-3	**RBT Level** L1,L2, L3	**Hours 8**

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.

Applications: In Software development process.

Video link / Additional online information: https://www.youtube.com/watch?v=T3q6QcCQZQg

Module-4	**RBT Level** L1,L2, L3	**Hours 8**

COMPONENT BASED SOFTWARE ENGINEERING

Engineering of Component-Based Systems; The CBSE Process; Domain Engineering; Component-Based Development; Classifying and Retrieving Components; Economics of CBSE

Laboratory Sessions/ Experimental learning: Create a project using MS projects for any real time scenario.

Applications: In Software development process.

Video link / Additional online information: https://youtu.be/tIZ1dg4pxCE

Module-5	**RBT Level** L1,L2, L3	**Hours 8**

SOFTWARE QUALITY PROCESS IMPROVEMENT Overview of Quality management and Process Improvement; Overview of SEI -CMM, ISO 9000, CMMI, PCMM, TQM and Six Sigma; overview of CASE tools. Software tools and environments: Programming environments; Project management tools; Requirements analysis and design modelling tools; testing tools; Configuration management tools;

Laboratory Sessions/ Experimental learning: Estimation of test coverage metrics using manual test metrics.

Applications: In Software development process. **Video link / Additional online information:** https://nptel.ac.in/courses/110105039/	
Course outcomes:	
CO1	Comprehend software development life cycle and Prepare SRS document for a project
CO2	Apply software design and development techniques
CO3	Identify verification and validation methods in a software engineering project
CO4	Apply on Component based software development process.
CO5	Involve in continuous learning to solve issues of process and software product using the advanced CASE tools and techniques.

Text/Reference Books:	
1	Ian Sommerville, "Software Engineering", 9th Edition, Addison- Wesley, 2011
2	R. S. Pressman, Software Engineering, a practitioner's approach, McGraw Hill,7th Edition, 2010
3	Rajib Mall, "Fundamentals of Software Engineering", PHI Publication, 3rd edition, 2009
4	Pankaj Jalote: An Integrated Approach to Software Engineering, Wiley India.

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

High-3, Medium-2, Low-1

Course Title	LINUX INTERNALS	**Semester**	04
Course Code	MVJ20CS44	**CIE**	50
Total No. of Contact Hours	40 L : T : P :: 40 : 0 : 0	**SEE**	50
No. of Contact Hours/week	3	**Total**	100

Credits	3	Exam. Duration	3 Hours

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

- To introduce Linux server and various distributions
- To understand user administration and make use of internet and intranet services.
- To learn Linux process control and shell programming.

Module-1	**RBT Level** L1,L2, L3	**Hours 8**

Linux Distributions –Open source software and GNU- Difference between Windows and Linux , Installing Linux in a server configuration, GNOME and KDE– X window system, Managing software.

Video link / Additional online information: https://www.youtube.com/watch?v=LzW87BLMhNc

Module-2	**RBT Level** L1,L2, L3	**Hours 8**

Managing users – User text files –User management tools, Command Line, Boot loaders, File Systems, Core System services, Compiling Linux kernel, Linux -Firewall.

Video link / Additional online information: https://www.youtube.com/watch?v=1hf_0EeOYBY

Module-3	**RBT Level** L1,L2, L3	**Hours 8**

DNS, FTP-Mechanics- Installing and customizing the server, setting up web server using Apache, SMTP - Install, configure and run postfix server, POP and IMAP, SSH - public key cryptography, creating a secure tunnel.

Video link / Additional online information: https://www.youtube.com/watch?v=ziaW3KdSOkI

Module-4	**RBT Level** L1,L2, L3	**Hours 8**

NFS – enable and configure NFS server and client, NIS – configuring Master and secondary NIS server and Client -NIS tools, SAMBA – Administration, Printing –Install cups – add and manage print jobs, DHCP, Virtualization.

Video link / Additional online information: https://www.youtube.com/watch?v=-X-_x0-4p3U

Module-5	**RBT Level** L1,L2, L3	**Hours 8**

Linux process environment – login process – parent child relationship – process variable- process monitoring – Invoking foreground and background process – terminating process - Daemons .Introduction to Shell programming – Shell scripts – executing shell scripts - creating scripts – simple examples.

Video link / Additional online information: https://www.youtube.com/watch?v=akU1Ji8Vzdk	
Course outcomes:	
CO1	Illustrate the fundamental concepts of Linux.
CO2	Understand the Single Host Administration Features.
CO3	Demonstrate Internet Services in Linux.
CO4	Deploy Intranet Services in Linux.
CO5	Analyze Linux process Environment and Shell Programming.

Text/Reference Books:	
1	Wale Soyinka, "Linux Administration A Beginners Guide", 5th edition, Tata McGraw-Hill, 2009. Ch1-9,13,16-24,26-28)Unit I-IV
2	Mc Kinnon, Mc Kinnon, "Installing and Administrating Linux", 2nd edition, Wiley, 2004. (Ch12,13)Unit-V
3	Steven Graham, Steve Shah, "Linux Administration A Beginners Guide", 3rd edition, Dreamtech press, 2003
4	Christopher Negus, "Red Hat Linux 9 Bible", Wiley Dreamtech India Pvt Ltd.2002

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

High-3, Medium-2, Low-1

Course Title	ARTIFICIAL INTELLIGENCE	**Semester**	04
Course Code	MVJ20CS46	**CIE**	50
Total No. of Contact Hours	40 L : T : P :: 40 : 0 : 0	**SEE**	50
No. of Contact Hours/week	3	**Total**	100
Credits	3	**Exam. Duration**	3 Hours

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

- Describe the basic principles, techniques, and applications of Artificial Intelligence
- Analyze and explain different AI learning methods.
- Compare and contrast different AI techniques available.

Module-1	**RBT Level** L1,L2	**Hours 8**

INTRODUCTION: What Is AI? The Foundations of Artificial Intelligence ,The History of Artificial Intelligence, The State of the Art .

Intelligent Agents : Agents and Environments ,Good Behavior: The Concept of Rationality ,The Nature of Environments, The Structure of Agents.Knowledge Representation Issues, Using Predicate Logic, Representing knowledge using Rules.

Experimental Learning: Implementation of Relational and Inheritable Knowledge

Video Links

- https://www.youtube.com/watch?v=3MW3ICnkQ9k

Module-2	**RBT Level** L1,L2 , L3	**Hours 8**

PROLOG- The natural Language of Artificial Intelligence: Introduction, Converting English to Prolog Facts and Rules, Goals, Prolog Terminology, Variables, Control Structures, Arithmetic operators, Matching in Prolog, Backtracking, Cuts, Recursion, Lists, Dynamic databases, Input/Output and Streams

Using Predicate Logic: Representing simple facts in logic, representing instance and ISA relationships, Computable Functions and Predicates, Resolution, Natural Deduction.

Experimental Learning:

Implementing programs in PROLOG to solve problems of Predicate Logic

Video Links:

- https://www.youtube.com/watch?v=pzUBrJLIESU

- https://www.youtube.com/watch?v=2juspgYR7as
- https://www.youtube.com/watch?v=h9jLWM2lFr0
- https://www.youtube.com/watch?v=-v1K9AnkAeM

Module-3	**RBT Level** L1,L2 , L3	**Hours 8**

Heuristic search techniques: Generate and test, Hill Climbing, Best First Search, Problem Reduction, Constraint Satisfaction, Means-ends Analysis.

Weak Slot- and- Filler Structures: Semantic Nets ,Frames.

Strong slot-and Filler Structures- Conceptual Dependency, Scripts.

Experimental Learning :

Program to implement Best first Search, A*, AO* algorithm

Video Links:

- https://www.youtube.com/watch?v=ieZr_TpRwnQ
- https://www.youtube.com/watch?v=lCrHYT_EhDs

Module-4	**RBT Level** L1,L2 ,L3	**Hours 8**

Game Playing : Overview, Minimax Search Procedure, Adding alpha beta cut off, Additional Refinements, Iterative Deepening, References on Specific games.

Learning: What is learning?, Forms of learning, Rote learning, learning by taking advice, Learning in problem solving, Induction leaning, Explanation based learning, Discovery, Analogy, Formal learning Theory, Neural Network Learning.

Experimental Learning :

Real time problem solving using Game Playing

Video Links:

- https://www.youtube.com/watch?v=_i-lZcbWkps
- https://www.youtube.com/watch?v=l-hh51ncgDI

Module-5	**RBT Level** L1,L2 ,L3	**Hours 8**

Natural Language Processing: Syntactic Processing, Semantic Analysis, Discourse and Pragmatic processing, Statistical Natural language processing and Spell checking.

Genetic Algorithms: A peek into the biological world, Genetic Algorithms(GAs),Significance of genetic operators, termination parameters, niching and speciation, evolving neural network, theoretical grounding.

Experimental Learning :

Program to implement spell checking problem **Video Links**: • https://www.youtube.com/watch?v=zG8AJhVy5NY • https://www.youtube.com/watch?v=Z_8MpZeMdD4

Course outcomes:	
CO1	Identify AI based problems and understand Intelligent agents
CO2	Apply predicate logic and heuristic techniques to solve AI problems.
CO3	Understand the different representation of knowledge.
CO4	Understand the concepts of learning and Natural Language Processing.
CO5	Understand Genetic Algorithms and solve AI problems using PROLOG.

Text/Reference Books:	
1	Artificial Intelligence: A Modern Approach, Stuart Rusell, Peter Norving, Pearson Education 2nd Edition.
2	E. Rich , K. Knight & S. B. Nair - Artificial Intelligence, 3/e, McGraw Hill.
3	Dan W. Patterson, Introduction to Artificial Intelligence and Expert Systems – Prentice Hal of India.
4	G. Luger, "Artificial Intelligence: Structures and Strategies for complex problem Solving", Fourth Edition, Pearson Education, 2002.
5	N.P. Padhy "Artificial Intelligence and Intelligent Systems" , Oxford University Press-2015

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

ourse Title	ANALYSIS AND DESIGN OF ALGORITHMS LAB	**Semester**	04
Course Code	MVJ20CSL47	**CIE**	50
Total No. of Contact Hours	40 L : T : P :: 10 : 0 : 30	**SEE**	50
No. of Contact Hours/week	3	**Total**	100
Credits	2	**Exam. Duration**	3 Hours

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

- To employ various design strategies for problem solving.
- To provide exposure to measure and compare the performance of different algorithms.
- To provide design and implement various Concepts in JAVA.

Sl No	Experiment Name	RBT Level	Hours
1	Write a recursive program to a. Solve Towers-of-Hanoi problem b.GCD	**L3**	**3**
2	Write a Java program to implement the Stack using arrays. Write Push(), Pop(), and Display() methods to demonstrate its working.	**L3**	**3**
3	Implement Recursive Binary search and Linear search and determine the time required to search an element. Repeat the experiment for different values of N and plot a graph of the time taken versus N.	**L3**	**3**
4	Given a set of N integer elements which is to be sorted using Selection Sort technique. Write the program using C language as well as in Java for different values of N and observe the total time taken to sort the elements in both the languages.	**L3**	**3**
5	Write program to do the following: a. Print all the nodes reachable from a given starting node in a digraph using BFS method. b. Check whether a given graph is connected or not using DFS method.	**L3**	**3**
6	The Merge sort is one of the most common algorithms used to sort arrays. The class Merge sort implements this algorithm. However, there is a bug in the implementation of the method sort. Debug the previous implementation using	**L3**	**3**

	the debugging options of your favourite IDE (e.g. eclipse), in order to find the error.		
7	Sort a given set of N integer elements using Quick Sort technique and Run the program for different values of N and record the time taken to sort.	**L3**	**3**
8	We are given a set of items, each with a weight and a value and we need to determine the number of each items to include in a collection so that the total weight is less than or equal to the given limit and the total value is as large as possible. Write a Java program by applying any reuse sub problem technique to find the solution.	**L3**	**3**
9	Suppose you're trying to find the shortest path from your house to various locations like Movie theatre, Gas Station,Grocery Store and Petrol pump. If we let various locations be vertices and the routes between them are edges, we can create a weighted graph representing the situation. Write a Java program to find the shortest path from your house (source) to the remaining locations.	**L3**	**3**
10	Write a Java program for the following Scenario, You have a business with several offices and you want to lease phone lines to connect them up with each other; and the phone company charges different amounts of money to connect different pairs of cities. You want a set of lines that connects all your offices with a minimum total cost and it should be a spanning tree.	**L3**	**3**
11	Develop a program in Java with a given set of vertices V in a weighted graph where each edge w (u,v) can be negative, find the shortest path weights d(s,v) from every source s to all vertices in the graph. If the graph contains negative cycle, report it.	**L3**	**3**
12	Given a set of cities and distance between every pair of cities, the problem is to find the shortest possible route that visits every city exactly once and returns to the starting point. Write a program to find the solution using dynamic programming method.	**L3**	**3**
13	Given a set of positive integers and an integer ‘s' write a program in Java to	**L3**	**3**

	determine whether there is any non-empty subset whose sum is ‘s'.		
14	Write a Java program to find a path that traverses all the vertices of the given graph G exactly once and then ends at the starting vertex in a connected undirected Graph G of *n* vertices using backtracking principle	**L3**	**3**

Course outcomes:	
CO1	Design algorithms using appropriate design techniques (brute-force, greedy, dynamic programming, etc.)
CO2	Implement a variety of algorithms such as sorting, graph related, combinatorial, etc., in a high level language.
CO3	Analyze and compare the performance of algorithms using language features.
CO4	Apply and implement learned algorithm design techniques and data structures to solve real-world problems.
CO5	Employ various design strategies for problem solving and implement various algorithms in JAVA .

CO-PO/PSO Mapping

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

High-3, Medium-2, Low-1

V SEMESTER

Course Title	TECHNICAL MANAGEMENT & ENTREPRENEURSHIP	**Semester**	05
Course Code	MVJ20TIM51	**CIE**	50
Total No. of Contact Hours	40 L : T : P :: 40 : 0 : 0	**SEE**	50
No. of Contact Hours/week	3	**Total**	100
Credits	3	**Exam. Duration**	3 Hours

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

- Describe the importance of management and functions of a manager.
- Explain the process of planning and organizing.
- Explain the requirements of direction, supervision and the methods of establishing control.
- Identify the role of entrepreneurs in the economic development of the nation and recognize the barriers of entrepreneurship.
- Explain the importance of Intellectual property protection.

Module-1	**RBT Level** L1,L2, L3	**Hours 8**

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

Module-2	**RBT Level** L1,L2, L3	**Hours 8**

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 principles of organizing, Departmentation, organization structure, committees, teams.

Application: Industry

Video Link: https://www.youtube.com/watch?v=pCUs3UKwYpc

Module-3	**RBT Level** L1,L2, L3	**Hours 8**

Direction and supervision: Requirements of effective direction, giving orders, motivation, job satisfaction, morale , organizational commitment, first level supervision or front line supervision.

Controlling: Meaning and steps in controlling , Essential of a sound control system , Methods of establishing control

Application: Industry

Video Link: https://www.youtube.com/watch?v=MufenDklR8E

Module-4	**RBT Level** L1,L2, L3	**Hours 8**

Entrepreneurship: Meaning of Entrepreneur; Evolution of the Concept, Functions of an Entrepreneur, Types of Entrepreneur, Entrepreneur – an emerging Class. Concept of Entrepreneurship – Evolution of Entrepreneurship, Development of Entrepreneurship, Stages in entrepreneurial process; Role of entrepreneurs in Economic Development; Entrepreneurship in India; Entrepreneurship – its Barriers.

Application: Industry

Video Link: https://www.youtube.com/watch?v=aozlwC3XwfY

Module-5	**RBT Level** L1,L2, L3	**Hours 8**

Introduction to IPR, origin and concepts of IPR, Concept of property, Forms of IP protection: Patents, copyrights, trademarks, designs, Trade secrets, Traditional knowledge, Geographical indications. Basic concepts and historical background of patent system and law- National and international scenario (American & European Patent Regimes).

International Treaties/Conventions on IPR: Paris Convention, Berne convention, Madrid agreement, Rome convention, World Intellectual Property Organization (WIPO), World Trade Organization, TRIPS Agreement, Patent Co-operation Treaty

Application: Industry

Video Link: https://www.youtube.com/watch?v=hHQWCFE0J84

Practical Experiments:

Case study on Enterprises:

- Case study (Microsoft),
- Case study (Captain G R Gopinath),
- Case study (N R Narayana Murthy & Infosys)

Practical Sessions:

- Idea Generation and Opportunity Recognition
- Strategy and Business Model Analysis
- Formulation of Project

Course outcomes:	
CO1	Describe the importance of management and functions of a manager.
CO2	Explain the process of planning and principles of organizing
CO3	Identify the role of entrepreneurs in the economic development of the nation.
CO4	Compare the different leadership styles.
CO5	Apply the ethical principles related to the intellectual property protection

Text/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	Principles of Management, P C Tripathi, P N Reddy, 5th edition, TataMcGraw Hill, 2012
4	Dynamics of Entrepreneurial Development & Management, Vasant Desai, Himalaya publishing house, 2009

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			
CO4	2					2			2		2			
CO5	2					2		2			2			

High-3, Medium-2, Low-1

Course Title	DATABASE MANAGEMENT SYSTEM	**Semester**	05
Course Code	MVJ20CS52	**CIE**	50
Total No. of Contact Hours	50 L : T : P :: 40 : 10 : 0	**SEE**	50
No. of Contact Hours/week	4	**Total**	100
Credits	4	**Exam. Duration**	3 Hours

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

- Provide a strong foundation in database concepts, technology, and practice.
- Practice SQL programming through a variety of database problems.
- Demonstrate the use of concurrency and transactions in database.
- Design and build database applications for real world problems.

Module-1	**RBT Level** L1,L2, L3	**Hours 10**

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.

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

Module-2	**RBT Level**	**Hours 10**

	L1,L2, L3	

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

Module-3	**RBT Level** L1,L2, L3	**Hours 10**

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.

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/

Module-4	**RBT Level** L1,L2, L3	**Hours 10**

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

Module-5	**RBT Level** L1,L2, L3	**Hours 10**

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.

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

Course outcomes:

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.

Text/Reference Books:	
1	Fundamentals of Database Systems, Ramez Elmasri and Shamkant B. Navathe, 7th Edition, 2017, Pearson
2	Database management systems, Ramakrishnan, and Gehrke, 3rd Edition, 2014, McGraw Hill
3	Silberschatz Korth and Sudharshan, Database System Concepts, 6th Edition, McGrawHill, 2013.
4	Database Principles Fundamentals of Design, Implementation and Management, Cengage Learning 2012.

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

Course Title	DATA COMMUNICATION & COMPUTER NETWORKS	**Semester**	05
Course Code	MVJ20CS53	**CIE**	50
Total No. of Contact Hours	50 L : T : P :: 40 : 10 : 0	**SEE**	50
No. of Contact Hours/week	4	**Total**	100
Credits	4	**Exam. Duration**	3 Hours

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

- To introduce the fundamental concepts and types of computer networks.
- To demonstrate the TCP/IP and OSI models with merits and demerits.
- To understand the difference between all communication protocols.

Module-1	**RBT Level** L1,L2, L3	**Hours 10**

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

Module-2	**RBT Level** L1,L2, L3	**Hours 10**

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

Module-3	**RBT Level** L1,L2, L3	**Hours 10**

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		
Module-4	**RBT Level** L1,L2, L3	**Hours 10**
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		
Module-5	**RBT Level** L1,L2, L3	**Hours 10**
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**		

Course outcomes:	
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

Text/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	Data communications and Computer Networks, P.C .Gupta, PHI.
4	An Engineering Approach to Computer Networks, S. Keshav, 2 nd Edition, Pearson Education.
5	Understanding communications and Networks, 3 rd Edition, W.A. Shay, Cengage Learning.
6	Computer Networking: A Top-Down Approach Featuring the Internet. James F. Kurose & Keith W. Ross, 3 rd Edition, Pearson Education.
7	Data and Computer Communication, William Stallings, Sixth Edition, Pearson Education, 2000

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

Course Title	WEB PROGRAMMING	**Semester**	05
Course Code	MVJ20CS54	**CIE**	50
Total No. of Contact Hours	40 L : T : P :: 40 : 0 : 0	**SEE**	50
No. of Contact Hours/week	3	**Total**	100
Credits	3	**Exam. Duration**	3 Hours

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

- Understand different kind of Internet Technologies.
- Learn java-specific web services architecture
- understand the SQL and JDBC
- Learn the AJAX and JSON.

