Course Title	Discrete Math & Probability Theory	Semester	III
Course Code	MVJ20MCD31	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	4 (L : T : P :: 2 : 2 : 0)	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	L1,L2,L3	8Hours

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	L1,L2,L3	8Hours

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	**L1,L2,L3**	**8Hours**
Relations: Cartesian Products, Relations, Properties of Relations, Computer Recognition – Zero-One Matrices and Directed Graphs, Partial Orders – Hasse Diagrams, Equivalence Relations and Partitions. Functions: Plain and One to One, Onto Functions. The Pigeon-hole Principle, Function Composition and 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	**L1,L2,L3**	**8Hours**
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	**L1,L2,L3**	**8Hours**
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, decoding and error detection. Application: Testing the level of significance & the goodness of fit for large sample and small sample. 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.	Ralph P. Grimaldi: Discrete and Combinatorial Mathematics, 5th Edition, Pearso Education. 2004.
2.	B.S. Grewal, "Higher Engineering Mathematics" Khanna Publishers, 43rd Edition, 2013.
3.	Ramana B. V., "Higher Engineering Mathematics", Tata Mc Graw-Hill, 2006.
4.	Kenneth H. Rosen: Discrete Mathematics and its Applications, 6th Edition, McGraw Hill, 2007
5.	Basavaraj S Anami and Venakanna S Madalli: Discrete Mathematics – A Concept based approach, Universities Press, 2016.

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

High-3, Medium-2, Low-1

Course Title	Data Structure	Semester	III
Course Code	MVJ20CD32	CIE	50
Total No. of Contact Hours	50	SEE	50
No. of Contact Hours/week	5 (L : T : P :: 3 : 2 : 0)	Total	100
Credits	4	Exam. Duration	3 Hours

Course objective is to:

- Understand the various techniques of sorting and searching.
- Design and implement arrays, stacks, queues, and linked lists.
- Understand the complex data structures such as trees and graphs.

Module-1	L1,L2,L3	10Hours

Basic Terminologies: Elementary Data Organizations, Data Structure Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off. Searching: Linear Search and Binary Search Techniques and their complexity analysis.

Laboratory Sessions/ Experimental learning:

- Implementation of searching Techniques

Applications: Array data type used in a programming language to specify a variable that can be indexed. Array data structure is used for arrangement of items at equally spaced and sequential addresses in computer memory makes it easier to perform operations like sorting, merging, traversal, retrievals

Video link / Additional online information :
https://www.tutorialspoint.com/data_structures_algorithms/array_data_structure.htm

Module-2	L1,L2,L3	10 Hours

ADT Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation – corresponding algorithms and complexity analysis. ADT queue, Types of Queue: Simple Queue, Circular Queue, Priority Queue; Operations on each types of Queues: Algorithms and their analysis.

Laboratory Sessions/ Experimental learning:

- Stack ADT to perform push and pop operations.
- Stack ADT for Expression Evaluation
- Array Implementation of Queue ADT

Applications: Expression Handling , Backtracking Procedure

Video link / Additional online information :
https://www.tutorialspoint.com/data_structures_algorithms/stack_algorithm.htm
https://www.tutorialspoint.com/data_structures_algorithms/dsa_queue.htm

Module-3	L1,L2,L3	10 Hours

Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and Queue, Header nodes, Doubly linked list: operations on it and algorithmic analysis; Circular Linked Lists: all operations their algorithms and the complexity analysis

Laboratory Sessions/ Experimental learning:

- Implementation of linked list techniques(SLL,DLL,CLL)

Applications: The cache in your browser that allows you to hit the BACK button where a linked list of URLs can be implemented. A linked list would be a reasonably good choice for implementing a linked list of file names, undo functionality in Photoshop

Video link / Additional online information :
https://www.tutorialspoint.com/data_structures_algorithms/linked_list_algorithms.htm
https://www.tutorialspoint.com/data_structures_algorithms/doubly_linked_list_algorithm.htm

Module-4	L1,L2,L3	10 Hours

Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree; Tree operations on each of the trees and their algorithms with Complexity analysis. Applications of Binary Trees. B Tree, B+ Tree: definitions, algorithms and analysis.

Laboratory Sessions/ Experimental learning:

- Develop a program to create a Binary Search Tree and to Traverse the tree.

Applications: Store hierarchical data, like folder structure, organization structure, XML/HTML data. Binary Search Tree is a tree that allows fast search, insert, delete on a sorted data. It also allows finding closest item. Heap is a tree data structure which is implemented using arrays and used to implement priority queues.

Video link / Additional online information :
https://www.tutorialspoint.com/data_structures_algorithms/tree_data_structure.htm
https://www.tutorialspoint.com/data_structures_algorithms/binary_search_tree.htm

Module-5	L1,L2,L3	10 Hours

Introduction to graph – types of graphs - Graph representations - Traversal algorithms- Depth First Search (DFS) and Breadth First Search (BFS) - Shortest path algorithms, Transitive closure, Minimum Spanning Tree, Topological sorting.

Laboratory Sessions/ Experimental learning:

- Implement shortest path Algorithms

Applications: The link structure of a website could be represented by a directed graph: the vertices are the web pages available at the website and a directed edge from page A to page B exists if and only if A contains a link to B. Graph colouring concept can be applied in job scheduling problems of CPU, jobs are assumed as vertices of the graph and there will be an edge between two jobs that cannot be executed simultaneously and there will be one-one relationship between feasible scheduling of graphs.

Video link / Additional online information :
https://www.tutorialspoint.com/data_structures_algorithms/graph_data_structure.htm

Course outcomes:	
CO1	Implement all the operations of linear data structures to store and retrieve the given data.
CO2	Create a hierarchical data structure to represent the given data using tree data structure.
CO3	Compare efficiency of various searching techniques using different tree data structures.
CO4	Apply stack, Queue, Lists, Trees and Graph concepts in problem solving
CO5	Implement all data structures in a high-level language for problem solving

Reference Books:	
1.	Seymour Lipschutz and Vijayalakshmi Pai G A, –Data Structures‖, Tata McGraw Hill, New Delhi, 2013.
2.	Ellis Horowitz, Sartaj Sahni, Susan Anderson Freed, Fundamentals of Data Structures in C, Second Edition, Universities Press, 2008.
3.	Mark Allen Weiss, Data Structures and Algorithm Analysis in C, Second Edition, Pearson Education, 2015

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

CO1	3	3	3	2	3	0	0	0	0	2	0	0
CO2	3	3	3	2	3	0	0	0	0	2	0	0
CO3	3	3	2	2	3	0	0	0	0	2	0	0
CO4	3	3	2	2	3	0	0	0	0	2	0	0
CO5	3	3	3	2	3	0	0	0	0	2	0	0

High-3, Medium-2, Low-1

Course Title	Software Testing	Semester	III
Course Code	MVJ20CD33	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	4 (L : T : P :: 3 : 1 : 0)	Total	100
Credits	3	Exam. Duration	3 Hours

Course objective is to:

- Understand HTML and CSS for designing web pages.
- Understand basics of JavaScript as a programming language.
- Understand the Document Object Model and enable them to create dynamic web pages that react to user input.
- Understand installing and configuring Apache Server and incorporating backend support for their web pages.
- Get exposure to the newer features available as part of the HTML standard

Module-1	L1,L2,L3	8 Hours

Syllabus Content: Basics of Software Testing: Basic definitions, Software Quality, Requirements, Behaviour and Correctness, Correctness versus Reliability, Testing and Debugging, Test cases, Insights from a Venn diagram, Identifying test cases, Test-generation Strategies, Test Metrics, Error and fault taxonomies, Levels of testing, Testing and Verification, Static Testing. Problem Statements: Generalized pseudocode, the triangle problem, the NextDate function, the commission problem, the SATM (Simple Automatic Teller Machine) problem, the currency converter, Saturn windshield wiper

Application: software systems

Video Link: https://www.youtube.com/watch?v=cv6GvRCIuTs

Module-2	L1,L2,L3	8 Hours

Syllabus Content:Black Box Testing Types of Black Box Testing Techniques: Boundary Value Testing, Normal Boundary Value Testing Robust Boundary Value Testing, Worst-Case Boundary Value Testing, Special Value Testing, Examples, Random Testing Guidelines for Boundary Value Testing

Equivalence Class Testing Equivalence Classes, Traditional Equivalence Class Testing Improved Equivalence Class Testing, Equivalence Class Test Cases for the Triangle Problem, Equivalence Class Test Cases for the NextDate Function, Equivalence Class Test Cases for the Commission Problem, Edge Testing Decision Table–Based Testing Decision

Tables, Decision Table Techniques Test Cases for the Triangle Problem, Test Cases for the Next Date Function, Test Cases for the Commission Problem

Application: Multilanguage support and compatibility Testing

Video Link: https://www.youtube.com/watch?v=2MRU2oRUlDo

Module-3	L1,L2,L3	8 Hours

Syllabus Content:

Evaluating Test Cases Mutation Testing, Fuzzing, Fishing Creel Counts and Fault Insertion Software Technical Reviews Economics of Software Reviews, Roles in a Review Types of Reviews, Contents of an Inspection Packet, An Industrial Strength Inspection Process, Effective Review Culture,Inspection Case Study

Application: Pit mutation testing

Video Link: https://www.youtube.com/watch?v=mZjPzlX9YJY

Module-4	L1,L2,L3	8 Hours

Syllabus Content:

Integration and Component-Based Software Testing: Overview, Integration testing strategies, Testing components and assemblies. System, Acceptance and Regression Testing: Overview, System testing, Acceptance testing, Usability, Regression testing, Regression test selection techniques, Test case prioritization and selective execution. Levels of Testing, Integration Testing: Traditional view of testing levels, Alternative life-cycle models, The SATM system, Separating integration and system testing, A closer look at the SATM system, Decomposition-based, call graph-based, Path-based integration

Application: Online delivery system

Video Link: https://www.coursera.org/lecture/engineeringandroidapps/integration-testing-FbJOF

Module-5	L1,L2,L3	8 Hours

Syllabus Content:

Software test automation – skill needed for automation – scope of automation – design and architecture for automation – requirements for a test tool – challenges in automation – Test metrics and measurements – project, progress and productivity metrics.

Application: TestSigma

Video Link: https://www.edureka.co/blog/test-automation-strategy/

Practical Experiments:
1. Study of any testing tool.
2. Study of any web testing tool
3. Study of any bug tracking tool
4. Study of any test management tool.
5. Case study on Selenium.

Course outcomes:	
CO1	Apply the concepts of Quality Engineering.
CO2	Design Test cases for various black box testing techniques
CO3	Plan, employ and measure proper Quality approaches applied.
CO4	Apply the appropriate technique for the design of flow graph.
CO5	Create automation test scripts

Text/Reference Books:	
1.	Paul C. Jorgensen: Software Testing, A Craftsman's Approach, 4th Edition, Auerbach Publications, 2013.
2.	Mauro Pezze, Michal Young: Software Testing and Analysis – Process, Principles and Techniques, Wiley India, 2009.
3.	Aditya P Mathur: Foundations of Software Testing, Pearson Education, 2008
4.	Software testing Principles and Practices – Gopalaswamy Ramesh, Srinivasan Desikan, 2nd Edition, Pearson, 2007
5.	Software Testing – Ron Patton, 2nd edition, Pearson Education, 2004

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

High-3, Medium-2, Low-1

Course Title	Python Programming	Semester	III
Course Code	MVJ20CD34	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	4 (L : T : P :: 3 : 1 : 0)	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
- Design, write, debug, run Python Programs
- Develop console -based applications using Python
- Develop console & windows applications using Python.
- Introduce event driven Graphical User Interface (GUI) programming using Python built in functions

Module-1	L1,L2,L3	8Hours

Syllabus Content:

Why should you learn to write programs, Introduction to Python, Variables, expressions and statements, Conditional execution, Functions.

Application:

- In learning and implementing small project process

Video Link:

1. https://www.py4e.com/
2. http://greenteapress.com/wp/think-python/

Module-2	L1,L2,L3	8 Hours

Syllabus Content: Iteration, Strings, Files.

Application:

- Pattern recognition and Reading resultant column in supervised learning data set

Video Link:

1. https://www.codecademy.com/learn/learn-python
2. http://www.tutorialspoint.com/python/

Module-3	L1,L2,L3	8 Hours

Syllabus Content:

Lists, Dictionaries, Tuples, Regular Expressions.

Application:

- Handling query languages and Managing Large set of data with respect to database

Video Link:

1. https://www.programiz.com/python-programming/class
2. https://www.udemy.com/course/web-scraping-with-python-beautifulsoup/

Module-4	L1,L2,L3	8 Hours

Syllabus Content:

Classes and objects, Classes and functions, Classes and methods.

Application:

- Designing games and puzzles

Video Link:

1. https://datatofish.com/json-string-to-csv-python/
2. https://automatetheboringstuff.com/

Module-5	L1,L2,L3	8 Hours

Syllabus Content:

Networked programs, Using Web Services, Using databases and SQL.

Application:

- Music composition and movie development

Video Link:

1. http://do1.drchuck.com/pythonlearn/EN_us/pythonlearn.pdf
2. https://www.datacamp.com/community/tutorials/reading-and-editing-pdfs-and-word-documents-from-python

Practical Experiments:

- Programs related to Basic concepts of Python like Operators, Control flow and

Iterations.

- Programs related to Functions, Strings, Files, Lists and Multi-Dimension Lists
- Installation and use of special Modules like pip, Wiki etc.
- Implementation of Python Program with a Database.

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)
2.	Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2ndEdition, Green Tea Press, 2015. (http://greenteapress.com/thinkpython2/thinkpython2.pdf)
3.	Charles Dierbach, "Introduction to Computer Science Using Python", 1st Edition, Wiley India Pvt Ltd. ISBN-13: 978-8126556014

CO-PO Mapping

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

High-3, Medium-2, Low-1

Course Title	Optimization Methods	Semester	III
Course Code	MVJ20CD35	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	4 (L : T : P :: 4 : 0 : 0)	Total	100
Credits	3	Exam. Duration	3 Hours

Course objective is to:

- Provide introduction to linear programming techniques .
- Provide theoretical foundation and the fundamental algorithms for linear & non-linear optimization.
- Provide introduction to multi-channel queuing models.

Module-1	L1,L2,L3	8 Hours

Linear Programming-Graphical Solution- The Simplex algorithm, Artificial Variable Technique -Duality-Dual Simplex - Variants of the Simplex Method Transportation Model Initial Basic Feasible Solution methods Test for optimality-Variants of the Transportation problem

Application:

logistic regression.

Video Link:

https://www.youtube.com/watch?v=4Xokcy8jeoI

Module-2	L1,L2,L3	8 Hours

Assignment Model- Hungarian algorithm Variants of the Assignment problem, Travelling Salesman Problem Integer Linear Programming- Gomary's cutting plane method Branch and Bound method

Application:

Numerical solution of linear systems.

Video Link:

https://www.youtube.com/watch?v=Q2dewZweAtU

Module-3	L1,L2,L3	8 Hours
Sequencing Problem - N jobs through 2 machines, N Jobs through 3 machines, N jobs through m machines Scheduling - Critical path Method, Project Evaluation and Review Techniques Application: Stochastic gradient descent. Video Link: https://www.youtube.com/watch?v=x6f5JOPhci0		
Module-4	**L1,L2,L3**	**8 Hours**
Introduction to constrained nonlinear optimization theory, Inventory control - Purchase and production model with and without shortage , price break. Application: constrained nonlinear optimization Video Link: https://www.youtube.com/watch?v=TudQZtgpoHk		
Module-5	**L1,L2,L3**	**8 Hours**
Queuing Model- Single channel model, Multichannel model. Application: Quadratic programs Video Link: https://www.youtube.com/watch?v=csG_qfOTvxw		

Course outcomes:	
CO1	Apply linear programming techniques to optimize problems arising in communication engineering
CO2	Solve the assignment problem through Hungarian algorithm
CO3	Determine the optimum values of integer programming problems using Gomary's cutting plane method

CO4	Write well documented and structured optimization algorithm
CO5	Solve the single and multi-channel queuing models.

Reference Books:	
1.	Sharma J.K.: "Operations Research Theory and applications", Macmillan India Ltd., V Edition, 2015.
2.	Hamdy A. Taha: Operations Research – An Introduction", Prentice Hall of India Pvt Ltd., EIGHT Edition, 2014.
3.	Chandrasekara Rao, K. Shanti Lata Misra "Operation Research", Alpha science international Ltd-2015.
4.	Kanti Swarup, P.K.Gupta and Man Mohan "Operations Research", Sultan Chand,2014

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

High-3, Medium-2, Low-1

Course Title	Professional Ethics in Computing	Semester	III
Course Code	MVJ20CD36	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	4 (L : T : P :: 4 : 0 : 0)	Total	100
Credits	3	Exam. Duration	3 Hours

Course objective is to:

- To inculcate the sense of social responsibility.
- To develop a firm ethical base
- To make the students realize the significance of ethics in professional environment.

Module-1	L1,L2,L3	8 Hours

Profession ---- Definition
Three types of ethics.
Engineering ethics
Rights and responsibilities of an engineer

Application:

Engineering ethics

Video Link:

https://lib.pstcc.edu/csplagiarism

Module-2	L1,L2,L3	8 Hours

Evolution of engineering ethics
Code of ethics
Kohlberg‟s theory
Gilligan‟s theory

Application:

Business ethics, Outline of ethics

Video Link:

https://www.youtube.com/watch?v=jj1CsGgDgGM

Module-3	L1,L2,L3	8 Hours

Engineering as social experimentation Engineer‟s social responsibility Application: Professional boundaries Video Link: https://www.youtube.com/watch?v=OBrMUs_T9Fs		
Module-4	L1,L2,L3	8 Hours
Computer ethics Ethical hacking Privacy Application: Professional responsibility Video Link: https://www.youtube.com/watch?v=Ij3iILP7H-4		
Module-5	L1,L2,L3	8 Hours
Environmental ethics. Livable environment Technology assessment. Application: Virtue ethics Video Link: https://nptel.ac.in/courses/110/105/110105097/		

Course outcomes:	
CO1	Ethical, social and environmental awareness.
CO2	Awareness on Engineer's rights and responsibilities
CO3	Act in morally desirable ways, towards moral commitment and responsible conduct.
CO4	Integrating academic learning with experimental learning in a profession.
CO5	Apply ethics in professional environment.

