MVJCE CURRICULUM

FOR

Artificial Intelligence & Machine Learning

(Scheme 2020)

III SEMESTER

Course Title	DISCRETE MATHEMATICAL STRUCTURES AND PROBABILITY	Semester	03
Course Code	MVJ20MCS31/IS31	**CIE**	50
Total No. of Contact Hours	40 L : T : P :: 40 : 0 : 20	**SEE**	50
No. of Contact Hours/week	3	**Total**	100
Credits	3	**Exam. Duration**	3 Hours

Course objective is to:

- Prepare for a background in abstraction, notation, and critical thinking for the mathematics most directly related to computer science.
- Understand and apply mathematical induction, combinatorics, discrete probability, sequence and recurrence, elementary number theory.
- Understand and apply probability distribution, sampling theory and joint probability distributions.

Module-1	**RBT Level** L1,L2 & L3	**10 Hrs.**

Properties of the Integers: The Well Ordering Principle – Mathematical Induction.

Principles of Counting: Fundamental Principles of Counting, The Rules of Sum and Product, Permutations, Combinations – The Binomial and Multinomial Theorem, Combinations with Repetition.

Application: Distribution with repetition.

Video Link:

1. http://nptel.ac.in/courses.php?disciplineID=111
2. http://www.class-central.com/subject/math(MOOCs)
3. http://academicearth.org/

Module-2	**RBT Level** L1,L2 & L3	**10 Hrs.**

The Principle of Inclusion and Exclusion: The Principle of Inclusion and Exclusion, Generalizations of the Principle. Derangements – Nothing is in its Right Place, Rook Polynomials.

Recurrence Relations: First Order Linear Recurrence Relation, The Second Order Linear

Homogeneous Recurrence Relation with Constant Coefficients.

Application: Arrangement with forbidden position.

Video Link:

1. http://nptel.ac.in/courses.php?disciplineID=111
2. http://www.class-central.com/subject/math(MOOCs)
3. http://academicearth.org/

Module-3	**RBT Level** L1,L2 & L3	**10 Hrs.**

Relations: Cartesian Products, Relations, Properties of Relations, Equivalence Relations. Zero-OneMatrices and Directed Graphs. Partial Orders – Hasse Diagrams and extreme elements.

Functions: Plain and One to One, Onto Functions. The Pigeon-hole Principle, Function Compositionand Inverse Functions.

Application: Zero-one matrix and Hasse diagram

Video Link:

1. http://nptel.ac.in/courses.php?disciplineID=111
2. http://www.class-central.com/subject/math(MOOCs)
3. http://academicearth.org/

Module-4	**RBT Level** L1,L2 & L3	**10 Hrs.**

Probability Distributions: Random variables (discrete and continuous), probability mass/density functions. Binomial distribution, Poisson distribution. Exponential and normal distributions, problems.

Joint probability distribution: Joint Probability distribution for two discrete random variables, expectation, covariance, correlation coefficient.

Application: Finding correlation between random variables.

Video Link:

1. http://nptel.ac.in/courses.php?disciplineID=111
2. http://www.class-central.com/subject/math(MOOCs)
3. http://academicearth.org/

Module-5	**RBT Level** L1,L2 & L3	**10 Hrs.**

Sampling Theory: Sampling, Sampling distributions, standard error, test of hypothesis for means and proportions, confidence limits for means, student's t-distribution and Chi-square distribution

Coding Theory: Coding of binary information and error detection.

Application: Testing the level of significance & the goodness of fit for large sample and smallsample.

Video Link:

1. http://nptel.ac.in/courses.php?disciplineID=111
2. http://www.class-central.com/subject/math(MOOCs)
3. http://academicearth.org/

Course outcomes:

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

Reference Books:

1.	B.S. Grewal, "Higher Engineering Mathematics" Khanna Publishers, 43rd Edition,2013.
2.	Ralph P. Grimaldi: Discrete and Combinatorial Mathematics, , 5th Edition, PearsonEducation. 2004.
3	Ramana B. V., "Higher Engineering Mathematics", Tata Mc Graw-Hill, 2006.
4	Bali N. P. & Manish Goyal, "A text book of Engineering Mathematics", Laxmi Publications, 8th Edition
5	Basavaraj S Anami and Venakanna S Madalli: Discrete Mathematics – A Concept based approach, Universities Press, 2016
6	Kenneth H. Rosen: Discrete Mathematics and its Applications, 6th Edition, McGraw Hill, 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	-	-	-	-	-	-	1	1	2	-
CO2	2	3	-	3	-	-	-	-	-	-	1	1	1	-
CO3	2	3	-	3	-	-	-	-	-	-	1	1	2	3
CO4	3	3	-	3	-	-	-	-	-	-	1	1	2	-
CO5	3	3	-	3	-	-	-	-	-	-	1	1	2	2

High-3, Medium-2, Low-1

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	SOFTWARE ENGINEERING	**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***

- 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**

INTRODUCTION TO SOFTWARE ENGINEERING: The Evolving nature of software engineering, Changing nature of software engineering, Software engineering Layers, The Software Processes, Software Myths.

PROCESS MODELS: A Generic Process Model, Waterfall Model, Incremental Process Models, Evolutionary Process Models, Spiral Model, the Unified Process, Personal and Team Process Models, the Capability Maturity Model Integration (CMMI).