Module-1	**RBT Level** L1,L2, L3	**Hours 8**

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:

Create a simple website with following effects on Text and images

1. Add Background image/s

2. Colors effect.
3. Shadows and transformation.

Real Time Applications: Animation website

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

- https://youtu.be/FPtLsZ62pdA
- https://nptel.ac.in/courses/106/106/106106222/
- https://youtu.be/vCo6p7zrbt4
- https://nptel.ac.in/courses/106/106/106106223

Module-2	**RBT Level** L1,L2, L3	**Hours 8**

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:

- SQL and DOM model creation in website as created in module 1.

Real Time Applications: Students results / Application form in online

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

- https://nptel.ac.in/courses/106/105/106105084/
- https://youtu.be/uUhOEj4z8Fo (NPTEL)
- https://youtu.be/3uxp7mqUIfk (NPTEL)
- https://youtu.be/tfPfwDrfSP8 (NPTEL)

Module-3	**RBT Level** L1,L2, L3	**Hours 8**

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:

Write a servlet program to display a message "Welcome to Java World" and deploy the process using GET and POST actions.

Real Time Applications: Online ordering using any E-Commerce site.

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

- https://nptel.ac.in/courses/106/105/106105224/
- https://youtu.be/J6qfWtQ54Ig
- https://nptel.ac.in/courses/106/105/106105084/

Module-4	**RBT Level** L1,L2, L3	**Hours 8**

PHP and XML: 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. XML: Document type definition, XML Schema DOM and presenting XML, XML Parser and Validations, XSL and XSLT Transformation.

Laboratory Sessions/ Experimental learning:

Design, Develop and Implement a student/Employee table and perform the following operations using PHP.

1. Insert a row
2. Delete a row
3. Alter the table.

Video link:

- https://youtu.be/XlryaovT_3k
- http://www.digimat.in/nptel/courses/video/106106127/L49.html
- http://www.nptelvideos.in/2012/11/internet-technologies.html

Module-5	**RBT Level** L1,L2, L3	**Hours 8**

AJAX and Web Services: 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, SOAP.

Laboratory Sessions/ Experimental learning:

- jQuery process and AJAX services.

Video link/Lecturer/Tutorials:

- https://www.w3schools.com/xml/ajax_intro.asp (Practical examples)
- https://youtu.be/jMdHE4qInU4
- https://youtu.be/FBDHe5T7quI

Course outcomes:

CO1	Learn web essentials, HTML5 and CSS3.
CO2	Understand about Client side programming, DHTML and JSON
CO3	Comprehend server side programming and JSP.
CO4	Learn PHP, functions, and XML.

CO5	Analyse the concepts of AJAX and web servies.

Text/Reference Books:	
1	Jean-Paul Tremblay & Paul G. Sor 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.
5	Jeffrey C and Jackson, ―Web Technologies A Computer Science Perspective‖, Pearson Education, 2011.
6	UttamK.Roy, ―Web Technologies‖, Oxford University Press, 2011
7	Gopalan N.P. and Akilandeswari J., ―Web Technology, Prentice Hall of India, 2011.

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

High-3, Medium-2, Low-1

Course Title	THEORY OF COMPUTATION	**Semester**	05
Course Code	MVJ20CS551	**CIE**	50
Total No. of Contact Hours	40 L : T : P :: 40 : 0 : 0	**SEE**	50
No. of Contact Hours/week	3	**Total**	100
Credits	3	**Exam. Duration**	3 Hours

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

- To have a knowledge of regular languages and context free languages.
- To have an understanding of finite state and pushdown automata.
- To make a study of the programming capabilities of Turing machines.

Module-1	**RBT Level** L1,L2, L3	**Hours 8**

Finite Automata: Mathematical preliminaries and notations – Central concepts of automata theory – Finite automata -Deterministic Finite Automata - Nondeterministic Finite Automata – Equivalence of DFA and NFA –Finite Automata with Epsilon transitions - Application of FA

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

- https://nptel.ac.in/courses/106/105/106105196/

Module-2	**RBT Level** L2 ,L3	**Hours 8**

Regular Expressions: Regular languages: Regular Expressions – Finite Automata and Regular Expressions –Applications of Regular Expressions - Regular Grammars.

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

- https://www.youtube.com/watch?v=OA8EY3HKZoc

Module-3	**RBT Level** L1,L2, L3	**Hours 8**

Regular Languages: Properties of regular languages: Pumping lemma for regular languages – Closure properties of regular languages –Equivalence and Minimization of Finite Automata. C

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

- https://www.youtube.com/watch?v=ganHwe4DU7A

Module-4	**RBT Level** L1,L2, L3	**Hours 8**

Context Free Grammar: Context Free languages: Context Free Grammars – Parse Trees - Ambiguity in Grammars and languages– Applications of Context Free Grammars – Pushdown automata (PDA) – Languages of a PDA -Equivalence of PDA‘s and CFG‘s

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

- https://www.youtube.com/watch?v=FjGrU7vczyg
- https://www.youtube.com/watch?v=b3OPl5wS4AQ

Module-5	**RBT Level** L1,L2, L3	**Hours 8**

Context Free Languages: Properties of Context Free Languages: Normal Forms (CNF, GNF) for Context Free Grammars - Pumping lemma for CFL‘s - Closure properties of CFL

Turing Machines: Turing Machines- Simple examples.

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

- https://www.youtube.com/watch?v=IhyEGNn-7Uo

Course outcomes:

CO1	Design Finite automata for different Problems
CO2	Understand about Regular Expressions
CO3	Apply pumping lemma to Regular languages and Context Free languages
CO4	Design Push down automata and write CFG for different problems
CO5	Analyze the properties of Context free languages and Turing Machine

Text/Reference Books:

1	J.E.Hopcroft, R.Motwani and J.D Ullman,”Introduction to Automata Theory, Languages Computations”, 3rd Edition, Pearson Education, 2011
2	J.Martin, “Introduction to Languages and the Theory of Computation”, 3rd Edition, TMH, 2007.
3	H.R.Lewis and C.H.Papadimitriou,”Elements of the theory of Computation”, 2nd Edition, Pea Education/PHI, 2003
4	Micheal Sipser, ―Theory and Computatio, 7th Edition, Thomson Course Technology, 2008
5	http://nptel.iitm.ac.in

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	-	-	-	-	-	-	1	2

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

High-3, Medium-2, Low-1

Course Title	SOFTWARE TESTING	**Semester**	05
Course Code	MVJ20CS552	**CIE**	50
Total No. of Contact Hours	40 L : T : P :: 40 : 0 : 0	**SEE**	50
No. of Contact Hours/week	3	**Total**	100
Credits	3	**Exam. Duration**	3 Hours

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

- To introduce Testing Concepts and Evolution.
- To explain Testing Strategies and their usage.
- To discuss the levels of testing.
- To introduce Organizational features and Policies of Testing.
- To discuss the Quality related issue.

Module-1	**RBT Level** L1,L2, L3	**Hours 8**

Introduction: Basic definitions-software testing principles- Role of tester- testing as a process- Overview of Testing maturity model- Defects -Hypothesis and tests.

Laboratory Sessions/ Experimental learning: Study Experiment for automated Testing Tool- Selenium

Applications: ATM, Banking Applications

Video link / Additional online information :

What is Software Testing & Why Testing is important?

- https://www.youtube.com/watch?v=Y7Wg4508tHo

Roles and Responsibilities of a Software Tester.

- https://www.youtube.com/watch?v=t5jJ4bNJ4kw

Module-2	**RBT Level** L1,L2, L3	**Hours 8**

Strategies and Methods for Test Case Design I : Introduction to Testing Design Strategies- The Smart Tester- Test Case Design Strategies- Using the Black Box Approach to Test Case Design - Random Testing- Equivalence Class Partitioning- Boundary Value Analysis (BVA) - An Example of the Application of Equivalence Class Partitioning and Boundary Value Analysis- Other Black Box Test Design Approaches: Cause-and-Effect Graphing- State Transition Testing - Error Guessing- Black Box Testing and Commercial Off-the-Shelf Components (COTS)- Black Box Methods and TMM Level 2 Maturity Goals

Laboratory Sessions/ Experimental learning:

Design and develop a program in a language of your choice to solve the triangle problem defined as follows: Accept three integers which are supposed to be the three sides of triangle and determine if the three values represent an equilateral triangle, isosceles triangle, scalene triangle, or they do not form a triangle at all. Derive test cases for your program based on boundary value analysis, execute the test cases and discuss the results.

Generate test cases using Black box testing technique to Calculate Standard Deduction on Taxable Income. The standard deduction is higher for tax payers who are 65 or older or blind. Use the method given below to calculate tax.

The first factor that determines the standard deduction is the filing status. The basic standard deduction for the various filing status are: Single $4,750 Married, filing a joint return $9,500 Married, filing a separate return $7,000

If a married couple is filing separate returns and one spouse is not taking standard Deduction, the other spouse also is not eligible for standard deduction.

An additional $1,000 is allowed as standard deduction, if either the filer is 65 yrs or the spouse is 65 yrs or older (the latter case applicable when the filing status is “Married” and filing “joint”).

An additional $1,000 is allowed as standard deduction, if either the filer is blind or the spouse is blind (the latter case applicable when the filing status is “married” and filing “joint”).

Applications: Mobile Applications , Health Care devices such as Glucose meter

Video link / Additional online information :

Black Box Testing Techniques

- https://www.youtube.com/watch?v=7T4DGEXht40

- https://www.softwaretestinghelp.com/black-box-testing/

Equivalence Partitioning with real time example

- https://www.youtube.com/watch?v=A9oBq8ZYv9A

Boundary Value Analysis with real time example

- https://www.youtube.com/watch?v=21wOCNHsSU4

State Transition Testing

- https://www.youtube.com/watch?v=4ie2C12LBXg

Error Guessing

- https://www.javatpoint.com/error-guessing-technique-in-black-box-testing

Module-3	**RBT Level** L1,L2, L3	**Hours 8**

Strategies and Methods for Test Case Design II: Using the White Box Approach to Test Design- Test Adequacy Criteria -Coverage and Control Flow Graphs - Covering Code Logic - Paths: Their Role in White Box–Based Test Design - Additional White Box Test Design Approaches : Data Flow and White Box Test Design -Loop Testing - Mutation Testing - Evaluating Test Adequacy Criteria - White Box Testing Methods and the TMM

Laboratory Sessions/ Experimental learning:

- Study Experiment for White Box Testing Tools

Applications: Automobile Industry,Air Craft Manufacturing

Video link / Additional online information :

White Box testing

- https://www.youtube.com/watch?v=3bJcvBLJViQ&feature=emb_logo
- https://www.geeksforgeeks.org/software-engineering-white-box-testing/

Control Flow Testing

- https://www.youtube.com/watch?v=1uklXlRovX4

Basis Path Testing – NPTEL Video

- https://www.youtube.com/watch?v=TAFhCV721tY

Data Flow and Mutation Testing:

- https://www.youtube.com/watch?v=RR_nEUtwbBA

Module-4	**RBT Level** L1,L2, L3	**Hours 8**

Levels of testing- Phase-I: The Need for Levels of Testing: Levels of Testing and Software Development Paradigms - Unit Test: Functions, Procedures, Classes, and Methods as Units - Unit

Test: The Need for Preparation - Unit Test Planning - Designing the Unit Tests - The Class as a Testable Unit: Special Considerations -The Test Harness - Running the Unit Tests and Recording Results- Integration Test: Goals - Integration Strategies for Procedures and Functions - Integration Strategies for Classes - Designing Integration Tests - Integration Test Planning

Laboratory Sessions/ Experimental learning:

- Take any System(e.g ATM System) and study its system specifications and report the various bugs.
- Study of automated tools used in Unit Testing

Applications: Lap Top Manufacturing, Washing Machine

Video link / Additional online information :

Unit Testing

- https://www.guru99.com/unit-testing-guide.html
- https://www.youtube.com/watch?time_continue=7&v=lj5nnGa_DIw&feature=emb_logo

Integration Testing

- https://www.guru99.com/integration-testing.html

Module-5	**RBT Level** L1,L2, L3	**Hours 8**

Levels of testing- Phase-II: System Test: The Different Types : Functional Testing - Performance Testing - Stress Testing -Configuration Testing - Security Testing - Recovery Testing - Regression Testing - Alpha, Beta, and Acceptance Tests - Summary Statement on Testing Levels - The Special Role of Use Cases -Levels of Testing and the TMM

Laboratory Sessions/ Experimental learning:

- Perform the steps involved in Acceptance Testing

Applications: TV Manufacturing, Microwave Oven Manufacturing

Video link / Additional online information :

Functional Testing

- https://www.guru99.com/functional-testing.html
- https://www.youtube.com/watch?v=U-_e1xPKnZY

Regression Testing

- https://www.youtube.com/watch?v=4MtsWBxCPHw

Course outcomes:

CO1	Recall the role of tester and their functionalities.
CO2	Apply mathematical logic for testing

CO3	Communicate effectively with developers and other stakeholders
CO4	Choose appropriate testing strategies to perform unit and integration test
CO5	Choose appropriate testing strategies to perform System test

Text/Reference Books:	
1	Ilene Burnstein, Practical Software Testing, Springer Verlag International Edition, Springer (India) Pvt Ltd, 2012
2	NareshChauhan, Software Testing Principles and Practices,Oxford University Press, 2013.
3	Edward Kit Software Testing in the Real World – Improving the Process, Pearson Education, 1995

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

High-3, Medium-2, Low-1

Course Title	LAW FOR ENGINEERS	**Semester**	05
Course Code	MVJ20CS553	**CIE**	50
Total No. of Contact Hours	40 L : T : P :: 40 : 0 : 0	**SEE**	50
No. of Contact Hours/week	3	**Total**	100
Credits	3	**Exam. Duration**	3 Hours

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

- Outline the commercial context for engineering processes and business models that are socially

responsible and environmentally sustainable.

- Channelize thinking towards basic understanding of the legal concepts and its implications for engineers.
- Acquaint with latest intellectual property rights and innovation environment with related regulatory framework.

Module-1	**RBT Level** L1,L2, L3	**Hours 8**

Origin of Environmental Law, Concept of Pollution – Sources of Pollution, Types of Pollution, and Effects of pollution. Nature and Scope of Environmental Law – Importance. Case Study.

Application: Environmental Law:

Video Link: https://www.digimat.in/nptel/courses/video/110106081/L01.html

Module-2	**RBT Level** L1,L2, L3	**Hours 8**

Provisions of various labor laws – workmen's compensation Act 1923; Disablement, Total Permanent disablement, Temporary disablement, Formula for compensation; Minimum wages act, 1948; Payment of bonus act, 1965; Weekly holidays Act, 1942; Payment of wages Act, 1936; employees Insurance Act, 1948.

Application: Labour Law

Video Link: https://www.digimat.in/nptel/courses/video/110106081/L01.html

Module-3	**RBT Level** L1,L2, L3	**Hours 8**

A brief introduction to criminal liability of Engineers as per the Indian Penal Code.

Application: Indian Penal Code

Video Link: https://www.digimat.in/nptel/courses/video/110106081/L01.html

Module-4	**RBT Level** L1,L2, L3	**Hours 8**

IPR and Law of Torts: Definition, categories of torts, Breach of Duty and Damages. Concept of Property, Types of Property; Introduction to IPR; Types of IPR: Copyrights, Patents, Trademarks, Designs, Trade Secrets, Plant Varieties and Geographical Indications; Infringement of IPRs and Remedies available under the Indian Law.

Application: IPR

Video Link: https://www.digimat.in/nptel/courses/video/110106081/L01.html

Module-5	**RBT Level** L1,L2, L3	**Hours 8**

Business Organizations and E-Governance: Sole Traders, Partnerships: Companies: The Company's Act: Introduction, Formation of a Company, Memorandum of Association, Articles of Association, Prospectus, Shares, Directors, General Meetings and Proceedings, Auditor, Winding up. E-Governance and role of engineers in E-Governance, Need for reformed engineering serving at the Union and State level, Role of I.T. professionals in Judiciary, Problem of Alienation and Secessionism in few states creating hurdles in Industrial development.

Applications: G2C, G2B,G2G

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

- https://www.digimat.in/nptel/courses/video/110105083/L01.html

Course outcomes:	
CO1	Enumerate the principles of sustainable development
CO2	Discuss the significance of various legislations pertaining to engineers
CO3	Understand legal systems relevant for engineering:
CO4	Understand codes of conduct, conflicts of interest and other ethical dilemmas
CO5	Correlate role of engineers with different organizations and governance models

Text/Reference Books:	
1	B.S. Patil, Legal Aspects of Building and Engineering Contracts
2	Ratanlal and Dhirajlal&: The Law of Torts.
3	S. Shantha Kumar- Introduction to Environmental Law.
4	Cornish W. R. (2008), Intellectual Property Rights, Patents, Trademarks, Copyrights & Allied Rights, Sweet & Maxwell
5	Madhavan Pillai - Labour and Industrial Laws.
6	Handbook on e-Governance Project Lifecycle, Department of Electronics & Information Technology, Government of India, https://www.meity.gov.in/writereaddata/files/eGovernance_Project_Lifecycle_Participant_Handbook-5Day_CourseV1_20412.pdf

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

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

High-3, Medium-2, Low-1

Course Title	PARALLEL AND DISTRIBUTED SYSTEMS	**Semester**	05
Course Code	MVJ20CS554	**CIE**	50
Total No. of Contact Hours	40 L : T : P :: 40 : 0 : 0	**SEE**	50
No. of Contact Hours/week	3	**Total**	100
Credits	3	**Exam. Duration**	3 Hours

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

- To understand the architecture of parallel systems and identify the scope for parallelism in present day's processors.

Prerequisites: Basics of Computer Organisation

Module-1	**RBT Level** L1,L2, L3	**Hours 8**

Introduction to Parallel Computing: Motivating Parallelism, Scope of Parallel Computing. **Parallel Programming Platforms**: Trends in microprocessor architectures - limitations of memory system performance – parallel computing platforms – communication costs in parallel machines – routing mechanisms for interconnection networks.

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

- https://nptel.ac.in/courses/106/102/106102114/

Module-2	**RBT Level** L1,L2, L3	**Hours 8**

Principles of Parallel Algorithm Design: Preliminaries – decomposition techniques – characteristics of tasks and interactions – mapping techniques for load balancing – methods for containing interaction overheads – parallel algorithm models.

Basic Communication Operations: One-to-all broadcast and all-to-one reduction – all-to-all broadcast reduction – all-reduce and prefix-sum operations – scatter and gather – all-to-all personalized communication – circular shift – improving the speed of some communication

operation

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

- https://nptel.ac.in/courses/106/102/106102114/

Module-3	**RBT Level** L1,L2 ,L3	**Hours 8**

Examples of Distributed Systems–Trends in Distributed Systems – Focus on resource sharing – Challenges. Case study: World Wide Web.

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

- https://nptel.ac.in/courses/106/102/106102114/

Module-4	**RBT Level** L1,L2 ,L3	**Hours 8**

System Model Inter process Communication – the API for internet protocols – External data representation and Multicast communication. Network virtualization: Overlay networks. Case study: MPI Remote Method Invocation And Objects: Remote Invocation – Introduction – Request-reply protocols – Remote procedure call – Remote method invocation. Case study: Java RMI.

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

- https://nptel.ac.in/courses/106/106/106106168/

Module-5	**RBT Level** L1,L2 ,L3	**Hours 8**

Peer-to-peer Systems – Introduction – Napster and its legacy – Peer-to-peer – Middleware – Routing overlays. Overlay case studies: Pastry, Tapestry.

Distributed File Systems –Introduction – File service architecture – Andrew File system.

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

- https://nptel.ac.in/courses/106/106/106106168/

Course outcomes:

CO1	Acquire the skills to implement software effectively and efficiently on parallel hardware platforms
CO2	Discuss trends in Distributed Systems.
CO3	Apply network virtualization.
CO4	Apply remote method invocation and objects.
CO5	Differentiate the file systems.