Reference Books:	
1.	Ethics in engineering: Mike W.Martin Roland, Mac Grow Hill.Schinzinger
2.	Engineerinethics---- M.Govindarajan, S.Natarajan&V.S.Senthil Kumar. Eastern economy Edn.PHI
3.	Engineering ethics-- Harris pitch and Rabbins, cengage.
4.	Caroline whit back---Ethics in engineering practice and research---- Cambridge.
5.	E-learning resources: http://nptel.ac.in/courses.php http://jntuk-coeerd.in/

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

High-3, Medium-2, Low-1

Course Title	Data Structure Lab	Semester	III
Course Code	MVJ20CDL37	CIE	50
Total No. of Contact Hours	30	SEE	50
No. of Contact Hours/week	3 (L : T : P :: 0 : 1 : 2)	Total	100
Credits	2	Exam. Duration	3 Hours

Course objective is to:

- Implement linear and non-linear data structures
- Understand the different operations of search trees
- Implement graph traversal algorithms
- Get familiarized to sorting and searching techniques

Sl No	Experiment Name	RBT Level	Hours
1	Implementation of searching algorithms a) Linear Search b) Binary Search	L3	3
2	Implementation of sorting algorithms a) Insertion sort b) Selection sort c) Quick sort d) Merge sort	L3	3
3	a) Array implementation of List ADT b) Linked list implementation of List ADT	L3	3
4	a) Array implementation of Stack ADT b) Linked list implementation of Stack ADT	L3	3
5	a) Array implementation of queue ADT b) Linked list implementation of queue ADT	L3	3
6	Program to create a Binary Search Tree and to traverse the tree.	L3	3
7	Program to compute the shortest path from a single source	L3	3
8	Program to construct a graph and perform graph traversal (BFS, DFS)	L3	3
9	Program to construct a minimum spanning tree using: a) Prims Algorithm b) Kruskal's Algorithm	L3	3
10	Development of a Mini project/Present a case Study	L3	3

Course outcomes:

CO1	Compute the time and space complexity of searching and sorting algorithms with asymptotic notations.
CO2	Implement all the operations of linear data structures to store and retrieve the given data.
CO3	Apply Algorithm for solving problems like sorting, searching, insertion and deletion of data
CO4	Create a hierarchical data structure to represent the given data using tree data structure.
CO5	Design graph algorithms to compute the shortest path of the given graph and to identify the Minimum spanning tree.

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

High-3, Medium-2, Low-1

Course Title	Python Programming Lab	Semester	III
Course Code	MVJ20CDL38	CIE	50
Total No. of Contact Hours	30	SEE	50
No. of Contact Hours/week	3 (L : T : P :: 0 : 1 : 2)	Total	100
Credits	2	Exam. Duration	3 Hours

Course objective is to:

- Gain knowledge in writing python programs to do a variety of programming tasks and develop various applications.

Sl No	Experiment Name	RBT Level	Hours
1	Python Program to Reverse a linked list	L3	3
2	Python Program for Find largest prime factor of a number	L3	3
3	Python Program for Efficient program to print all prime factors of a given number	L3	3
4	Python Program for Product of unique prime factors of a number	L3	3
5	Python Program for Find sum of odd factors of a number	L3	3
6	Python Program for Coin Change	L3	3
7	Python Program for Tower of Hanoi	L3	3
8	Python Program to Check if binary representation is palindrome	L3	3
9	Python Program for Basic Euclidean algorithms	L3	3
10	Python Program for Maximum height when coins are arranged in a triangle	L3	3

Course outcomes:

CO1	Write, Test and Debug Python Programs
CO2	Implement Conditionals and Loops for Python Programs
CO3	Use functions and represent Compound data

CO4	Read and write data from & to files in Python
CO5	Develop Applications using Python

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

High-3, Medium-2, Low-1

Course Title	CONSTITUTION OF INDIA, PROFESSIONAL ETHICS AND CYBER LAW	Semester	III
Course Code	MVJ20CPH39	CIE	50
Total No. of Contact Hours	15	SEE	50
No. of Contact Hours/Week	1 (L : T : P :: 1 : 0 : 0)	Total	100
Credits	01	Exam. Duration	2 hrs

Course objective is to:

- To know the fundamental political codes, structure, procedures, powers, and duties of Indian constitution, Indian government institutions, fundamental rights, directive principles and the duties of the citizens.
- To provide overall legal literacy to the young technograts to manage complex societal issues in the present scenario.
- To understand engineering ethics & their responsibilities, identify their individual roles and ethical responsibilities towards society.

Module-1	RBT Level L1,L2,L3	03 Hours

Introduction to Indian Constitution

The Necessity of the Constitution, The Societies before and after the Constitution adoption. Introduction to the Indian Constitution, The Making of the Constitution, The role of the Constituent Assembly – Preamble and Salient features of the Constitution of India. Fundamental Rights and its Restriction and Limitations in different Complex Situations. Directive Principles of State Policy (DPSP) and its present relevance in our society with examples. Fundamental Duties and its Scope and Significance in Nation Building.

Module – II	RBT Level L1,L2,L3	03 Hours

Union Executive and State Executive

Parliamentary System, Federal System, Centre-State Relations. Union Executive – President, Prime Minister, Union Cabinet, Parliament - LS and RS, Parliamentary Committees, Important Parliamentary Terminologies. Supreme Court of India, Judicial Reviews and Judicial Activism. State Executives – Governor, Chief Minister, State Cabinet, State Legislature, High Court and Subordinate Courts, Special Provisions (Article 370, 371, 371J) for some States.

Module – III	RBT Level L1,L2,L3	03 Hours

Elections, Amendments and Emergency Provisions

Elections, Electoral Process, and Election Commission of India, Election Laws.

Amendments - Methods in Constitutional Amendments (How and Why) and Important Constitutional Amendments. Amendments – 7,9,10,12,42,44,61,73,74,75,86, and 91,94,95,100,101,118 and some important Case Studies. Recent Amendments with explanation. Important Judgements with Explanation and its impact on society (from the list of Supreme Court Judgements).

Emergency Provisions, types of Emergencies and it's consequences.

Constitutional Special Provisions:

Special Constitutional Provisions for SC & ST, OBC, Special Provision for Women, Children & Backward Classes.

Module – IV	RBT Level L1,L2,L3	03 Hours

Professional / Engineering Ethics

Scope & Aims of Engineering & Professional Ethics - Business Ethics, Corporate Ethics, Personal Ethics. Engineering and Professionalism, Positive and Negative Faces of Engineering Ethics, Code of Ethics as defined in the website of Institution of Engineers (India) : Profession, Professionalism, Professional Responsibility. Clash of Ethics, Conflicts of Interest. **Responsibilities in Engineering** - Responsibilities in Engineering and Engineering Standards, the impediments to Responsibility.Trust and Reliability in Engineering, IPRs (Intellectual Property Rights), Risks, Safety and liability in Engineering.

Module – V	RBT Level L1,L2,L3	03 Hours

Internet Laws, Cyber Crimes and Cyber Laws:

Internet and Need for Cyber Laws, Modes of Regulation of Internet, Types of cyber terror capability, Net neutrality, Types of Cyber Crimes, India and cyber law, Cyber Crimes and the information Technology Act 2000, Internet Censorship, Cybercrimes and enforcement agencies.

Course Outcomes: On completion of this course, students will be able to	
CO1	Have constitutional knowledge and legal literacy
CO2	Understand Engineering and Professional ethics and responsibilities of Engineers.
CO3	Understand the cyber-crimes and cyber laws for cyber safety measure.

Text Books:	
1.	Constitution of India and Professional Ethics, T.S. Anupama, Sunstar Publisher
Reference Books:	
1.	Durga Das Basu (DD Basu): "Introduction to the Constitution on India", (Students Edition.)

	Prentice –Hall EEE, 19th/20th Edn., (Latest Edition) or 2008.
2.	Shubham Singles, Charles E. Haries, and Et al : "Constitution of India and Professional Ethics" by Cengage Learning India Private Limited, Latest Edition – 2018.
3	M.Govindarajan, S.Natarajan, V.S.Senthilkumar, "Engineering Ethics", Prentice – Hall of India Pvt. Ltd. New Delhi, 2004.
4.	M.V.Pylee, "An Introduction to Constitution of India", Vikas Publishing, 2002.
5.	Latest Publications of NHRC - Indian Institute of Human Rights, New Delhi.

CIE Assessment:
CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (40 marks each), the final IA marks to be awarded will be the average of three tests Assignment (10 marks)
SEE Assessment:
Question paper for the SEE consists one part. It is compulsory and consists of objective type 1 mark each for total of 50 marks covering the whole syllabus. Ten questions must be set from each unit. The duration of examination is 3 hours.

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

High-3, Medium-2, Low-1

Course Title	UNIVERSAL HUMAN VALUES I	Semester	III
Course Code	MVJ20UHV310	CIE	50
Total No. of Contact Hours	15	SEE	50
No. of Contact Hours/week	1 (L : T : P :: 1 : 0 : 0)	Total	100
Credits	1	Exam. Duration	3 Hrs.

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

- Perceive the need for developing a holistic perspective of life
- Sensitise the scope of life – individual, family (inter-personal relationship), society and nature/existence, Strengthening self-reflection
- Develop more confidence and commitment to understand, learn and act accordingly.

Module-1	L1,L2	3 Hrs

Welcome and Introductions: Getting to know each other (Self-exploration)
Aspirations and Concerns: Individual academic, career, Expectations of family, peers, society, nation, Fixing one's goals (Basic human aspirations Need for a holistic perspective Role of UHV)
Self-Management: Self-confidence, peer pressure, time management, anger, stress, Personality development, self-improvement (Harmony in the human Being)
Health: Health issues, healthy diet, healthy lifestyle, Hostel life (Harmony of the Self and Body Mental and physical health)
Relationships: Home sickness, gratitude, towards parents, teachers and, others Ragging and interaction, Competition and cooperation, Peer pressure (Harmony in relationship Feelings of trust, respect, gratitude, glory, love)
Society: Participation in society (Harmony in the society)
Natural Environment: Participation in nature (Harmony in nature/existence)

Video link:
https://youtube.com/playlist?list=PLYwzG2fd7hzc4HerTNkc3pS_IvcCfKznV
https://youtube.com/playlist?list=PLYwzG2fd7hzcZz1DkrAegkKF4TseekPFv
Presentation: https://fdp-si.aicte-india.org/AicteSipUHV_download.php

Module-2	L1,L2	3 Hrs

Introduction to Value Education: Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education), Self-exploration as the Process for Value Education, Happiness and Prosperity – Current Scenario.
Video link:
https://www.youtube.com/watch?v=85XCw8SU084

https://www.youtube.com/watch?v=E1STJoXCXUU&list=PLWDeKF97v9SP_Kt6jqzA3pZ3yA7g_OAQz https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw		
Module-3	**L1,L2**	**3 Hrs**
Introduction to Harmony in the Human Being: Understanding Human being as the Co-existence of the Self and the Body, The Body as an Instrument of the Self, Harmony of the Self with the Body. **Video link:** https://www.youtube.com/watch?v=GpuZo495F24 https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw		
Module-4	**L1,L2**	**3 Hrs**
Introduction to Harmony in the Family and Society: Harmony in the Family – the Basic Unit of Human Interaction, Other Feelings, Justice in Human-to-Human Relationship, Understanding Harmony in the Society. **Video link:** https://www.youtube.com/watch?v=F2KVW4WNnS8 https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw		
Module-5	**L1,L2**	**3 Hrs**
Introduction to Implications of the Holistic Understanding: Natural Acceptance of Human Values, Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Holistic Technologies, Production Systems and Management Models-Typical Case Studies. **Video link:** https://www.youtube.com/watch?v=BikdYub6RY0 https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw		
Course outcomes: On completion of the course, students would be able to		
CO1	Develop a holistic perspective about life	
CO2	Explore his/her role (value) in all aspects of living – as an individual, as a member of a family, as a part of the society as an unit in nature	
CO3	Become more responsible in life, and in handling problems with sustainable solutions	
CO4	Have better critical ability	
CO5	Become sensitive to their commitment	

Scheme of Evaluation

Details		Marks
Assessment by Faculty mentor (Class Room Evaluation)	CIE(50)	10
Self-Assessment + Assessment by peers		20
Activities / Experimentations related to courses/Assignment		10
Mini Projects / Case Studies		10

Semester End Examination	SEE (50)	50
Total		100

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

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

High-3, Medium-2, Low-1

Course Title	Additional Mathematics-I (Common to all branches)	Semester	III
Course Code	MVJ20MDSDIP301	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	4	Total	100
Credits	-	Exam. Duration	3hrs

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	L1,L2	8Hrs.

Differential calculus: Recapitulations of successive differentiations -nth derivative -Leibnitz theorem and Problems, Mean value theorem -Rolle's theorem, Lagrange's Mean value theorem , Cauchy's theorem and Taylor's theorem for function of one variables.
Video Link:
https://users.math.msu.edu/users/gnagy/teaching/ode.pdf

Module-2	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 Simples Problems.
Video Link:
https://www.youtube.com/watch?v=rCWOdfQ3cwQ
https://nptel.ac.in/courses/111/105/111105122/

Module-3	L1,L2	8Hrs.

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 Link:
https://www.whitman.edu/mathematics/calculus_online/chapter16.html

https://www.math.ust.hk/~machas/vector-calculus-for-engineers.pdf		
Module-4	L1,L2,L3	8 Hrs.
Probability: Introduction-Conditional Probability, Multiplication theorem ,Independent events ,Baye's theorem and Problems. Video Link: https://www.khanacademy.org/math/statistics-probability/probability-library https://nptel.ac.in/courses/111/105/111105041/		
Module-5	L1,L2,L3	8 Hrs.
Differential equation: Homogenous 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 change of order 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 to Application to Engineering problems.
CO4	Understand the basic Concepts of Probability
CO5	Solve first order linear differential equation analytically using standard methods.

Text Books:	
1.	B.S. Grewal, "Higher Engineering Mathematics" Khanna Publishers, 43rd Edition, 2013.
2.	Ramana B. V., "Higher Engineering Mathematics", Tata Mc Graw-Hill, 2006.

Reference Books:	
1.	Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley-India publishers, 10th edition,2014.
2.	G. B. Gururajachar: Calculus and Linear Algebra, Academic Excellent Series Publication, 2018-19

CIE Assessment:

CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests Quizzes/mini tests (10 marks) Assignments (10 marks)
SEE Assessment:
Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus. Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students have to answer five full questions. One question must be set from each unit. The duration of examination is 3 hours.

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

High-3, Medium-2, Low-1

Course Title	Numerical Methods, Operations Research & Statistics	Semester	IV
Course Code	MVJ20MCD41	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	4 (L : T : P :: 2 : 2 : 0)	Total	100
Credits	3	Exam. Duration	3 Hours

Course objective is to:

The purpose of this course is to make students well conversant with numerical methods to solve ordinary differential equations, sampling theory and Operational research emerging in science and engineering.

Module-1	L1,L2, L3	8 Hours

Numerical Methods-1

Numerical solution of Ordinary Differential Equations of first order and first degree: Modified Euler's method, Taylor's series method, Runge-Kutta method of fourth order, Predictor and Corrector method: Milne's Method and Adams-Bashforth Method.

Application: Solving Ordinary Differential Equations.

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

Module-2	L1,L2, L3	8 Hours

Numerical Methods-2:

Numerical solution of Ordinary Differential Equations of second order: Runge-Kutta method of fourth order, Predictor and Corrector method: Milne's Method and Adams Bashforth Method.

Calculus of Variations: Variation of function and Functional, variational problems. Euler's equation, Geodesics.

Application: Hanging chain problem.

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

Module-3	L1,L2, L3	8 Hours

Operations Research-1

Introduction to Linear Programming Problem (LPP): Prototype example, Assumptions of LPP, Formulation of LPP and Graphical method various examples. The simplex method, Big M method, Two phase method and dual simplex method.

Application: Graphical solution procedure.

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

Module-4	L1,L2, L3	8 Hours

Operations Research-2
The transportation problem: Initial Basic Feasible Solution (IBFS) by North West Corner Rule method, Matrix Minima Method, Vogel's Approximation Method.
Game Theory: The formulation of two persons, zero sum games; saddle point, maxmin and minmax principle, Solving simple games- a prototype example, Games with mixed strategies.

Application: Transportation problem.

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

Module-5	L1,L2, L3	8 Hours

Statistical Methods
Correlation and Regression: Correlation, Regression coefficients, line of regression problems.

Curve fitting: Fitting of the curves of the form $y = ax + b$, $y = ax^2 + bx + c$, $y = ae^{bx}$ by the method of least squares.

Application: Finding the best fit between two variables.

Video Links:

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	Solve first and second order ordinary differential equation arising in flow problems using single step numerical methods.
CO2	Determine the extremals of functional and solve the simple problems of the Calculus of variations.

CO3	Solve the mathematical formulation of linear programming problem.
CO4	Solve the applications of transport problems and theory of games.
CO5	Fit a suitable curve by the method of least squares and determine the lines of regression for a set of statistical data.

Reference Books:	
1.	B.S. Grewal, "Higher Engineering Mathematics" Khanna Publishers, 43rd Edition, 2013.
2.	S. D. Sharma, "Operations Research", Kedar Nath and Ram Nath Publishers, Seventh Revised Edition 2014.
3.	Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley-India publishers, 10th edition, 2014.
4.	Ramana B. V., "Higher Engineering Mathematics", Tata Mc Graw-Hill, 2006.
5.	Bali N. P. & Manish Goyal, "A text book of Engineering Mathematics", Laxmi Publications, 8th Edition
6.	Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley-India publishers, 10th edition, 2014.

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

High-3, Medium-2, Low-1

Course Title	Design & Analysis of Algorithm	Semester	IV
Course Code	MVJ20CD42	CIE	50
Total No. of Contact Hours	50	SEE	50
No. of Contact Hours/week	4 (L : T : P :: 3 : 2 : 0)	Total	100
Credits	4	Exam. Duration	3 Hours

Course objective is to:

- Explain various computational problem-solving techniques.
- Apply appropriate method to solve a given problem.
- Describe various methods of algorithm analysis

Module-1	L1,L2, L3	10 Hours

Introduction to Algorithms: The role of algorithms in computing, Growth of functions, Asymptotic notations, Designing and Analysing algorithms-an Introduction using insertion sort. Review on the Math needed for algorithm design and analysis.

Laboratory Sessions/ Experimental learning:

- Implement insertion sort and test its efficiency.

Applications: Develop a realistic model for the input to the program. Analyse the unknown quantities, assuming the modelled input. Calculate the total running time by multiplying the time by the frequency for each operation, then adding all the products.

Video link / Additional online information :
https://www.tutorialspoint.com/data_structures_algorithms/asymptotic_analysis.htm

Module-2	L1,L2, L3	10 Hours

Divide and Conquer: Solving recurrences – The Substitution method, Recurrence Tree method and Master's method, Multiplying large integers, Binary Search, Sorting [Merge Sort and Quick Sort], Selection in linear time [Expected and Worst-case], Strassen's algorithm for Matrix Multiplication, The maximum sub-array problem.