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**

REQUIREMENTS ENGINEERING: Functional and Non-Functional Requirements, The Software requirements Document, Requirements Specification, requirements Engineering, Requirements Elicitation and Analysis, Requirement Validation, Requirement Management, System Modeling: Context Models, Interaction Models, Structural Models, Behavioral Model, Model-Driven Engineering.

DESIGN CONCEPTS: The Design Process, Design Concepts, The Design Models, Architectural Design: Software Architecture, Architectural Genres, Architectural Styles.

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**

DESIGN AND IMPLEMENTATION: The Object Oriented Design with UML, Design Patterns, Implementation Issues, Open Source Development. User Interface Design: The Golden Rules, User Interface Analysis and Design, Interface Analysis, Interface Design Steps, Design Evaluation. **SOFTWARE TESTING STRATEGIES:** A Strategic approach to Software Testing, Strategic Issues, Test Strategies for Conventional Software, Validation Testing, System Testing, The Art of Debugging, White-Box Testing, Black Box Testing.

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**

PRODUCT METRICS: A Frame Work for Product Metrics, Metrics for the Requiremets Model, Metrics for Design Model, Metrics for Source Code, Metrics for Testing.

PROCESS AND PROJECT METRICES: Metrics in the Process and Project Domains, Software Measurements, Metrics for Software Quality, Risk Management: Risk verses Proactive Risk Strategies, Software Risks, Risk Identification, Risk Projection, Risk Refinements, Risk Mitigation

Monitoring and Management (RMMM), The RMMM Plan. **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**
QUALITY MANAGEMENT: Quality Concepts, Software Quality, Software Quality Dilemma, Achieving Software Quality, Review Techniques, Reviews: A Formal spectrum, Informal Reviews, Formal Technical Reviews, **SOFTWARE QUALITY ASSURANCE:** Background Issues, Elements of Software Quality Assurance, Tasks, Goals and Metrics, Software Reliability, the ISO 9000 Quality Standards. **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	Understand various Process Models.
CO2	Investigate various requirements engineering and apply design concepts.
CO3	Identify numerous Software Testing Strategies.
CO4	Evaluate Process and Project Metrices.
CO5	Illustrate Quality Management and Software Quality Assurance Concepts

Text/Reference Books:	
1	Roger S. Pressman (2011), Software Engineering, A Practitioner's approach, 7 th edition, McGraw Hill International Edition, New Delhi
2	Sommerville (2001), Software Engineering, 9 th edition, Pearson education, India
3	K. K. Agarval, Yogesh Singh (2007), Software Engineering, 3rd edition, New Age International Publishers, India.
4	Lames F. Peters, Witold Pedrycz(2000), Software Engineering an Engineering approach, John Wiely & Sons, New Delhi, India
5	Shely Cashman Rosenblatt (2006), Systems Analysis and Design, 6th edition, Thomson Publications, 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	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***

- 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.
- Learn the arithmetic and logic unit.
- Learn the different ways of communication with I/O devices & memories, memory hierarchies, cache memories and virtual memories.
- Understand & implement arithmetic process.
- Understand the processor and pipelining concepts.

- 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** 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	ANALOG AND DIGITAL ELECTRONICS	**Semester**	III
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***

- Analyse the working of oscillators and use of regulators.
- Make use of simplifying techniques in the design of combinational circuits.
- Illustrate combinational and sequential digital circuits.
- Demonstrate the use of flipflops and design registers and counters.
- Design and test Analog-to-Digital and Digital-to-Analog conversion techniques.

Module-1	**RBT Level** L2	10 Hrs.

Prerequisites : Basic analog Circuits

Metal Oxide Semiconductor Field Effect transistor(MOSFET): Structure and I-V characteristics,

MOSFET as a switch, MOSFET as an amplifier, CMOS and its applications.

Oscillators: Basic working and applications of RC Phase shift oscillator, Wien Bridge oscillator, LC oscillator, Colpitt oscillator, Crystal Oscillator.

Linear Power Supplies: Constituents of a Linear Power Supply, Designing Mains Transformer, Linear IC voltage regulators, Regulated Power Supply Parameters

Module-2	**RBT Level** L2,L3	10 Hrs.

Prerequisites:Digital Electronic Fundamentals

Karnaugh maps:Minimum forms of switching functions, two and three variable Karnaugh maps, four variable karnaugh maps, Quine-McClusky Method: determination of prime implicants, The prime implicant chart, petricks method, simplification of incompletely specified functions, simplification using map-entered variables

Activity: Writing and Analyzing C program for K-maps.

Module-3	**RBT Level** L2,L3	10Hrs.

Combinational Circuits: Multiplexer, Decoders, Adders, Subtractors, BCD arithmetic, carry look ahead adder, serial adder, ALU-Design and popular MSI chips, digital comparator, parity checker/generator, code converters, priority encoders, decoders/drivers for display devices,

Activity: Designing a 32-bit ALU

Module-4	**RBT Level** L2,L3	10 Hrs.

Flip-Flops and Registers:

Flip Flops: S-R,J-K,D and T flip flops,Edge-triggered JK FLIP-FLOPs

Registers: Types of Registers, Serial In - Serial Out, Serial In - Parallel out, Parallel In - Serial Out, Parallel In - Parallel Out, Universal Shift Register, Applications of Shift Registers.

Counters: Asynchronous Counters, Decoding Gates, Synchronous Counters, Changing the Counter Modulus, Decade Counters, Applications of Counters.

Activity: Implementing 2 digit counters using seven segment display

Module-5	**RBT Level**	10 Hrs.