Text/Reference Books:

1	Ananth Grama, Anshul gupta, George Karypis and Vipin Kumar, "Introduction to Parallel Computing", Pearson Education, Second edition, 2004..
2	Pradeep K Sinha, "Distributed Operating Systems: Concepts and Design", Prentice Hall of India, 2007.
3	M.J. Quinn, "Parallel Computing – Theory and Practice", McGraw-Hill, 1994.
4	Tanenbaum A.S., Van Steen M., "Distributed Systems: Principles and Paradigms", Pearson Education, 2007.

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

High-3, Medium-2, Low-1

Course Title	DATABASE MANAGEMENT SYSTEM LABORATORY	**Semester**	05
Course Code	MVJ20SCSL56	**CIE**	50
Total No. of Contact Hours	40 L : T : P :: 10 : 0 : 30	**SEE**	50
No. of Contact Hours/week	3	**Total**	100
Credits	2	**Exam. Duration**	3 Hours

Course objective is to:

The students will be able to

- Foundation knowledge in database concepts, technology and practice to groom students into well-informed database application developers.
- Strong practice in SQL programming through a variety of database problems.
- Develop database applications using front-end tools and back-end DBMS.

Sl No	Experiment Name	RBT Level	Hours
1	**The following relations keep track of airline flight information**: FLIGHTS (no: integer, from: string, to: string, distance: integer, Departs: time, arrives: time, price: real) AIRCRAFT (aid: integer, aname: string, cruisingrange: integer) CERTIFIED (eid: integer, aid: integer) EMPLOYEES (eid: integer, ename: string, salary: integer) Note that the Employees relation describes pilots and other kinds of employees as well; every pilot is certified for some aircraft, and only pilots are certified to fly. Write each of the following queries in SQL. i. Find the names of aircraft such that all pilots certified to operate them have salaries more than Rs.80, 000. ii. For each pilot who is certified for more than three aircrafts, find the eid and the maximum cruisingrange of the aircraft for which she or he is certified. iii. Find the names of pilots whose salary is less than the price of the cheapest route from Bengaluru to Frankfurt. iv. For all aircraft with cruising range over 1000 Kms, .find the name of the aircraft and the average salary of all pilots certified for this aircraft. v. Find the names of pilots certified for some Boeing aircraft. vi. Find the aids of all aircraft that can be used on routes from Bengaluru to New Delhi.	**L3**	**3**
2	**Consider the Schema for a banking enterprise:** BRANCH(branch-name:string, branch-city:string, assets:real) ACCOUNT(accno:int, branch-name:string, balance:real) DEPOSITOR(customer-name:string, accno:int) CUSTOMER(customer-name:string, customer-Street:string, customer-city:string) LOAN(loan-number:int, branch-name:string, amount:real) BORROWER(customer-name:string, loan-number:int) i. Create the above tables by properly specifying the primary keys	**L3**	**3**

	and the foreign keys ii. Enter at least five tuples for each relation iii. Find all the customers who have at least two accounts at the Main branch. iv. Find all the customers who have an account at all the branches located in a specific city. Demonstrate how you delete all account tuples at every branch located in a specific city.		
3	**Consider the schema for College Database:** STUDENT(USN, SName, Address, Phone, Gender) SEMSEC(SSID, Sem, Sec) CLASS(USN, SSID) SUBJECT(Subcode, Title, Sem, Credits) IAMARKS(USN, Subcode, SSID, Test1, Test2, Test3, FinalIA) Write SQL queries to 1. List all the student details studying in fourth semester 'C' section. 2. Compute the total number of male and female students in each semester and in each section. 3. Create a view of Test1 marks of student USN '1MJ15CS101' in all subjects. 4. Calculate the FinalIA (average of best two test marks) and update the corresponding table for all students. 5. Categorize students based on the following criterion: If FinalIA = 17 to 20 then CAT = 'Outstanding' If FinalIA = 12 to 16 then CAT = 'Average' If FinalIA< 12 then CAT = 'Weak' Give these details only for 8th semester A, B, and C section students.	**L3**	**3**
4	Consider the schema for Company Database: EMPLOYEE(SSN, Name, Address, Sex, Salary, SuperSSN, DNo) DEPARTMENT(DNo, DName, MgrSSN, MgrStartDate) DLOCATION(DNo,DLoc) PROJECT(PNo, PName, PLocation, DNo) WORKS_ON(SSN, PNo, Hours) Write SQL queries to	**L3**	**3**

	1. Make a list of all project numbers for projects that involve an employee whose last name is 'Scott', either as a worker or as a manager of the department that controls the project. 2. Show the resulting salaries if every employee working on the 'IoT' project is given a 10 percent raise. 3. Find the sum of the salaries of all employees of the 'Accounts' department, as well as the maximum salary, the minimum salary, and the average salary in this department 4. Retrieve the name of each employee who works on all the projects controlled by department number 5 (use NOT EXISTS operator). 5. For each department that has more than five employees, retrieve the department number and the number of its employees who are making more than Rs. 6,00,000.		
	STUDY EXPERIMENT For any problem selected, write the ER Diagram, apply ER-mapping rules, normalize the relations, and follow the application development process. • Make sure that the application should have five or more tables, at least one trigger and one stored procedure, using suitable front end tool. **Indicative areas include; health care, education, industry, transport, supply chain etc.**	**L2**	**2**

Course outcomes:	
CO1	Demonstrate the creation of relational tables using DDL/DML
CO2	Design and demonstrate the execution of simple queries retrieve information
CO3	Demonstrate the execution of complex queries
CO4	Design and implement a front end using modern tools
CO5	Implement, analyze and evaluate the project developed for an application.

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	1	-	1	-	-	2	2	-

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

High-3, Medium-2, Low-1

Course Title	COMMUNICATION NETWORK LAB	**Semester**	05
Course Code	MVJ20CSL57	**CIE**	50
Total No. of Contact Hours	40 L : T : P :: 10 : 0 : 30	**SEE**	50
No. of Contact Hours/week	3	**Total**	100
Credits	2	**Exam. Duration**	3 Hours

Course objective is to:

This course will enable students to

- To learn and use network commands.
- To learn socket programming.
- To implement and analyze various network protocols.
- To learn and use simulation tools.
- To use simulation tools to analyze the performance of various network protocols.

Sl No	**Experiment Name**	**RBT Level**	**Hours**
1	Learn to use commands like tcpdump, netstat, ifconfig, nslookup and traceroute. Capture ping and traceroute PDUs using a network protocol analyzer and examine.	**L3**	**3**
2	Write a program for error detecting code using CRC-CCITT (16-bits).	**L3**	**3**
3	Write a program to find the shortest path between vertices using bellman-ford algorithm.	**L3**	**3**
4	Applications using TCP sockets like: a) Echo client and echo server b) Chat c) File Transfer	**L3**	**3**

5	Simulation of DNS using UDP sockets.	**L3**	**3**
6	Write a code for simulating ARP /RARP protocols.	**L3**	**3**
7	Implementation of Stop and Wait Protocol and Sliding Window Protocol.	**L3**	**3**
8	Write a program for congestion control using leaky bucket algorithm.	**L3**	**3**
9	Simulate the transmission of ping messages/trace route over a network topology consisting of 6 nodes and find the number of packets dropped due to congestion.	**L3**	**3**
10	Simulate an Ethernet LAN using n nodes and set multiple traffic nodes and plot congestion window for different source / destination.	**L3**	**3**
11	Simulate simple ESS and with transmitting nodes in wireless LAN by simulation and determine the performance with respect to transmission of packets.	**L3**	**3**
12	Simulate and study the performance of GSM on NS2/NS3 (Using MAC layer) or equivalent environment.	**L3**	**3**
13	Simulate and study the performance of CDMA on NS2/NS3 (Using stack called Call net) or equivalent environment	**L3**	**3**
14	Simulate and study the performance of LTE on NS2/NS3	**L3**	**3**

Web Link and Video Lectures:

- 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:

CO1	Implement various protocols using TCP and UDP.
CO2	Compare the performance of different transport layer protocols.
CO3	Use simulation tools to analyze the performance of various network protocols.
CO4	Analyze various routing algorithms
CO5	Implement error correction codes.

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

High-3, Medium-2, Low-1

Course Title	WEB PROGRAMMING LABORATORY	**Semester**	05
Course Code	MVJ20CSL58	**CIE**	50
Total No. of Contact Hours	40 L : T : P :: 10 : 0 : 30	**SEE**	50
No. of Contact Hours/week	3	**Total**	100
Credits	2	**Exam. Duration**	3 Hours

Course objective is to:

This course will enable students to get practical experience in design, develop, implement, analyze and evaluation of

- Web pages and Style sheet creation.
- Client side programming and Java script
- PHP and Database creation.

Sl No	Experiment Name	RBT Level	Hours
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.	**L3**	**3**
2	Design HTML form for keeping student record and validate it using script.	**L3**	**3**
3	Write an HTML program to design an entry form of student details	**L3**	**3**

	send it to store at database server like SQL, Oracle or MS Access.		
4	Write a JavaScript code that displays text "TEXT-GROWING" increasing font size in the interval of 100ms in RED COLOR, when font size reaches 50pt it displays "TEXT-SHRINKING" in BLUE c Then the font size decreases to 5pt.	**L3**	**3**
5	Assume four users user1, user2, user3 and user4 having the passw pwd1, pwd2, pwd3 and pwd4 respectively. Write a servlet for doing following. 1.Create a Cookie and add these four user id's and passw to this Cookie. 2. Read the user id and passwords entered in the L form and authenticate with the values available in the cookies.	**L3**	**3**
6	Write a JSP which insert the details of the 3 or 4 users who register the web site by using registration form. Authenticate the user whe submits the login form using the user name and password from database.	**L3**	**3**
7	Validate the form using PHP regular expression. PHP stores a form in to database	**L3**	**3**
8	Write a PHP program to display a digital clock which displays current time of the server.	**L3**	**3**
9	Creating simple application to access data base using JDBC Format HTML with CSS.	**L3**	**3**
10	Write a Program for manipulating Databases and SQL with real application	**L3**	**3**

Course outcomes:	
CO1	Construct Web pages using HTML/XML and style sheets.
CO2	Build dynamic web pages with validation using Java Script objects and by applying different event handling mechanisms.
CO3	Develop dynamic web pages using server side scripting.
CO4	Use PHP programming to develop web applications
CO5	Use JDBC and SQL to develop web applications

CO-PO/PSO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2

CO1	3	3	2	-	3	3	-	-	3	-	3	2	1	-
CO2	3	3	2	-	3	3	-	-	3	-	3	2	1	2
CO3	3	3	2	-	3	3	-	-	3	-	3	2	1	2
CO4	3	3	2	-	3	3	-	-	3	-	3	2	1	3
CO5	3	3	2	-	3	3	-	-	3	-	3	2	2	3

High-3, Medium-2, Low-1

VI SEMESTER

Course Title	COMPILER DESIGN	**Semester**	06
Course Code	MVJ20CS61	**CIE**	50
Total No. of Contact Hours	50 L : T : P :: 40 : 10 : 0	**SEE**	50
No. of Contact Hours/week	4	**Total**	100
Credits	4	**Exam. Duration**	3 Hours

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

- To learn the various parsing techniques and different levels of translation.
- To learn how to obtain specific object code from source language.
- To learn how to optimize the code and schedule for optimal performance.

Module-1	**RBT Level L1, L2, L3,L4**	**Hours 10**

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

Module-2	**RBT Level L1,L2,L3,L4**	**Hours 10**

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

Module-3	**RBT Level L1,L2,L3,L4**	**Hours 10**

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

Module-4	**RBT Level L1,L2,L3,L4**	**Hours 10**

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/		
Module-5	**RBT Level L1,L2,L3,L4**	**Hours 10**
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		

Course outcomes:	
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

Text/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 Dependencebased Approach‖, Morgan Kaufmann Publishers, 2002.
3	Keith D Cooper and Linda Torczon, ―Engineering a Compiler‖, Morgan Kaufmann Publishers Elsevier Science, 2004
4	V. Raghavan, ―Principles of Compiler Design‖, Tata McGraw Hill Education Publishers, 2010.
5	Allen I. Holub, ―Compiler Design in C‖, Prentice-Hall Software Series, 1993.
6	Steven S. Muchnick, ―Advanced Compiler Design and Implementation‖, Morgan Kaufmann Publishers - Elsevier Science, India, Indian Reprint 2003.

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

Course Title	CRYPTOGRAPHY AND NETWORK SECURITY	**Semester**	06
Course Code	MVJ20CS62	**CIE**	50
Total No. of Contact Hours	50 L : T : P :: 40 : 10 : 0	**SEE**	50
No. of Contact Hours/week	4	**Total**	100
Credits	4	**Exam. Duration**	3 Hours

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

- Acquire fundamental knowledge on the concepts of finite fields and number theory.
- To gain various block cipher and stream cipher models.
- Describe the principles of public key cryptosystems, hash functions and digital signature.
- Learn the various malicious attacks and firewall applications.
- To develop various security protocols for web and email applications

Module-1	**RBT Level** L1,L2 , L3	**Hours 10**

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- Discrete logarithms.

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/

Module-2	**RBT Level** L2 , L3	**Hours 10**

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/

Module-3	**RBT Level** L2,L3 , L4	**Hours 10**

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 – EI Gamal – Schnorr.

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

Module-4	**RBT Level** L3,L4 , L6	**Hours 10**

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.

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

Module-5	**RBT Level** L4,L5 ,L6	**Hours 10**

E-MAIL, IP & WEB 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). Web Security: SSL/TLS Basic Protocol-computing the keys- client authentication-PKI as deployed by SSL-SET

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

Course outcomes:	
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.

Text/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.
4	Man Young Rhee, "Internet Security: Cryptographic Principles", " Algorithms and Protocols", Wiley Publications, 2003.
5	Charles Pfleeger, "Security in Computing", 4th Edition, Prentice Hall of India, 2006.
6	Ulysess Black, "Internet Security Protocols", Pearson Education Asia, 2000.

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

Course Title	MOBILE APPLICATION DEVELOPMENT	**Semester**	06
Course Code	MVJ20CS631	**CIE**	50
Total No. of Contact Hours	40 L : T : P :: 40 : 0 : 0	**SEE**	50
No. of Contact Hours/week	3	**Total**	100
Credits	3	**Exam. Duration**	3 Hours

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

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

Module-1	**RBT Level** L1,L2 ,L3	**Hours 8**

Introduction: Introduction to mobile application - Market values for mobile applications System requirements for mobile application – Mobile application development architecture.

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

- https://www.tutorialspoint.com/android/ Online

Module-2	**RBT Level** L2, L3	**Hours 8**

Designing Applications using Android: Developing user interfaces -Layout -Input Controls and Events- Menus - Dialogs, Notifications and Toasts

Applications: Design a Simple Calculator App

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

- http://www.androidhive.info/

Module-3	**RBT Level**	**Hours 8**

	L2,L3, L4	
Multimedia & Services: Lifecycle of a Service - Managing Services –GPS – location API – Playing audio, video. **Video link / Additional online information (related to module if any):** • https://nptel.ac.in/courses/106/106/106106147/		
Module-4	**RBT Level** L3,L4 , L6	**Hours 8**
Technology I Android: Introduction –Establishing the development environment –Android architecture –Activities and views –Interacting with UI –Persisting data using SQLite –Packaging and deployment **Video link / Additional online information (related to module if any):** • http://developer.android.com/develop/index.htm		
Module-5	**RBT Level** L4,L5, L6	**Hours 8**
Technology II–IOS: Introduction to Objective C –IOS features –UI implementation–Touch frameworks –Data persistence using Core Data and SQLite. **Video link / Additional online information (related to module if any):** • https://www.codeschool.com/learn/ios		

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

Text/Reference Books:	
1	Jeff McW herter and Scott Gowell, "Professional Mobile Application Development", Wrox, 2012.
2	David Mark, Jack Nutting, Jeff LaMarche and Frederic Olsson, “Beginning iOS 6 Development: Exploring the iOS SDK”, Apress, 2013.
3	James Dovey and Ash Furrow, “Beginning Objective C”, Apress, 2012
4	Charlie Collins, Michael Galpin and Matthias Kappler, “Android in Practice”, DreamTech, 2012

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

Course Title	CLOUD COMPUTING	**Semester**	06
Course Code	MVJ20CS632	**CIE**	50
Total No. of Contact Hours	40 L : T : P :: 40 : 0 : 0	**SEE**	50
No. of Contact Hours/week	3	**Total**	100
Credits	3	**Exam. Duration**	3 Hours

Course objective is to:

This course will enable students 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.

Module-1	**RBT Level** L1,L2 , L3	**Hours 8**

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. Introduction to big data analytics, using MapReduce/Hadoop for analyzing unstructured data, Hadoop ecosystem of tools.

Applications:

Microsoft Azure, Amazon Web Services

Video link / Additional online information :

- https://www.youtube.com/watch?v=PW-V-72MJNY

Module-2	**RBT Level** L2 , L3	**Hours 8**

'Integration as a Service' Paradigm for the Cloud Era:

An Introduction, The Onset of Knowledge Era, The Evolution of SaaS , The Challenges of SaaS Paradigm, Approaching the SaaS Integration Enigma, New Integration Scenarios, The Integration Methodologies, SaaS Integration Products and Platforms , SaaS Integration Services, Businesses-to-Business Integration (B2Bi) Services, A Framework of Sensor- Cloud Integration, SaaS Integration Appliances, Issues for Enterprise Applications on the Cloud, Transition Challenges, Enterprise Cloud Technology and Market Evolution, Business Drivers Toward a Marketplace for Enterprise Cloud Computing, The Cloud Supply Chain

Laboratory Sessions/ Experimental learning:

1. Installation and Configuration of Hadoop.

Applications: PAAS(Facebook, Google App Engine)

Video link / Additional online information :

- https://www.youtube.com/watch?v=ifZh5SJAujA

Module-3	**RBT Level** L2,L3, L4	**Hours 8**

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

Module-4	**RBT Level** L3,L4 , L6	**Hours 8**

Platform and Software as a Service**:**Technologies and Tools for Cloud Computing- Aneka Cloud Platform- Aneka Resource Provisioning Service- Hybrid Cloud Implementation - CometCloud Architecture- Autonomic Behavior of CometCloud- Overview of CometCloud-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

Module-5	**RBT Level** L4,L5 , L6	**Hours 8**

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

Course outcomes:

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.

Text/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.

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

Course Title	AGILE TECHNOLOGIES	**Semester**	06
Course Code	MVJ20CS633	**CIE**	50
Total No. of Contact Hours	40 L : T : P :: 40 : 0 : 0	**SEE**	50
No. of Contact Hours/week	3	**Total**	100
Credits	3	**Exam. Duration**	3 Hours

Course objective is to:

- To discuss the essence of agile development methods.
- Carry out all stages of an agile software process in a team, to produce working software.
- Provide practical knowledge of how to manage a project using Scrum framework.
- Use test driven development to ensure software quality.