Laboratory Sessions/ Experimental learning:

- Implement maximum sub array algorithm and test their correctness and efficiency

Applications: Closest Pair of Points, Strassen's Multiplication, Karatsuba Algorithm, Cooley-Tukey Algorithm

Video link / Additional online information :
https://www.tutorialspoint.com/design_and_analysis_of_algorithms/design_and_analysis_of_algorithms_
divide_conquer_htm

Module-3	L1,L2, L3	10 Hours

Greedy Algorithms: Characteristics of Greedy algorithms, The problem of making change, Greedy algorithms for Scheduling, Minimum Spanning Trees – Kruskal's Algorithm and Prim's Algorithm, Greedy Algorithms for finding the shortest paths in a Graph, The Knapsack problem Amortized Analysis: The accounting method, The potential method.

Laboratory Sessions/ Experimental learning:

- Implement Knapsack Algorithm using Greedy method.

Applications: Dijkstra's Algorithm, Google Map

Video link / Additional online information :
https://www.tutorialspoint.com/design_and_analysis_of_algorithms/design_and_analysis_of_algorithms_
greedy_method_htm

Module-4	L1,L2, L3	10 Hours

Dynamic Programming: Calculating the binomial co-efficient, the problem of making change, The Knapsack problem, Chained matrix multiplication, Finding the shortest paths in a Graph, Reformulating Dynamic programming algorithms using recursion and memory functions.

Laboratory Sessions/ Experimental learning:

- Implement single source shortest path algorithm.

Applications: Logistic/Transportation Problems

Video link / Additional online information :
https://www.tutorialspoint.com/design_and_analysis_of_algorithms/design_and_analysis_of_algorithms_
dynamic_programming_htm

Module-5	L1,L2, L3	10 Hours

Backtracking: N-Queen's Problem -Graph colouring.

Branch and Bound: Assignment Problem - Traveling Salesman Problem. Computability classes – P, NP, NP-complete and NP-hard.

Laboratory Sessions/ Experimental learning:

- Implement graph colouring Problem

Applications: Electrical Engineering, Robotics, Artificial Intelligence, Materials Engineering, Solving Puzzles

Video link / Additional online information :
https://www.tutorialspoint.com/design_and_analysis_of_algorithms/design_and_analysis_of_algorithms_p_np_class_htm

Course outcomes:	
CO1	Analyze the correctness of algorithms using induction and loop invariants.
CO2	Construct algorithms using design paradigms like divide and conquer, greedy and dynamic programming for a given problem.
CO3	Analyze how the performance of an algorithm is affected based on the choice of data structures the algorithm uses.
CO4	Construct graph-based algorithms to solve engineering problems.
CO5	Outline P and NP problems with the help of backtracking and branch and bound techniques

Reference Books:	
1.	Introduction to the Design and Analysis of Algorithms, Anany Levitin:, 2rd Edition, 2009.Pearson.
2.	Computer Algorithms/C++, Ellis Horowitz, Satraj Sahni and Rajasekaran, 2nd Edition, 2014, Universities Press
3.	Charles E. Leiserson, Thomas H. Cormen, Ronald L. Rivest, Clifford Stein – Introduction to Algorithms, Third edition, PHI, 2010.

CO-PO Mapping

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

High-3, Medium-2, Low-1

Course Title	Advanced JAVA & J2EE	Semester	IV
Course Code	MVJ20CD43	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	4 (L : T : P :: 3 : 1 : 0)	Total	100
Credits	3	Exam. Duration	3 Hours

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

- Construct client-server applications using Java socket API
- Identify the need for advanced Java concepts like Enumerations and Collections
- Make use of JDBC to access database through Java Programs
- Adapt servlets to build server side programs
- Demonstrate the use of JavaBeans to develop component-based Java software

Module-1	L1,L2,L3	8 Hours

Syllabus Content:

Enumerations, Autoboxing and Annotations(metadata): Enumerations, Enumeration fundamentals, the values() and valueOf() Methods, java enumerations are class types, enumerations Inherits Enum, example, type wrappers, Autoboxing, Autoboxing and Methods, Autoboxing/Unboxing occurs in Expressions, Autoboxing/Unboxing, Boolean and character values, Autoboxing/Unboxing helps prevent errors, A word of Warning. Annotations, Annotation basics, specifying retention policy, Obtaining Annotations at run time by use of reflection, Annotated element Interface, Using Default values, Marker Annotations, Single Member annotations, Built-In annotations

Application:

- choices on a menu, rounding modes, command line flags, etc.
- Autoboxing & Auto unboxing:
- Annotations

Video Link: https://www.youtube.com/watch?v=vJ-Zn4fo0MQ&t=608s

Module-2	L1,L2,L3	8 Hours

Syllabus Content:

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, The Random Access Interface, Working With Maps, Comparators, The Collection Algorithms, Why Generic Collections, The legacy Classes and Interfaces,
Parting Thoughts on Collections.

Application: Writing an application

Video Link: https://www.youtube.com/watch?v=Ma7u6KEKzPE

Module-3	L1,L2,L3	8 Hours

Syllabus Content:

String Handling :The String Constructors, String Length, Special String Operations, String Literals, String Concatenation, String Concatenation with Other Data Types, String Conversion and to String( ) Character Extraction, char At( ), getChars( ), getBytes( ) toCharArray(), String Comparison, equals( ) and equalsIgnoreCase( ), regionMatches( ) startsWith( ) and endsWith( ), equals( ) Versus == , compareTo( ) Searching Strings, Modifying a String, substring( ), concat( ), replace( ), trim( ), Data Conversion Using valueOf( ), Changing the Case of Characters Within a String, Additional String Methods, StringBuffer , StringBuffer Constructors, length( ) and capacity( ), ensureCapacity( ), setLength( ), charAt( ) and setCharAt( ), getChars( ),append( ), insert( ), reverse( ), delete( ) and deleteCharAt( ), replace( ), substring( ), Additional StringBuffer Methods, StringBuilder

Application: Datatype

Video Link: https://www.youtube.com/watch?v=N63JCXwdd14

Module-4	L1,L2,L3	8 Hours

Syllabus Content:

Background; The Life Cycle of a Servlet; Using Tomcat for Servlet Development; A simple Servlet; The Servlet API; The Javax.servlet Package; Reading Servlet Parameter; The Javax.servlet.http package; Handling HTTP Requests and Responses; Using Cookies; Session Tracking. Java Server Pages (JSP): JSP, JSP Tags, Tomcat, Request String, User Sessions, Cookies, Session Objects

Application: java-based web application.

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

Module-5	L1,L2,L3	8 Hours

Syllabus Content:

JDBC Overview – JDBC implementation – Connection class – Statements - Catching Database Results, handling database Queries. Networking– Inet Address class – URL class- TCP sockets - UDP sockets, Java Beans –RMI.

Application: Connecting, storing, retrieving data between program and any database.

Video Link: https://www.youtube.com/watch?v=Cq4lwVE2Fzk

Practical Experiments:

1. Program to demonstrate working of Inet Address class and the methods of the InetAddress class for Java Networking
2. Program to demonstrate how to apply event handling mechanism to JCheckBox Swing Components :

3. Program to demonstrate JDBC 4. Program to demonstrate RMI 5. Program to demonstrate SERVLETS 6. Program to demonstrate JSP Program to demonstrate JAVA BEANS

Course outcomes:	
CO1	Interpret the need for advanced Java concepts like enumerations and collections in developing modular and efficient programs
CO2	Build client-server applications and TCP/IP socket programs
CO3	Illustrate database access and details for managing information using the JDBC API
CO4	Describe how servlets fit into Java-based web application architecture
CO5	Develop reusable software components using Java Beans

Text/Reference Books:	
1.	Herbert Schildt: JAVA the Complete Reference, 7th/9th Edition, Tata McGraw Hil 2007.
2.	Jim Keogh: J2EE-TheCompleteReference, McGraw Hill, 2007.
3.	Stephanie Bodoff et al: The J2EE Tutorial, 2nd Edition, Pearson Education,2004.
4.	Uttam K Roy, Advanced JAVA programming, Oxford University press, 2015.
5.	Herbert Schildt: JAVA the Complete Reference, 7th/9th Edition, Tata McGraw Hill, 2007.

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

High-3, Medium-2, Low-1

Course Title	Data Mining & Data Warehouse	Semester	IV
Course Code	MVJ20CD44	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	4 (L : T : P :: 4 : 0 : 0)	Total	100
Credits	3	Exam. Duration	3 Hours

Course objective is to:

- Gather and analyze large sets of data to gain useful business understanding
- Understand the data mining functionalities, technologies and steps in pre-processing the data
- Learn data mining algorithms, methods and tools

Module-1	L1,L2,L3	8 Hours

Raw data to valuable information-Lifecycle of Data - What is data warehousing - The building Blocks: Defining Features - Data warehouses and data marts - Overview of the components - Metadata in the data warehouse - Basic elements of data warehousing - Principles of dimensional modelling: Star schema, Snowflake schema and Galaxy schema.

Application:
Identify the potential risk of default and manage and control collections
Performance analysis of each product, service, interchange, and exchange rates
Store and analyze information about faculty and students
Maintain student portals to facilitate student activities

Video Link:
https://www.youtube.com/watch?v=8lHpioyvSng

Module-2	L1,L2,L3	8 Hours

Introduction to Data Mining Systems, Knowledge Discovery Process -Data Objects and attribute types, Statistical description of data, Data Preprocessing- Data Cleaning, Data Integration and Transformation, Data Reduction.

Application:

Financial Analysis
Telecommunication Industry.
Intrusion Detection
Retail Industry
Higher Education
Video Link:
https://www.youtube.com/watch?v=QRZlYzxEFDg

Module-3	L1,L2,L3	8 Hours

Market Basket Analysis, Frequent Item sets, Closed Itemsets, Association Rules, Frequent Itemset Mining Methods- Apriori algorithm, Generating Association rules from Frequent

Itemsets, A Pattern- Growth Approach for mining frequent Itemsets, Mining Frequent Itemsets using the Vertical Data Format.

Application:

Market Basket Analysis
Medical Diagnosis:
Census Data
Protein Sequence

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

Module-4	L1,L2,L3	8 Hours

Classification and Prediction ,Basic Concepts, Decision Tree Induction, Bayesian Classification ,Rule Based Classification, Classification by Back propagation , Support Vector Machines, Lazy learners.

Application:

Sentiment Analysis
Email Spam Classification
Document Classification
Image Classification

Video Link:
https://www.youtube.com/watch?v=gkagE_fE2sk

Module-5	L1,L2,L3	8 Hours

Types of Data in Cluster Analysis , Data similarity and dissimilarity measures ,A Categorization of Major Clustering Methods -Partitioning Methods-K-means, K-medoids , Hierarchical Methods-Agglomerative vs Divisive, Distance measures, BIRCH, Clustering High-Dimensional Data- Outlier Analysis and Detection.

Application:

Clustering analysis

In the field of biology, it can be used to derive plant and animal taxonomies.

Identification of areas of similar land use in an earth observation database.

Video Link:
https://www.youtube.com/watch?v=2QTeuO0C-fY

Experimental Part:

1. Apriori Algorithm for market Basket Analysis
2. Bayesian Classification
3. Decision Tree Induction Algorithm

4. Frequent Pattern-Growth Algorithm

Course outcomes:	
CO1	Design data warehouse by applying principles of dimensional modelling and ETL concepts
CO2	Analyze various data pre-processing techniques for efficient data mining.
CO3	Apply association rule mining for finding hidden and interesting patterns in data.
CO4	Apply statistical procedure, machine learning and neural network based classification algorithms for data prediction
CO5	Apply clustering algorithms for the application and generalizations for real time problems

Text/Reference Books:	
1.	Jiawei Han, Micheline Kamber and Jian Pei, Data Mining Concepts and Techniques, Third Edition, Elsevier, 2012.
2.	Paulraj Ponniah, Data Warehousing Fundamentals: A Comprehensive Guide for IT Professionals, Wiley, 2010
3.	Alex Berson, Stephen J Smith, Data warehousing, Data mining, and OLAP, Tata McGraw Hill edition, 2007
4.	Pang-Ning Tan, Michael Steinbach and Vipin Kumar,Introduction to Data Mining, Pearson Education, 2007
5.	G. K. Gupta ,Introduction to Data Mining with Case Studies, Easter Economy Edition, Prentice Hall of India, 2006

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

High-3, Medium-2, Low-1

Course Title	Information Retrieval & Visualization	Semester	IV
Course Code	MVJ20CD45	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	4 (L : T : P :: 4 : 0 : 0)	Total	100
Credits	3	Exam. Duration	3 Hours

Course objective is to:

- Learn classical techniques of Information Retrieval and Evaluation
- Learn how to query and process
- Get an idea about how the different IR algorithms works.
- Understand Web Crawler and its functions.
- Realize the applications of Information Retrieval

Module-1	L1,L2	8 Hours

Basic Concepts – Retrial Process – Modelling – Classic Retrieval – Set Theoretic, Algebraic and Probabilistic Models.

Retrieval Techniques: Structured Retrieval Models – Retrieval Evaluation – Word Sense Disambiguation.

Application:

Using retrieval Techniques for searching information.

Video Link:
https://www.youtube.com/playlist?list=PLMyP8LIIL3ht_WV4EXjN-uD3EPEK3hIyu

Module-2	L2,L3	8 Hours

Languages – Key Word-based Querying – Pattern Matching – Structural Queries – Query Operations – User Relevance Feedback – Local and Global Analysis.

Document Pre-Processing – Clustering – Text Compression – Indexing and Searching – Inverted Files – Boolean Queries – Sequential Searching – Pattern Matching.

Application:

Analyzing query and document formatting for searching.

Video Link:
https://www.youtube.com/playlist?list=PLMyP8LIIL3ht_WV4EXjN-uD3EPEK3hIyu

hfhf

Module-3	L2,L3	8 Hours

Overview of Retrieval Models –Boolean Retrieval – The Vector Space Model – Probabilistic Models – Information Retrieval as Classification – BM25 Ranking Algorithm – Complex Queries and Combining Evidence – Web Search – Machine Learning and Information Retrieval.

Application: Select and ranks relevant documents

Video Link: https://www.slideshare.net/mounialalmas/introduction-to-information-retrieval-models

Module-4	L2,L3	8 Hours

Deciding what to search – Crawling the Web – Directory Crawling – Document Feeds – conversion problem – Storing the Documents – Detecting Duplicates – Remove noise.

Application:

Develop application data

Video Link:
https://www.youtube.com/playlist?list=PLMyP8LIIL3ht_WV4EXjN-uD3EPEK3hIyu

Module-5	L2,L3	8 Hours

Searching the Web – Challenges – Characterizing the Web – Search Engines – Browsing – Meta-searchers – Online IR systems – Online Public Access Catalogs.

Digital Libraries: Introduction – Architectural Issues – Document Models – Representations and Access – Prototypes and Standards.

Case Study: Google, Yahoo and Bing Search engines

Application:

Interpret overall working of a search engine.

Video Link:
https://www.youtube.com/playlist?list=PLMyP8LIIL3ht_WV4EXjN-uD3EPEK3hIyu

Practical Experiments/ Case Study:	L3	20

- Experiments related to Ontology and Semantic Web
- Experiments related to Semantic Web Services
- Cast Study: Google Page Ranking Algorithm

Course outcomes:

CO1	Rank the document using classical ranking methods
CO2	Querying documents by delivering keywords
CO3	Implement ranking algorithms for rank the documents

CO4	Know how the crawler works
CO5	Know how the web search, online IR systems and search engines works

Text/Reference Books:	
1.	Ricardo Baeza-Yate, Berthieri Ribeiro-Neto, Modern Information Retrieval, Pearson Education Asia, 2012.
2.	W.Bruce Croft, Donald Metzler and Trevor Strohman, Search Engines – Information Retrieval in Practice, Pearson Education, 2015
3.	Grossman, David A. Frieder, Ophir, Information Retrieval Algorithms and Heuristics, 2nd Edition, Springer
4.	G.G. Chowdhury, Introduction to Modern Information Retrieval, Second Edition, Neal-Schuman Publishers, 2010.

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

High-3, Medium-2, Low-1

Course Title	Virtual Reality	Semester	IV
Course Code	MVJ20CD46	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	4 (L : T : P :: 4 : 0 : 0)	Total	100
Credits	3	Exam. Duration	3 Hours

Course objective is to:

- Explain this technology, underlying principles, its potential and limits
- Knowledge about devices involved
- Learn about the criteria for defining useful applications.
- Illustrate process of creating virtual environments
- Applications of Virtual Reality

Module-1	L1,L2,L3	8 Hours

Introduction: The three I's of virtual reality, commercial VR technology and the five classic components of a VR system. Input Devices: (Trackers, Navigation, and Gesture Interfaces): Three dimensional position trackers, navigation and manipulation, interfaces and gesture interfaces.

Application: Students can understand the basics of Virtual Reality.

Video Link: https://nptel.ac.in/courses/106/106/106106138/

Module-2	L1,L2,L3	8 Hours

Output Devices: Graphics displays, sound displays & haptic feedback.

Application: Students can get knowledge about the hardware involved in virtual reality.

Video Link: https://www.youtube.com/watch?v=Z1jQ62VDVSo

Module-3	L1,L2,L3	8 Hours

Modeling: Geometric modelling, kinematics modeling, physical modeling, behaviour modeling, model management

Application: Students will get the knowledge about various modeling techniques.

Video Link: https://www.youtube.com/watch?v=dF4QEfj61XQ

Module-4	L1,L2,L3	8 Hours

Human Factors: Methodology and terminology, user performance studies, VR health and safety issues.

Application: Students will learn impact of virtual reality of real life.