	L2	

D/A Conversion and A/D Conversion:

Digital to analog converters: weighted resistor/converter, R-2R Ladder D/A converter, specifications for D/A converters, examples of D/A converter lCs, sample and hold circuit.

Analog to digital converters: quantization and encoding, parallel comparator A/D converter, successive approximation A/D converter, counting A/D converter, dual slope A/D converter, A/D converter using voltage to frequency and voltage to time conversion, specifications of A/D converters, example of A/D Converter ICs

Activity: Demonstration of CODEC which houses both ADC and DAC.

Laboratory Sessions

Plotting the V-I characteristics of MOSFET

Implementing adders and subtarctors

Implementing the simplified equation obtained from K-maps and verify with the truth table

Course outcomes:

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

Reference Books:

1.	Anil K Maini, Varsha Agarwal, Electronic Devices and Circuits, Wiley, 2012.
2.	Charles H Roth and Larry L Kinney, Fundamentals of Logic design, Cengage Learning,2019.
3.	Donald P Leach, Albert Paul Malvino & Goutam Saha, Digital Principles and Applications, 8th Edition, Tata McGraw Hill, 2015.
4.	M. Morris Mani, Digital Design, 4th Edition, Pearson Prentice Hall, 2008.

5.	David A. Bell, Electronic Devices and Circuits, 5th Edition, Oxford University Press, 2008

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:

The students will be able to get practical experience in design, 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>
</table>
</td><td>L3</td><td>3</td></tr>
</table>

	3 | Kolkata | 59 4 | Mumbai | 72 5 | Delhi | 12 a) To display name of cities where salesman has delivered maximum and minimum number of items b) To search the number of items to be delivered of a user supplied city.		
2	Implement Knuth-Morris- Pratt pattern matching algorithm using C program.	**L3**	**3**
3	Design, Develop and Implement a menu driven Program in C with the listed operations for the data structure which follows Last In First Out (LIFO) order. (Use Array Implementation of specified DS with maximum size MAX). a. Push an Element b. Pop an Element c. Demonstrate how it can be used to check Palindrome d. Demonstrate Overflow and Underflow situations e. Display the status f. Exit Support the program with appropriate functions for each of the above operations	**L3**	**3**
4	Design, Develop and Implement a Program in C for converting an Infix Expression to Postfix Expression. Program should support for both parenthesized and free parenthesized expressions with the operators: +, -, *, /, % (Remainder), ^ (Power) and alphanumeric operands.	**L3**	**3**
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	**L3**	**3**

	d. Display the status of Ring Buffer e. Exit Support the program with appropriate functions for each of the above operations		
6	Design, Develop and Implement a menu driven Program in C for the following operations on Singly Linked List (SLL) of Student Data with the fields: USN, Name, Programme, Sem, PhNo a. Create a SLL of N Students Data by using front insertion b. Display the status of SLL and count the number of nodes in it c. Perform Insertion / Deletion at End of SLL d. Perform Insertion / Deletion at Front of SLL e. Exit	**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. b) Traverse the BST recursively in inorder, preorder & postorder c) Search the BST for a given element (KEY) and report the appropriate message	**L3**	**3**
9	Design, Develop and Implement a Program in C for the following operations on Graph(G) of Cities	**L3**	**3**

	a. Create a Graph of N cities using Adjacency Matrix. b. Print all the nodes reachable from a given starting node in a digraph using DFS/BFS method		
10	Develop a C program to sort a given set of n integer elements using Quick Sort method. Run the program for varied values of n and show the results of each iteration.	**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	ANALOG AND DIGITAL	**Semester**	03

	ELECTRONICS LABORATORY		
Course Code	MVJ20CSL38	**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***

- Analog components and circuits including transistor, regulator, etc.
- Combinational logic circuits.
- Flip - Flops and their operations
- Counters and Registers using Flip-flops.
- Synchronous and Asynchronous Sequential Circuits

Sl No	Experiment Name	RBT Level	Hours
1	Study of transistor phase shift oscillator and observe the effect of variation in R & C on oscillator frequency and compare with theoretical value.	**L2**	**3**
2	Design and test IC 723 voltage regulator	**L3**	**3**
3	Given a 4-variable logic expression, simplify it using Entered Variable Map and realize the simplified logic expression using 8:1 multiplexer IC.	**L2**	**3**
4	Design and implement a faster way3 to add binary numbers using carry look ahead adders.	**L3**	**3**
5	a) Realization and implementation of 2-bit comparator using logic gates. b) Implementation of 4-bit magnitude comparator using IC 7485.	**L3**	**3**
6	To design and construct basic flip-flops R-S ,J-K,J-K Master slave flip-flops using gates and verify their truth table	**L3**	**3**
7	Implementation of SISO, SIPO, PISO and PIPO shift registers using Flip- flops	**L3**	**3**
8	Design and implementation of 3-bit synchronous up/down counter	**L3**	**3**

9	Design and implement a ring counter and Johnson counter using 4-bit shift register and demonstrate its working.	**L3**	**3**
10	Design and implement a mod-n (n<8) synchronous up counter using J-K Flip-Flop ICs and demonstrate its working.	**L3**	**3**
11	Design and implement an asynchronous counter using decade counter IC to count up from 0 to n (n<=9) and demonstrate on 7-segment display (using IC-7447).	**L3**	**3**
12	Design 4 bit r-2r ladder DAC using opamp.	**L3**	**3**