• Should be able to demonstrate a more advanced capability to apply lean and agile development techniques to solve complex problems.		
Module-1	**RBT Level** L1,L2 ,L3	**Hours 8**
Fundamentals of Agile: The Genesis of Agile, Introduction and background, Agile Manifesto and Principles, Overview of Scrum, Extreme Programming, Feature Driven development, Lean Software Development, Agile project management, Design and development practices in Agile projects, Test Driven Development, Continuous Integration, Refactoring, Pair Programming, Simple Design, User Stories, Agile Testing, Agile Tools		
Module-2	**RBT Level** L1,L2 ,L3	**Hours 8**
Agile Scrum Framework: Introduction to Scrum, Project phases, Agile Estimation, Planning game, Product backlog, Sprint backlog, Iteration planning, User story definition, Characteristics and content of user stories, Acceptance tests and Verifying stories, Project velocity, Burn down chart, Sprint planning and retrospective, Daily scrum, Scrum roles – Product Owner, Scrum Master, Scrum Team, Scrum case study, Tools for Agile project management		
Module-3	**RBT Level** L1,L2 ,L3	**Hours 8**
Agile Testing: The Agile lifecycle and its impact on testing, Test-Driven Development (TDD), xUnit framework and tools for TDD, Testing user stories - acceptance tests and scenarios, Planning and managing testing cycle, Exploratory testing, Risk based testing, Regression tests, Test Automation, Tools to support the Agile tester		
Module-4	**RBT Level** L1,L2 ,L3	**Hours 8**
Agile Software Design and Development: Agile design practices, Role of design Principles including Single Responsibility Principle, Open Closed Principle, Liskov Substitution Principle, Interface Segregation Principles, Dependency Inversion Principle in Agile Design, Need and significance of Refactoring, Refactoring Techniques, Continuous Integration, Automated build tools, Version control.		
Module-5	**RBT Level** L1,L2 ,L3	**Hours 8**
Industry Trends: Market scenario and adoption of Agile, Agile ALM, Roles in an Agile project, Agile applicability, Agile in Distributed teams, Business benefits, Challenges in Agile, Risks and Mitigation, Agile projects on Cloud, Balancing Agility with Discipline, Agile rapid development		

technologies.	
Course outcomes:	
CO1	Understand the background and driving forces for taking an Agile approach to software development.
CO2	Understand the business value of adopting Agile approaches.
CO3	Drive development with unit tests using Test Driven Development
CO4	Deploy automated build tools, version control and continuous integration
CO5	Apply design principles and refactoring to achieve Agility.

Text/Reference Books:	
1	Ken Schawber, Mike Beedle," Agile Software Development with Scrum", Pearson Education.
2	Lisa Crispin, Janet Gregory, "Agile Testing: A Practical Guide for Testers and Agile Teams" , Addison Wesley.
3	Robert C. Martin, "Agile Software Development, Principles, Patterns and Practices", Prentice Hall.
4	Robert Spalding: "Storage Networks the Complete Reference", Tata McGraw-Hill, 2011.
5	Alistair Cockburn, "Agile Software Development: The Cooperative Game",Addison Wesley
6	Mike Cohn , "User Stories Applied: For Agile Software", Addison Wesley

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

High-3, Medium-2, Low-1

Course Title	SOCIAL NETWORK ANALYSIS	**Semester**	06

Course Code	MVJ20CS634	**CIE**	50
Total No. of Contact Hours	40 L : T : P :: 40 : 0 : 0	**SEE**	50
No. of Contact Hours/week	3	**Total**	100
Credits	3	**Exam. Duration**	3 Hours

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

- To develop the skills of Social Network Concepts and Techniques
- To represent and process Network Relations
- To familiarize with Web based Social Network Applications

Module-1	**RBT Level** L1,L2, L3	**Hours 8**

INTRODUCTION: Analyzing the Social Web, A brief history of the Social Web, Websites discussed, Tools used.

NODES, EDGES AND NETWORK MEASURES: Basics of Network Structure, Representing Networks, Basic Network Structures and Properties.

NETWORK STRUCTURE AND MEASURES: Describing Nodes and Edges, Describing Networks

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

- https://nptel.ac.in/content/storage2/106/106/106106169/MP4/mod01lec05.mp4
- https://nptel.ac.in/content/storage2/106/106/106106169/MP4/mod01lec07.mp4
- https://nptel.ac.in/content/storage2/106/106/106106169/MP4/mod02lec19.mp4

Module-2	**RBT Level** L1,L2, L3	**Hours 8**

NETWORK VISUALIZATION: Layouts, Visualizing Network features**. TIE STRENGTH**:

The role of Tie Strength, Measuring Tie Strength, Tie Strength and Network Structure, Tie Strength and Network Propagation

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

- https://nptel.ac.in/content/storage2/106/106/106106169/MP4/mod03lec30.mp4
- https://nptel.ac.in/content/storage2/106/106/106106169/MP4/mod03lec31.mp4
- https://nptel.ac.in/content/storage2/106/106/106106169/MP4/mod04lec40.mp4

Module-3	**RBT Level** L1,L2 ,L3	**Hours 8**

ENTITY RESOLUTION AND LINK PREDICTION: Link Prediction, Entity Resolution, Link Prediction: Case Study – Friend Recommendation.

COMMUNITY DISCOVERY IN SOCIAL NETWORKS: Introduction to Community Discovery, Communities in Context, Quality Functions, The Kernighan-Lin algorithm, Agglomerative/Divisive Algorithms,

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

- https://nptel.ac.in/content/storage2/106/106/106106169/MP4/mod06lec79.mp4
- https://nptel.ac.in/content/storage2/106/106/106106169/MP4/mod06lec80.mp4
- https://nptel.ac.in/content/storage2/106/106/106106169/MP4/mod06lec81.mp4

Module-4	**RBT Level** L1,L2 ,L3	**Hours 8**

COMMUNITY DISCOVERY IN SOCIAL NETWORKS (CONTD): Spectral Algorithms, Multi-level Graph Partitioning, Markov Clustering, Other Approaches.

MODELS AND ALGORITHMS FOR SOCIAL INFLUENCE ANALYSIS: Introduction to Social Influence, Influence Related Statistics, Social Similarity and Influence, Homophily, Existential Test for Social Influence, Influence and Actions, Influence and Interaction, Influence Maximization in Viral Marketing, Other Applications.

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

- https://nptel.ac.in/content/storage2/106/106/106106169/MP4/mod05lec70.mp4
- https://nptel.ac.in/content/storage2/106/106/106106169/MP4/mod05lec71.mp4

Module-5	**RBT Level** L1,L2 ,L3	**Hours 8**

MODELLING, AGGREGATING AND KNOWLEDGE REPRESENTATION: Ontology and their role in the Semantic Web: Ontology-based knowledge Representation -Ontology languages for the Semantic Web: Resource Description Framework – Web Ontology Language – Modelling and aggregating social network data: State-of-the-art in network data representation – Ontological representation of social individuals – Ontological representation of social relationships – Aggregating and reasoning with social network data – Advanced representations.

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

- https://nptel.ac.in/content/storage2/106/106/106106169/MP4/mod10lec133.mp4
- https://nptel.ac.in/content/storage2/106/106/106106169/MP4/mod12lec152.mp4

Course outcomes:

CO1	Understand and visualize the basic concepts of network structure and representation of

	Social Network Analysis
CO2	Analyze the Social Network structure and its visualize them in the form of layouts
CO3	Apply the Social Network Concepts in solving problems related to social, personal, business and international levels
CO4	Understand and Implement the algorithm for discovering communities in Social Networks
CO5	Understand the algorithm and models for social influence analysis

Text/Reference Books:	
1	Jennifer Goldbeck, "Analyzing the Social Web", Morgan Kaufmann Publications, 2013
2	Charu C. Aggarwal, "Social Network Data Analytics", Springer Publications, 2011
3	Peter Mika, Social Networks and the Semantic Web, First Edition, Springer 2007.
4	Borko Furht, Handbook of Social Network Technologies and Applications, 1st Edition, Springer, 2010.

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

High-3, Medium-2, Low-1

Course Title	INFORMATION RETRIEVAL TECHNIQUES	**Semester**	06
Course Code	MVJ19CS641	**CIE**	50
Total No. of Contact Hours	40 L : T : P :: 40 : 0 : 0	**SEE**	50
No. of Contact Hours/week	3	**Total**	100
Credits	3	**Exam. Duration**	3 Hours

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

- To understand the basics of Information Retrieval.
- To understand machine learning techniques for text classification and clustering.
- To understand various search engine system operations.
- To learn different techniques of recommender system.

Module-1	**RBT Level** L1,L2	**Hours 8**

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 Links:

- https://www.youtube.com/watch?v=Y2OybHMjz6U

Module-2	**RBT Level** L1,L2 , L3	**Hours 8**

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 Links:

- https://www.youtube.com/watch?v=m0oiAOgSQFw

Module-3	**RBT Level** L1,L2 , L3	**Hours 8**

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 Links:

- https://www.youtube.com/watch?v=CwjLMV52tzI

Module-4	**RBT Level**	**Hours 8**

	L1,L2 ,L3	

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 Links:

- https://www.youtube.com/watch?v=JjywDlY1OJk

Module-5	**RBT Level** L1,L2 ,L3	**Hours 8**

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 Links:

- https://www.youtube.com/watch?v=1JRrCEgiyHM

Course outcomes:	
CO1	Use an open source search engine framework and explore its capabilities
CO2	Apply appropriate method of classification or clustering.
CO3	Design and implement innovative features in a search engine.
CO4	Implement Web Crawling Algorithms.
CO5	Design and implement a recommender system.

Text/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.

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

Course Title	DATA ANALYTICS	**Semester**	06
Course Code	MVJ20CS642	**CIE**	50
Total No. of Contact Hours	40 L : T : P :: 40 : 0 : 0	**SEE**	50
No. of Contact Hours/week	3	**Total**	100
Credits	3	**Exam. Duration**	3 Hours

Course objective is to: ***This course will enable students to be exposed to big data***

- Learn the different ways of Data Analysis
- Be familiar with data streams
- Learn the mining and clustering
- Be familiar with the visualization

Module-1 INTRODUCTION TO BIG DATA	**RBT Level** L1,L2, L3	**Hours 8**

Introduction to Big Data Platform – Challenges of conventional systems - Web data – Evolution of Analytic scalability, analytic processes and tools, Analysis vs reporting - Modern data analytic tools, Stastical concepts: Sampling distributions, resampling, statistical inference, prediction error. **Experimental learning**: How to calculate Standard Deviation, Mean, Variance Statistics in Excel

Applications: Agriculture, Economic

Video link : https://www.youtube.com/watch?v=Vfo5le26IhY

Module-2 DATA ANALYSIS	**RBT Level** L2, L3	**Hours 8**

Regression modeling, Multivariate analysis, Bayesian modeling, inference and Bayesian networks, Support vector and kernel methods, Analysis of time series: linear systems analysis, nonlinear dynamics - Rule induction - Neural networks: learning and generalization, competitive learning, principal component analysis and neural networks; Fuzzy logic: extracting fuzzy models from data, fuzzy decision trees, Stochastic search methods.

Experimental learning:

- How to read a data set using python
- How to perform data preprocessing

Applications: Autonomous Vehicles

Video link : https://www.youtube.com/watch?v=Vfo5le26IhY

Module-3 MINING DATA STREAMS	**RBT Level** L2, L3	**Hours 8**

Introduction to Streams Concepts – Stream data model and architecture - Stream Computing, Sampling data in a stream – Filtering streams – Counting distinct elements in a stream – Estimating moments – Counting oneness in a window – Decaying window - Realtime Analytics Platform(RTAP) applications - case studies - real time sentiment analysis, stock market predictions.

Laboratory Sessions:

- Build cats classifier using neural network
- Build a model to classify clothes into various categories in Fashion dataset.

Applications: Image Processing

Video link : https://www.youtube.com/watch?v=DooxDIRAkPA

Module-4 FREQUENT ITEMSETS AND CLUSTERING	**RBT Level** L2, L3	**Hours 8**

Mining Frequent itemsets - Market based model – Apriori Algorithm – Handling large data sets in Main memory – Limited Pass algorithm – Counting frequent itemsets in a stream – Clustering Techniques – Hierarchical – K- Means – Clustering high dimensional data – CLIQUE and PROCLUS – Frequent pattern based clustering methods – Clustering in non-euclidean space – Clustering for streams and Parallelism.

Laboratory Sessions: Word Count Map Reduce program to understand Map Reduce Paradigm

Installing and configuring Hadoop

Application: Social Media

Video link : https://www.youtube.com/watch?v=1vbXmCrkT3Y

Module-5 FRAMEWORKS AND VISUALIZATION	**RBT Level** L2, L3	**Hours 8**

MapReduce – Hadoop, Hive, MapR – Sharding – NoSQL Databases - S3 - Hadoop Distributed file systems – Visualizations - Visual data analysis techniques, interaction techniques; Systems and applications

Laboratory Sessions: Create Bar chart, Histogram, Heap Map, scatter plot, Box Plot, Corellogram, Area Chart

Application: Customer Engagement

Video link : https://www.youtube.com/watch?v=9HR3p6MmwU0

Course outcomes:	
CO1	Apply the statistical analysis methods.
CO2	Compare and contrast various soft computing frameworks.
CO3	Design distributed file systems.
CO4	Apply Stream data model.
CO5	Use Visualisation techniques

Text/Reference Books:	
1	Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer, 2007.
2	Anand Rajaraman and Jeffrey David Ullman, Mining of Massive Datasets,Cambridge University Press, 2012.
3	Bill Franks, Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with advanced analystics, John Wiley & sons, 2012.
4	Glenn J. Myatt, Making Sense of Data, John Wiley & Sons, 2007 Pete Warden, Big Data Glossary, O‟ Reilly, 2011.
5	Jiawei Han, Micheline Kamber “Data Mining Concepts and Techniques”, Second Edition, Elsevier, Reprinted 2008.

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

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

High-3, Medium-2, Low-1

Course Title	GAME THEORY	**Semester**	06
Course Code	MVJ20CS643	**CIE**	50
Total No. of Contact Hours	40 L : T : P :: 40 : 0 : 0	**SEE**	50
No. of Contact Hours/week	3	**Total**	100
Credits	3	**Exam. Duration**	3 Hours

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

- Familiarize with the process of game design and development
- Understand the processes, mechanics, issues in game design
- Understand the architecture of game programming.
- Analyze game engine development, modeling, techniques and frameworks

Module-1	**RBT Level** L1,L2, L3	**Hours 8**

Introduction: Elements of Game Play – Artificial Intelligence – Getting Input from the Player - Sprite Programming – Sprite Animation - Multithreading – Importance of Game Design – Game Loop.

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

- https://www.youtube.com/watch?v=a52BtWkyjl0

Module-2	**RBT Level** L1,L2, L3	**Hours 8**

3D GRAPHICS FOR GAME PROGRAMMING: Coordinate Systems, Ray Tracing, Modeling in Game Production, Vertex Processing, Rasterization, Fragment Processing and Output Merging, Illumination and Shaders, Parametric Curves and Surfaces

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

- https://www.youtube.com/watch?v=fwzYuhduME4

Module-3	**RBT Level** L1,L2, L3	**Hours 8**

GAME DESIGN PRINCIPLES: Character Development, Story Telling, Narration, Game Balancing, Core mechanics, Principles of level design, Genres of Games, Collision Detection, Game Logic, Game AI, Path Finding, Case study : Tetris. **Video link / Additional online information (related to module if any):** • https://www.youtube.com/watch?v=n7u1puLdP90		
Module-4	**RBT Level** L1,L2, L3	**Hours 8**
GAMING ENGINE DESIGN : Renderers, Software Rendering, Hardware Rendering, and Controller Based Animation, Spatial Sorting, Level of Detail, Collision Detection, Standard Objects, and Physics, Case study : The Sims **Video link / Additional online information (related to module if any):** • https://www.youtube.com/watch?v=2pfdTSZ-GUM		
Module-5	**RBT Level** L1,L2, L3	**Hours 8**
GAME DEVELOPMENT : Developing 2D and 3D Interactive Games Using OpenGL, DirectX – Isometric and Tile Based Games, Puzzle Games, Single Player Games, Multi-Player Games. Case study: Mine craft. **Video link / Additional online information (related to module if any):** • https://www.youtube.com/watch?v=h0bdo06qNVw		

Course outcomes:	
CO1	Understand the elements of Game Play.
CO2	Understand the framework of 3D Graphics in Game Theory.
CO3	Demonstrate the Game Design Principles.
CO4	Develop and deploy Gaming Engine Design.
CO5	Develop game programming skills and create interactive games.

Text/Reference Books:	
1	David H. Eberly, ―3D Game Engine Design: A Practical Approach to Real-Time Computer Graphics‖, Second Edition, Morgan Kaufmann, 2010.
2	Jung Hyun Han, ―3D Graphics for Game Programming‖, First Edition, Chapman and Hall/CRC, 2011.
3	Jonathan S. Harbour, ―Beginning Game Programming‖, Course Technology, Third Edition PTR, 2009.
4	Ernest Adams and Andrew Rollings, ―Fundamentals of Game Design‖, Third Edition, Pearson Education, 2014

5	Scott Rogers, ―Level Up: The Guide to Great Video Game Design‖, First Edition, Wiley, 2010.
6	Jim Thompson, Barnaby Berbank-Green, and Nic Cusworth, ―Game Design: Principles, Practice, and Techniques - The Ultimate Guide for the Aspiring Game Designer‖, First Edition, Wiley, 2008.

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

Course Title	USER INTERFACE DESIGN	**Semester**	06
Course Code	MVJ20CS644	**CIE**	50
Total No. of Contact Hours	40 L : T : P :: 40 : 0 : 0	**SEE**	50
No. of Contact Hours/week	3	**Total**	100
Credits	3	**Exam. Duration**	3 Hours

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

- Study the concept of menus, windows, interfaces.
- Study about business functions.
- Study the characteristics and components of windows and the various controls for the windows.
- Study about various problems in window design with text, graphics.
- Study the testing methods.

Module-1	**RBT Level** L1,L2, L3	**Hours 8**

Introduction-Importance-Human-Computer interface-characteristics of graphics interface-Direct manipulation graphical system - web user interface-popularity characteristic & principles.

Case Study- Bright Colors in UI Design: Strong and Weak Sides

Video link / Additional online information:

- https://www.mockplus.com/blog/post/learn-ui-design
- https://nptel.ac.in/courses/124/107/124107008/
- https://nptel.ac.in/courses/107/103/107103083/

Module-2	**RBT Level** L1,L2 , L3	**Hours 8**

User interface design process-Obstacles-usability-human characteristics in design - Human interaction speed-business functions-requirement analysis-Direct- Indirect methods-basic business functions-Design standards-system timings - Human consideration in screen design - structures of menus - functions of menus-contents of menu-formatting -phrasing the menu - selecting menu choice navigating menus-graphical menus.

Case Study - UnivCam - Album & Image sorting application

Video link / Additional online information:

- https://www.mockplus.com/blog/post/learn-ui-design
- https://nptel.ac.in/courses/124/107/124107008/
- https://nptel.ac.in/courses/107/103/107103083/

Module-3	**RBT Level** L2,L3,L4	**Hours 8**

Windows-Characteristics- components - presentation styles-types-managements organizations-operations-web systems-device-based controls: characteristics- Screen -based controls: operate control - text boxes-selection control combination control-custom control-presentation control.

Case Study - Fitbit: The UX behind the habit of exercise

Video link / Additional online information:

- https://www.mockplus.com/blog/post/learn-ui-design
- https://nptel.ac.in/courses/124/107/124107008/
- https://nptel.ac.in/courses/107/103/107103083/

Module-4	**RBT Level** L3,L4, L6	**Hours 8**

Text for web pages -Effective feedback-guidance & assistance- Internationalization-accessibility - Icons-Image-Multimedia-coloring.

Mini Project - Designing a VUI—Voice User Interface

Video link / Additional online information: • https://www.mockplus.com/blog/post/learn-ui-design • https://nptel.ac.in/courses/124/107/124107008/ • https://nptel.ac.in/courses/107/103/107103083/		
Module-5	**RBT Level** L3,L4, L5	**Hours 8**
Windows layout-test - Prototypes - kinds of tests - retest - Information search - visualization - Hypermedia - www - Software tools. **Case Study**-Media coverage through data visualization **Video link / Additional online information:** • https://www.mockplus.com/blog/post/learn-ui-design • https://nptel.ac.in/courses/124/107/124107008/ • https://nptel.ac.in/courses/107/103/107103083/		

Course outcomes:	
CO1	Describe the Characteristics of Graphics Interface and its Principles
CO2	Design the standards and structures for Human computer interaction
CO3	Understand the components of web systems and text boxes
CO4	Demonstrate the Guidance of multimedia systems and its accessibility .
CO5	Summarize the concepts of windows layout and visualization

Text/Reference Books:	
1	Wilbent. O. Galitz ,"The Essential Guide to User Interface Design", John Wiley& Sons, 2001.
2	Ben Sheiderman, "Design the User Interface", Pearson Education, 1998.
3	Alan Cooper, "The Essential of User Interface Design", Wiley - Dream Tech Ltd., 2002.