Video Link: https://www.youtube.com/watch?v=8DvwtzdNK5U

Module-5	L1,L2,L3	8 Hours
Medical applications, military applications, robotics applications. Application: Students can get the knowledge about the applications of virtual reality. Video Link: https://www.youtube.com/watch?v=fJES5HYMOg0		
Practical Experiments/Research paper Study: • Mobile Augmented Reality Based Experiments • Simulating Educational Physical Experiments in Augmented Reality • Web based Virtual Reality	L3	20 Hours

Course outcomes:	
CO1	Illustrate technology, underlying principles
CO2	Explain process of creating virtual environments
CO3	Explain its potential and limits and to learn about the criteria for defining useful applications.
CO4	Simulate physical experiments
CO5	Explain future research scope of virtual reality

Text/Reference Books:	
1.	Virtual Reality Technology, Second Edition, Gregory C. Burdea & Philippe Coiffet, John Wiley & Sons

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

High-3, Medium-2, Low-1

Course Title	Design & Analysis of Algorithm Lab	Semester	IV
Course Code	MVJ20CDL47	CIE	50
Total No. of Contact Hours	30	SEE	50
No. of Contact Hours/week	3 (L : T : P :: 0 : 1 : 2)	Total	100
Credits	2	Exam. Duration	3 Hours

Course objective is to:

- Understanding the basic algorithm techniques
- Solve different algorithmic technique problems
- Synthesize the efficiency of the algorithms in common engineering design situation

Sl No	Experiment Name	RBT Level	Hours
1	Implementation of Binary Search Trees	L3	3
2	Implementation of merge and quick sort algorithms and test their correctness and efficiency	L3	3
3	Implementation of Floyd-Warshall Algorithm and test their efficiency	L3	3
4	Implementation of 0/1 Knapsack problem using (a) Dynamic Programming method (b)Greedy method.	L3	3
5	(a) Implementation of all-Pairs Shortest Paths problem (b) Implementation of Travelling Sales Person problem	L3	3
6	Implementation and analysis of running time of eight-queen problem	L3	3
7	Implementation of insertion and topological sorting and test their efficiency.	L3	3
8	Program to find a subset of a given set S = {Sl, S2,.....,Sn} of *n* positive integers	L3	3
9	Program to find all Hamiltonian Cycles in a connected undirected Graph	L3	3
10	Mini Project /Case Presentation	L3	3

Course outcomes:

CO1	Analyze the complexities of various problems
CO2	Apply different algorithmic design paradigms and methods of analysis
CO3	Analyzing the different complexity for different algorithmic techniques

CO4	Implement various algorithms in a high-level language
CO5	Compare the performance of different algorithms for same problem

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

High-3, Medium-2, Low-1

Course Title	Advanced Java Programming Lab	Semester	IV
Course Code	MVJ20CDL48	CIE	50
Total No. of Contact Hours	30	SEE	50
No. of Contact Hours/week	3 (L : T : P :: 0 : 1 : 2)	Total	100
Credits	2	Exam. Duration	3 Hours

Course objective is to:

Develop error-free, well-documented Java programs.

Sl No	Experiment Name	RBT Level	Hours
1	WAP on Network Programming i.e. Client-Server Programming.	L3	3
2	WAP on Multithreading using runnable interface.	L3	3
3	WAP to Create a New Data Source for Ms. Access	L3	3
4	WAP to show connectivity with database using JDBC/ODBC driver.	L3	3
5	WAP to get Information about database using Database Meta Data	L3	3
6	WAP to get Information about particular table using Result Set Meta Data	L3	3
7	WAP to implement the concept of swings.	L3	3
8	WAP to develop an RMI application.	L3	3
9	WAP in Servlets to get and display value from an HTML page.	L3	3
10	WAP in JSP to get and display value from an HTML page.	L3	3

Course outcomes:

CO1	Develop Java network programs.
CO2	Develop search engine, and web framework programs
CO3	Learn how to write advanced-level Object-Oriented programs using Java.
CO4	Develop appropriate data model and database scheme
CO5	Test and Validate Programs

CO-PO Mapping

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

CO5	0	0	3	0	0	0	0	0	0	0	0	0

High-3, Medium-2, Low-1

Course Title	Balike Kannada	Semester	IV
Course Code	MVJ20BKAN49	CIE	50
Total No. of Contact Hours	15	SEE	50
No. of Contact Hours/week	1 (L : T : P :: 1 : 0 : 0)	Total	100
Credits	1	Exam. Duration	3Hrs

Course objective :This course will enable students to understand Kannada and communicate in Kannada language Vyavharika Kannada –Parichaya (Introduction to Vyavharika kannada) Kannada Aksharamaale haagu uchcharane(Kannada Alphabets and Pronounciation. Sambhashanegaagi Kannada Padagalu (Kannada Vocubulary for Communication). Kannada Grammer in Conversations(Sambhasaneyalli Kannada Vyakarana) Activities in Kannada
CHAPTER-1
Vyavharika Kannada –Parichaya (Introduction to Vyavharika kannada)
CHAPTER-2
Kannada Aksharamaale haagu uchcharane(Kannada Alphabets and Pronounciation
CHAPTER-3
Sambhashanegaagi Kannada Padagalu (Kannada Vocubulary for Communication).
CHAPTER-4
Kannada Grammer in Conversations(Sambhasaneyalli Kannada Vyakarana)
CHAPTER-5

Activities in Kannada		
cheme of Evaluation:		
Details		Marks
Average of three Internal Assessment (IA) Tests of 30 Marks each i.e. Σ (Marks Obtained in each test) / 3	CIE(50)	30
ASSIGNMENT		20
Semester End Examination	SEE (50)	50
Total		100

Course Title	SAMSKRUTHIKA KANNADA	Semester	IV
Course Code	MVJ20SKAN49	CIE	50
Total No. of Contact Hours	15	SEE	50
No. of Contact Hours/week	1 (L: T: P :: 1 : 0 : 0)	Total	100
Credits	1	Exam. Duration	3Hrs

Course objective :This course will enable students to understand Kannada and communicate in Kannada language Samskruthika Kannada –Parichaya (Introduction to Adalitha kannada) Kannada Kavyagala parichaya (Kannada D Ra Bendre, Siddalingaiha) Adalithdalli Kannada Padagalu (Kannada Kagunitha Balake, Patra Lekhana, Prabhandha) Kannada Computer Gnyana (Kannada Shabdha Sangraha, Computer Paribashika padagalu) Activities in Kannada.
CzsÁåAiÀÄ -1
PÀ£ÀßqÀ ¨sÁµÉ-¸ÀAQë¥ÀÛ «ªÀgÀuÉ.
CzsÁåAiÀÄ -2
¨sÁµÁ ¥ÀæAiÉÆÃUÀ¯ÁèUÀÄªÀ ¯ÉÆÃ¥ÀzÉÆÃµÀUÀ¼ÀÄ ªÀÄvÀÄÛ CªÀÅUÀ¼À ¤ªÁgÀuÉ.
CzsÁåAiÀÄ -3
¯ÉÃR£À aºÉßUÀ¼ÀÄ ªÀÄvÀÄÛ CªÀÅUÀ¼À G¥ÀAiÉÆÃU.À
CzsÁåAiÀÄ -4
¥ÀvÀæ ªÀåªÀºÁgÀ.
CzsÁåAiÀÄ -5
DqÀ½vÀ ¥ÀvÀæUÀ¼ÀÄ.
CzsÁåAiÀÄ -6
¸ÀPÁðgÀzÀ DzÉÃ±À ¥ÀvÀæUÀ¼ÀÄ
CzsÁåAiÀÄ -7
¸ÀAQÃ¥ÀÛ ¥Àæ§AzsÀ gÀZÀ£É, ¥Àæ§AzsÀ ªÀÄvÀÄÛ ¨sÁµÁAvÀgÀ
CzsÁåAiÀÄ -8
PÀ£ÀßqÀ ±À§Ý¸ÀAUÀæºÀ
CzsÁåAiÀÄ -9
PÀA¥ÀÆålgï ºÁUÀÆ ªÀiÁ»w vÀAvÀæeÁÕ£À
CzsÁåAiÀÄ -10

¥Áj¨sÁ¶PÀ DqÀ½vÀ PÀ£ÀßqÀ ¥ÀzÀUÀ¼ÀÄ ªÀÄvÀÄÛ vÁAwæPÀ/PÀA¥ÀÆålgï ¥Áj¨sÁ¶PÀ ¥ÀzÀUÀ¼ÀÄ.

Scheme of Evaluation:

Details		Marks
Average of three Internal Assessment (IA) Tests of 30 Marks each i.e. Σ (Marks Obtained in each test) / 3	CIE(50)	30
ASSIGNMENT		20
Semester End Examination	SEE (50)	50
Total		100

Course Title	Additional Mathematics-II (Common to all branches)	Semester	IV
Course Code	MVJ20MDSDIP401	CIE	50
Total No. of Contact Hours	40	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 analysethe engineeringproblems.

Module-1	L1,L2	8Hrs.

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

Module-2	L1,L2	8 Hrs.

Differential calculus:
Tangent and normal, sub tangent and subnormal 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 functions, Properties of Beta function and Gamma function ,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	L1,L2	8Hrs.

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 Link: https://www.toppr.com/guides/maths/three-dimensional-geometry/ https://www.toppr.com/guides/maths/three-dimensional-geometry/distance-between-skew-lines/		
Module-4	**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 Link: https://nptel.ac.in/courses/111/105/111105041/ https://www.mathsisfun.com/data/probability.html		
Module-5	**L1,L2,L3**	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-Dimentional 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.

Text Books:	
1	B.S. Grewal, "Higher Engineering Mathematics" Khanna Publishers, 43rd Edition, 2013.
2	Ramana B. V., "Higher Engineering Mathematics", Tata Mc Graw-Hill, 2006.

Reference Books:	
1	Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley-India publishers, 10thedition,2014.
2	G. B. Gururajachar: Calculus and Linear Algebra, Academic Excellent Series Publication, 2018-19

CIE Assessment:
CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests - Quizzes/mini tests (10 marks) - Assignments (10 marks)
SEE Assessment:
Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus. Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students have to answer five full questions. One question must be set from each unit. The duration of examination is 3 hours.

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

High-3, Medium-2, Low-1

Course Title	Technical Management & Entrepreneurship	Semester	V
Course Code	MVJ20TIM51	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	4 (L : T : P :: 4 : 0 : 0)	Total	100
Credits	3	Exam. Duration	3 Hours

Course objective is to:

- Describe the importance of management and functions of a manager.
- Explain the process of planning and organizing.
- Explain the requirements of direction and supervision and Explain 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	L1,L2,L3	8 Hours

Syllabus Content:

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	L1,L2,L3	8 Hours

Syllabus Content:

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	L1,L2,L3	8 Hours

Syllabus Content:

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	L1,L2,L3	8 Hours
Syllabus Content: 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	L1,L2,L3	12 Hours
Syllabus Content: 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:	L3	20 Hours
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

CIE Assessment:

CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests
Quizzes/mini tests (4 marks)
Mini Project / Case Studies (8 Marks)
Activities/Experimentations related to courses (8 Marks)

SEE Assessment:

- Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.
- Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students have to answer five full questions.
- One question must be set from each unit. The duration of examination is 3 hours.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
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	Principles of Database Systems	Semester	V
Course Code	MVJ20CD52	CIE	50
Total No. of Contact Hours	50	SEE	50
No. of Contact Hours/week	4 (L : T : P :: 4: 0 : 0)	Total	100
Credits	4	Exam. Duration	3 Hours

Course objective is to:

- Provide Key Knowledge in database system concepts, applications and advantages.
- To get knowledge about SQL programming
- Design a database as redundant and error free
- Students can build a database application for real world problems
- Can derive the knowledge or pattern from real world data

Module-1	L1,L2,L3	10 Hours

Introduction: Database-System Applications – Purpose of Database – View of Data – Database Languages – Relational Databases – Database Design – Data Storage and Querying – Transaction Management – Database Architecture – Data mining and Information Retrieval – Specialty Databases – Database Users and Administrators.
Introduction to Relational Model: Structure of Relational Database – Database Schema – Keys – Schema Diagrams – Relational Query Languages – Relational Operations – Relational Algebra.
Application: This module will give basic knowledge of database and SQL.
Video Link: https://www.youtube.com/watch?v=X9bQsAoqmfI

Module-2	L1,L2,L3	10 Hours

Introduction to SQL: Overview of the SQL Query Languages – SQL Definition – Basic Structure of SQL Queries – Additional Basic Operations – Set Operations – Null Values – Aggregate Functions - Nested Subqueries – Modification of Database.
Intermediate SQL: Join Expressions – Views – Integrity Constraints – SQL Data types and Schemas – Authorization.
Advanced SQL: Functions and Procedures – Triggers.
Application: Students can learn more complex queries and can design error free database using constraints.

Video Link: https://www.youtube.com/watch?v=fRMv14j5XJU		
Module-3	L1,L2,L3	10Hours
Relational Database Design: Features of Good Relational Designs – Atomic Domains and First Normal Form – Decomposition Using Functional Dependencies – Functional-Dependency Theory – Algorithm for Decomposition – 2nd Normal Form, 3rd Normal Form, Boyce Codd Normal Form Decomposition using Multivalued Dependencies – 4th Normal Form and domain Key Normal Form. Application: Students can learn how to divide the table without any data lose and can execute queries without any anomalies. Video Link: https://www.youtube.com/watch?v=Ko_LE3TNO64&t=1s		
Module-4	L1,L2,L3	10 Hours
Transaction: Transaction Concept – A Simple Transaction Model – Transaction Atomicity and Durability – Transaction Isolation – Serializability – Isolation Levels – Implementation of Isolation Level – Concurrency Control: Lock-Based Protocol – Timestamp-Based Protocols – Validation-Based Protocol. Advanced SQL: Accessing SQL From a Programming Language. Application design and Development: Application Programs and User Interfaces – Web Fundamentals – Servlet and JSP Application: Students can develop a web-based application for accessing database. Video Link: https://www.youtube.com/watch?v=w83Ug6IwVTw https://www.youtube.com/watch?v=Thm0xW9oTow https://www.youtube.com/watch?v=C_J6K8DodS8		
Module-5	L1,L2,L3	10 Hours
Data Warehousing, Data Mining, and Information Retrieval: Data Warehousing and Mining – Data Warehousing – Data Mining – Classification – Association Rules – Data mining algorithms using Weka Tools. Application: Students can develop an application using JAVA with Weka for data mining operations. Video Link: https://www.youtube.com/watch?v=XlbM9ibjUuM		
Practical Experiments Accessing Database through JDBC (Hands-On) Clustering – Using Weka tool (Hands-On)		

Classification using Weka tool (Hands-On) Machine Learning algorithms using Weka tool (Hands-On)

Course outcomes:	
CO1	Understand the database requirements of real-world problems
CO2	Querying the data according to different requirements
CO3	Design database for real world problems like bank, commercial shops
CO4	Develop application program to real world problems
CO5	Database mining to derive pattern among different data sets

Text/Reference Books:	
1.	Database System Concepts, Sixth Edition, by Abraham Silberschatz, Henery F. Korth, S. Sundarshan
2.	Fundamentals of Database Systems, RamezElmasri and Shamkant B. Navathe, 7th Edition, 2017, Pearson.
3.	Database Management System, Ramakrishnan and Gehrke, 3rd Edition, Mc-GrawHill, 2013.
4.	Data Mining Concepts and Techniques, Second Edition, by Jiawei Han and Micheline Kamber, Elsevier.

CIE Assessment:
CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests Quizzes/mini tests (4 marks) Mini Project / Case Studies (8 Marks) Activities/Experimentations related to courses (8 Marks)
SEE Assessment:
• Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus. • Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students have to answer five full questions. • One question must be set from each unit. The duration of examination is 3 hours.

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

High-3, Medium-2, Low-1

Course Title	R Programming for Data Science	Semester	V
Course Code	MVJ20CD53	CIE	50
Total No. of Contact Hours	50	SEE	50
No. of Contact Hours/week	4 (L : T : P :: 4: 0 : 0)	Total	100
Credits	4	Exam. Duration	3 Hours

Course objective is to:

- To program in R and how to use R for effective data analysis.
- To learn how to install and configure software necessary for a statistical programming environment.
- To discuss generic programming language concepts.

Module-1	L1,L2	10 Hours
Syllabus Content:Overview of R. What is R? What is S? Basic Features of R Free Software ,Design of the R System. Limitations of R. R Resources.		
Module-2	**L2,L3**	**10 Hours**
Syllabus Content:Entering Input, Evaluation, R Objects, Numbers, Attributes, Creating Vectors, Mixing Objects, Explicit Coercion, Matrices, Lists Factors, Missing Values, Data Frames Names.		
Module-3	**L3,L4**	**10 Hours**
Syllabus Content:Getting Data In and Out of R , Reading and Writing Data , Reading Data Files with read.table() , Reading in Larger Datasets with read.table(), Calculating Memory Requirements for R Objects Using the readr Package , , Binary Formats		
Module-4	**L3,L4,L5**	**10 Hours**
Syllabus Content:Control Structures , if-else, for Loops , Nested for loops ,while Loops , repeat Loops , next, break.		
Module-5	**L3,L4,L5**	**10 Hours**
Syllabus Content: Using Textual and Binary Formats for Storing Data Using dput() and dump()Functions in R , Your First Function , Argument Matching , Lazy Evaluation The ... Argument, Arguments Coming After the ... Argument, Loop Functions , Looping on the		

Command Line, lapply() , sapply() , split() Splitting a Data Frame , apply() , Col/Row Sums and Means , Other Ways to Apply mapply().

Course outcomes:	
CO1	writing R functions, debugging, and organizing and commenting R code
CO2	Understand the basics in R programming in terms of constructs, control statements, string functions
CO3	Understand the use of R for Big Data analytics
CO4	Learn to apply R programming for Text processing
CO5	Able to appreciate and apply the R programming from a statistical perspective

Text/Reference Books:	
1.	Roger D. Peng: R Programming for Data Science ,[E-book]

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

High-3, Medium-2, Low-1

Course Title	Data Communication	Semester	V
Course Code	MVJ20CD54	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	3 (L : T : P :: 3: 0 : 0)	Total	100
Credits	3	Exam. Duration	3 Hours

Course objective is to: This course will enable students to

- To discuss the digital data communication techniques.
- Gain knowledge on basic concepts of data communication layers, protocols and performance.
- Understand a few representative protocols and network components.

Module-1	L1, L2	8 Hours
Syllabus Content: Data Communications, Networks, The Internet, Protocol sand standards,NetworkModels-Reference models OSI, TCP/IPModel, Addressing, Data&Signal-Analog and Digital, Periodic Analog Signals, Digital Signals, Transmission impairment, Data Rate Limits, Performance.		
Module-2	**L2, L3**	**8 Hours**
Syllabus Content:Digital to Digital Conversions, Analog to Digital Conversions, Transmission Modes, Analog Transmission-Digital to Analog conversion, Analog to Analog conversion, Multiplexing- FDM, WDM, STDM, StatisticalTDM, Spread Spectrum, Guided Media-Twisted pair cable, Co-axial cable, Fiber optic cable, Unguided media-Wireless-Radiowaves, Microwaves, Infrared.		
Module-3	**L3, L4**	**8 Hours**
Syllabus Content:Circuit switched networks, Datagram networks, Virtual circuit networks, Structure of a Switch-Structure of Circuit Switches & Packet Switches, Data Link Layer-Detection and Correction-Introduction, Block Coding-Error Detection and Correction, Hamming Distance, Minimum Hamming Distance, Linear Block Codes, Cyclic Codes-CRC, Polynomials, Checksum		
Module-4	**L3, L4, L5**	**8 Hours**
Syllabus Content:Data Link Layer – Data Link Control- Framing, Flow and error control, Protocols, Noiseless Channels, Noisy Channels, HDLC, Point-to-Point Protocol- Framing, Transition phases, Multiple Access- Random access-Aloha, CSMA, CSMA/CD, CSMA/CA, Controlled access- reservation, polling, token passing, Channelization -		

FDMA,TDMA,CDMA.		
Module-5	**L3, L4, L5**	**8 Hours**
Syllabus Content:Wired LANs: Ethernet – Standard Ethernet, Fast Ethernet, Gigabit Ethernet, Wireless LANs- IEEE 802.11, Bluetooth - Architecture, Bluetooth layers, Radio layer, Baseband layer, L2CAP Connecting Devices–Hub, Repeater, Bridges, Transparent Bridges, Switches, Router, and Gateway.		