Course outcomes:	
CO1	Demonstrate various Electronic Devices like Cathode ray Oscilloscope, Signal generators, Digital Trainer Kit, Multimeters and components like Resistors, Capacitors, Op amp and Integrated Circuit
CO2	Examine and verify different analog circuits.
CO3	Design and demonstrate various combinational logic circuits.
CO4	Design and demonstrate various types of counters and Registers using Flip-flops
CO5	Design and demonstrate the working of DAC

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

High-3, Medium-2, Low-1

Course Title	ADDITIONAL MATHEMATICS-I	**Seme**ster	IV
Course Code	MVJ20MATDIP31	**CIE**	50
Total No. of Contact Hours	40 L : T : P :: 40 : 0 : 0	**SEE**	50
No. of Contact Hours/week	4	**Total**	100

Credits	-	Exam. Duration	3 HOURS

Course objective is to: This course viz., aims to prepare the students:

To familiarize the important and basic concepts of Differential calculus and Differential Equation, ordinary/partial differential equations and Vector calculus and analyse the engineering problems.

Module-1	RBT Level L1,L2	8 Hrs.

Differential calculus: Recapitulation of successive differentiation -nth derivative -Leibnitz theorem and Problems, Taylor's and Maclaurin's theorem for function of one variable.

Video Link: https://users.math.msu.edu/users/gnagy/teaching/ode.pdf

Module-2	RBT Level L1,L2	8 Hrs.

Integral Calculus:

Review of elementary Integral calculus, Reduction formula

$\int_0^{\frac{\pi}{2}} sin^m x\,dx$, $\int_0^{\frac{\pi}{2}} cos^m x\,dx$, $\int_0^{\frac{\pi}{2}} sin^m cos^n x\,dx$ and problems.

Evaluation of double and triple integrals and Simple Problems.

Video Link

- https://www.youtube.com/watch?v=rCWOdfQ3cwQ
- https://nptel.ac.in/courses/111/105/111105122/

Module-3	RBT Level L1,L2	8 Hrs.

Vector Calculus: Derivative of vector valued functions, Velocity, Acceleration and related problems, Scalar and Vector point functions, Gradient, Divergence, Curl, Solenoidal and Irrotational vector fields.Vector identities - div (φA), curl (φA), curl (grad φ), div (curl A)

Video Links:

- https://www.whitman.edu/mathematics/calculus_online/chapter16.html
- https://www.math.ust.hk/~machas/vector-calculus-for-engineers.pdf

Module-4	RBT Level L1,L2,L3	8 Hrs.

Probability:

Introduction-Conditional Probability, Multiplication theorem ,Independent events ,Baye's theorem and Problems

Video Links:

- https://www.khanacademy.org/math/statistics-probability/probability-library
- https://nptel.ac.in/courses/111/105/111105041/

Module-5	**RBT Level** L1,L2,L3	8 Hrs.

Differential equation: Homogeneous differential equation, Linear differential equation, Bernoulli's differential equation and Exact differential equation.

Video Link: https://www.mathsisfun.com/calculus/differential-equations.html

Course outcomes:

CO1	Apply the knowledge of Differential calculus in the modeling of various physical and engineering phenomena
CO2	Apply the concept of integration and variables to evaluate multiple integrals and their usage in computing the area and volumes.
CO3	Study on Vector calculus to understand the various solution of the Application to Engineering problems.
CO4	Understand the basic Concepts of Probability
CO5	Solve first order linear differential equation analytically using standard methods.

Reference Books:

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

CO-PO/PSO Mapping

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

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

High-3, Medium-2, Low-1

IV SEMESTER

Course Title	COMPLEX ANALYSIS, PROBABILITY AND STATISTICAL METHODS	**Semester**	04
Course Code	MVJ20MCS41	**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 provide an insight into applications of complex variables, conformal mapping and special functions arising in potential theory, quantum mechanics, heat conduction and field theory.
- To develop probability distribution of discrete, continuous random variables and joint probability distribution occurring in digital signal processing, design engineering and microwave engineering.

Module-1	**RBT Level L1, L2, L3,L4**	**Hours 8**
Calculus of complex functions: Review of function of a complex variable, limits, continuity, and differentiability. Analytic functions: Cauchy-Riemann equations in Cartesian and polar forms and consequences. **Construction of analytic functions:** Milne-Thomson method-Problems.		
Module-2	**RBT Level L1,L2,L3,L4**	**Hours 8**

Conformal transformations: Introduction. Discussion of transformations:$w = Z^2, w = e^z, w = z + \frac{1}{z}, (z \neq 0)$.Bilinear transformations- Problems. **Complex integration:** Line integral of a complex function-Cauchy's theorem and Cauchy's integral formula and problems.		
Module-3	**RBT Level L1,L2,L3,L4**	**Hours 8**
Probability Distributions: Review of basic probability theory. Random variables (discrete and continuous), probability mass/density functions. Binomial, Poisson, exponential and normal distributions- problems (No derivation for mean and standard deviation)-Illustrative examples.		
Module-4	**RBT Level L1,L2,L3,L4**	**Hours 8**
Statistical Methods: Correlation and regression-Karl Pearson's coefficient of correlation and rank correlation -problems. Regression analysis- lines of regression –problems. **Curve Fitting:** Curve fitting by the method of least squares- fitting the curves of the form- $y = ax + b, y = ax^b \; and \; y = ax^2 + bx + c.$		
Module-5	**RBT Level L1,L2,L3,L4**	**Hours 8**
Joint probability distribution: Joint Probability distribution for two discrete random variables, expectation and covariance. **Sampling Theory:** Introduction to sampling distributions, standard error, Type-I and Type-II errors. Test of hypothesis for means, student's t-distribution, Chi-square distribution as a test of goodness of fit.		