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

High-3, Medium-2, Low-1

Course Title	OBJECT ORIENTED ANALYSIS AND DESIGN	**Semester**	06
Course Code	MVJ20CS651	**CIE**	50
Total No. of Contact Hours	40 L : T : P :: 40 : 0 : 0	**SEE**	50
No. of Contact Hours/week	3	**Total**	100
Credits	3	**Exam. Duration**	3 Hours

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

- Learn the concept of Object Oriented Software Development Process.
- Get acquainted with UML Diagrams.
- Understand Object Oriented Analysis Processes.
- Make them understand different problems in design along with learning how solve them using design patterns.

Module-1	**RBT Level** L1,L2 ,L3	**Hours 8**

Object Basics, Object oriented philosophy, objects, classes, attributes, object behaviour and methods, encapsulation and information hiding, class hierarchy, polymorphism, object relationships and associations, aggregations and object containment, case study, object identity, persistence. Object oriented systems development life cycle: Software development process, building high quality software, use- case driven approach, reusability.

Video links:

- https://nptel.ac.in/courses/106/105/106105153/
- https://www.youtube.com/watch?v=qiyMyyYqZVY

Module-2	**RBT Level** L1,L2, L3	**Hours 8**

Object Oriented Methodologies: Rumbaugh etc all object modelling technique, Booch methodology, Jacobson et al methodologies, patterns, frameworks, the unified approach. Unified modelling language: Static and dynamic models, UML diagrams, UML class diagrams, use-case diagrams, UML dynamic modelling, packages, UML extensibility and UML meta model.

Video links:

- https://nptel.ac.in/courses/106/105/106105224/

Module-3	**RBT Level** L1,L2, L3	**Hours 8**

Object Oriented Analysis Process: Business object analysis, use-case driven object oriented analysis, business process modelling, use-case model, developing effective documentation, case study. Classification: Classification theory, noun phrase approach, common class patterns approach, use-case driven approach, classes, responsibilities, and collaborators, naming classes.

Video links:

- https://www.digimat.in/nptel/courses/video/106105153/L01

Module-4	**RBT Level** L1,L2, L3	**Hours 8**

Identifying Object Relationships, Attributes and Methods: Association, super-subclass relationships, a- part of relationships, case study, class responsibility, defining attributes for via net bank objects, object responsibility, defining methods for via net bank objects Design process and design axioms: Corollaries, design patterns.

Video links:

- https://www.digimat.in/nptel/courses/video/106105153/L16

Module-5	**RBT Level** L1,L2 , L3	**Hours 8**

Designing Classes: UML object constraint languages, designing classes, class visibility, refining attributes for the via net bank objects, designing methods and protocols, designing methods for the via net bank objects, packages and managing classes. Designing access layer, case study. Designing view layer, macro level process.

Video links:

- https://www.digimat.in/nptel/courses/video/106105153/L51

Course outcomes:

CO1	Understand Object Oriented Software Development Process, Master key principles in OO analysis, design, and development.
CO2	Gain exposure to Object Oriented Methodologies & UML Diagrams.
CO3	Apply Object Oriented Analysis Processes for projects.
CO4	Understand the basics of object oriented design and design patterns.
CO5	Familiarize with the application of the Unified Modelling Language (UML) towards analysis and design.

Text/Reference Books:

1	Ali Bahrami, Object Oriented Systems Development using the Unified Modelling Language, McGraw Hill, Reprint 2009.
2	Craig Larman, ―Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development‖, Third Edition, Pearson Education, 2005.
3	Martin Fowler, ―UML Distilled: A Brief Guide to the Standard Object Modeling Language‖, Third edition, Addison Wesley, 2003.
4	Grady Booch: Object-oriented analysis and design, Addison – Wesley, 1994.

CO-PO/PSO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	2	2	1	0	2	1	1	2	-
CO2	1	1	1	1	1	1	1	1	-	1	1	1	1	-
CO3	3	3	3	3	3	3	2	1	0	1	1	1	2	2
CO4	2	2	2	2	2	2	2	1	1	1	1	1	3	-
CO5	1	1	3	3	1	3	1	1	1	0	1	0	-	1

High-3, Medium-2, Low-1

Course Title	WEB TECHNOLOGIES	**Semester**	06
Course Code	MVJ20CS652	**CIE**	50
Total No. of Contact Hours	40 L : T : P :: 40 : 0 : 0	**SEE**	50
No. of Contact Hours/week	3	**Total**	100
Credits	3	**Exam. Duration**	3 Hours

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

- To understand different Internet Technologies.
- To learn java-specific web services architecture
- To understand the SQL and JDBC
- To learn the AJAX and JSON

Module-1	**RBT Level** L1,L2, L3	**Hours 8**

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

Module-2	**RBT Level** L1,L2, L3	**Hours 8**

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

Module-3	**RBT Level** L1,L2 , L3	**Hours 8**

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

Module-4	**RBT Level** L1,L2, L3	**Hours 8**

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

Module-5	**RBT Level** L1,L2, L3	**Hours 8**

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

Course outcomes:

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.

Text/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.
5	UttamK.Roy, ―Web Technologies‖, Oxford University Press, 2011.

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

Course Title	NETWORKS AND SYSTEM SECURITY	**Semester**	06
Course Code	MVJ20CS653	**CIE**	50
Total No. of Contact Hours	50 L : T : P :: 40 : 10 : 0	**SEE**	50
No. of Contact Hours/week	3	**Total**	100
Credits	3	**Exam. Duration**	3 Hours

Course objective is to:

This course will enable students to

- To provide understanding of the main issues related to security in modern networked computer systems.
- To understand the foundations of computer security, basic knowledge about security-relevant decisions in designing IT infrastructures, techniques to secure complex systems;
- To discuss the different security tools used in network security

- To introduce practical skills in managing a range of systems, from personal laptop to large-scale infrastructures.
- To understand protective and recovery strategies.

Module-1	**RBT Level** L1,L2, L3	**Hours 8**

Building a Secure Organization:

Obstacles to Security, Security Is Inconvenient, Computers Are Powerful and Complex, Computer Users Are Unsophisticated, Computers Created Without a Thought to Security, Current Trend Is to Share, Not Protect, Data Accessible from Anywhere, Security Isn't About Hardware and Software, The Management Sees Security as a Drain on the Bottom Line, Ten Steps to Building a Secure Organization.

Applications:

To verify and validate the banking application by Security vulnerabilities targeted to the confidentiality, integrity, and availability of an application. It cover various attack vectors such as injection attacks, authentication and session management, security misconfiguration, and sensitive data exposure.

Video link / Additional online information :

SQL Injection Tutorial : https://www.youtube.com/watch?v=3Axp3VDnf0I

Module-2	**RBT Level** L2, L3	**Hours 8**

Preventing System Intrusions:

What Is an Intrusion, Sobering Numbers, Know Your Enemy: Hackers versus Crackers, Motives, Tools of the Trade, Bots, Symptoms of Intrusions, Know Today's Network Needs, Network Security Best Practices, Security Policies, Risk Analysis, Tools of Your Trade, Controlling User Access Traditional Reconnaissance and Attacks, Malicious Software, Defense in Depth, Preventive Measures, Intrusion Monitoring and Detection, Reactive Measures

Laboratory Sessions/ Experimental learning:

- Installation and analyze of Solar Winds Security Event Manager and Manage Engine Event Log Analyzer.

Applications: Snort, Security Onion

Video link / Additional online information :

Automation TaskBots, MetaBots, and IQ Bots : https://www.youtube.com/watch?v=9-GYTX2O84k

Module-3	**RBT Level** L2,L3, L4	**Hours 8**

Unix and Security: Basic Unix Security- Protecting User Accounts and Strengthening Authentication- Reducing Exposure to Threats by Limiting Superuser Privileges- Safeguarding Vital Data by Securing Local and Network File Systems- Introduction to Linux and Unix– Hardening Linux and Unix- Proactive Defense for Linux and Unix- Internet Protocol Architecture- An Internet Threat Model- Defending Against Attacks on the Internet- Botnet Overview- Typical Bot Life - The Botnet Business Model - Botnet Defense- Botmaster Traceback

Laboratory Sessions/ Experimental learning:

Threat modeling in cyber security is a way of identifying, listing, prioritizing, and mitigating potential threats in order to protect systems and data. Threat analysis and modeling can performed on education domain by brainstorming to rigorous formal frameworks

Applications: Honey pots and honey nets

Video link / Additional online information :

Threat Models : https://www.youtube.com/watch?v=GqmQg-cszw4

Module-4	**RBT Level** L3,L4, L6	**Hours 8**

Intranet Security: Plugging the Gaps: Network Access Control and Access Control - Measuring Risk: Audits- Guardian at the Gate: Authentication and Encryption - Wireless Network Security - Shielding the Wire: Network Protection - Weakest Link in Security: User Training - Documenting the Network: Change Management - Rehearse the Inevitable: Disaster Recovery- Controlling Hazards: Physical and Environmental Protection - Know Your Users: Personnel Security- Protecting Data Flow: Information and System Integrity - Security Assessments - Risk Assessments- Local Area Network Security

Laboratory Sessions/ Experimental learning:

To make students aware of dictionary attacks, and to teach students how to defend systems against such attacks by proactively filtering weak passwords, salting passwords, and limiting authentication attempts. In the process of doing the experiment, students also learn about secure hash functions and their implementation in OpenSSL

Applications: Television remote control, Wi-Fi, Cell phones, wireless power transfer, computer interface devices

Video link / Additional online information :

Wireless network security :https://www.youtube.com/watch?v=6pYZ2N9y2fQ

Module-5	**RBT Level** L4,L5, L6	**Hours 8**

Wireless Network Security:

Cellular Networks- Wireless Ad Hoc Networks- Security Protocols- Secure Routing- Overview of Cellular Networks- The State of the Art of Cellular Network Security- Cellular Network Attack Taxonomy- Cellular Network Vulnerability Analysis- Radio Frequency Identification Introduction- RFID Challenges- RFID Protections

Laboratory Sessions/ Experimental learning:

Create an application using RFID and verify the various challenges occurred in the RFID application

Applications: The logistics and supply chain is the most common industry applying RFID.

Video link / Additional online information :

How does RFID & NFC work? : https://www.youtube.com/watch?v=mzPb9QLJu8k

Course outcomes:	
CO1	Understand the concepts and foundations of computer security, and identify vulnerabilities of IT systems.
CO2	Analyse a given network and carryout protective and recovery strategies.
CO3	Analyse a given network and list possible threats to it.
CO4	Use basic security tools to enhance system security and can develop basic security enhancements in stand-alone applications.
CO5	Carryout survey on the implementation of security to a given organisation.

Text/Reference Books:	
1	John R. Vacca, Network and System Security, Springer Publication
2	Michael T. Goodrich and Roberto Tamassia, Introduction to Computer Security, Addison Wesley, 2011.
3	William Stallings, Network Security Essentials: Applications and Standards, Prentice Hall, edition, 2010.

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

High-3, Medium-2, Low-1

Course Title	MOBILE COMPUTING	**Semester**	06
Course Code	MVJ20CS654	**CIE**	50
Total No. of Contact Hours	40 L : T : P :: 40 : 0 : 0	**SEE**	50
No. of Contact Hours/week	3	**Total**	100
Credits	3	**Exam. Duration**	3 Hours

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

- To make the student understand the concept of mobile computing terminology and basics
- To understand the wireless protocols.
- To understand various routing mechanisms.

Module-1	**RBT Level** L1,L2, L3	**Hours 8**

Introduction: Mobile Communications, Mobile Computing – Paradigm, Promises/Novel Applications and Impediments and Architecture; Mobile and Handheld Devices, Limitations of Mobile and Handheld Devices.

Global System for Mobile Communication(GSM): Services, System Architecture, Radio Interfaces, Protocols, Localization, Calling, Handover, New Data Services, GPRS Architecture, GPRS Network Nodes.

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

- https://www.youtube.com/watch?v=bur9hq_abog (NPTEL VIDEO)

Module-2	**RBT Level** L1,L2, L3	**Hours 8**

Medium Access Control (MAC) : Motivation for a specialized MAC (Hidden and exposed terminals, Near and far terminals), Wireless LAN/(IEEE 802.11) architecture, key IEEE802.11 a/b/c/d/e/g/i/n/T/ac/ standards.

Wireless Application Protocol (WAP): The Mobile Internet standard, WAP Gateway and Protocols, wireless mark up Languages (WML). Wireless Local Loop(WLL): Introduction to WLL Architecture, wireless Local Loop Technologies.

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

- https://www.youtube.com/watch?v=sx0UPzztC5o (NPTEL VIDEO)

Module-3	**RBT Level**	**Hours 8**

	L1,L2, L3	

Mobile Network Layer : IP and Mobile IP Network Layers, Packet Delivery and Handover Management, Location Management, Registration, Tunneling and Encapsulation, Route Optimization using Soft computing techniques – ANT Bee colony, Support Vector Machine, Particle Swarm Optimization and Genetic Algorithm.

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

- https://www.youtube.com/watch?v=0QLRULNfbFg

Module-4	**RBT Level** L1,L2, L3	**Hours 8**

Mobile Transport Layer : Conventional TCP/IP Protocols, Indirect TCP, Snooping TCP, Mobile TCP.

Third Generation (3G) Mobile Services: Introduction to International Mobile Telecommunications 2000 (IMT 2000) vision, Wideband Code Division Multiple Access (W- CDMA) and CDMA 2000, Quality of services in 3G.

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

- https://www.youtube.com/watch?v=KCcdF4IVrQk
- https://www.youtube.com/watch?v=ymnQ5rpcYA&list=PLbMVogVj5nJSi8FUsvglRxLtN1TN9y4nx

Module-5	**RBT Level** L1,L2, L3	**Hours 8**

Mobile Ad hoc Networks (MANETs) : Introduction, Applications & Challenges of a MANET, Routing, Classification of Routing Algorithms, Algorithms such as DSR, AODV, DSDV, etc. , Mobile Agents, Service Discovery ,case study using NS2 –traffic analysis using CBR and VBR.

Wireless Enterprise Networks: Introduction to Virtual Networks, Blue tooth technology, Blue tooth Protocols.

Video link:

- https://nptel.ac.in/courses/106/105/106105160/
- https://www.digimat.in/nptel/courses/video/106105160/L01.html

Course outcomes:

CO1	Able to interpret GSM architecture and its services.
CO2	Analyze the various wireless application protocols and its different concepts for various mobile applications.
CO3	Learn the representation of mobile network layer protocols and its functionalities.
CO4	Understand, analyze & develop any existing or new models of mobile environments

	for 3G networks.
CO5	Understand, evaluate and create the platforms, protocols and related concepts along with along with mobile in mobile environment.

Text/Reference Books:	
1	Jochen Schiller, ―Mobile Communications‖, PHI, Second Edition, 2009.
2	Raj Kamal, "Mobile Computing", Oxford University Press, 2007, ISBN: 0195686772
3	Dharma Prakash Agarval, Qing and An Zeng, "Introduction to Wireless and Mobile systems",Thomson Asia Pvt Ltd, 2005.
4	Martin Sauter, "From GSM to LTE-Advanced: An Introduction to Mobile Networks and Mobile Broadband," Second Edition, Wiley.
5	William.C.Y.Lee,―Mobile Cellular Telecommunications-Analog and Digital Systems‖, Second Edition,TataMcGraw Hill Edition ,2006.
6	Prasant Kumar Pattnaik, Rajib Mall, ―Fundamentals of Mobile Computing‖, PHI Learning Pvt.Ltd, New Delhi – 2012

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

High-3, Medium-2, Low-1

Course Title	COMPILER DESIGN LABORATORY	**Semester**	06
Course Code	MVJ20CSL66	**CIE**	50
Total No. of Contact Hours	40 L : T : P :: 10 : 0 : 30	**SEE**	50
No. of Contact Hours/week	3	**Total**	100
Credits	2	**Exam. Duration**	3 Hours

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

- Learning tools for compiler writing
- Designing the specification of language constructs
- Learning code generation and optimization

Sl No	Experiment Name	RBT Level	Hours
1	Tokenizer with LEX for declarations in C language.	**L3**	**3**
2	Tokenizer with LEX for assignment statement.	**L3**	**3**
3	Parser with LEX and YACC to validate ―for‖ statement.	**L3**	**3**
4	Evaluation of arithmetic expression with LEX and YACC.	**L3**	**3**
5	Symbol table creation from a list of declarations.	**L3**	**3**
6	Syntax tree creation from ―if‖ statement.	**L3**	**3**
7	Three address code generation from assignment statement with array references.	**L3**	**3**
8	Three address code generation from ―while‖ statement.	**L3**	**3**
9	Construction of flow graph from list of three address statements.	**L3**	**3**
10	Constant propagation in a flow graph.	**L3**	**3**
	OPEN ENDED EXPERIMENT 1. Translation of three address code to assembly language with fixed number of registers. 2. Stack and heap management at run time	**L3**	**3**

Course outcomes:

CO1	Implement the token recognizer from token specification
CO2	Implement the parser from the syntax specification
CO3	Implement the intermediate code generator for the specified intermediate language
CO4	Implement simple optimizations
CO5	Implement translator with specific input and object language

CO-PO/PSO Mapping

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

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

High-3, Medium-2, Low-1

Course Title	CRYPTOGRAPHY AND NETWORK SECURITY LABORATORY	**Semester**	06
Course Code	MVJ20CSL67	**CIE**	50
Total No. of Contact Hours	40 L : T : P :: 10 : 0 : 30	**SEE**	50
No. of Contact Hours/week	3	**Total**	100
Credits	2	**Exam. Duration**	3 Hours

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

1. Compare and contrast symmetric and asymmetric encryption systems and their vulnerability to various attacks.
2. Learn the various number theory concepts and applications.
3. Analyse the message digest algorithms and create digest values.
4. To develop and apply authentication, email security, web security services and mechanisms
5. Create java script for web applications for providing security.

Sl No	**Experiment Name**	**RBT Level**	**Hours**
1	Write a program that contains a string (char pointer) with a value \Hello World'. The program should XOR each character in this string with 0 and displays the result.	**L3**	**3**
2	Write a program that contains a string (char pointer) with a value \Hello World'. The program should AND or and XOR each character in this string with 127 and display the result.	**L3**	**3**
3	Write a Java program to perform encryption and decryption using the following algorithms: a) Ceaser Cipher b) Substitution Cipher c) Hill Cipher.	**L3**	**3**
4	Write a Java program to implement the DES algorithm logic.	**L3**	**3**

5	Write a C/JAVA program to implement the BlowFish algorithm logic.	**L3**	**3**
6	Write a C/JAVA program to implement the Rijndael algorithm logic.	**L3**	**3**
7	Using Java Cryptography, encrypt the text "Hello world" using BlowFish. Create your own key using Java key tool.	**L3**	**3**
8	Write a Java program to implement RSA Algorithm with p=3, q=11.	**L3**	**3**
9	Implement the Diffie-Hellman Key Exchange mechanism using HTML and JavaScript. Consider the end user as one of the parties (Alice) and the JavaScript application as other party (bob).	**L3**	**3**
10	Calculate the message digest of a text using the MD5 algorithm in JAVA.	**L3**	**3**
11	Calculate the message digest of a text using the SHA-1 algorithm in JAVA.	**L3**	**3**
12	Using Java Cryptography, encrypt the text "Hello world" using BlowFish. Create your own key using Java key tool.	**L3**	**3**
	OPEN ENDED EXPERIMENT 1. Perform encryption and decryption using mono-alphabetic cipher. The program should support the following : o Construct an input file named plaintext.txt (consisting of 1000 alphabets, without any space or special characters) o Encrypt the characters of plaintext.txt and store the corresponding ciphertext characters in ciphertext.txt o Compute the frequency of occurrence of each alphabet in both plaintext.txt and ciphertext.txt and tabulate the results 2. Write a program to perform the following using Playfair cipher technique o Encrypt a given message M with different keys {k1,k2,...,kn}. Print key and cipher text pair o Decrypt the cipher texts obtained in (i) to get back M	**L3**	**3**

Course outcomes:	
CO1	Identify the major types of threats to information security and the associated attacks, Services and Mechanisms
CO2	Design and develop cryptographic algorithms using public key cryptography.
CO3	Generate the own key for developing cryptography algorithms.
CO4	Implement the key exchange algorithms using scripts.
CO5	Design the various security protocols for web applications.