Course outcomes:	
CO1	Analyze OSI and TCP network models and the layers associated functionalities
CO2	Analyze and apply different types of signal conversion techniques in physical layer
CO3	Analyze and apply different types of error detection and correction mechanisms..
CO4	Analyze flow control and Error control mechanism using standard data link layer protocols and Compare
CO5	Analyze different protocols used for Ethernet and various connecting devices used in networks.

Text/Reference Books:	
1.	BehrouzA.Forouzan, "Data Communication and Networking,", McGrawHill, 5thEdition,2012.
2.	WilliamStallings, "Data and Computer Communication", PearsonEducation,10thEdition, 2014.

CIE Assessment:

CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests
Quizzes/mini tests (4 marks)
Mini Project / Case Studies (8 Marks)
Activities/Experimentations related to courses (8 Marks)

SEE Assessment:

- Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.
- Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students have to answer five full questions.
- One question must be set from each unit. The duration of examination is 3 hours.

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

High-3, Medium-2, Low-1

Course Title	Soft Computing	Semester	V
Course Code	MVJ20CD551	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	3 (L : T : P :: 3: 0 : 0)	Total	100
Credits	3	Exam. Duration	3 Hours

Course objective is to:

- To understand various types of soft computing techniques, and applications of soft computing
- To get an idea on : Artificial Intelligence, Various types of production systems, characteristics of production systems, Neural Networks, architecture, functions and various algorithms involved.
- To understand Fuzzy Logic, Various fuzzy systems and their functions, Genetic algorithms, its applications and advances.

Module-1	L1,L2	8 Hours

Syllabus Content:

Artificial neural network: Introduction, characteristics- learning methods – taxonomy – Evolution of neural networks- basic models - important technologies - applications. Fuzzy logic: Introduction - crisp sets- fuzzy sets - crisp relations and fuzzy relations: cartesian product of relation - classical relation, fuzzy relations, tolerance and equivalence relations, non-iterative fuzzy sets. Genetic algorithm- Introduction - biological background - traditional optimization and search techniques - Genetic basic concepts.

Module-2	L1,L2	8 Hours

McCulloch-Pitts neuron - linear separability - hebb network - supervised learning network: perceptron networks - adaptive linear neuron, multiple adaptive linear neuron, BPN, RBF, TDNN- associative memory network: auto-associative memory network, hetero-associative memory network, BAM, hopfield networks, iterative autoassociative memory network & iterative associative memory network – unsupervised learning networks: Kohonenself organizing feature maps, LVQ – CP networks, ART network.

Module-3	L3,L4	8 Hours

Membership functions: features, fuzzification, methods of membership value assignments-Defuzzification: lambda cuts - methods - fuzzy arithmetic and fuzzy measures: fuzzy arithmetic - extension principle - fuzzy measures - measures of fuzziness -fuzzy integrals - fuzzy rule base and approximate reasoning : truth values

and tables, fuzzy propositions, formation of rules-decomposition of rules, aggregation of fuzzy rules, fuzzy reasoning-fuzzy inference systems-overview of fuzzy expert system-fuzzy decision making.		
Module-4	L3,L4,L5	8 Hours
Genetic algorithm and search space - general genetic algorithm – operators - Generational cycle - stopping condition – constraints - classification - genetic programming – multilevel optimization – real life problem- advances in GA.		
Module-5	L3,L4,L5	8 Hours
Neuro-fuzzy hybrid systems - genetic neuro hybrid systems - genetic fuzzy hybrid and fuzzy genetic hybrid systems - simplified fuzzy ARTMAP - Applications: A fusion approach of multispectral images with SAR, optimization of traveling salesman problem using genetic algorithm approach, soft computing based hybrid fuzzy controllers.		

Course outcomes:	
CO1	Explain soft computing techniques and their applications.
CO2	Analyze various neural network architectures
CO3	Understand perceptronsand counter propagation networks.
CO4	Define the fuzzy systems
CO5	Analyze the genetic algorithms and their applications.

Reference Books:	
1.	J.S.R.Jang, C.T. Sun and E.Mizutani"Neuro-Fuzzy and Soft Computing", PHI / Pearson Education, 2004.
2.	S.N.Sivanandam and S.N.Deepa: Principles of Soft Computing", Wiley India Pvt Ltd, 2011.
3.	S.Rajasekaran and G.A.Vijayalakshmi Pai "Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis & Applications" Prentice-Hall of India Pvt. Ltd,2006.
4.	George J. Klir, Ute St. Clair, Bo Yuan "Fuzzy Set Theory: Foundations and Applications "Prentice Hall,1997.

CIE Assessment:
CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests

Quizzes/mini tests (4 marks) Mini Project / Case Studies (8 Marks) Activities/Experimentations related to courses (8 Marks)
SEE Assessment:
• Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus. • Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students have to answer five full questions. • One question must be set from each unit. The duration of examination is 3 hours.

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

High-3, Medium-2, Low-1

Course Title	Pattern Recognition	Semester	V
Course Code	MVJ20CD552	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	3 (L : T : P :: 3: 0 : 0)	Total	100
Credits	3	Exam. Duration	3 Hours

Course objective is to:

- To introduce the fundamentals of pattern recognition and classification.
- Understand Non-parametric Techniques
- Learn Bayesian decision theory, Maximum likelihood estimation, Hidden Markov Models, some of the non-parametric techniques.

Module-1	L1,L2	8 Hours

Basics of Probability, Random Processes and Linear Algebra (recap): Probability: independence of events, conditional and joint probability, Bayes theorem Random Processes: Stationary and non-stationary processes, Expectation, Autocorrelation, Cross-Correlation, spectra.

Linear Algebra: Inner product, outer product, inverses, eigen values, eigen vectors, singular values, singular vectors.

Module-2	L2,L3	8 Hours

Bayes Decision Theory : Minimum-error-rate classification. Classifiers, Discriminant functions, Decision surfaces. Normal density and discriminant functions. Discrete features.

Parameter Estimation Methods : Maximum-Likelihood estimation :Gaussian case. Maximum a Posteriori estimation. Bayesian estimation: Gaussian case. Unsupervised learning and clustering - Criterion functions for clustering. Algorithms for clustering: K-Means, Hierarchical and other methods.

Module-3	L3,L4	8 Hours

Cluster validation. Gaussian mixture models, Expectation-Maximization method for parameter estimation. Maximum entropy estimation. Sequential Pattern Recognition. Hidden Markov Models (HMMs). Discrete HMMs. Continuous HMMs. Nonparametric techniques for density estimation. Parzen-window method. K-Nearest Neighbour method.

Dimensionality reduction: Principal component analysis - it relationship to eigen analysis. Fisher discriminant analysis - Generalised eigen analysis.

Module-4	L3,L4,L5	8 Hours

Eigen vectors/Singular vectors as dictionaries. Factor Analysis, Total variability space -

a dictionary learning methods. Non negative matrix factorisation - a dictionary learning method.Linear discriminant functions : Gradient descent procedures, Perceptron, Support vector machines - a brief introduction. Artificial neural networks: Multilayer perceptron - feedforwark neural network. A brief introduction to deep neural networks,

Module-5	L3,L4,L5	8 Hours
convolutional neural networks, recurrent neural networks.Non-metric methods for pattern classification : Non-numeric data or nominal data. Decision trees: Classification and Regression Trees (CART).		

Course outcomes:	
CO1	Understand the major concepts and techniques in pattern recognition
CO2	Acquire abilities to solve problems in specialized application areas such as speech recognition, signal classification
CO3	Capable of designing pattern recognition systems and QAM
CO4	Explain Linear Discriminant functions
CO5	Explore Unsupervised Learning and Clustering

Text/Reference Books:	
1.	J R.O.Duda, P.E.Hart and D.G.Stork , " Pattern Classification", John Wiley,2001
2.	S S.Theodoridis and K.Koutroumbas," Pattern Recognition"Academic Press,4th Ed -2009
3.	C.M.Bishop,"Pattern Recognition and Machine Learning" ,Springer,2006

CIE Assessment:
CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests Quizzes/mini tests (4 marks) Mini Project / Case Studies (8 Marks) Activities/Experimentations related to courses (8 Marks)
SEE Assessment:

- Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.
- Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students have to answer five full questions.
- One question must be set from each unit. The duration of examination is 3 hours.

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

High-3, Medium-2, Low-1

Course Title	Web Technology	Semester	V
Course Code	MVJ20CD553	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	3 (L : T : P :: 3 : 0 : 0)	Total	100
Credits	3	Exam. Duration	3 Hours

Course objective is to:

- Teach students HTML and CSS for designing web pages.
- Introduce students to the basics of JavaScript as a programming language.
- Familiarize students with the Document Object Model and enable them to create dynamic web pages that react to user input.
- Teach students about installing and configuring Apache Server and incorporating backend support for their web pages.
- Introduce students to the newer features available as part of the HTML standard

Module -1	L1,L2,L3	8 Hours

Introduction, UI Design and UX : Internet, WWW, Web Servers and Browsers, URLs, MIME, HTTP, Basic Markup, Images, Hyperlinks, Lists, Tables, Forms, DataList, Canvas, Audio and Video, Geo-Location, Local Storage, Web Workers, Offline Web Applications, Drag and Drop.HTML Tables and Forms, Introducing Tables, Styling Tables, Introducing Forms, Form Control Elements, Table and Form Accessibility, Microformats

Application: To deliver data (HTML files, image files, query results) on the World Wide Web.

Video Link:

https://www.freecodecamp.org/

https://developer.mozilla.org/en-US/docs/Web/CSS

Module -2	L1,L2,L3	8 Hours

Style Sheets: CSS Introduction to Cascading Style Sheets-Features-Core Syntax-Style Sheets and HTML Style Cascading and Inheritance-Text Properties-Box Model Normal Flow Box Layout-Beyond the Normal Flow-Other Properties-Case Study. Client- Side Programming:

Application: Describing the presentation of Web pages, including colors, layout, and fonts

Video Link:

https://www.vogella.com/tutorials/CSS/article.html

https://nptel.ac.in/courses/106/105/106105084/

Module - 3	L1,L2,L3	8 Hours

JavaScript: Introduction to Client-Side Scripting, JavaScript Basics, Screen Input and Keyboard Output, Functions, Objects, Inheritance, Hoisting, Arrays, JavaScript Objects, Accessing and Modifying DOM, Events and Event Handlers - Load, Mouse, Synthetic Events, Key and Form Related Events, Event Bubbling, Cookies.
Application: Web Sites, Web Server Applications, Mobile Apps, Games Platform
Video Link:
https://www.udemy.com/courses/development/web-development/

https://javascript.info/hello-world#modern-markup

Module-4	L1,L2,L3	8 Hours

PHP Arrays and Superglobals, Arrays, $_GET and $_POST Superglobal Arrays, $_SERVERArray, $_Files Array, Reading/Writing Files, PHP Classes and Objects, Object-Oriented Overview, Classes and Objects in PHP, Object Oriented Design, Error Handling and Validation, What are Errors and Exceptions, PHP Error Reporting, PHP Error and Exception Handling
Application: e-Commerce Applications. Web Pages and Web-Based Applications
Video Link:
http://www.nptelvideos.com/video.php?id=2142&c=27

http://www.nptelvideos.com/video.php?id=2131&c=27

http://www.nptelvideos.com/video.php?id=2116&c=27

Module-5	L1,L2,L3	8 Hours

Bootstrap: Grid Systems, Layout, Tables and Forms, Buttons and Images, Progress Bar, Navigations. jQuery: Usage, Selecting DOM Elements, Getting and Setting Attributes, Changing Styles, File Handling and System Calls, Arrays, Cookies, Sessions, Database Access.
Application: Bootstrap is a front-end framework used to create modern websites and web apps
Video Link:
https://getbootstrap.com/docs/4.5/examples/

https://www.w3schools.com/bootstrap/bootstrap_buttons.asp

Practical Experiments:	
Create a web page with the following. a. Cascading style sheets. b. Embedded style sheets. c. Inline style sheets. Use our college information for the web pages. JavaScript to design a simple calculator Java script to Validate the Registration, user login, user profile and payment by credit card pages PHP program to display a digital clock which displays the current time of the server.. PHP program to keep track of the number of visitors visiting the web page and to display this count of visitors	
Course outcomes:	
CO1	Outline the basic concepts of information and web architecture.
CO2	Design solutions for programming questions using JavaScript
CO3	Study Hyper Text markup language and create websites using HTML, CSS Codes.
CO4	Setup a web server and host a website with back end support.
CO5	Incorporate the latest HTML features in the web pages designed by them with fallback options wherever required.

Text/Reference Books:	
1.	Jeffrey C.Jackson, "Web Technologies--A Computer Science Perspective", Pearson Education,2006.
2.	Robert. W. Sebesta, "Programming the World Wide Web", Fourth Edition, Pearson Education
3.	Deitel, Deitel, Goldberg, "Internet & World Wide Web How To Program", Third Edition, Pearson Education, 2006.
4.	Marty Hall and Larry Brown,"Core Web Programming" Second Edition, Volume I and II, Pearson Education, 2001.
5.	Bates, "Developing Web Applications", Wiley, 2006.
CIE Assessment:	
CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests Quizzes/mini tests (4 marks)	

Mini Project / Case Studies (8 Marks) Activities/Experimentations related to courses (8 Marks)
SEE Assessment:
Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus. Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students have to answer five full questions. One question must be set from each unit. The duration of examination is 3 hours.
CO-PO Mapping

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

High-3, Medium-2, Low-1

Course Title	Data Compression	Semester	V
Course Code	MVJ20CD554	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	3 (L : T : P :: 3: 0 : 0)	Total	100
Credits	3	Exam. Duration	3 Hours

Course objective is to:

- This course viz., aims to prepare the students:
- Gain a fundamental understanding of data compression methods for text, images,
  and video, and related issues in the storage, access, and use of large data sets
- Select, giving reasons that are sensitive to the specific application and particular circumstance, most appropriate compression techniques for text, audio, image and video information
- Illustrate the concept of various algorithms for compressing text, audio, image and video information.

Module-1	L1,L2	8Hrs.

Loss less compression, Lossy Compression, Measures of performance, Modeling and coding, Mathematical Preliminaries for Loss-less compression: A brief introduction to information theory, Models: Physical models, Probability models, Markov models, composite source model, Coding: uniquely decodable codes, Prefix codes.

Module-2	L2,L3	8 Hrs.

Minimum variance Huffman codes, Adaptive Huffman coding: Update procedure, Encoding procedure, Decoding procedure. Golomb codes, Rice codes, Tunstall codes, Applications of Hoffman coding: Loss less image compression, Text compression, Audio Compression.

Module-3	L3,L4	8Hrs.

Coding a sequence, Generating a binary code, Comparison of Binary and Huffman coding, Applications: Bi-level image compression- The JBIG standard, JBIG2, Image compression. Dictionary Techniques: Introduction, Static Dictionary: Diagram Coding, Adaptive Dictionary.

Module-4	L3,L4,L5	8 Hrs.

Scalar quantization, adaptive quantization, non uniform quantization Vector quantization, structured vector quantizers Differential encoding, adaptive DPCM Delta modulation, speech coding, image coding Preliminaries for losses compression.

Module-5	L3,L4,L5	8 Hrs.
Digital Video and video compression. MPEG, MPEG-4 Digital Audio, Human auditory systems ADPCM audio compression , Symbol ranking, Sparse strings. Word based text compression. Textual, image compression. Dynamic Markov coding. FHM curve compression.		
Course outcomes:		
CO1	program, analyze Hoffman coding: Loss less image compression, Text compression, Audio Compression.	
CO2	program and analyze various Image compression and dictionary based techniques like static Dictionary, Diagram Coding, Adaptive Dictionary.	
CO3	understand the statistical basis and performance metrics for lossless compression.	
CO4	understand the conceptual basis for commonly used lossless compression techniques, and understand how to use and evaluate several readily available implementations of those techniques.	
CO5	understand the structural basis for and performance metrics for commonly used lossy compression techniques and conceptual basis for commonly used lossy compression techniques.	
Text Books:		
1.	"Data Compression, The Complete Reference",David Salomon,Springer International Edition, 2007, ISBN-10: 1846286026, ISBN-13: 978-1846286025 3rd Edition,2007	
2.	"The Data Compression Book",Mark Nelson,BPB publications, ISBN-10: 1558514341, ISBN-13: 978-1558514348,2ndEdition,1995	

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

High-3, Medium-2, Low-1

Course Title	Database System Lab	Semester	V
Course Code	MVJ20CDL56	CIE	50
Total No. of Contact Hours	30	SEE	50
No. of Contact Hours/week	3 (L : T : P :: 0 : 0 :4)	Total	100
Credits	2	Exam. Duration	3 Hours

Course objective is to:

- To understand the functions of database system.
- Query processing and execution to retrieve data.
- Get the idea about complex query execution.
- get the knowledge about database and programming connection.
- Get the knowledge about data mining algorithms.