Course outcomes:	
CO1	Use the concepts of analytic function and complex potentials to solve the problems arising in electromagnetic field theory.
CO2	Utilize conformal transformation and complex integral arising in aerofoil theory, fluid flow visualization and image processing.
CO3	Apply discrete and continuous probability distributions in analyzing the probability models arising in engineering field.
CO4	Make use of the correlation and regression analysis to fit a suitable mathematical model for the statistical data.
CO5	Construct joint probability distributions and demonstrate the validity of testing the hypothesis.

Text/Reference Books:	
1	E. Kreyszig ,Advanced Engineering Mathematics, John Wiley & Sons, 10th Edition, 2016
2	B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Edition, 2017.
3	Srimanta Pal et al, Engineering Mathematics, Srimanta Pal et al, Oxford University Press, 3rd

	Edition, 2016.
4	C.Ray Wylie, Louis C.Barrett, Advanced Engineering Mathematics ,McGraw-Hill Book Co, 6th Edition, 1995.
5	S.S.Sastry, Introductory Methods of Numerical Analysis, Prentice Hall of India, 4th Edition 2010.
6	B.V.Ramana, Higher Engineering Mathematics, McGraw-Hill, 11th Edition,2010.
7	N.P.Bali and Manish Goyal, A Text Book of Engineering Mathematics, Laxmi Publications, 2014.

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

High-3, Medium-2, Low-1

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	DATABASE MANAGEMENT SYSTEM	**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 the basic concepts and the applications of database systems.
- Master the basics of SQL and construct queries using SQL.
- Understand the relational database design principles.
- Analyze the basic issues of transaction processing and concurrency control.
- Familiarize with database storage structures and access techniques.

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

Introduction to Database System Concepts: Database-System Applications, Purpose of Database Systems, View of Data, Database Language, Database Design, Database Architecture, Database Users and Administrators.

Introduction to the Relation Models and Database Design using ER Model: Structure of

Relational Databases, Database Schema, Keys, Schema Diagrams, Relational Query Languages, Relational Operations Overview of the Design Process, The Entity-Relationship Model, Constraints, Removing Redundant Attributes in Entity Sets, Entity-Relationship Diagrams, Reduction to Relational Schemas, Entity-Relationship Design Issues, Extended E-R Features.

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** L2, L3	**Hours 8**

Introduction to SQL: Overview of the SQL Query Language, SQL Data Definition, Basic Structure of SQL Queries, Additional Basic Operations, Set Operations, Null Values, Aggregate Functions Nested Sub queries, Modification of the Database.

Intermediate and Advanced SQL: Join Expressions, Views , Integrity Constraints, SQL Data Types, Authorization. Functions and Procedures, Triggers, Advanced Aggregation Features.

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** L2,L3, L4	**Hours 8**

Formal Relational Query Languages: The Relational Algebra, The Tuple Relational Calculus, The Domain Relational Calculus.

Schema Refinement and Normal Forms: Introduction to Schema Refinement, Functional Dependencies - Reasoning about FDs, Normal Forms, Properties of Decompositions, Normalization, Schema Refinement in Database Design, Other Kinds of Dependencies.

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** L3,L4 , L6	**Hours 8**

Indexing and Hashing: Basic Concepts, Ordered Indices, B+-Tree Index Files, B+-Tree Extensions, Multiple-Key Access, Static Hashing, Dynamic Hashing, Comparison of Ordered Indexing and Hashing, Bitmap Indices.

Transactions: Transaction Concept, a Simple Transaction Model, Storage Structure, Transaction Atomicity and Durability, Transaction Isolation, Serializability, Transaction Isolation and Atomicity, Transaction Isolation Levels.

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** L4,L5, L6	**Hours 8**

Concurrency Control: Lock-Based Protocols, Deadlock Handling, Multiple Granularity, Timestamp-Based Protocols, Validation-Based Protocols, Multi version schemes.

Recovery System: Failure Classification, Storage, Recovery and Atomicity, Recovery Algorithm, Buffer Management, Failure with Loss of Nonvolatile Storage, ARIES, Remote Backup 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=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	Apply the concepts of Normalization and design database which possess no anomalies.
CO4	Describes storage and indexing like tree structured and Hash based indexing.
CO5	Develop application to interact with databases.

Text/Reference Books:	
1	Abraham Silberschatz, Henry F. Korth, S. Sudarshan, ―Database System Concepts‖, 6th Edition, Tata McGraw-Hill.
2	Raghu Rama Kirshna, Johannes Gehrk, ―Database Management System‖ Tata McGraw Hill 3rd Edition.
3	Database Systems, 6th edition,R Elmasri,Shamkant B.Navathe, Pearson Education.
4	Database System Concepts, Peter Rob & Carlos Coronel, Cengage Learning.
5	Introduction to Database Management, M. L. Gillenson and others, Wiley Student Edition.
6	Database Development and Management, Lee Chao, Auerbach publications, Taylor & Francis Group.