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

High-3, Medium-2, Low-1

VII SEMESTER

Course Title	INTERNET OF THINGS	**Semester**	07
Course Code	MVJ20CS71	**CIE**	50
Total No. of Contact Hours	50 L : T : P :: 40 : 10 : 0	**SEE**	50
No. of Contact Hours/week	4	**Total**	100
Credits	4	**Exam. Duration**	3 Hours

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

- To learn the basic issues, policy and challenges in the Internet.
- To get an idea of some of the application areas where Internet of Things can be applied.
- To understand the cloud and internet environment.
- To understand the various modes of communications with Internet.

Module-1	**RBT Level** L1,L2, L3	**Hours 10**

Prerequisites : Basic Knowledge about C or C++

Introduction to IoT: Definition – Foundations – Challenges and Issues - Identification - Security. Components in internet of things: Control Units – Sensors – Communication modules –Power Sources – Communication Technologies – RFID – Bluetooth – Zigbee – Wifi – Rflinks –Mobile Internet – Wired Communication-IoT Platform Overview-Raspberry pi-Arduino boards.*

Applications: Sensors in IoT.

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

- http://www.theinternetofthings.eu/what-is-the-internet-of-things.
- https://www.engineersgarage.com/article_page/sensors-different-types-of-sensors/
- https://www.educba.com/applications-of-sensors/

*** Programming Assignments are Mandatory.**

Module-2	**RBT Level** L2, L3	**Hours 10**

IoT Protocols: Protocol Standardization for IoT-M2M and WSN Protocols-SCADA and RFID Protocols-Issues with IoT Standardization-Protocols-IEEE 802.15.4-BACNet Protocol-Zigbee Architecture - Network layer – APS Layer – Security.*

Applications:

IoT Protocol Applications

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

- https://inductiveautomation.com/resources/article/what-is-scada
- https://iotbytes.wordpress.com/application-protocols-for-iot/
- https://data-flair.training/blogs/iot-protocols/
- https://www.avsystem.com/blog/iot-protocols-and-standards/

*** Programming Assignments are Mandatory.**

Module-3	**RBT Level** L2, L3,L4	**Hours 10**

Resource Management in the Internet of Things: Clustering - Software Agents - Data Synchronization - Clustering Principles in an Internet of Things Architecture - The Role of Context - Design Guidelines - Software Agents for Object – Data Synchronization- Types of Network Architectures - Fundamental Concepts of Agility and Autonomy-Enabling Autonomy and Agility by the Internet of Things - The Evolution from the RFID-based EPC Network to an Agent based Internet of Things- Agents for the Behaviour of Objects.*

Applications: RFID Applications

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

RFID Applications:

- https://www.digiteum.com/rfid-technology-internet-of-things
- https://www.uio.no/studier/emner/matnat/ifi/INF5910CPS/h10/undervisningsmateriale/RFID-IoT.pdf

*** Programming Assignments are Mandatory.**

Module-4	**RBT Level** L3,L4,L6	**Hours 10**

Case Study and IoT Application Development: IoT applications in home- infrastructures security- Industries- IoT electronic equipment's. Use of Big Data and Visualization in IoT Industry 4.0 concepts - Sensors and sensor Node –Interfacing using Raspberry Pi/Arduino- Web Enabled Constrained Devices.*

Laboratory Sessions/ Experimental learning: Interfacing using Raspberry Pi/Arduino

Applications: Elements in group

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

- https://www.simform.com/home-automation-using-internet-of-things/
- https://iot5.net/iot-applications/smart-home-iot-applications/
- https://maker.pro/raspberry-pi/tutorial/how-to-connect-and-interface-raspberry-pi-with-arduino#
- https://create.arduino.cc/projecthub/ruchir1674/how-to-interface-arduino-with-raspberrypi-504b06

* **Programming Assignments are Mandatory.**		
Module-5	**RBT Level** L4,L5,L6	**Hours 10**
Web of Things: Web of Things versus Internet of Things-Architecture Standardization for WoT-Platform Middleware for WoT- WoT Portals and Business Intelligence-Cloud of Things: Grid/SOA and Cloud Computing-Cloud Standards –Cloud of Things Architecture-Open Source e-Health sensor platform. **Video link / Additional online information (related to module if any):** • https://www.water-io.com/iot-vs-wot • https://www.talend.com/resources/iot-cloud-architecture/ * **Programming Assignments are Mandatory.**		

Course outcomes:	
CO1	Identify the components of IoT.
CO2	Analyze various protocols of IoT.
CO3	Design portable IoT using appropriate boards
CO4	Develop schemes for the applications of IOT in real time scenarios.
CO5	Design business Intelligence and Information Security for WoT

Text/Reference Books:	
1	Honbo Zhou, "The Internet of Things in the Cloud:A Middleware Perspective" -CRC Press-20
2	Dieter Uckelmann, Mark Harrison, "Architecting the Internet of Things", Springer2011.
3	Arshdeep Bahga, Vijay Madisetti, "Internet of Things (A Hands-On-Approach)", VPT, 2014.
4	Olivier Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things – Key applicat and Protocols", Wiley, 2012.
5	Luigi Atzori, Antonio Lera, Giacomo Morabito, "The Internet of Things: A Survey", Journa Networks, Elsevier Publications, October, 2010.

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

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

High-3, Medium-2, Low-1

Course Title	MACHINE LEARNING	**Semester**	07
Course Code	MVJ20CS72	**CIE**	50
Total No. of Contact Hours	50 L : T : P :: 40 : 10 : 0	**SEE**	50
No. of Contact Hours/week	4	**Total**	100
Credits	4	**Exam. Duration**	3 Hours

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

- Define machine learning and problems relevant to machine learning.
- Differentiate supervised, unsupervised and reinforcement learning.
- Apply neural networks, Bayes classifier and k nearest neighbor, for problems appear in machine learning.
- Perform statistical analysis of machine learning techniques.

Module-1	**RBT Level** L1,L2, L3	**Hours 10**

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

Module-2	**RBT Level** L1,L2, L3	**Hours 10**

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

Module-3	**RBT Level** L1,L2, L3	**Hours 10**

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

Module-4	**RBT Level** L1,L2, L3	**Hours 10**

Artificial Neural Networks and Instance based Learning

Artificial Neural Networks: Introduction, Neural Network representation, Appropriate problems, Perceptrons, Backpropagation 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

Module-5	**RBT Level**	**Hours 10**

	L1,L2,L3	

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 Convolutional 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

Course outcomes:

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

Text/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.
3	Ethem Alpaydın, Introduction to machine learning, second edition, MIT press.

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

Course Title	GREEN COMPUTING	**Semester**	07
Course Code	MVJ20CS731	**CIE**	50
Total No. of Contact Hours	40 L : T : P :: 40 : 0 : 0	**SEE**	50
No. of Contact Hours/week	3	**Total**	100
Credits	3	**Exam. Duration**	3 Hours

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

- To acquire knowledge to adopt green computing practices to minimize negative impacts on the environment.
- Skill in energy saving practices in their use of hardware.
- Examine technology tools that can reduce paper waste and carbon footprint by user and to understand how to minimize equipment disposal requirements

Module-1	**RBT Level** L1,L2, L3	**Hours 8**

FUNDAMENTALS

Green IT Fundamentals: Business, IT, and the Environment – Green computing: carbon foot print, scoop on power – Green IT Strategies: Drivers, Dimensions, and Goals – Environmentally Responsible Business: Policies, Practices, and Metrics.

Real Time Applications: how they keep data safe while in transit

Video link / Additional online information:

- https://nptel.ac.in/courses/106/104/106104182/
- https://www.youtube.com/watch?v=350Rb2sOc3U

Module-2	**RBT Level** L1,L2, L3	**Hours 8**

GREEN ASSETS AND MODELING

Green Assets: Buildings, Data Centers, Networks, and Devices – Green Business Process Management: Modeling, Optimization, and Collaboration – Green Enterprise Architecture – Environmental Intelligence – Green Supply Chains – Green Information Systems: Design and Development Models.

Real Time Applications: climate-smart agriculture, land restoration, groundwater management, ecosystem-based adaptation

Video link / Additional online information:

- https://nptel.ac.in/courses/110/107/110107128/
- https://nptel.ac.in/courses/110/107/110107093/

Module-3	**RBT Level** L1,L2, L3	**Hours 8**

GRID FRAMEWORK

Virtualizing of IT systems – Role of electric utilities, Telecommuting, teleconferencing and teleporting – Materials recycling – Best ways for Green PC – Green Data center – Green Grid framework.

Real Time Applications: ChessBrain

Video link / Additional online information:

- https://nptel.ac.in/noc/courses/noc18/SEM2/noc18-ee42/
- https://onlinecourses.nptel.ac.in/noc19_ee64/preview

Module-4	**RBT Level** L1,L2, L3	**Hours 8**

GREEN COMPLIANCE

Socio-cultural aspects of Green IT – Green Enterprise Transformation Roadmap – Green Compliance: Protocols, Standards, and Audits – Emergent Carbon Issues: Technologies and Future.

Real Time Applications: Addressing Inconsistent Date Formats, Reducing False Positives in PEP Screening, Integrating Screening with Credit Card Approval Processes.

Video link / Additional online information:

- https://onlinecourses.nptel.ac.in/noc19_ee64/preview

Module-5	**RBT Level** L1,L2, L3	**Hours 8**

CASE STUDIES

The Environmentally Responsible Business Strategies (ERBS) – Case Study Scenarios for Trial Runs – Case Studies Applying Green IT Strategies and Applications to a Home, Hospital, Packaging Industry and Telecom Sector.

Real Time Applications: The energy consumption in Torrent systems with malicious content, The use of thin client instead of desktop PC

Video link / Additional online information:

- https://nptel.ac.in/courses/106/105/106105195/
- https://nptel.ac.in/courses/106/104/106104182/

Course outcomes:

CO1	Acquire knowledge to adopt green computing practices to minimize negative impacts on the

	environment.
CO2	Enhance the skill in energy saving practices in their use of hardware.
CO3	Evaluate technology tools that can reduce paper waste and carbon footprint by the stakeholders.
CO4	Understand the ways to minimize equipment disposal requirements.
CO5	Carry out multiple real time case studies.

Text/Reference Books:	
1	Bhuvan Unhelkar, "Green IT Strategies and Applications-Using Environmental Intelligence", CRC Press, June 2011
2	Woody Leonhard, Katherrine Murray, "Green Home computing for dummies", August 2009.
3	Bhuvan Unhelkar, Green IT Strategies and Applications-Using Environmental Intelligence, CRC Press, June 2014.
4	Woody Leonhard, Katherine Murray, Green Home computing for dummies, August 2012.
5	Alin Gales, Michael Schaefer, Mike Ebbers, "Green Data Center: steps for the Journey", Shoff/IBM rebook, 2011.
6	Carl speshocky, "Empowering Green Initiatives with IT", John Wiley & Sons, 2010.
7	Wu Chun Feng (editor), "Green computing: Large Scale energy efficiency", CRC Press, 2012.
8	John Lamb, The Greening of IT, Pearson Education, 2009.

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	-
CO2	3	3	3	-	-	-	-	-	1	-	1	2	2	-
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	1	2

High-3, Medium-2, Low-1

Course Title	ETHICAL HACKING	**Semester**	07
Course Code	MVJ20CS641	**CIE**	50
Total No. of Contact Hours	40 L : T : P :: 40 : 0 : 0	**SEE**	50
No. of Contact Hours/week	3	**Total**	100
Credits	3	**Exam. Duration**	3 Hours

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

- To understand numerous methods of real-world information intelligence
- To learn about vulnerability scanners
- To understand techniques used to sniff traffic across a network
- To familiarize with the methodologies that can be used to hack into a target
- To appreciate the wide variety of attacks that can be performed against a wireless network

Module-1	**RBT Level** L1,L2 ,L3	**Hours 8**

INTRODUCTION TO HACKING

Terminologies, Categories of Penetration Test, Writing Reports, Structure of a Penetration Testing Report, Vulnerability Assessment Summary, Risk Assessment, Methodology, Linux Basics: File Structure, Cron Job, Users, Common Applications , BackTrack, Services.

Applications: Network packet analysis, Password guessing and cracking

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

- https://www.tutorialspoint.com/ethical_hacking/ethical_hacking_process.htm
- https://www.tutorialspoint.com/ethical_hacking/ethical_hacking_hacker_types.htm

Module-2	**RBT Level** L2 , L3	**Hours 8**

INFORMATION GATHERING, TARGET ENUMERATION AND PORT SCANNING TECHNIQUES

Active, Passive and Sources of information gathering, Copying Websites Locally, NeoTrace, Cheops-ng, Intercepting a Response, WhatWeb, Netcraft, Basic Parameters, Xcode Exploit Scanner, Interacting with DNS Servers, Fierce, Zone Transfer with Host Command and Automation, DNS Cache Snooping- Attack Scenario, Automating Attacks, SNMP - Problem, Sniffing Passwords, SolarWinds Toolset, sweep, Brute Force and Dictionary- Tools , Attack, Enumeration, Intelligence Gathering Using Shodan, Target enumeration and Port Scanning Techniques.

Applications: Session hijacking, Session spoofing

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

- https://www.tutorialspoint.com/ethical_hacking/ethical_hacking_enumeration.htm
- https://www.tutorialspoint.com/ethical_hacking/ethical_hacking_sniffing.htm

Module-3	**RBT Level** L2,L3 ,L4	**Hours 8**

VULNERABILITY ASSESSMENT & NETWORK SNIFFING

Introduction to Vulnerability Assessment - Pros and Cons, NMap, Updation of database, Testing SCADA Environments with Nmap, Nessus, Sniffing: Types, Hubs versus Switches, Modes, MITM Attacks, ARP Protocol Basics- working, Attacks, DoS Attacks, Dsniff tool, Using ARP Spoof to Perform MITM Attacks, Sniffing the Traffic with Dsniff, Sniffing Pictures with Drifnet, Urlsnarf and Webspy, Sniffing with Wireshark, Ettercap- ARP Poisoning, Hijacking Session with MITM Attack, ARP Poisoning with Cain and Abel, Sniffing Session Cookies with Wireshark, Hijacking the Session, SSL Strip: Stripping HTTPS Traffic, Requirements, Automating Man in the Middle Attacks, DNS Spoofing, DHCP Spoofing

Applications: Network traffic sniffing, Denial of Service attacks

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

- https://www.tutorialspoint.com/ethical_hacking/ethical_hacking_sniffing.htm
- https://www.tutorialspoint.com/ethical_hacking/ethical_hacking_tcp_ip_hijacking.htm

Module-4	**RBT Level** L3,L4, L6	**Hours 8**

Understanding Network Protocols: Attacking Network Remote Services, Common Target Protocols, tools for cracking network remote services, Attacking SMTP, Attacking SQL Servers, Client Side Exploitation Methods: E-Mails Leading to Malicious Attachments & Malicious Links, Compromising Client Side Update, Malware Loaded on USB Sticks

Post exploitation: Acquiring Situation Awareness, Privilege Escalation, Maintaining Access, Data Mining, Identifying and Exploiting Further Targets, Windows Exploit Development Basics.

Applications: Exploiting buffer overflow vulnerabilities

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

- https://www.tutorialspoint.com/ethical_hacking/ethical_hacking_sql_injection.htm
- https://www.tutorialspoint.com/ethical_hacking/ethical_hacking_exploitation.htm

Module-5	**RBT Level** L4,L5, L6	**Hours 8**

WIRELESS & WEB HACKING

Wireless Hacking : Requirements , Aircracking , Hidden SSIDs , Monitor Mode , Monitoring Tool-Beacon Frames on Wireshark ,Airodump-ng , Wireless Adapter in Monitor Mode , Determining the Target , Cracking a WPA/WPA2 Wireless Network Using Aircrack-ng , Capturing Packets and Four-Way Handshake.

Web Hacking : Attacking the Authentication , Brute Force and Dictionary Attacks , Types of Authentication , Crawling Restricted Links , Testing for the Vulnerability , Authentication Bypass with Insecure Cookie Handling , SQL injection, XSS – DOM based,BeEF,CSRF, Bypassing CSRF and BeEF with XSS, Vulnerability in FCKeditor, efront.

Applications: Cross Site Scripting, Firewall

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

- https://www.tutorialspoint.com/ethical_hacking/ethical_hacking_ddos_attacks.htm
- https://www.tutorialspoint.com/ethical_hacking/ethical_hacking_wireless.htm

Course outcomes:	
CO1	Understand the core concepts related to malware, hardware and software vulnerabilities and their causes
CO2	Understand ethics behind hacking and vulnerability disclosure
CO3	Appreciate the Cyber Laws and impact of hacking Exploit the vulnerabilities related to computer system and networks using state of the art tools and technologies
CO4	Learn & understand different network protocols and attack strategies
CO5	Understanding the usefulness of wireless & web hacking

Text/Reference Books:	
1	Rafay Baloch ,―Ethical Hacking and Penetration Testing Guide‖, CRC Press, 2015.
2	Patrick Engebretson, ―The Basics of Hacking and Penetration Testing : Ethical Hacking and Penetration Testing Made Easy‖, Syngress Media, Second Revised Edition, 2013.

3	Michael T. Simpson, Kent Backman, James E. Corley, ―Hands On Ethical Hacking

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

Course Title	DIGITAL FORENSICS	**Semester**	07
Course Code	MVJ20CS733	**CIE**	50
Total No. of Contact Hours	40 L : T : P :: 40 : 0 : 0	**SEE**	50
No. of Contact Hours/week	3	**Total**	100
Credits	3	**Exam. Duration**	3 Hours

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

- Understand the basic digital forensics and techniques for conducting the forensic examination on different digital devices.
- Examine digital evidences such as the data acquisition, identification analysis.

Module-1	**RBT Level** L2	**Hours 8**

Computer forensics fundamentals, Benefits of forensics, computer crimes, computer forensics evidence and courts, legal concerns and private issues.

Laboratory Sessions/ Experimental learning:

Familiarization with any one digital forensics tool

Video link / Additional online information:

- https://www.youtube.com/watch?v=2ESqwX3qb94-
- https://nptel.ac.in/courses/106/104/106104119/

Module-2	**RBT Level** L2,L3	**Hours 8**

Understanding Computing Investigations – Procedure for corporate High-Tech investigations, understanding data recovery work station and software, conducting and investigations.

Laboratory Sessions/ Experimental learning:

Case Study on cybercrime Investigation

Video link / Additional online information:

- https://www.coursera.org/lecture/cyber-conflicts/introduction-to-cybercrime-and-fundamental-issues-xndSq
- https://www.youtube.com/watch?v=VoeLc5295XU
- https://www.youtube.com/watch?v=l77AgiphUQo

Module-3	**RBT Level** L2,L3	**Hours 8**

Data acquisition- understanding storage formats and digital evidence, determining the best acquisition method, acquisition tools, validating data acquisitions, performing RAID data acquisitions, remote network acquisition tools, other forensics acquisitions tools.

Laboratory Sessions/ Experimental learning:

Studying different cases where IPR and laws are applied.

Video link / Additional online information:

- https://www.youtube.com/watch?v=qJ693ZlvceA
- https://www.youtube.com/watch?v=6vNxslcf9AE

Module-4	**RBT Level** L2,L3	**Hours 8**

Processing crimes and incident scenes, securing a computer incident or crime, seizing digital evidence at scene, storing digital evidence, obtaining digital hash, reviewing case.

Laboratory Sessions/ Experimental learning:

Case study on protection of copyright on cyberspace

Video link / Additional online information:

- https://nptel.ac.in/courses/109/105/109105112/
- https://nptel.ac.in/courses/109/105/109105112/
- https://nptel.ac.in/courses/106/106/106106129/

Module-5	**RBT Level** L2	**Hours 8**

Current computer forensics tools- software, hardware tools, validating and testing forensic software,

addressing data-hiding techniques, performing remote acquisitions, E-Mail investigations-investigating email crime and violations, understanding E-Mail servers, specialized E-Mail forensics tool.

Laboratory Sessions/ Experimental learning: Email Forensics

Video link / Additional online information:

- https://www.lawctopus.com/video-lectures-law-sudhir-law-review/
- https://www.youtube.com/watch?v=wV2OiOM3q3k

Course outcomes:	
CO1	Analyze Computer Crime and Criminals and Liturgical Procedures
CO2	Apply the laws and regulations to the applications
CO3	Analyze the email tracking cyber applications
CO4	Understanding the protection of Intellectual Property Rights
CO5	To be well-trained as next-generation computer crime investigators.