Sl No	Experiment Name	RBT Level	Hours
1	a. Study of User privileges b. Experiments on All Data Definition Language (create, modify, drop table etc.,)	L3	3
2	Experiments on All Data Manipulation Language (Insert, Delete, Update)	L3	3
3	Experiments on Nested Sub-queries and Inner Queries	L3	3
4	Experiments on All types of Joins	L3	3
5	Experiment on Cursor, Assertion and Triggers	L3	3
6	Experiments on PL\SQL and Procedure and Function	L3	3
7	Implementation of Normal forms – (The faculty should give some set of attributes and students should solve by different normal forms)	L3	3
8	Front-end & Back-end application 1 (Front end – any programming language, Back-end – any database software)	L3	3
9	Front-end & Back-end application 2 (GUI Based)	L3	3
10	Front-end & Back-end application 3 (GUI based application for shops, etc.,)	L3	3
11	Implementation of Data mining Algorithms 1 – using Weka or Orange.	L3	3
12	Implementation of Data mining Algorithms 2 – using Weka or Orange	L3	3

13	Implementation of Data mining Algorithms 3 – using Weka or Orange.	L3	3

Course outcomes:	
CO1	Create table, insert data using sql commands
CO2	Execute queries for acquire data from database
CO3	Develop a program for commercial shop bill maintenance
CO4	Develop a web application to remote data processing
CO5	Implement data mining algorithms for derive patterns in data

CIE Assessment:
Regular Lab work :20 Record writing :5 Lab Tests(Minimum 2 tests shall be conducted for 15 marks and average of two will be taken) Viva 10 marks
SEE Assessment:
Examinations will be conducted for 100 marks and scaled-down to 50. The weightage shall be, Write-up : 20 marks Conduction : 40 marks Analysis of results : 20 marks Viva : 20 marks

CO-PO Mapping

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

High-3, Medium-2, Low-1

Course Title	R Programming Lab	Semester	V
Course Code	MVJ20CDL57	CIE	50
Total No. of Contact Hours	30	SEE	50
No. of Contact Hours/week	3 (L : T : P :: 0 : 0 : 4)	Total	100
Credits	2	Exam. Duration	3 Hours

Course objective is to:

- Install and use R for simple programming tasks.
- Extend the functionality of R by using add-on packages
- Extract data from files and other sources and perform various data manipulation tasks on them.

Sl No	Experiment Name	RBT Level	Hours
1	To perform the basic mathematical operations in r programming	L3	3
2	Implementation of vector and List data objects operations.	L3	3
3	Implementation of various operations on matrix, array and factors in R	L3	3
4	Implementation and perform the various operations on data frames in R.	L3	3
5	Study and implementation of various control structures in R.	L3	3
6	Data Manipulation	L3	3
7	Simulating a Linear Model	L3	3
8	Random Sampling in R	L3	3
9	Data visualization with R and ggplot2	L3	3
10	Working with CSV files in R	L3	3

Course outcomes:

CO1	Install and use R for simple programming tasks.
CO2	Extend the functionality of R by using add-on packages

CO3	Extract data from files and other sources and perform various data manipulation tasks on them.

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

High-3, Medium-2, Low-1

Course Title	Data Communication Lab	Semester	V
Course Code	MVJ20CDL58	CIE	50
Total No. of Contact Hours	30	SEE	50
No. of Contact Hours/week	3 (L : T : P :: 0 : 0 : 4)	Total	100
Credits	2	Exam. Duration	3 Hours

Course objective is to:

- To understand the working principle of various communication protocols.
- To analyse the various routing algorithms.
- To know the concept of data transfer between nodes.

Sl No	Experiment Name	RBT Level	Hours
1	a) Establish a Peer-to-Peer network of two computers using Cisco packet tracer b) Simulate a LAN using Hub in Cisco Packet tracer.	L3	3
2	a) Create a LAN using Switch in Cisco Packet Tracer b) Create a connection between two different LAN using router practically in Cisco packet tracer	L3	3
3	a) There are 20PC's in your network. Five PC's are connected to one Ethernet hub, and five PC's are connected to another hub. Each hub is connected to separate switch and both the switches are connected to a separate router. The routers are connected via an Ethernet bridge. The remaining 10 PC's are connected directly to one of the two switches. How many Ethernet segments are there? Implement this scenario using cisco packet tracer. b) To analyse the performance of various configurations and protocols in LAN	L3	3
4	Construct a VLAN and make the PC's communicate among a VLAN	L3	3
5	Construct a Wireless LAN and make the PC's communicate	L3	3

	wirelessly		
6	To understand the concept and operation of Routing Information Protocol (RIP)	L3	3
7	To construct simple LAN and understand the concept and operation of Address Resolution Protocol (ARP)	L3	3
8	To construct multiple router networks and understand the operation of EIGRP Protocol.	L3	3
9	To understand the operation of TELNET by accessing the router in server room from a PC in IT office.	L3	3

Course outcomes:	
CO1	Understand fundamental underlying principles of communication
CO2	Understand details and functionality of layered network architecture.
CO3	Apply mathematical foundations to solve computational problems in communication
CO4	Analyze performance of various communication protocols.
CO5	Practice packet /file transmission between nodes.

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

High-3, Medium-2, Low-1

Course Title	ENVIRONMENTAL STUDIES	Semester	V
Course Code	MVJ20ENV59	CIE	50
Total No. of Contact Hours	20	SEE	50
No. of Contact Hours/week	1(L : T : P :: 1 : 0 : 0)	Total	100
Credits	1	Exam. Duration	3 Hrs.

course objective is to:

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

Prerequisites: Basic Science

Module-1	L1, L2	4 Hrs.

Introduction to environmental studies, Multidisciplinary nature of environmental studies; Scope and importance; Concept of sustainability and sustainable development.
Ecosystems (Structure and Function): Forest, Desert, Rivers, Ocean
Biodiversity: Types, Hot spots; Threats and Conservation of biodiversity, Deforestation.
Video link:
https://nptel.ac.in/courses/127/106/127106004/

Module-2	L1,L2	4 Hrs.

AdvancesinEnergySystems(Merits,Demerits,GlobalStatusandApplications):
Hydrogen,Solar,OTEC, Tidal andWind.
Natural Resource Management (Concept and case-study): Disaster Management, Sustainable Mining, Cloud Seeding, and Carbon Trading.
Video link:

https://nptel.ac.in/courses/121/106/121106014/

Module-3	L1	4 Hrs.

Environmental Pollution (Sources, Impacts, Corrective and Preventive measures, Relevant EnvironmentalActs,Case-studies): SurfaceandGroundWaterPollution;Noisepollution;SoilPollutionand Air Pollution. Waste Management & Public Health Aspects: Bio-medical Waste; Solid waste; Hazardous waste; E-waste. Video link: https://nptel.ac.in/courses/122/106/122106030/ https://nptel.ac.in/courses/105/103/105103205/ https://nptel.ac.in/courses/120/108/120108005/ https://nptel.ac.in/courses/105/105/105105160/		
Module-4	L1,	4 Hrs.
Global Environmental Concerns (Concept, policies, and case-studies): Global Warming ClimateChange;AcidRain;OzoneDepletion;Fluorideproblemindrinkingwater. **Video link:** https://nptel.ac.in/courses/122/106/122106030/ https://nptel.ac.in/courses/120108004/ https://onlinecourses.nptel.ac.in/noc19_ge23/preview		
Module-5	L1,L2	4 Hrs.
Latest Developments in Environmental Pollution Mitigation Tools (Concept and Applications): G.I.S. & Remote Sensing, Environment Impact Assessment, Environmental Management Systems, ISO 14001. Video link: https://nptel.ac.in/courses/105/102/105102015/ https://nptel.ac.in/courses/120/108/120108004/		
Course outcomes: On completion of the course, students would be able to		
CO1	Describe the principles of ecology and environmental issues that apply to air, land, and water issues on a global scale.	
CO2	Develop critical thinking and/or observation skills, and apply them to the analysis of a problem or question related to the environment.	
C03	Demonstrate ecology knowledge of a complex relationship between biotic and Abiotic components.	
CO4	Apply their ecological knowledge to illustrate and graph a problem and describe the realities .	
Scheme of Evaluation		

Details		Marks
Average of three Internal Assessment (IA) Tests of 30 Marks each i.e. (Marks Obtained in each test) / 3	CIE(50)	40
Quizzes		10
Semester End Examination	SEE(50)	50
Total		100

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

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

High-3, Medium-2, Low-1

Course Title	Universal Human Values II -understanding harmony and ethical human conduct	Semester	V
Course Code	MVJ20UHV510	CIE	50
Total No. of Contact Hours	30	SEE	50
No. of Contact Hours/week	2 (L : T : P :: 2 : 0 : 0)	Total	100
Credits	2	Exam. Duration	3 Hrs.

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

Appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.

Facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.

Highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature.

Prerequisites: Universal Human Values I

Module-1	L1,L2	6 Hrs

Review on Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education), Self-exploration as the Process for Value Education, Happiness and Prosperity – Current Scenario,

Value Education: Understanding Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, , Method to Fulfill the Basic Human Aspirations,

Practical Sessions: Sharing about Oneself (Tutorial 1), Exploring Human Consciousness (Tutorial 2), Exploring Natural Acceptance (Tutorial 3)

Video link:

https://www.youtube.com/watch?v=85XCw8SU084

https://www.youtube.com/watch?v=E1STJoXCXUU&list=PLWDeKF97v9SP_Kt6jqzA3pZ3yA7g_OAQz

https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw

Module-2	L1,L2	6 Hrs

Review on Understanding Human being as the Co-existence of the Self and the Body, The Body as an Instrument of the Self, Harmony of the Self with the Body.

Harmony in the Human Being: Distinguishing between the Needs of the Self and the Body, Understanding Harmony in the Self, Programme to ensure self-regulation and Health. Practical Sessions: Exploring the difference of Needs of Self and Body (Tutorial 4), Exploring Sources of Imagination in the Self (Tutorial 5), Exploring Harmony of Self with the Body (Tutorial 6). **Video link:** https://www.youtube.com/watch?v=GpuZo495F24 https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw		
Module-3	**L1,L2**	**6 Hrs**
Review on Harmony in the Family – the Basic Unit of Human Interaction, Other Feelings, Justice in Human-to-Human Relationship, Understanding Harmony in the Society. Harmony in the Family and Society: Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Vision for the Universal Human Order, Practical Sessions: Exploring the Feeling of Trust (Tutorial 7), Exploring the Feeling of Respect (Tutorial 8), Exploring Systems to fulfill Human Goal (Tutorial 9). **Video link:** https://www.youtube.com/watch?v=F2KVW4WNnS8 https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw		
Module-4	**L1,L2**	**6 Hrs**
Harmony in the Nature/Existence: Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfillment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence. Practical Sessions: Exploring the Four Orders of Nature (Tutorial 10), Exploring Co-existence in Existence (Tutorial 11). Video link: https://www.youtube.com/watch?v=1HR-QB2mCF0 https://www.youtube.com/watch?v=lfN8q0xUSpw https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw		
Module-5	**L1,L2**	**6 Hrs**
Review on Natural Acceptance of Human Values,Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Holistic Technologies, Production Systems and Management Models-Typical Case Studies. Implications of the Holistic Understanding – a Look at Professional Ethics: Definitiveness of (Ethical) Human Conduct, Competence in Professional Ethics, Strategies for Transition		

towards Value-based Life and Profession
Practical Sessions: Exploring Ethical Human Conduct (Tutorial 12), Exploring Humanistic Models in Education (Tutorial 13), Exploring Steps of Transition towards Universal Human Order (Tutorial 14).

Video link:
https://www.youtube.com/watch?v=BikdYub6RY0
https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw

Course outcomes: On completion of the course, students would be able to

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

Scheme of Evaluation

Details		Marks
Assessment by Faculty mentor (Class Room Evaluation)	CIE(50)	10
Self-Assessment + Assessment by peers		20
Activities / Experimentations related to courses/Assignment		10
Mini Projects / Case Studies		10
Semester End Examination	SEE (50)	50
Total		100

Text Books:

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

3.	Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2
Reference Books:	
1.	Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010
2.	Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
3.	Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
4.	The Story of Stuff (Book).
5.	The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi

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

High-3, Medium-2, Low-1

Course Title	Artificial Intelligence	Semester	VI
Course Code	MVJ20CD61	CIE	50
Total No. of Contact Hours	50	SEE	50
No. of Contact Hours/week	4 (L : T : P :: 4 : 0 : 0)	Total	100
Credits	4	Exam. Duration	3hrs

Course objective is to:

- Identify the problems where AI is required and the different methods available
- Compare and contrast different AI techniques available.
- Define and explain learning algorithms

Module-1	L1,L2	10Hrs.
Introduction: What is AI? Intelligent Agents: Agents and environment; Rationality; the nature of environment; the structure of agents. Problem-solving: Problem-solving agents; Example problems; Knowledge representation issues: Representations and mappings Approaches to knowledge representation, Issues in knowledge representation.		
Module-2	**L2,L3**	**10 Hrs.**
Game Playing: Minimax search procedure, Adding alpha-beta cutoffs, additional refinement. Iterative Deepening and references on specific games Natural Language Processing: Syntactic Processing, Semantic Analysis, Discourse and Pragmatic processing, Statistical Natural language processing and Spell checking		
Module-3	**L3,L4**	**10Hrs.**
Logical Agents: Knowledge based agents, The Wumpus world, Logic-Propositional logic Propositional theorem proving, Effective propositional model checking, Agents based on propositional logic. Using predicate logic: Representing simple facts in logic.		
Module-4	**L3,L4,L5**	**10 Hrs.**
Resolution, Natural Deduction, 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.		
Module-5	**L3,L4,L5**	**10 Hrs.**
Neural Network Learning and Genetic Learning, Statistical learning, Maximum likelihood parameter learning, Bayesian parameter learning, passive reinforcement learning, active reinforcement learning		

Course outcomes:	
CO1	Prolog programming.
CO2	List data structure in Prolog.
CO3	Prolog programming constructs.
CO4	Arithmetic expressions in Prolog.
CO5	Understanding the under the hood workings of Prolog interpreter.

Text Books:	
1.	Stuart Russel, Peter Norvig, "Artificial Intelligence: A Modern ApproachPearson Education, 2nd Edition, 2003.
2.	Elaine Rich, Kevin Knight, Shivashankar B Nair, "Artificial Intelligence 2013", Tata MCGraw Hill ,3rd edition.

Reference Books:	
1.	George F Luger, "Artificial IntelligencePearson Education, 5th Edition, 2009
2.	D W Rolston,Artificial Intelligence and Expert Systems Development, Mc Graw hill.

CIE Assessment:
CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests Quizzes/mini tests (10 marks) Assignments (10 marks)
SEE Assessment:
Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus. Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students have to answer five full questions. One question must be set from each unit. The duration of examination is 3 hours.

CO-PO Mapping

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

High-3, Medium-2, Low-1

Course Title	Machine Learning	Semester	VI
Course Code	MVJ20CD62	CIE	50
Total No. of Contact Hours	50	SEE	50
No. of Contact Hours/week	4 (L : T : P :: 4: 0 : 0)	Total	100
Credits	4	Exam. Duration	3 Hours

Course objective is to:

- Define machine learning and problems relevant to machine learning.
- Differentiate supervised, unsupervised and reinforcement learning
- Apply neural networks, Bayes classifier and k nearest neighbour, for problems appear in machine learning.

Module-1	L1,L2	10Hours

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.

Module-2	L2, L3	10Hours

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

Module-3	L3,L4	10Hours

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

Module-4	L3,L4, L5	10Hours

Bayesian Learning: Introduction, Bayes theorem, Bayes theorem and concept learning, ML and LS error hypothesis, ML for predicting probabilities, MDL principle, Naive Bayes classifier, Bayesian belief networks, EM algorithm.

Module-5	L3,L4, L5	10Hours

Evaluating Hypothesis: Motivation, Estimating hypothesis accuracy, Basics of sampling theorem, General approach for deriving confidence intervals, Difference in error of two hypothesis, Comparing learning algorithms. Instance Based Learning: Introduction, k-nearest neighbor learning, locally weighted regression, radial basis function, cased-based reasoning, Reinforcement Learning: Introduction, Learning Task, Q Learning

Course outcomes:	
CO1	Identify the problems for machine learning. And select the either supervised, unsupervised or reinforcement learning.
CO2	Explain theory of probability and statistics related to machine learning
CO3	Investigate concept learning, ANN, Bayes classifier, k nearest neighbor, Q, Question
CO4	Identify and apply Machine Learning algorithms to solve real world problems
CO5	Perform statistical analysis of machine learning techniques.

Reference Books:	
1	Tom M. Mitchell, "Machine Learning" McGraw Hill Education, India Edition 2013.
2	Trevor Hastie, Robert Tibshirani, Jerome Friedman, h, "The Elements of Statistical Learning", springer series in statistics,2nd edition
3	EthemAlpaydın, "Introduction to machine learning", MIT press, 2nd edition

CO-PO Mapping												
CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
CO1	3	3	0	3	0	0	0	0	0	0	0	1
CO2	3	2	0	3	0	0	0	0	0	0	0	0
CO3	3	3	0	2	0	0	0	0	0	0	0	0
CO4	2	3	0	3	0	0	0	0	0	0	0	1
CO5	3	3	0	3	0	0	0	0	0	0	0	1

High-3, Medium-2, Low-1

Course Title	Unix System Programming	Semester	VI
Course Code	MVJ20CD631	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	3 (L : T : P :: 3 : 0 : 0)	Total	100
Credits	3	Exam. Duration	3 Hours

Course objective is to:

- Explain the fundamental design of the Unix operating system.
- Familiarize with the systems calls provided in the Unix environment.
- Design and build an application/service over the Unix operating system.
- Familiarize with signals and daemon process characteristics.
- Explain inter-process communication.