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	ARTIFICIAL INTELLIGENCE	**Semester**	04
Course Code	MVJ20AM44	**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 fundamental concepts in Artificial Intelligence.
- Understand the problem solving techniques and knowledge representation.
- Design intelligent components or programs to meet desired needs.
- Implement, and evaluate a computer-based intelligent systems.

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

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

Video link / Additional online information (related to module if any): http://nptel.ac.in/courses/106106126/

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

Knowledge Representation & Reasons: Knowledge – Based Agents, The Wumpus world. **Propositional Logic:** Reasoning patterns in propositional logic - Resolution, Forward & Backward Chaining.

Inference in First order logic: Propositional vs. first order inference, Unification & lifting, Forward chaining, Backward chaining, Resolution.

Video link / Additional online information (related to module if any): http://nptel.ac.in/video.php?subjectId=106105079

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

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

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

Video link / Additional online information (related to module if any): https://www.youtube.com/watch?v=6hmIKIWBVSI

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

Constrain satisfaction problems: Backtracking search for CSPs local search for constraint satisfaction problems. **Game Playing:** Games, Minimax algorithm, Optimal decisions in multiplayer games, Alpha-Beta pruning, Evaluation functions, Cutting of search. **Video link / Additional online information (related to module if any):** https://nptel.ac.in/courses/106/106/106106158/		
Module-5	**RBT Level** L4,L5 , L6	**Hours 8**
Planning: Classical planning problem, Language of planning problems, Expressiveness and extension, planning with state – space search, Forward state spare search, Backward state space search, Heuristics for state space search, Partial order planning Graphs, Planning graphs **Learning:** what is learning, Forms of learning, Inductive learning, Learning Decision Trees. **Video link / Additional online information (related to module if any):** https://www.youtube.com/watch?v=3C6ZLS-gfXU		

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

Text/Reference Books:	
1	Stuart Russel, Peter Norvig, (2009), Artificial Intelligence – A Modern Approach,3rd Edition, Pearson Education.
2	E.Rich and K.Knight, (2008), Artificial Intelligence , 3rd Edition, Tata McGraw Hill.
3	Patterson, (2009), Artificial Intelligence and Expert Systems, 2nd Edition, PHI.
4	Giarrantana/ Riley, (2004), Expert Systems: Principles and Programming,4th Edition, Thomson.
5	Ivan Bratka, (2000), PROLOG Programming for Artificial Intelligence. 3rdEdition – Pearson Education.

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	EMBEDDED SYSTEMS	**Semester**	04
Course Code	MVJ20AM45	**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 architecture and programming of ARM processor.
- Become familiar with the embedded computing platform design and analysis.
- Get thorough knowledge in interfacing concepts.
- Design an embedded system and to develop programs.

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

INTRODUCTION TO EMBEDDED COMPUTING AND ARM PROCESSORS

Complex systems and micro processors– Embedded system design process –Design example: Model train controller- Instruction sets preliminaries – ARM Processor – CPU: programming input and output- supervisor mode, exceptions and traps – Co-processors- Memory system mechanisms – CPU performance- CPU power consumption.

Activity:

- Comparison of Microprocessor and Microcontroller hardware Model
- Comparing the Microprocessor and Microcontroller Software Model

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

EMBEDDED COMPUTING PLATFORM DESIGN

The CPU Bus-Memory devices and systems–Designing with computing platforms – consumer

electronics architecture – platform-level performance analysis – Components for embedded programs- Models of programs- Assembly, linking and loading – compilation techniques- Program level performance analysis – Software performance optimization – Program level energy and power analysis and optimization – Analysis and optimization of program size- Program validation and testing.

Activity: Writing ARM Assembly program for Embedded System Applications

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

SENSOR INTERFACING WITH ARDUINO

Basics of hardware design and functions of basic passive components-sensors and actuators-Arduino code – library file for sensor interfacing-construction of basic applications.

Activity:

- Use of External interrupt0 to turn ON/OFF led connected to Pin P1.25 of ARM Processor.
- Use of Software Interrupt SWI instruction in programming.
- Calculating physical memory address from logical address.

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

EMBEDDED FIRMWARE

Reset Circuit, Brown-out Protection Circuit-Oscillator Unit – Real Time Clock-Watchdog Timer – Embedded Firmware Design Approaches and Development Languages.

Case Study: Digital Clock, Battery operated Smartcard Reader

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

EMBEDDED C PROGRAMMING

Introduction-Creating _hardware delays‘using Timer 0 and Timer 1-Reading switches-Adding Structure to the code-Generating a minimum and maximum delay-Example: Creating a portable hardware delay- Timeout mechanisms-Creating loop timeouts-Testing loop timeouts- hardware timeouts-Testing a hardware timeout.

Case Study: Automated Meter Reading System (AMR) and Digital Camera, Real time concepts

Course outcomes:

CO1	Describe the architecture and programming of ARM processor.
CO2	Explain the concepts of embedded systems.
CO3	Understand the Concepts of peripherals and interfacing of sensors.

CO4	Capable of using the system design techniques to develop firmware.
CO5	Illustrate the code for constructing a system.