Text/Reference Books:	
1	Warren G. Kruse II and Jay G. Heiser, "Computer Forensics: Incident Response Essentials", Addison Wesley, 2002.
2	Nelson, B, Phillips, A, Enfinger, F, Stuart, C., "Guide to Computer Forensics and Investigations, 2nd ed., Thomson Course Technology, 2006, ISBN: 0-619-21706-5.
3	Vacca, J, Computer Forensics, Computer Crime Scene Investigation, 2nd Ed, Charles River Media, 2005, ISBN: 1-58450-389.

CO-PO/PSO Mapping

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

High-3, Medium-2, Low-1

Course Title	SOFT COMPUTING	**Semester**	07
Course Code	MVJ20CS734	**CIE**	50
Total No. of Contact Hours	40 L : T : P :: 40 : 0 : 0	**SEE**	50
No. of Contact Hours/week	3	**Total**	100
Credits	3	**Exam. Duration**	3 Hours

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

- Understand soft computing concepts and techniques and foster their abilities in designing and implementing soft computing based solutions for real-world and engineering problems.
- Understand fuzzy systems, fuzzy logic and its applications
- Learn about Artificial Neural Networks and various categories of ANN.
- Learn about Genetic Algorithms and optimization problems.
- Learn about Computational Intelligence Paradigms and applications of CI

Module-1	**RBT Level** L1,L2,L3,L4	**Hours 8**

INTRODUCTION TO SOFT COMPUTING:

Evolution of Computing, Concept of computing systems. Soft Computing Constituents, From Conventional AI to Computational Intelligence, Machine Learning Basics, Some applications of Soft computing techniques

Real Time Applications: Framework for predicting analytics on sales forecast using back propagation network

Video link:

- https://onlinecourses.nptel.ac.in/noc20_cs17
- https://www.youtube.com/watch?v=K9gjuXjJeEM

Module-2	**RBT Level** L1,L2,L3,L4	**Hours 8**

NEURAL NETWORKS :

Biological neurons and it's working, Simulation of biological neurons to problem solving. Architecture-: Single Layer and Multilayer -Feed Forward Networks-Training and Learning methods, Applications of ANNs to solve some real life problems.

Real Time Applications: Natural Language processing using artificial neural networks

Video link:

- https://nptel.ac.in/courses/106/106/106106184/
- https://www.youtube.com/watch?v=4TC5s_xNKSs&feature=emb_logo
- https://www.youtube.com/watch?v=xbYgKoG4x2g

Module-3	**RBT Level** L1,L2,L3,L4	**Hours 8**

FUZZY LOGIC :

Introduction to Fuzzy logic, Fuzzy Sets, Membership Functions, Operations on Fuzzy sets, Fuzzy Rules and Fuzzification and Defuzzification ,Fuzzy Inference Systems, Fuzzy logic controller design, Some applications of Fuzzy logic.

Real Time Applications:

- Traffic Simulation System Based on Fuzzy Logic
- Fuzzy logic rule based medical diagnosis system

Video link:

- https://onlinecourses.nptel.ac.in/noc20_ma48/
- https://nptel.ac.in/courses/111/102/111102130/

Module-4	**RBT Level** L1,L2,L3,L4	**Hours 8**

GENETIC ALGORITHM:

Biological background, Concept of "Genetics" and "Evolution" and its application to probabilistic search techniques, Basic GA framework and different GA architectures, GA operators: Encoding, Crossover, Selection, Mutation, etc., classifications and applications of GA, Solving single-objective optimization problems using GAs.

Real Time Applications:

Solving Combinatorial Optimization Problems Using Genetic Algorithms and Ant Colony Optimization

Video link:

- https://onlinecourses.nptel.ac.in/noc20_cs81
- https://www.youtube.com/watch?v=ra13Sv7XZ3M

Module-5	**RBT Level** L1,L2,L3,L4	**Hours 8**

COMPUTATIONAL INTELLIGENCE:

Computational Intelligence Paradigms, Swarm Intelligence Techniques, Basic Particle Swarm

Optimization, Applications. **Real Time Applications:** Hybrid Computational Intelligence Systems for Real World Applications **Video link:** • https://nptel.ac.in/courses/106/106/106106126/

Course outcomes:	
CO1	Learn about soft computing techniques and their applications.
CO2	Analyze various neural network architectures and Understand perceptrons and counter propagation networks.
CO3	Define the fuzzy systems and applications.
CO4	Analyze the genetic algorithms and their applications.
CO5	Analyze Computational Intelligence Paradigms and applications of CI.

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

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	-

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

High-3, Medium-2, Low-1

Course Title	DEEP LEARNING	**Semester**	07
Course Code	MVJ20CS741	**CIE**	50
Total No. of Contact Hours	40 L : T : P :: 40 : 0 : 0	**SEE**	50
No. of Contact Hours/week	3	**Total**	100
Credits	3	**Exam. Duration**	3 Hours

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

- Identify the importance of different classification patters.
- Recognition of patters using multiple techniques.
- Apply classification techniques to develop model for unsupervised learning.
- Apply biometric technology in real time applications.

Module-1	**RBT Level** L1,L2 , L3	**Hours 8**

Introduction to Deep Learning and Linear Algebra:

Scalars, vectors, multiplying matrices, inverse ,eigen decomposition, SVD(singular value decomposition), PCA, stochastic gradient descent, building a machine learning algorithm Real Time Applications: System memory allocation

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

- https://nptel.ac.in/content/storage2/106/105/106105215/MP4/mod01lec01.mp4
- https://nptel.ac.in/content/storage2/106/105/106105215/MP4/mod01lec02.mp4
- https://nptel.ac.in/content/storage2/106/105/106105215/MP4/mod01lec03.mp4

Module-2	**RBT Level** L1,L2 , L3	**Hours 8**

Deep Feed forward Networks: Learning XOR , Gradient based learning, hidden units , Architecture

design, Back propagation and other differentiation algorithms

Real Time Applications: Self Driving Cars, News Aggregation and Fraud News Detection, Natural Language Processing, Virtual Assistants, Entertainment, Visual Recognition, Fraud Detection, Healthcare.

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

- https://nptel.ac.in/content/storage2/106/105/106105215/MP4/mod06lec26.mp4
- https://nptel.ac.in/content/storage2/106/105/106105215/MP4/mod06lec27.mp4
- https://nptel.ac.in/content/storage2/106/106/106106184/MP4/mod04lec33.mp4

Module-3	**RBT Level** L1,L2 , L3	**Hours 8**

Optimization for Training Deep Models: how learning differs from optimization, challenges, basic algorithms , parameter initialization strategies, algorithms with adaptive learning rates

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

- https://nptel.ac.in/content/storage2/106/106/106106184/MP4/mod02lec19.mp4
- https://nptel.ac.in/content/storage2/106/106/106106184/MP4/mod04lec40.mp4

Module-4	**RBT Level** L1,L2 , L3	**Hours 8**

Convolutional Networks: The convolution operation, motivation, pooling, variants of basic convolution function, efficient convolution learning algorithms, random or unsupervised features.

Real Time Applications: Social media, online shopping etc.

Video link:

- 1. https://nptel.ac.in/content/storage2/106/106/106106184/MP4/mod10lec86.mp4
- 2. https://nptel.ac.in/content/storage2/106/106/106106184/MP4/mod10lec88.mp4
- 3. https://nptel.ac.in/content/storage2/106/106/106106184/MP4/mod10lec89.mp4

Module-5	**RBT Level** L1,L2 , L3	**Hours 8**

Deep Learning Research: Probabilistic PCA and factor analysis , independent component analysis, slow feature analysis

Research Ideas:

- Efficient Net: Rethinking Model Scaling for Convolutional Neural Networks
- Deep Learning for Anomaly Detection
- The Deep Learning Revolution and Its Implications for Computer Architecture and Chip Design.

Course outcomes:

CO1	Classify patterns using Bayesian Decision Theory
CO2	Recognize patterns using parametric techniques
CO3	Perform subspace analysis for classification problems
CO4	Choose an appropriate model for unsupervised learning.
CO5	Design various biometric technologies for different applications

Text/Reference Books:	
1	Deep Learning (Adaptie Computation and machine learning series), Ian Goodfellow, Yoshua Bengio and Aaron Courville.
2	Deep Learning from Scratch: Building with Python from First Principles, Seith Weidman
3	Deep Learning with python, François Chollet

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

High-3, Medium-2, Low-1

Course Title	NATURAL LANGUAGE PROCESSING	**Semester**	07
Course Code	MVJ20CS742	**CIE**	50
Total No. of Contact Hours	40 L : T : P :: 40 : 0 : 0	**SEE**	50
No. of Contact Hours/week	3	**Total**	100
Credits	3	**Exam Duration**	3 Hours

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

- To learn the fundamentals of natural language processing
- To understand the use of CFG and PCFG in NLP
- To understand the role of semantics of sentences and pragmatics
- Gain knowledge in automated Natural Language Generation and Machine Translation

Module-1	**RBT Level** L3	**Hours 8**

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/

Module-2	**RBT Level** L3	**Hours 8**

WORD LEVEL AND SYNTACTIC ANALYSIS: Ngrams Models of Syntax - Counting Words - Unsmoothed Ngrams-Smoothing-Back off Deleted Interpolation – Entropy – EnglishWord 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/

Module-3	**RBT Level** L3	**Hours 8**

CONTEXT FREE GRAMMARS: Context-Free Grammars, Grammar rules for English, Tree banks, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing, Ambiguity, Dynamic Programming parsing – Shallow parsing Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs – Feature structures, Unification of feature structures

Laboratory Sessions: Chunking for a given sentence

Applications: Compiler **Video link** : https://www.youtube.com/watch?v=6b40kKe2SFg		
Module-4	**RBT Level** L3	**Hours 8**
SEMANTICS AND PRAGMATICS: Representing Meaning - Meaning Structure of Language - First Order Predicate Calculus-Representing Linguistically Relevant Concepts –Syntax Driven 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		
Module-5	**RBT Level** L1,L2, L3	**Hours 8**
LANGUAGE GENERATION AND DISCOURSE ANALYSIS: 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		

Course outcomes:	
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

Text/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", MIT

	Press. Cambridge, MA:1999
3	Steven Bird, Ewan Klein and Edward Loper, ―Natural Language Processing with Python, I Edition, OReilly Media, 2009.
4	Natural Language Processing and Information Retrieval: Tanvier Siddiqui, U.S.Tiwary
5	Allen, James, Natural Language Understanding, Second Edition, Benjamin/Cumming, 1995.

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

Course Title	HUMAN COMPUTER INTERACTION	**Semester**	07
Course Code	MVJ20CS743	**CIE**	50
Total No. of Contact Hours	50 L : T : P :: 40 : 10 : 0	**SEE**	50
No. of Contact Hours/week	3	**Total**	100
Credits	3	**Exam. Duration**	3 Hours

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

- Software process and Design rules
- Implementation and user support
- Different models for cognition and collaboration
- Introduction to Ubiquitous computing

Module-1	**RBT Level** L1,L2, L3	**Hours 8**

Prerequisites- Basic Knowledge of Graphic user Interface, OOP and software tools

FOUNDATIONS -Introduction to Ubiquitous computing The Human – Input-output channels – Human Memory – Thinking – emotions – Psychology & design of interactive systems; Computer – Text entry devices- Positioning, Pointing & drawing – Display devices for Virtual reality, 3D; Interaction – models – Frameworks & HCI, Ergonomics – Interaction styles – WIMP Interfaces – context; paradigms for Interaction

Case Study - Human Computer Interaction Based on RFID and Context-Awareness in Ubiquitous Computing Environments.

Video link / Additional online information:

- https://nptel.ac.in/courses/106/103/106103115/
- https://nptel.ac.in/courses/106/106/106106177/
- https://www.tutorialspoint.com/human_computer_interface/index.htm

Module-2	**RBT Level** L1,L2, L3	**Hours 8**

SOFTWARE PROCESS & DESIGN RULES- Interaction design basics – user focus – scenarios – navigation – screen design & layout; HCI in software process – life cycle – Usability engineering – Interactive design & prototyping ; Design rules – Principles for usability – standards – guidelines – golden rules – HCI patterns

Case Study- Sign to speech converter facilitated wireless communication

Video link / Additional online information:

- https://nptel.ac.in/courses/106/103/106103115/
- https://nptel.ac.in/courses/106/106/106106177/
- https://www.tutorialspoint.com/human_computer_interface/index.htm

Module-3	**RBT Level** L2,L3, L4	**Hours 8**

IMPLEMENTATION & USER SUPPORT- Implementation support – Windowing system elements – uses tool kits – user interface management; Evaluation techniques – goals – expert analysis – choosing a method; universal design principles – multimodal interaction; user support – requirements – Approaches – adaptive help systems – designing user support systems.

Case Study-HCI - Digital Fridge

Video link / Additional online information:

- https://nptel.ac.in/courses/106/103/106103115/
- https://nptel.ac.in/courses/106/106/106106177/

- https://www.tutorialspoint.com/human_computer_interface/index.htm

Module-4	**RBT Level** L3,L4,L5	**Hours 8**

COGNITIVE, COMMUNICATION & COLLABORATIVE MODELS- Cognitive models – Goal & task hierarchies – Linguistic models – Physical & device models – architectures ; communication & collaboration models – Face-to-face communication – conversation – text based – group working; Task analysis – difference between other techniques – task decomposition – Knowledge based analysis – ER based techniques –uses.

Case study- HCI Design in the OR: A Gesturing Case-Study

Video link / Additional online information:

- https://nptel.ac.in/courses/106/103/106103115/
- https://nptel.ac.in/courses/106/106/106106177/
- https://www.tutorialspoint.com/human_computer_interface/index.htm

Module-5	**RBT Level** L3,L4, L6	**Hours 8**

UBIQUITOUS COMPUTING, HYPERTEXT, WWW- Ubiquitous computing application research – virtual & augmented reality – information & data visualization ; understanding hypertext – finding things – Web Technology & issues – Static Web content – Dynamic Web content; Groupware systems – Computer mediated communication – DSS – Frameworks for groupware.

Mini Project- Develop a user interface

Video link / Additional online information:

- https://nptel.ac.in/courses/106/103/106103115/
- https://nptel.ac.in/courses/106/106/106106177/
- https://www.tutorialspoint.com/human_computer_interface/index.htm

Course outcomes:

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.

Text/Reference Books:

1	Alan Dix , Janet Finlay, Gregory D.Abowd, Russell Beale, " Human Computer Interacti

	Third Edition, Pearson Education, 2004
2	John M.Carrol, "Human Computer Interaction in the New Millennium", Pearson Educat 2002

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

High-3, Medium-2, Low-1

Course Title	BLOCKCHAIN TECHNOLOGY	**Semester**	07
Course Code	MVJ20CS744	**CIE**	50
Total No. of Contact Hours	40 L : T : P :: 40 : 0 : 0	**SEE**	50
No. of Contact Hours/week	3	**Total**	100
Credits	3	**Exam. Duration**	3 Hours

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

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

Module-1	**RBT Level** L1,L2, L3	**Hours 8**

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

Applications: Telecommunications, finance, universities

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

- https://coincentral.com/byzantine-generals-problem/
- https://www.tutorialspoint.com/distributed_dbms/distributed_dbms_databases.htm

Module-2	**RBT Level** L2,L3	**Hours 8**

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

Applications: Government, healthcare

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

- https://blockonomi.com/merkle-tree/
- https://www.khanacademy.org/economics-finance-domain/core-finance/money-and-banking/bitcoin/v/bitcoin-transaction-block-chains.

Module-3	**RBT Level** L2,L3,L4	**Hours 8**

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

Applications: Decentralized Applications, Encrypted messaging applications

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

- https://blockonomi.com/nakamoto-consensus/
- https://cointelegraph.com/explained/proof-of-work-explained

Module-4	**RBT Level** L3,L4, L6	**Hours 8**

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

Applications: Peer - to - peer payment application.

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

• https://blockgeeks.com/guides/hyperledger/ • https://blockgeeks.com/guides/smart-contracts/		
Module-5	**RBT Level** L4,L5, L6	**Hours 8**
Cryptocurrency Regulation: Stakeholders, Roots of Bit coin, Legal Aspects-Crypto currency Exchange, Black Market and Global Economy. Applications: Internet of Things, Medical Record Management System, Domain Name Service and future of Blockchain. **Video link / Additional online information (related to module if any):** • https://www.water-io.com/iot-vs-wot • https://www.talend.com/resources/iot-cloud-architecture/		

Course outcomes:	
CO1	Basic Cryptographic primitives used in Blockchain – Secure, Collison-resistant hash functions, digital signature, public key cryptosystems, zero-knowledge proof systems.
CO2	Policies and applications of Blockchain in Distributed databases.
CO3	Explain the Nakamoto consensus, List and describe differences between proof-of-work and proof-of-stake consensus.
CO4	Design, build, and deploy smart contracts and distributed applications.
CO5	Cryptocurrency governance, regulations and applications.

Text/Reference Books:	
1	Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press (July 19, 2016).
2	Antonopoulos, Mastering Bitcoin: Unlocking Digital Cryptocurrencies.
3	Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System.
4	DR. Gavin Wood, "ETHEREUM: A Secure Decentralized Transaction Ledger,"Yellow paper.2014.
5	Nicola Atzei, Massimo Bartoletti, and Tiziana Cimoli, A survey of attacks on Ethereum smart contracts

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	1	-

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

High-3, Medium-2, Low-1

Course Title	PYTHON PROGRAMMING	**Semester**	07
Course Code	MVJ20CS751	**CIE**	50
Total No. of Contact Hours	40 L : T : P :: 40 : 0 : 0	**SEE**	50
No. of Contact Hours/week	3	**Total**	100
Credits	3	**Exam. Duration**	3 Hours

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

- To write, test, and debug simple Python programs.
- To implement Python programs with conditionals and loops.
- Use functions for structuring Python programs.
- Represent compound data using Python lists, tuples, dictionaries.
- Read and write data from/to files in Python.

Module-1	**RBT Level** L1,L2, L3	**Hours 8**

Introduction to Python: The basic elements of python, variable, expression, Branching Programs, Control Structures, Strings and Input, Iteration.

Laboratory Sessions/ Experimental learning:

1. Write a Python program to display the current date and time.
2. Write a Python program which accepts the radius of a circle from the user and compute the area.
3. Write a python program for taking multiple inputs from user.

Video link / Additional online information:

- https://www.youtube.com/watch?v=Y3Ri2GdYfYg&list=PLqftY2uRk7oXvERQEgATSr-

KzAh8WLW_D

- https://www.youtube.com/watch?v=TqPzwenhMj0
- https://www.youtube.com/watch?v=gzDPuWKjmGQ

Module-2	**RBT Level** L1,L2, L3	**Hours 8**

Functions, Scoping and Abstraction: Functions and scoping, Specifications, Recursion, Global variables, Modules, Files, System Functions and Parameters

Laboratory Sessions/ Experimental learning:

1. Write a Python program to find the Max of three numbers using function.
2. Write a Python program to reverse a string.
3. Python Program to Read a List of Words and Return the Length of the Longest One.

Video link / Additional online information:

- https://www.youtube.com/watch?v=oSPMmeaiQ68
- https://www.youtube.com/watch?v=LoIe_9cTtPE
- https://www.youtube.com/watch?v=ixdr6V2vRC4

Module-3	**RBT Level** L1,L2, L3	**Hours 8**

Structured Types, Mutability and Higher-Order Functions: Strings, Tuples, Lists and Dictionaries, Lists and Mutability, Functions as Objects

Laboratory Sessions/ Experimental learning:

1. Python Program to Remove All Tuples in a List of Tuples with the USN Outside the Given Range.
2. Python Program to form a New String Made of the First 2 and Last 2 characters from a Given String.
3. Python Program to Sum All the Items in a Dictionary.
4. Python Program to Concatenate Two Dictionaries into One.