Module-1	L1,L2,L3	8 Hours

UNIX and ANSI Standards: The ANSI C Standard, The ANSI/ISO, C++ Standards, Difference between ANSI C and C++, The POSIX Standards, The POSIX.1 FIPS Standard, The X/Open Standards. UNIX and POSIX APIs: The POSIX APIs, The UNIX and POSIX Development Environment, API Common Characteristic.
Application: Operating system
Video Link: https://www.youtube.com/watch?v=hy4OeVCLGZ4

Module-2	L1,L2,L3	8 Hours

File Types, The UNIX and POSIX File System, The UNIX and POSIX File Attributes, Inodes in UNIX System V, Application Program Interface to Files, UNIX Kernel Support for Files, Relationship of C Stream Pointers and File Descriptors, Directory Files, Hard and Symbolic Links. UNIX File APIs: General File APIs, File and Record Locking, Directory File, APIs, Device File APIs, FIFO File APIs, Symbolic Link File APIs.
Application: Organizing and storing large data
Video Link: https://www.youtube.com/watch?v=HIXzJ3Rz9po

Module-3	L1,L2,L3	8Hours

The Environment of a UNIX Process: Introduction, main function, Process Termination, Command-Line Arguments, Environment List, Memory Layout of a C Program, Shared Libraries, Memory Allocation, Environment Variables, setjmp and longjmp Functions, getrlimit, setrlimit Functions, UNIX Kernel Support for Processes. Process Control: Introduction, Process Identifiers, fork, vfork, exit, wait, waitpid, wait3, wait4 Functions, Race Conditions, exec Functions, Changing User IDs and Group IDs, Interpreter Files, system

Function, Process Accounting, User Identification, Process Times, I/O Redirection. Process Relationships: Introduction, Terminal Logins, Network Logins, Process Groups, Sessions, Controlling Terminal, tcgetpgrp and tcsetpgrp Functions, Job Control, Shell Execution of Programs, Orphaned Process Groups Application: booting of the system Video Link: https://www.youtube.com/watch?v=4bfzEyb4YD0		
Module-4	**L1,L2,L3**	**8 Hours**
The UNIX Kernel Support for Signals, signal, Signal Mask, sigaction, The SIGCHLD Signal and the waitpid Function, The sigsetjmp and siglongjmp Functions, Kill, Alarm, Interval Timers, POSIX.lb Timers. Daemon Processes: Introduction, Daemon Characteristics, Coding Rules, Error Logging, Client-Server Model. Application: Communication Video Link: https://www.youtube.com/watch?v=X8VDJHzrHRE		
Module-5	**L1,L2,L3**	**8Hours**
Overview of IPC Methods, Pipes, popen, pclose Functions, Coprocesses, FIFOs, System V IPC, Message Queues, Semaphores, Shared Memory, Client-Server Properties, Stream Pipes, Passing File Descriptors, An Open Server-Version 1, Client-Server Connection Functions. Application: Data flow, Communication Video Link: https://www.youtube.com/watch?v=W0BX6geRCDQ		
Practical Experiments: program to demonstrates inter-process communication. Programs using mkfifo, open, read, write and close APIs. program to check whether the region is locked or not. If the region is locked, print pid of the process which has locked. If the region is not locked, lock the region with an exclusive lock, read the last 50 bytes and unlock the region. program to illustrate the race condition.		
Course outcomes:		
CO1	Understand and reason out the working of Unix system and POSIX standards	
CO2	Understand the UNIX file system and build an application/service over the Unix operating system	
CO3	Demonstrate the Unix process environment and process control	
CO4	Explain signals and daemon process characteristics.	

CO5	Understand and write UNIX programs on inter-process communication.

Text/Reference Books:	
1.	Unix System Programming Using C++ - Terrence Chan, PHI, 1999.
2	Advanced Programming in the UNIX Environment - W.Richard Stevens, Stephen A. Rago, 3nd Edition, Pearson Education / PHI, 2005.
3	Advanced Unix Programming- Marc J. Rochkind, 2nd Edition, Pearson Education, 2005.
4	The Design of the UNIX Operating System - Maurice.J.Bach, Pearson Education / PHI, 1987.
5	Unix Internals - Uresh Vahalia, Pearson Education, 2001.

CIE Assessment:

CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests
Quizzes/mini tests (4 marks)
Mini Project / Case Studies (8 Marks)
Activities/Experimentations related to courses (8 Marks)

SEE Assessment:

Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.
Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students have to answer five full questions. One question must be set from each unit. The duration of examination is 3 hours.

CO-PO Mapping

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

High-3, Medium-2, Low-1

Course Title	Data Centre Networking	Semester	VI
Course Code	MVJ20CD632	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	3(L : T : P :: 3: 0 : 0)	Total	100
Credits	3	Exam. Duration	3 Hours

Course objective is to:

- Explain systems and network architecture as well as services.
- Understand data centre services, and trends that might affect data centre designs.
- Understand network security devices available to protect data centres.

Module-1	L1,L2,	8Hours
Cloud networking overview: Networking basics, cloud data center and networkingintroduction, characteristics of cloud networking, evolution from mainframes to cloud.		
Module-2	**L2, L3**	**8 Hours**
Technology: Switch fabric technology – fabric architecture overview, fabric topologies, congestion management. Cloud and data center topologies: traditional multitiered, data center network switch types, flat data center networks, rack scale architectures.		
Module-3	**L3, L4**	**8 Hours**
Networking standards, virtualization and networking: ethernet data rate standards, virtual LANs, data center bridging, improving network bandwidth, remote DMA, virtual switching. Network virtualization.		
Module-4	**L3,L4, L5**	**8 Hours**
Multi-tenant networks, traditional network tunnelling protocols, VXLAN, NVGRE, Tunnel Locations. Defined networking. Data center software background, OpenFlow, Network Functionvirtualization, SDN Deployment.		
Module-5	**L3,L4, L5**	**8 Hours**
High Performance Computing Networks: HPC System architectures, Multisocket CPU boards, HPC Networking standards.		

Course outcomes:	
CO1	Determine a data centre environment's requirement including systems and network architecture as well as services.

CO2	Evaluate options for server farms, network designs, high availability, load balancing, data centre services, and trends that might affect data centre designs
CO3	Assess threats, vulnerabilities and common attacks, and network security devices available to protect data centres.
CO4	Design a data centre infrastructure integrating features that address security, performance, and availability.
CO5	Measure data centre traffic patterns and performance metrics.

Reference Books:	
1.	Greg Lee, Morgan Kaufmann ,"Cloud Networking: Understanding Cloud Based Data Center Networks", 2015
2.	Patricia Morreale and James Anderson,"Software Defined Networking: Design and Deployment"CRC Press,2014

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

High-3, Medium-2, Low-1

Course Title	Information Storage and Management	Semester	VI
Course Code	MVJ20CD633	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	3 (L : T : P :: 3 : 0 : 0)	Total	100
Credits	3	Exam. Duration	3 Hours

Course objective is to:

- To understand data creation, the amount of data being created, the value of data to a business, challenges in data storage and data management
- To understand solutions available for data storage, Core elements of a data center infrastructure, role of each element in supporting business activities
- To understand the storage architecture and available technologies.

Module-1	L1,L2	8 Hours

Introduction to Information Storage Management, Evolution of Storage Technology. Data Centre Infrastructure, Key challenges in managing information. Data Center Environment: Application, Database Management System (DBMS) - Host : Connectivity, Storage, Disk Drive Components.

Module-2	L2,L3	8 Hours

Fiber Channel: Overview ,SAN and its Evolution, Components of FC SAN, FC Connectivity FC Architecture, IPSAN-iSCSI components, iSCSI Topologies, iSCSI Protocol Stack,iSCSI Names NAS: General Purpose Servers versus NAS Devices ,Benefits of NAS- File Systems and Network File Sharing, Components of NAS, NAS I/O Operation

Module-3	L3,L4	8 Hours

Business Continuity: Information Availability ,BC Terminology, BC Planning life cycle. Failure Analysis, Business Impact Analysis Backup and Archive: Backup Purpose ,Backup Considerations, Backup Granularity

Module-4	L3,L4,L5	8 Hours

Storage Security Framework and Domain Monitoring the Storage Infrastructure: Monitoring Parameters , Components Monitored Storage Infrastructure Management Activities Storage Management Examples: Storage Allocation to a New Server/Host , File System Space Management.

Module-5	L3,L4,L5	8 Hours

Cloud Enabling Technologies : Characteristics of Cloud Computing , Benefits of Cloud Computing Cloud Service Models, Cloud Deployment models Cloud computing Infrastructure, Cloud Challenges.	
Course outcomes:	
CO1	Select from various storage technologies to suit for required application
CO2	Apply security measures to safeguard storage & farm
CO3	Analyse QoS on Storage.
CO4	Describe the different role in providing disaster recovery and business continuity capabilities.
CO5	Distinguish different remote replication technologies.

Text/Reference Books:	
1.	EMC Corporation,"Information Storage and Management" ,Wiley India, ISBN13: 978-1118094839, 2nd edition.
2.	UifTroppen Rainer Wolfgang Muller ,"Storage Networks Explained", India, Wiley ISBN13: 978-0470741436, 2010
3.	Robert Spalding,Storage Networks:" The Complete Reference Osborne", Tata McGraw Hill, ISBN-13: 978-0072224764, 2003
4.	Farley ,"Building Storage Networks "Osborne, Tata McGraw Hill, ISBN-13: 978-0072130720,2009.

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

High-3, Medium-2, Low-1

Course Title	Storage Area Network	Semester	VI
Course Code	MVJ20CD634	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	3 (L : T : P :: 3 : 0 : 0)	Total	100
Credits	3	Exam. Duration	3 Hours

Course objective is to: This course will enable students to

- Understand Storage Area Networks characteristics and components.
- Become familiar with the SAN vendors and their products Learn Fibre Channel protocols
- Become familiar with Cisco MDS 9000 Multilayer Directors and Fabric Switches Thoroughly learn Cisco SAN-OS features.
- Understand SAN components use them to communicate with each other
- Understand the use of all SAN-OS commands. Practice variations of SANOS features

Module-1	L1,L2,L3	8 Hours

Syllabus Content:
Review data creation and the amount of data being created and understand the value of data to a business, challenges in data storage and data management, Solutions available for data storage, Core elements of a data center infrastructure, role of each element in supporting business activities Hardware and software components of the host environment, Key protocols and concepts used by each component, Physical and logical components of a connectivity environment.

Application: To create, maintain the storage section of a data center, these basic terms and their concept need to know.
Video Link: https://www.youtube.com/watch?v=akEr8cUAd5g&t=1729s

Module-2	L1,L2,L3	8Hours

Syllabus Content:
Concept of RAID and its components , Different RAID levels and their suitability for different application environments: RAID 0, RAID 1, RAID 3, RAID 4, RAID 5, RAID 0+1, RAID 1+0, RAID 6, Compare and contrast integrated and modular storage systems ,High-level architecture and working of an intelligent storage system Evolution of networked storage, Architecture, components, and topologies of FC-SAN, NAS, and lP-SAN

Application: storing data across multiple hard drives. Video Link: https://www.youtube.com/watch?v=U-OCdTeZLac		
Module-3	L1,L2,L3	8Hours
Syllabus Content: Types of DAS, DAS Benefits and Limitations, Disk Drive Interfaces, Introduction to Parallel SCSI, Overview of Fibre Channel, The SAN and Its Evolution, Components of SAN, FC Connectivity, Fibre Channel Ports, Fibre Channel Architecture, Zoning, Fibre Channel Login Types, FC Topologies. Application: to access storage devices Video Link: https://www.youtube.com/watch?v=-NkhKMRtCeo		
Module-4	L1,L2,L3	8Hours
Syllabus Content: Introduction to Business Continuity: Information Availability, BC Terminology, BC Planning Life Cycle, Failure Analysis, Business Impact Analysis, BC Technology Solutions,Backup and Archive: Backup Purpose, Backup Considerations, Backup Granularity,Recovery Considerations, Backup Methods, Backup Architecture, Backup and Restore Operations, Backup Topologies, Backup in NAS Environments Application: to create a copy of data that can be recovered in the event of a primary data failure. Video Link: https://www.youtube.com/watch?v=B9WKfdc_O7k		
Module-5	L1,L2,L3	8Hours
Syllabus Content: Local Replication: Replication Terminology, Uses of Local Replicas, Replica Consistency, Local Replication Technologies, Tracking Changes to Source and Replica, Restore and Restart Considerations, Creating Multiple Replicas. Remote Replication: Modes of Remote Replication, Remote Replication Technologies. Securing the Storage Infrastructure: Information Security Framework, Risk Triad, Storage Security Domains. Security Implementations in Storage Networking Application: to ensure it stays operational even after an attack or threatening incident. Business continuity. Video Link: https://www.youtube.com/watch?v=VCdX-wm3_4A		

CASE STUDY
Disaster recovery Business continuity CAS Performance Analysis of Cluster Server based on Storage Area Network Best Practices for Storage Area Networks

Course outcomes:	
CO1	Analyse different storage networking technologies and virtualization
CO2	Identify key challenges in managing information
CO3	Explain components and the implementation of NAS
CO4	Illustrate the storage infrastructure and management activities
CO5	Describe architecture and types of archives and forms of virtualization

Text/Reference Books:	
1.	Robert Spalding, "Storage Networks: The Complete Reference", Tata McGraw Hill, Osborne, 2003.
2.	EMC Education Services, "Information Storage and Management",Wiley India Publications,2009.

CIE Assessment:
CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests Quizzes/mini tests (4 marks) Mini Project / Case Studies (8 Marks) Activities/Experimentations related to courses (8 Marks)
SEE Assessment:
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CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		3	2	2	2		2				1	2
CO2	3	3	2	2	2		2				2	2
CO3	3	3	2	2	2		2				3	2
CO4	3	3	2	2	2		2				2	2
CO5	3	3	2	2	2		2				3	2

High-3, Medium-2, Low-1

Course Title	Object Oriented Analysis & Design	Semester	VI
Course Code	MVJ20CD641	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	3 (L : T : P :: 3 : 0 : 0)	Total	100
Credits	3	Exam. Duration	3 Hours

Course objective is to: This course will enable students to

- Understand Object Oriented Programming, Object Oriented Analysis and Modeling using the Unified Modeling Language (UML).
- Familiarize themselves with the models used in UML, including static as well as dynamic (behavioural) models.
- Understand the importance of system architecture and system design in product development.

Module-1	L1,L2	8Hours

Syllabus Content:

Introduction, Use Cases and Class Models: Introduction to Object Oriented Programming – OOP Principles, Class Fundamentals , Structure of Complex Systems, Decomposing Complexity - Elements of Analysis and Design, Object Modeling - Unified Process - Phases of Unified Process. Benefits and Risks of Object Oriented Development,

Module-2	L2,L3	8Hours

Syllabus Content:

Class Models and Dynamic Models: Class Modeling, Object Constraint Language, Advanced Class Modeling, Activity Models, Sequence Models, , Macro and Micro Process Development, Object Interoperability- Designing Interface Objects.Object Oriented Methodologies-Rumbaugh et al.'s object modeling technique-The Booch Methodology-The Jacobson et al. Methodologies

Module-3	L3,L4	8Hours

Discussion on few Examples of OOAD Application Scenarios-Choosing a case study for OOAD.Elements of Analysis – Requirements Workflow – Analysis Workflow, E System and Class Design: System Design, Class Design, Implementation Models, Object Oriented Languages, Database Design.

Module-4	L3,L4,L5	8Hours

Syllabus Content: Elements of Design – O-O Design Workflow – Mapping of Elements onto Phases of Unified Process – UML Diagrams for Design – Iterations – Case Study. Introduction to UML as an Analysis and Design Tool,Class Diagrams, Object Oriented Design Principles: GRASP (General Responsibility Assignment Software Patterns) and SOLID (Single Responsibility, Open-Closed, Liskov Substitution, Interface Segregation, Dependency Inversion).		
Module-5	**L3,L4,L5**	**8Hours**
Syllabus Content: State Transition Diagrams, Object Diagrams, Interaction Diagrams, Use case Diagrams, Activity Diagrams, Collaboration Diagrams and Module Diagrams. Component Diagram, Deployment Diagrams – Mapping of Diagrams to Analysis and Design Components, Design Patterns: What Design Patterns Are, How Design Patterns Solve Problems, How to Select a Design Pattern, How to Implement a Design Pattern		

Course outcomes:	
CO1	Use the concepts of classes and objects in Object Oriented Programming. Use UML to model a complex system by defining actors and use cases.
CO2	Construct Class Models and analyze the dynamics of a system using Activity, Sequence, State and Process models.
CO3	Depict the architecture of a software system by using component and deployment models and design a database based on a class model.
CO4	Use GRASP and SOLID principles in the design of software.
CO5	Apply software design patterns in a variety of situations.

Text/Reference Books:	
1.	Grady Booch, Robert A. Maksimchuk , Michael W. Engle, Bobbi J. Young, Jim Conallen Kelli A. Houston: "Object Oriented Analysis and Design with Application", Addiso Wesley,3rd edition, 2012.
2.	Morris Mano: Digital logic and Computer design, Pearson, 4th Edition, 2008.
3.	Ali Bahrami, "Object Oriented System Development",Tata McGraw-Hill,2012.

CO-PO Mapping

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

High-3, Medium-2, Low-1

Course Title	Cloud Computing	Semester	VI
Course Code	MVJ20CD642	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	3(L : T : P :: 3 : 0 : 0)	Total	100
Credits	3	Exam. Duration	3 Hours

Course objective is to:

- To provide students with the fundamentals and essentials of Cloud Computing.
- To provide students a sound foundation of the Cloud Computing so that they are able to start using and adopting Cloud Computing services and tools in their real life scenarios.
- To enable students exploring some important cloud computing driven commercial systems and applications.

Module-1	L1,L2	8Hours

Introduction to Networking, Data communication, Cloud Computing, Origin of Cloud Computing, Basic Concepts and Terminology.

Goals and Benefits, Risks and Challenges, Roles and Boundaries, Cloud Characteristics .Cloud Delivery Models, Cloud Deployment Models

Module-2	L2,L3	8 Hours

Broadband Networks and Internet Architecture, Data Center Technology, Virtualization Technology.

Web Technology, Multitenant Technology, Service Technology .

Applications, Cloud computing for Healthcare, Energy Systems, Transportation Systems, Manufacturing Industry

Module-3	L3,L4	8Hours

Cloud Infrastructure Mechanisms: Logical Network Perimeter, Virtual Server: Cloud Storage Device, Cloud Usage Monitor, Resource Replication, Ready-Made Environment .

Specialized Cloud Mechanisms: Automated Scaling Listener, Load Balancer, SLA Monitor, Pay Per Use Monitor: Audit Monitor, Failover System, Hypervisor, Resource Cluster, Multi:Device Broker

Module-4	L3,L4,L5	8 Hours

Cloud Management Mechanisms: Remote Administration System, Resource Management System, SLA Management System, Billing Management System .

Cost Metrics and Pricing Models: Business Cost Metrics, Cloud Usage Cost Metrics, Cost Management Considerations . Service Quality Metrics and SLAs: Service Quality Metrics, SLA Guidelines.		
Module-5	**L3,L4,L5**	**8Hours**
Fundamental Cloud Architectures: Illustration with Case Study Fundamental Cloud Security: Basic Terms and Concepts, Threat Agents, Cloud Security Threats . Cloud Security Mechanisms: Encryption, Hashing: Digital Signature, Public Key Infrastructure, Identity and Access Management		
Experimental Part: 1. Apriori Algorithm for market Basket Analysis 2. Bayesian Classification 3. Decision Tree Induction Algorithm 4. Frequent Pattern-Growth Algorithm		

Course outcomes:	
CO1	Use the concepts of classes and objects in Object Oriented Programming. Use UML to model a complex system by defining actors and use cases.
CO2	Construct Class Models and analyze the dynamics of a system using Activity, Sequence, State and Process models.
CO3	Depict the architecture of a software system by using component and deployment models and design a database based on a class model.
CO4	Use GRASP and SOLID principles in the design of software.
CO5	Apply software design patterns in a variety of situations.