Text/Reference Books:	
1	Marilyn Wolf, ―Computers as Components – Principles of Embedded Computing System Design, Third Edition ―Morgan Kaufmann Publisher (An imprint from Elsevier), 2012. (unit I & II).
2	https://www.coursera.org/learn/interface-with-arduino#syllabus (Unit III) 3 .Michael J. Pont, ―Embedded C, 2 nd Edition, Pearson Education, 2008.(Unit IV & V).
3	Shibu K.V, ―Introduction to Embedded Systems, McGraw Hill.2014.
4	Jonathan W.Valvano, ―Embedded Microcomputer Systems Real Time Interfacing, Third Edition Cengage Learning, 2012.
5	Raj Kamal, ―Embedded Systems-Architecture,programming and design, 3 edition,TMH.2015.
6	Lyla, ―Embedded Systems, Pearson , 2013 6. David E. Simon, ―An Embedded Software Primer‖, 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	1	-	-	-	-	-	-	-	-	2	-
CO2	3	2	1	3	3	2	-	-	2	-	1	-	1	1
CO3	3	2	1	3	-	2	-	-	2	-	-	-	2	-
CO4	3	3	2	3	3	2	-	-	2	2	2	-	1	2
CO5	3	2	3	3	3	2	-	-	2	2	2	2	1	1

High-3, Medium-2, Low-1

Course Title	OBJECT ORIENTED CONCEPTS	**Semester**	04
Course Code	MVJ20AM46	**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 fundamental features of object oriented language and JAVA
- Set up Java JDK environment to create, debug and run simple Java programs.
- Create multi-threaded programs and event handling mechanisms.
- Introduce event driven Graphical User Interface (GUI) programming using applets and swings.

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

Introduction to Object Oriented Concepts: A Review of structures, Procedure–Oriented Programming system, Object Oriented Programming System, Comparison of Object Oriented Language with C, Console I/O, variables and reference variables, Function Prototyping, Function Overloading.

Class and Objects: Introduction, member functions and data, objects and functions.

Applications: Develop a good program and connecting it with the real world

Video Link: https://nptel.ac.in/courses/106/105/106105191/

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

Class and Objects (contd): Objects and arrays, Namespaces, Nested classes, Constructors, Destructors.

Introduction to Java: Java's magic: the Byte code; Java Development Kit (JDK); the Java Buzzwords, Object-oriented programming; Simple Java programs. Data types, variables and arrays, Operators, Control Statements.

Applications: Arrays in mathematical vectors, matrices.

Video Link: https://nptel.ac.in/courses/106/105/106105191/

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

Classes, Inheritance, Exception Handling

Classes: Classes fundamentals; Declaring objects; Constructors, this keyword, garbage collection.

Inheritance: inheritance basics, using super, creating multi level hierarchy, method overriding.

Exception handling: Exception handling in Java.

Applications: Inheritance in Banking Sectors

Video Link: https://nptel.ac.in/courses/106/105/106105191/

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

Packages and Interfaces: Packages, Access Protection, Importing Packages. Interfaces.

Multi Threaded Programming: Multi Threaded Programming: What are threads? How to make the classes threadable ; Extending threads; Implementing runnable; Synchronization; Changing **Applications:** Multithreads in Browsers, Servers **Video Link:** https://nptel.ac.in/courses/106/105/106105191/		
Module-5	**RBT Level** L1,L2 ,L3	**Hours 8**
Event Handling: Two event handling mechanisms; The delegation event model; Event classes; Sources of events; Event listener interfaces; Using the delegation event model; Adapter classes; Inner classes. **Swings:** Swings: The origins of Swing; Two key Swing features; Components and Containers; The Swing Packages; A simple Swing Application; Create a Swing Applet; Jlabel and ImageIcon; JTextField;The Swing Buttons; JTabbedpane; JScrollPane; JList; JComboBox; JTable. **Applications:** AWT , GUI Applications **Video Link:** https://freevideolectures.com/course/4227/nptel-programming-in-java/43		

Course outcomes:	
CO1	Explain the object-oriented concepts and JAVA.
CO2	Develop computer programs to solve real world problems in Java.
CO3	Illustrate the use of classes, Exceptions and distinguish the usage of different types of Inheritance and constructors in real world.
CO4	Demonstrate the use of packages and to create multi-threaded programs.
CO5	Develop simple GUI interfaces for a computer program to interact with users, and to understand the event-based GUI handling principles using swings.

Text/Reference Books:	
1	Sourav Sahay, Object Oriented Programming with C++ , 2nd Ed, Oxford University Press,2006.
2	Herbert Schildt, Java The Complete Reference, 7th Edition, Tata McGraw Hill, 2007.
3	Mahesh Bhave and Sunil Patekar, "Programming with Java", First Edition, Pearson Education,2008, ISBN:9788131720806.
4	Herbert Schildt, The Complete Reference C++, 4th Edition, Tata McGraw Hill, 2003.
5	Stanley B.Lippmann, Josee Lajore, C++ Primer, 4th Edition, Pearson Education, 2005.
6	Rajkumar Buyya,S Thamarasi selvi, xingchen chu, Object oriented Programming with java, Tata McGraw Hill education private limited.
7	Richard A Johnson, Introduction to Java Programming and OOAD, CENGAGE Learning.