Video link / Additional online information:

- https://www.youtube.com/watch?v=lSItwlnF0eU
- https://www.youtube.com/watch?v=mzx74TdGYbg
- https://www.youtube.com/watch?v=BL5bAt8fgvU

Module-4	**RBT Level** L1,L2, L3	**Hours 8**

Classes and Object-Oriented Programming: Abstract Data Types and Classes, Inheritance, Encapsulation and Information Hiding

Debugging, Exceptions and Assertions: Debugging, Handling Exceptions, Assertions

Laboratory Sessions/ Experimental learning:

1. Write a Python class to convert an integer to a roman numeral.
2. Write a Python class named Rectangle constructed by a length and width and a method which will compute the area of a rectangle.

Video link / Additional online information :

- https://www.youtube.com/watch?v=ZDa-Z5JzLYM
- https://www.youtube.com/watch?v=8O5kX73OkIY
- https://www.youtube.com/watch?v=NMTEjQ8-AJM

Module-5	**RBT Level** L1,L2, L3	**Hours 8**

Simple Algorithms and Data structures: Search Algorithms, Sorting Algorithms, Hash Tables

Laboratory Sessions/ Experimental learning:

1. Write a Python program to create an Enum object and display a member name and value.

Sample data :

Afghanistan = 93

Albania = 355

Algeria = 213

Andorra = 376

Angola = 244

Antarctica = 672

Expected Output :

Member name: Albania

Member value: 355

2. Write a Python program to sort a list of elements using the bubble sort algorithm.

Video link / Additional online information :

- https://www.youtube.com/watch?v=KW0UvOW0XIo
- https://www.youtube.com/watch?v=m9n2f9lhtrw

Course outcomes:

CO1	Understand Python syntax and semantics and be fluent in the use of Python flow control and functions.
CO2	Demonstrate proficiency in handling Strings and File Systems.
CO3	Implement Python Programs using core data structures like Lists, Dictionaries and use Regular Expressions.

CO4	Interpret the concepts of Object-Oriented Programming as used in Python.
CO5	Implement exemplary applications related to Network Programming, Web Services and Databases in Python.

Text/Reference Books:	
1	Charles R. Severance, "Python for Everybody: Exploring Data Using Python 3", 1st Edition, CreateSpace Independent Publishing Platform, 2016. (http://do1.drchuck. com/pythonlearn/EN_us/pythonlearn.pdf) (Chapters 1 – 13, 15)
2	Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2ndEdition, Green Tea Press, 2015. (http://greenteapress.com/thinkpython2/thinkpython2.pdf) (Chapters 15, 16, 17)(Download pdf files from the above links)
3	Charles Dierbach, "Introduction to Computer Science Using Python", 1st Edition, Wiley India Pvt Ltd. ISBN-13: 978-8126556014.
4	Mark Lutz, "Programming Python", 4th Edition, O'Reilly Media, 2011.ISBN-13: 978-9350232873.
5	Wesley J Chun, "Core Python Applications Programming", 3rdEdition,Pearson Education India, 2015. ISBN-13: 978-9332555365.

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

High-3, Medium-2, Low-1

Course Title	CYBER FORENSICS AND IPR	**Semester**	07
Course Code	MVJ20CS752	**CIE**	50
Total No. of Contact Hours	40 L : T : P :: 40 : 0 : 0	**SEE**	50

No. of Contact Hours/week	3	**Total**	100
Credits	3	**Exam. Duration**	3 Hours

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

- Be familiar with different forensics methods
- To analyse various computer forensics technologies
- To disseminate knowledge on laws and acts to protects IPR.
- Understanding, defining and differentiating different types of intellectual properties (IPs) and their roles in cyberspace.

Module-1	**RBT Level** L2	**Hours 8**

Prerequisites: Basic Knowledge of crypto algorithms

Introduction to Digital Forensics, Forensic Software and Hardware, Analysis and Advanced Tools, Forensic Technology and Practices, Forensic Ballistics and Photography, Face, Iris and Fingerprint Recognition, Audio Video Analysis

Laboratory Sessions/ Experimental learning:

Familiarization with any one digital forensics tool

Video link / Additional online information:

- https://www.youtube.com/watch?v=2ESqwX3qb94-
- https://nptel.ac.in/courses/106/104/106104119/

Module-2	**RBT Level** L2,L3	**Hours 8**

Introduction to Cyber Crime Investigation, Investigation Tools, eDiscovery, Digital Evidence Collection, Evidence Preservation, E-Mail Investigation, E-Mail Tracking, IP Tracking, E-Mail Recovery, Hands on Case Studies, Encryption and Decryption Methods, Search and Seizure of Computers, Recovering Deleted Evidences, Password Cracking.

Laboratory Sessions/ Experimental learning:

Case Study on cybercrime Investigation

Video link / Additional online information:

- https://www.coursera.org/lecture/cyber-conflicts/introduction-to-cybercrime-and-fundamental-issues-xndSq
- https://www.youtube.com/watch?v=VoeLc5295XU
- https://www.youtube.com/watch?v=l77AgiphUQo

Module-3	**RBT Level** L2,L3	**Hours 8**

Laws and Ethics, Digital Evidence Controls, Evidence Handling Procedures, Basics of Indian Evidence ACT IPC and CrPC , Electronic Communication Privacy ACT, Legal Policies

Laboratory Sessions/ Experimental learning:

Studying different cases where IPR and laws are applied.

Video link / Additional online information:

- https://www.youtube.com/watch?v=qJ693ZlvceA
- https://www.youtube.com/watch?v=6vNxslcf9AE

Module-4	**RBT Level** L2,L3	**Hours 8**

Protection of Intellectual Property Rights in Cyberspace in India: The Cyberspace The Relevance of Domain Names in Intellectual Property Rights, Deception by Squatting in Cyberspace, Bad Faith in Relation to Domain Name Infringement, Some Leading Cases Involving Complaints from India before WIPO, Protection of Copyright on Cyberspace, Rights of Software Copyright Owners, Infringement of Copyright on Cyberspace, Cyberspace, the Internet, Websites and the Nature of the Copyright, Linking, Hyper-Linking and Framing, Remedies for Infringement of Copyright on Cyberspace, The Liabilities of an Internet Services Provider (ISP) in Cyberspace

Laboratory Sessions/ Experimental learning:

Case study on protection of copyright on cyberspace

Video link / Additional online information:

- https://nptel.ac.in/courses/109/105/109105112/
- https://nptel.ac.in/courses/109/105/109105112/
- https://nptel.ac.in/courses/106/106/106106129/

Module-5	**RBT Level** L2	**Hours 8**

Penalties, Compensation and Adjudication of Violations of Provisions of IT Act and Judicial Review: Penalty and Compensation for Damage to Computer, Computer System, Compensation for Failure to Protect Data, Penalty for Failure to Furnish Information, Return or any Other Penalty , Adjudication of Disputes under the IT Act, Cyber Appellate Tribunal, Its Functions and Powers under the IT Act

Laboratory Sessions/ Experimental learning:

Listing the Scenarios of Penalties in India

Video link / Additional online information:	
• https://www.lawctopus.com/video-lectures-law-sudhir-law-review/ • https://www.youtube.com/watch?v=wV2OiOM3q3k	
Course outcomes:	
CO1	Analyze Computer Crime and Criminals and Liturgical Procedures
CO2	Apply the laws and regulations to the applications
CO3	Analyze the email tracking cyber applications
CO4	Understanding the protection of Intellectual Property Rights
CO5	Knowledge of law and acts

Text/Reference Books:	
1	Nelson Phillips and EnfingerSteuart, ―Computer Forensics and Investigations‖, Ceng Learning, New Delhi, 2009.
2	Harish Chander, Cyber Laws and IT protections, PHI Edition
3	Dumortier, International Encyclopedia Of Cyber Law (3vol) , Jos
4	Bernadette H Schell, Clemens Martin, Cybercrime, ABC , CLIO Inc, California, 2004
5	Study Material for Professional Programme Intellectual Property Rights, Law and Practice, Institute of Company Secretaries of India, Statutory Body Under an Act of Parliament, Septen 2013.

CO-PO/PSO Mapping

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

High-3, Medium-2, Low-1

Course Title	MOBILE APPLICATION AND DEVELOPMENT	**Semester**	07
Course Code	MVJ20CS753	**CIE**	50

Total No. of Contact Hours	40 L : T : P :: 40 : 0 : 0	**SEE**	50
No. of Contact Hours/week	3	**Total**	100
Credits	3	**Exam. Duration**	3 Hours

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

- To Design and Develop Android application by setting up Android development environment.
- Implement adaptive, responsive user interfaces that work across a wide range of devices.
- Explain long running tasks and background work in Android applications.
- Demonstrate methods in storing, sharing and retrieving data in Android applications.
- Discuss the performance of android applications and understand the role of permissions and security.
- Describe the steps involved in publishing Android application to share with the world.

Module-1	**RBT Level** L1,L2, L3	**Hours 8**

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, Android tools, Android Application components – Android Manifest file, Android Application Lifecycle – Activities, Activity lifecycle, activity states, monitoring state changes.

Applications: To develop the mobile computing application.

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

- https://nptel.ac.in/courses/106/106/106106156/
- https://nptel.ac.in/courses/106/106/106106147/
- https://www.coursera.org/specializations/android-app-development
- https://google-developer-training.github.io/android-developer-fundamentals-course-concepts/en/Unit%201/10_c_intro_to_android.html

Module-2	**RBT Level** L2,L3	**Hours 8**

ANDROID UI ARCHITECTURE & UI WIDGETS: Fundamental Android UI design Layouts, Drawable resources, UI widgets, Notification, Toasts, Menu, Dialogs, Building dynamic UI with fragments.

Applications: To develop the Progressive Web Applications

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

- https://nptel.ac.in/courses/106/106/106106156/

- https://nptel.ac.in/courses/106/106/106106147/
- https://developer.ibm.com/solutions/application-modernization/
- https://developer.android.com/guide/topics/ui

Module-3	**RBT Level** L2,L3,L4	**Hours 8**

INTENTS AND BROADCASTS: Intent, 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 Toasts.

Applications: To develop the Cross-Platform Native Mobile Applications

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

- https://www.indianappdevelopers.com/blog/advantages-real-time-mobile-applications/
- https://nptel.ac.in/courses/106/106/10610615
- https://www.tutorialspoint.com/android/android_broadcast_receivers.htm
- https://google-developer-training.github.io/android-developer-fundamentals-course-concepts/en/Unit%203/73_c_broadcast_receivers.html

Module-4	**RBT Level** L3,L4, L6	**Hours 8**

DATA STORAGE, SERVICES & CONTENT PROVIDERS: Saving Data, interacting with other Apps, Apps with content sharing, Shared Preferences, Preferences activity, Files access, SQLite database, Overview of services in Android, Implementing Service, Service lifecycle, Inter Process Communication.

Applications: To develop the Hybrid Mobile Applications.

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

- https://www.endivesoftware.com/blog/real-time-solutions-in-mobile-apps/
- https://aws.amazon.com/mobile/mobile-application-development/
- https://developer.android.com/guide/topics/providers/content-providers

Module-5	**RBT Level** L4,L5, L6	**Hours 8**

ADVANCED APPLICATIONS: Building apps with Multimedia, Building apps with Graphics & Animations, Building apps with Sensors, Bluetooth, Camera, Telephony Services, Building apps with Location Based Services and Google maps.

Applications: Native Mobile Applications

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

• https://nptel.ac.in/courses/106/106/10610615 • https://www.endivesoftware.com/blog/real-time-solutions-in-mobile-apps/ • https://www.coursera.org/specializations/advanced-app-android * Programming Assignments are Mandatory.

Course outcomes:	
CO1	Understand the basics of Android devices and Platform
CO2	Describe the architecture and advanced features of android technology
CO3	Interpret and use the data storage, file sharing and IPC in android platform.
CO4	Develop the skills in designing and building mobile applications using android platform.
CO5	Build mobile applications using multimedia graphics and animations, Publish Android applications in to Android Market

Text/Reference Books:	
1	Google Developer Training, "Android Developer Fundamentals Course – Concept Reference", Google Developer Training Team, 2017.https://www.gitbook.com/book/google-developer-training/ android developer fundamentals course-concepts/details.(Download pdf file from the above link).
2	RetoMeier;ProfessionalAndroid2ApplicationDevelopment;WileyIndiaPvt.ltd;1stEdition;2012; ISBN-13:9788126525898.
3	Phillips, Stewart, Hardy and Marsicano; Android Programming, 2nd edition -Big Nerd Ranch Guide;2015; ISBN-13978-0134171494.
4	Android Application Development for Java Programmers, James C Sheusi, Cengage Learning, 2013.
5	MarkMurphy; Beginning Android3; A press Springer India Pvt Ltd.; 1st Edition; 2011; ISBN-13: 978-1-4302-3297-1
6	Eric Hellman; Android Programming– Pushing the limits by Hellman; Wiley; 2013; ISBN 13:978 1118717370.
7	Phillips, Stewart, Hardy and Marsicano; Android Programming, 2nd edition -Big Nerd Ranch Guide;2015; ISBN-13978-0134171494.

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

High-3, Medium-2, Low-1

Course Title	MACHINE LEARNING AND ITS APPLICATION	**Semester**	07
Course Code	MVJ20CS754	**CIE**	50
Total No. of Contact Hours	40 L : T : P :: 40 : 0 : 0	**SEE**	50
No. of Contact Hours/week	3	**Total**	100
Credits	3	**Exam. Duration**	3 Hours

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

- Define machine learning and problems relevant to machine learning.
- Differentiate supervised, unsupervised and reinforcement learning.
- Apply neural networks, Bayes classifier and k nearest neighbor, for problems appear in machine learning.
- Perform statistical analysis of machine learning techniques.
- Design, build, and deploy smart contracts and distributed applications.

Module-1	**RBT Level** L1,L2, L3	**Hours 8**

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: Use Case study to understand purpose, 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

Module-2	**RBT Level** L1,L2, L3	**Hours 8**

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: Use Case Study and ask students to design a Decision Tree.

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

Module-3	**RBT Level** L1,L2, L3	**Hours 8**

Bayesian Learning: Introduction, Bayes theorem, Bayes theorem and concept learning, MDL principle, Naive Bayes classifier, Bayesian belief networks.

Evaluating Hypotheses: Estimating hypothesis accuracy, Basics of sampling theorem.

Laboratory Sessions/ Experimental learning:

Give Real Time Case study and ssk the students to build Bayes Belief Networks .

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

Module-4	**RBT Level** L1,L2, L3	**Hours 8**

Artificial Neural Networks: Introduction, Neural Network representation, Appropriate problems, Perceptrons, Backpropagation algorithm. Instanced Based Learning: Introduction, k-nearest neighbor learning, locally weighted regression.

Laboratory Sessions/ Experimental learning: Give real time Case Study and ask students to design an ANN.

Video link:

- https://www.youtube.com/watch?v=xbYgKoG4x2g&list=PL53BE265CE4A6C056.
- https://nptel.ac.in/courses/106/106/106106184/

Module-5	**RBT Level** L1,L2, L3	**Hours 8**

Reinforcement Learning: Introduction, Learning Task, Q Learning.

Deep Learning: Introduction to Deep Learning-Reasons to go Deep Learning, **Video link:** • https://nptel.ac.in/courses/106/106/106106143/ • https://nptel.ac.in/courses/106/105/106105215/

Course outcomes:	
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

Text/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.
3	Ethem Alpaydın, Introduction to machine learning, second edition, MIT press.

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

High-3, Medium-2, Low-1

Course Title	INTERNET OF THINGS LABORATORY	**Semester**	07
Course Code	MVJ20CSL76	**CIE**	50
Total No. of Contact Hours	40 L : T : P :: 10 : 0 : 30	**SEE**	50
No. of Contact Hours/week	3	**Total**	100
Credits	2	**Exam. Duration**	3 Hours

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

- Understand the concepts of Internet of Things.
- Analyze basic protocols in wireless sensor network.
- Design IoT applications in different domain and be able to analyze their performance.
- Implement basic IoT applications on embedded platform.

Sl No	Experiment Name	RBT Level	Hours
1	Familiarization with Arduino/Raspberry Pi and perform necessary software installation.	**L3**	**3**
2	To interface LED/Buzzer with Arduino/Raspberry Pi and write a program to turn ON LED for 1 sec after every 2 seconds.	**L3**	**3**
3	To interface motor using relay with Arduino/Raspberry Pi and write a program to turn ON motor when push button is pressed.	**L3**	**3**
4	To interface OLED with Arduino/Raspberry Pi and write a program to print temperature and humidity readings on it.	**L3**	**3**
5	To interface Bluetooth with Arduino/Raspberry Pi and write a program to send sensor data to smartphone using Bluetooth.	**L3**	**3**
6	To interface Push button/Digital sensor (IR/LDR) with Arduino / Raspberry Pi and write a program to turn ON LED when push button is pressed or at sensor detection.	**L3**	**3**
7	To interface DHT11 sensor with Arduino/Raspberry Pi and write a program to print temperature and humidity readings.	**L3**	**3**
8	Write a program on Arduino/Raspberry Pi to publish temperature data to MQTT broker.	**L3**	**3**
9	To interface Bluetooth with Arduino/Raspberry Pi and write a program to turn LED ON/OFF when '1'/'0' is received from smartphone using Bluetooth.	**L3**	**3**
	Web Link and Video Lectures: 1. https://www.arduino.cc/en/Tutorial-0007/BlinkingLED 2. https://www.arduino.cc/en/Tutorial/ADXL3xx 3. https://www.arduino.cc/en/Tutorial/CharacterAnalysis 4. https://www.arduino.cc/en/Tutorial/Button 5. https://www.arduino.cc/en/Tutorial/Dimmer 6. https://www.arduino.cc/en/Tutorial/ifStatementConditional		

Course outcomes:	
CO1	To understand how sensors and embedded systems work
CO2	Design and implement an accessory with BLE connectivity using standard mobile application development tools
CO3	To understand how to communicate with other mobile devices using various communication platforms such as Bluetooth and Wi-Fi.
CO4	Develop and demonstrate applications e.g. smartphone-based, sensor station
CO5	To understand how to program on embedded and mobile platforms.

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

High-3, Medium-2, Low-1

Course Title	MACHINE LEARNING LABORATORY	**Semester**	07
Course Code	MVJ20CSL77	**CIE**	50
Total No. of Contact Hours	40 L : T : P :: 10 : 0 : 30	**SEE**	50
No. of Contact Hours/week	3	**Total**	100
Credits	2	**Exam. Duration**	3 Hours

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

- Make use of Data sets in implementing the machine learning algorithms
- Implement the machine learning concepts and algorithms in any suitable language of choice.

Sl No	**Experiment Name**	**RBT Level**	**Hours**

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.	**L3**	**3**
2	For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.	**L3**	**3**
3	Develop a program to demonstrate the prediction of values of a given dataset using Linear regression.	**L3**	**3**
4	Write a program to demonstrate the working of the decision tree based **ID3 algorithm**. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.	**L3**	**3**
5	Build an Artificial Neural Network by implementing the **Backpropagation algorithm** and test the same using appropriate data sets.	**L3**	**3**
6	Write a program to implement the **naïve Bayesian classifier** for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.	**L3**	**3**
7	Assuming a set of documents that need to be classified, use the **naïve Bayesian Classifier** model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.	**L3**	**3**
8	Write a program to construct a **Bayesian network** considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.	**L3**	**3**
9	Apply **EM algorithm** to cluster a set of data stored in a .CSV file. Use the same dataset for clustering using ***k*-Means algorithm**. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.	**L3**	**3**
10	Write a program to implement ***k*-Nearest Neighbour algorithm** to classify the iris data set. Print both correct and wrong predictions.	**L3**	**3**

	Java/Python ML library classes can be used for this problem.		
11	Implement the non-parametric **Locally Weighted Regression algorithm** in order to fit data points. Select appropriate data set for your experiment and draw graphs.	**L3**	**3**

Course outcomes:	
CO1	Understand the implementation procedures for the machine learning algorithms.
CO2	Design Java/Python programs for various Learning algorithms.
CO3	Apply appropriate data sets to the Machine Learning algorithms.
CO4	Identify and apply Machine Learning algorithms to solve real world problems.
CO5	Perform statistical analysis of machine learning techniques.

CO-PO/PSO Mapping

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

High-3, Medium-2, Low-1