8	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	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	**L3**	**3**

	and plot a graph of the time taken versus N.		
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 the debugging options of your favourite IDE (e.g. eclipse), in order to find the error.	**L3**	**3**
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	**L3**	**3**

	that connects all your offices with a minimum total cost and it should be a spanning tree.		
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 determine whether there is any non-empty subset whose sum is ‘s'.	**L3**	**3**
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

Course Title	DATABASE MANAGEMENT SYSTEM LAB	**Semester**	04
Course Code	MVJ20CSL48	**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***

- Learn to create and use a database.
- Be familiarized with a query language
- Have hands on experience on DDL Commands
- Have a good understanding of DML Commands and DCL commands
- Familiarize advanced SQL queries.
- Be Exposed to different applications

Sl No	**Experiment Name**	**RBT Level**	**Hours**
1	Creation of a database and writing SQL queries to retrieve information from the database.	**L3**	**3**
2	Performing Insertion, Deletion, Modifying, Altering, Updating and Viewing records based on conditions.	**L3**	**3**
3	Creation of Views, Synonyms, Sequence, Indexes, Save point.	**L3**	**3**
4	Creating an Employee database to set various constraints.	**L3**	**3**
5	Creating relationship between the databases.	**L3**	**3**
6	Study of PL/SQL block.	**L3**	**3**
7	Write a PL/SQL block to satisfy some conditions by accepting input from the	**L3**	**3**

	user.		
8	Write a PL/SQL block that handles all types of exceptions.	**L3**	**3**
9	Creation of Procedures.	**L3**	**3**
10	Creation of database triggers and functions	**L3**	**3**
11	Mini project (Application Development using Oracle/ Mysql) a) Inventory Control System. b) Material Requirement Processing. c) Hospital Management System. d) Railway Reservation System. e) Personal Information System. f) Web Based User Identification System. g) Timetable Management System. h) Hotel Management System	**L3**	**3**

Course outcomes:	
CO1	Design and implement a database schema for a given problem-domain
CO2	Populate and query a database
CO3	Create and maintain tables using PL/SQL.
CO4	Prepare reports.

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

High-3, Medium-2, Low-1

Course Title	ADDITIONAL MATHEMATICS-II	**Seme**ster	IV
Course Code	MVJ20MATDIP41	**CIE**	50

Total No. of Contact Hours	40 L : T : P :: 40 : 0 : 0	**SEE**	50
No. of Contact Hours/week	4	**Total**	100
Credits	-	**Exam. Duration**	3 HOURS

Course objective is to: This course viz., aims to prepare the students:

To familiarize the important tools Linear Algebra, differential Calculus, Beta and Gamma functions, 3-Dimentional Geometry and probability for analysing the engineering problems.

Module-1	**RBT Level** L1,L2	8 Hrs.

Linear Algebra:

Introduction, Rank of a matrix-echelon form. Solution of system of linear equations – consistency. Gauss-elimination method and problems. Eigen values and Eigen vectors of square matrix of order two and Problems

Video Link:

- https://www.math.ust.hk/~machas/matrix-algebra-for-engineers.pdf
- https://nptel.ac.in/content/storage2/courses/122104018/node18.html

Module-2	**RBT Level** L1,L2	8 Hrs.

Differential calculus:

Tangent and normal, both Cartesian and polar forms. Increasing and decreasing functions, Maxima and Minima for a function of one variable. Point of inflections and Problems.

Beta and Gamma functions:

Beta and Gamma functions, Relation between Beta and Gamma function-simple problems.

Video Link

- https://www.youtube.com/watch?v=6RwOoPN2zqE
- https://www.youtube.com/watch?v=s6F5yjY6jWk&list=PLMLsjhQWWlUqBoTCQDtYlloI-o-9hxp11
- http://tutorial.math.lamar.edu/Classes/DE/IntroPDE.aspx

Module-3	**RBT Level** L1,L2	8 Hrs.

Analytical solid geometry :

Introduction –Directional cosine and Directional ratio of a line, Equation of line in space- different forms, Angle between two line, shortest distance between two line, plane and equation of plane in different forms and problems.

Video Links:

- https://www.toppr.com/guides/maths/three-dimensional-geometry/
- https://www.toppr.com/guides/maths/three-dimensional-geometry/distance-between-skew-lines/

Module-4	**RBT Level** L1,L2,L3	8 Hrs.

Probability:

Random variable, Discrete probability distribution, Mean and variance of Random Variable, Theoretical distribution- Binomial distribution, Mean and variance Binomial distribution -Problems. Poisson distribution as a limiting case of Binomial distribution, Mean and variance of Poisson distribution.

Normal Distribution-Basic properties of Normal distribution –standard form of normal distribution and Problems

Video Links:

- https://nptel.ac.in/courses/111/105/111105041/
- https://www.mathsisfun.com/data/probability.html

Module-5	**RBT Level** L1,L2	8 Hrs.

Partial Differential equation: Formation of PDE's by elimination of arbitrary constants and functions. Solution of non-homogeneous PDE by direct integration. Homogeneous PDEs involving derivative with respect to one independent variable only.

Video Link:

- http://tutorial.math.lamar.edu/Classes/DE/IntroPDE.aspx
- https://www.studyyaar.com/index.php/module-video/watch/233-cauchys-legendres-de-a-method- of- variation-of-parameters

Course outcomes:

CO1	Apply the knowledge of Matrices to solve the system of linear equations and to understand the concepts of Eigen value and Eigen vectors for engineering problems.

CO2	Demonstrate various physical models ,find Maxima and Minima for a function of one variable., Point of inflections and Problems .Understand Beta and Gamma function
CO3	Understand the 3-Dimensional geometry basic, Equation of line in space- different forms, Angle between two line and studying the shortest distance.
CO4	Concepts of Probability related to engineering applications.
CO5	Construct a variety of partial differential equations and solution by exact methods.

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

CO-PO/PSO Mapping

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

High-3, Medium-2, Low-1