Text/Reference Books:	
1.	Thomas Erl, ZaighamMahmood,RichardoPuttini, "Cloud Computing:Concepts", Prentice Hall/PearsonPTR, ISBN: 9780133387520,Fourth Printing, 2014
2.	ArshdeepBahga, Vijay Madisetti:"Cloud Computing: A Hands-On Approach", University Press, ISBN: 9780996025508,2016
3.	K.Chandrasekaran ,"Essentials of Cloud Computing ",Chapman and Hall/CRC Press, ISBN 9781482205435,2014
4.	Thomas Erl, Robert Cope, Amin Naserpour,Cloud Computing Design Patterns, Prentice Hall/Service Tech Press, Pearson, ISBN: 978-0133858563,2015

CO-PO Mapping

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

High-3, Medum-2, Low-1

Course Title	OPEN ELECTIVE I-Mobile Application Development	Semester	VI
Course Code	MVJ20CD643	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	3 (L : T : P :: 3 : 0 : 0)	Total	100
Credits	3	Exam. Duration	3 Hours

Course objective is to:

- Learning about data transmission standards
- Learning about systems for mobile application distribution
- Preparing for mobile application development

Module-1	L1,L2	8 Hours

Introduction: Introduction to mobile application development, trends, introduction to various platforms, introduction to smart phones

Android platform: Android platform features and architecture, versions, comparison added features in each versions. ART(Android Runtime),ADB(Android Debug Bridge).

Development environment/IDE: Android studio and its working environment, gradle build system, emulator setup Application anatomy.

Module-2	L2,L3	8Hours

Application framework basics: resources layout, values, asset XML representation and generated R.Javafile ,Android manifest file. Creating a simple application., GUI for Android: Introduction to activities, activities life-cycle, Android v7 support library form API21 for lower version support

Intent :intent object, intent filters ,adding categories, linking activities, user interface design components

Module-3	L3,L4	8Hours

Views and View Groups: Basic views, picker views, adapter views, Menu, App Bar etc, basics of screen design; different layouts. App widgets.Lollipop Material design: new themes, new widgets, Card layouts. Recycler View

Fragments: Introduction to activities, activities life-cycle.Different Data persistence schemes: Shared preferences, File Handling, Managing data using SQLite database

Content providers: user content provider, Android in build content providers.

Module-4	L3,L4,L5	8hours

Services :introduction to services – local service, remote service and binding the service, the communication between service and activity, Intent Service.

MultiThreading: Handlers ,AsyncTask

Android network programming :HttpUrlConnection, Connecting to REST-based and SOAP based Web services

Broad cast receivers:LocalBroadcastManager, Dynamic broadcast receiver, System Broadcast. PendingIntent,

Module-5	L3,L4,L5	8 Hours

Notifications Telephony Manager:Sending SMS and making calls., Location based services: Google maps V2 services using Google API, Animations and Graphics: Property Animation ,View Animations, Drawable Animations Media and Camera API: Working with video and audio inputs, camera API

Course outcomes:

CO1	Recognize and setup a mobile device and application runtimeenvironment
CO2	setup programming tools for a mobile application developer (for selected modern mobile platforms)
CO3	select appropriate data transmission standards in terms of social competence
CO4	understand the need for continuous improvement of his/her skills due to the rapidly changing environment of mobile devices.

Text/Reference Books:

1	Dawn Griffiths, David Griffiths, Head First: Android Development, OReilly,ISBN: 9781449362188, 2015
2	Greg Milette,Adam Stroud, "PROFESSIONALAndroid™ Sensor Programming", John Wiley and Sons, Inc, ISBN/978111265055,9781280678943,978111227459, 2012
3	Paul Deital,HarveyDeital, Alexander Wald ,"Android 6 for Programmers ,App Driven approach",Prentice Hall ,ISBN: 9780134289366, 2015

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

High-3, Medium-2, Low-1

Course Title	Information & Network Security	Semester	VI
Course Code	MVJ20CD644	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	3(L : T : P :: 3 : 0 : 0)	Total	100
Credits	3	Exam. Duration	3 Hours

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

- To understand the fundamentals of Cryptography
- To acquire knowledge on standard algorithms used to provide confidentiality integrity and authenticity.
- To understand the various key distribution and management schemes

Module-1	L1,L2	8Hrs.
Definitions & challenges of security, OSI security architecture, attacks & services. Cryptography & cryptanalysis. Classical encryption techniques, substitution techniques, transposition techniques. Block ciphers, DES, AES structure, multiple encryption-triple DES.		
Module-2	**L2,L3**	**8 Hrs.**
Number theory fundamentals, principles of pubic key crypto systems, RSA algorithm, Strength of RSA, Diffie-Hellman key exchange, Elliptic curve cryptography. Symmetric key distribution using symmetric and asymmetric encryptions, distribution of public keys, X.509 Certificates, PKI.		
Module-3	**L3,L4**	**8Hrs.**
Cryptographic hash functions, applications, security requirements, hash function based on block chaining, SHA-512. MAC, security requirements, HMAC, CMAC, key wrapping, Digital signatures.		
Module-4	**L3,L4,L5**	**8 Hrs.**
Remote user authentication, symmetric and asymmetric encryptions for user authentications, Kerberos, identity management & verification. Web security, Secure Socket Layer (SSL), Transport Layer Security (TLS), Secure Shell (SSH), HTTPS, E-mail security, PGP, S/MIME		
Module-5	**L3,L4,L5**	**8 Hrs.**

IP Security, Policy, encapsulating security payload, combining security association, internet key exchange. Wireless security, Security, IEEE 802.11i services, IEEE 802.11i phases of operation, discovery phase, Authentication phase, key management phase, and protected data transfer phase

Course outcomes:	
CO1	Analyze the vulnerabilities in any computing system and hence be able to design a security solution.
CO2	Identify the security issues in the network and resolve it.
CO3	Evaluate security mechanisms using rigorous approaches, including theoretical
CO4	Compare and Contrast different IEEE standards and electronic mail security
CO5	Design security applications in the field of Information technology

Text Books:	
1	"Cryptography & Network Security- Principles and Practices" William Stallings ,Pearson Publishers Sixth Edition,2014
2	"Understanding cryptography" Christof Paar& Jan Pelz,Heidelberg [u.a.] Springer ,2014

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

High-3, Medium-2, Low-1

Course Title	OPEN ELECTIVE I- Computer Network	Semester	VI
Course Code	MVJ20CD651	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	3 (L : T : P :: 3 : 0 : 0)	Total	100
Credits	3	Exam. Duration	3 Hours

Course objective is to:

- Understand the Computer Networks and Data Transmissions
- Learn Functions of different protocols in networked computers
- Get details about Functions of Network layer, Router and deliver of data to host network

Module-1	L1,L2	8 Hours

Data Communication – Networks – The Internet – Protocols and Standards. Network Model: OSI model -TCP/IP Protocol Suit – Addressing. Transmission Media: Guided Media – Unguided Media. Data Link Control: Framing – Flow and Error Control – Protocols – Noiseless & Noisy Channels – HDLC – Point-to-Point Protocol. Connecting Devices – Backbone Networks

Application Layer: The Web and HTTP: Overview of HTTP – Non-Persistent and Persistent Connections – HTTP Message Format – User-Server Interaction: Cookies – Web Caching.

Module-2	L2,L3	8Hours

IPv4 Public and Private Address Subnetting VLSM-CIDR Network Devices: Router, Switch, HUB, Bridge, Internet's Directory Service: Service Provided by DNS, Overview of How DNS Works, DNS Records and Messages – Peer-to-Peer File Distribution – Distributed Hash Tables.

Module-3	L3,L4	8Hours

Introduction and Transport-Layer Services: Relationship Between Transport and Network Layers. Overview of the Transport Layer in the Internet – Multiplexing and Demultiplexing: Connectionless Transport: UDP, UDP segment Structure, UDP Checksum, Principles of Reliable Data Transfer: Building a Reliable Data Transfer Protocol, Pipelined Reliable Data Transfer Protocols, Go-Back-N, Selective Repeat.

Module-4	L3,L4,L5	8 Hours

Connection-Oriented Transport TCP: The TCP Connection, TCP Segment Structure, Round-Trip Time Estimation and Time out, Reliable Data Transfer, Flow Control, TCP Connection Management, Principles of Congestion Control: The Causes and the Costs of Congestion Approaches to Congestion Control., Medium Access Control Techniques

Random, Round Robin, Reservation, ALOHA Pure and Slotted, CSMA/CD CSMA/CA		
Module-5	L1,L2,L3	8Hours
Ethernet, Token Ring, Token Bus, ARQ 3 Types, Error Detection Codes, Parity Check, Checksum Error Correction Codes,Hamming codes , Physical Layer overview, Latency, Bandwidth, Delay, Wireless: 802.11, Transmission Media : Twisted pair, Coaxial, Fibre, 802.15, 802.15.4, 802.16.		

Course outcomes:	
CO1	Establish LAN and assigning IP address to each node
CO2	Can apply different protocols to transfer data between computers
CO3	Know how the network deliver the packets to destination network
CO4	Know how switch happing between mobile towers and Functions of mobile networks
CO5	Guess the problems in audio/video transfer through network

Text/Reference Books:	
1.	Behrouz A. Forouzan, Data Communications and Networking,ISBN: 9780073376226,5th edition, July 1, 2010
2..	Todd Lammle, CCNA Study Guide, ISB: 10:0470901071 ISBN:13: 9780470901076, Edition7, Publication Date: April 5, 2011
3	William Stallings, Data and Computer Communications, Edition 9, 2010

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

High-3, Medium-2, Low-1

Course Title	Data Warehousing and Data mining	Semester	VI
Course Code	MVJ20CD652	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	3 (L : T : P :: 3: 0 : 0)	Total	100
Credits	3	Exam. Duration	3 Hours

Course objective is to:

- Gather and analyze large sets of data to gain useful business understanding
- Understand the data mining functionalities, technologies and steps in pre-processing the data
- Learn data mining algorithms, methods and tools

Module-1	L1, L2, L3	8Hours

Raw data to valuable information-Lifecycle of Data - What is data warehousing - The building Blocks: Defining Features - Data warehouses and data marts - Overview of the components - Metadata in the data warehouse - Basic elements of data warehousing . Identify the potential risk of default and manage and control collections Performance analysis of each product, service, interchange, and exchange rates Store and analyze information about faculty and students-Maintain student portals to facilitate student.activities

Video Link:
https://www.youtube.com/watch?v=8lHpioyvSng

Module-2	L1,L2,L3	8Hours

Introduction to Data Mining Systems, Knowledge Discovery Process -Data Objects and attribute types, Statistical description of data, Data Preprocessing- Data Cleaning, Data Integration and Transformation, Data Reduction.
Application:
Financial Analysis
Telecommunication Industry.
Intrusion Detection

Retail Industry
Higher Education

Video Link: https://www.youtube.com/watch?v=QRZlYzxEFDg		
Module-3	L1,L2,L3	8Hours
Market Basket Analysis, Frequent Item sets, Closed Itemsets, Association Rules, Frequent Itemset Mining Methods- Apriori algorithm, Generating Association rules from Frequent Itemsets, A Pattern- Growth Approach for mining frequent Itemsets. Application: Market Basket Analysis Medical Diagnosis: Census Data Protein Sequence Video Link: https://www.youtube.com/watch?v=RiFrbyiYpRs		
Module-4	L1,L2,L3	8Hours
Classification and Prediction ,Basic Concepts, Decision Tree Induction, Bayesian Classification ,Rule Based Classification, Classification by Back propagation , Support Vector Machines. Application: Sentiment Analysis Email Spam Classification Document Classification Image Classification Video Link: https://www.youtube.com/watch?v=gkagE_fE2sk		
Module-5	L1,L2,L3	8 Hours
Types of Data in Cluster Analysis , Data similarity and dissimilarity measures ,A Categorization of Major Clustering Methods -Partitioning Methods-K-means, K-medoids , Hierarchical Methods-Agglomerative vs Divisive, Distance measures, BIRCH. Application: Clustering analysis In the field of biology, it can be used to derive plant and animal taxonomies. Identification of areas of similar land use in an earth observation database. Video Link: https://www.youtube.com/watch?v=2QTeuO0C-fY		

Experimental Part: Apriori Algorithm for market Basket Analysis Bayesian Classification Decision Tree Induction Algorithm Frequent Pattern-Growth Algorithm	
Course outcomes:	
CO1	Design data warehouse by applying principles of dimensional modelling and ETL concepts
CO2	Analyze various data pre-processing techniques for efficient data mining.
CO3	Apply association rule mining for finding hidden and interesting patterns in data.
CO4	Apply statistical procedure, machine learning and neural network based classification algorithms for data prediction
CO5	Apply clustering algorithms for the application and generalizations for real time problems

Text/Reference Books:	
1.	Jiawei Han, Micheline Kamber and Jian Pei, Data Mining Concepts and Techniques, Third Edition, Elsevier, 2012.
2.	Paulraj Ponniah, Data Warehousing Fundamentals: A Comprehensive Guide for IT Professionals, Wiley, 2010
3.	Alex Berson, Stephen J Smith, Data warehousing, Data mining, and OLAP, Tata McGraw Hill edition, 2007
4.	Pang-Ning Tan, Michael Steinbach and Vipin Kumar,Introduction to Data Mining, Pearson Education, 2007
5.	G. K. Gupta ,Introduction to Data Mining with Case Studies, Easter Economy Edition, Prentice Hall of India, 2006

CIE Assessment:
CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests Quizzes/mini tests (4 marks) Mini Project / Case Studies (8 Marks) Activities/Experimentations related to courses (8 Marks)
SEE Assessment:
i. Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus. ii. Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students have to answer five full questions. iii. One question must be set from each unit. The duration of examination is 3 hours.

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

High-3, Medium-2, Low-1

Course Title	Introduction to Artificial Intelligence	Semester	VI
Course Code	MVJ20CD653	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	3 (L : T : P :: 3 : 0 : 0)	Total	100
Credits	3	Exam. Duration	3 Hours

Course objective is to: This course will enable students to

- Identify the problems where AI is required and the different methods available.
- Compare and contrast different AI techniques available.
- Define and explain learning algorithms.
- Design different learning algorithms for improving the performance of AI systems.
- Implement projects using different AI learning techniques.

Module-1	L1,L2,L3	8Hours

Syllabus Content:
What is artificial intelligence, Problems, Problem Spaces and search, Heuristic search technique.

Application:
Solving various AI based problems.

Video Link:

http://www.nptelvideos.in/2012/11/artificial-intelligence.html
https://www.cualit.com/artificial-intelligence-practical-use-cases/

Module-2	L1,L2,L3	8 Hours

Syllabus Content:
Knowledge Representation Issues, Using Predicate Logic, Representing knowledge using Rules.
Application:
Developing information about the objects

Video Link:

http://www.nptelvideos.in/2012/11/artificial-intelligence.html https://www.cualit.com/artificial-intelligence-practical-use-cases/		
Module-3	L1,L2,L3	8Hours
Syllabus Content: Symbolic Reasoning under Uncertainty, Statistical reasoning, Weak Slot and Filter Structures. Application: Connecting one concept to another , combining ideas about data. Video Link: http://www.nptelvideos.in/2012/11/artificial-intelligence.html https://www.cualit.com/artificial-intelligence-practical-use-cases/		
Module-4	L1,L2,L3	8Hours
Syllabus Content: Strong slot-and-filler structures, Game Playing. Application: Designing Smart Games Video Link: http://www.nptelvideos.in/2012/11/artificial-intelligence.html https://www.cualit.com/artificial-intelligence-practical-use-cases/		
Module-5	L1,L2,L3	8Hours
Syllabus Content: Natural Language Processing, Learning, Expert Systems. Application: Sentiment analysis Video Link: http://www.nptelvideos.in/2012/11/artificial-intelligence.html https://www.cualit.com/artificial-intelligence-practical-use-cases/		
Course outcomes:		
CO1	Identify the AI based problems.	
CO2	Apply techniques to solve problems	
CO3	Define learning and explain various learning techniques.	
CO4	Discuss expert systems	

CO5	Implement projects using different AI learning techniques.

Text/Reference Books:

1.	E. Rich , K. Knight & S. B. Nair - Artificial Intelligence, 3/e, McGraw Hill.
2.	Stuart Russel, Peter Norvig, "Artificial Intelligence: A Modern Approach" , 2nd Edition, Pearson Education, 2003.
3.	Dan W. Patterson, Introduction to Artificial Intelligence and Expert Systems – Prentice Hal of India.
4.	G. Luger, "Artificial Intelligence: Structures and Strategies for complex problem Solving", Fourth Edition, Pearson Education, 2002.

CIE Assessment:

CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests
Quizzes/mini tests (4 marks)
Mini Project / Case Studies (8 Marks)
Activities/Experimentations related to courses (8 Marks)

SEE Assessment:

Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus. Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students have to answer five full questions.
One question must be set from each unit. The duration of examination is 3 hours.

CO-PO Mapping

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

High-3, Medium-2, Low-1

Course Title	Web programming	Semester	VI
Course Code	MVJ20CD654	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	3 (L : T : P :: 3 : 0 : 0)	Total	100
Credits	3	Exam. Duration	3 Hours

Course objective is to:

- Teach students HTML and CSS for designing web pages.
- Introduce students to the basics of JavaScript as a programming language.
- Familiarize students with the Document Object Model and enable them to create dynamic web pages that react to user input.
- Teach students about installing and configuring Apache Server and incorporating backend support for their web pages.
- Introduce students to the newer features available as part of the HTML standard

Module -1	L1,L2,L3	8Hours

Introduction, UI Design and UX : Internet, WWW, Web Servers and Browsers, URLs, MIME, HTTP, Basic Markup, Images, Hyperlinks, Lists, Tables, Forms, DataList, Canvas, Audio and Video, Geo-Location, Local Storage, Web Workers, Offline Web Applications, Drag and Drop.HTML Tables and Forms, Introducing Tables, Styling Tables, Introducing Forms, Form Control Elements, Table and Form Accessibility, Microformats

Application: To deliver data (HTML files, image files, query results) on the World Wide Web.

Video Link:

https://www.freecodecamp.org/

https://developer.mozilla.org/en-US/docs/Web/CSS

Module -2	L1,L2,L3	8Hours

Style Sheets: CSS Introduction to Cascading Style Sheets-Features-Core Syntax-Style Sheets and HTML Style Cascading and Inheritance-Text Properties-Box Model Normal Flow Box Layout-Beyond the Normal Flow-Other Properties-Case Study. Client- Side Programming:

Application: Describing the presentation of Web pages, including colors, layout, and fonts

Video Link:

https://www.vogella.com/tutorials/CSS/article.html

https://nptel.ac.in/courses/106/105/106105084/

Module - 3	L1,L2,L3	8Hours
JavaScript: Introduction to Client-Side Scripting, JavaScript Basics, Screen Input and Keyboard Output, Functions, Objects, Inheritance, Hoisting, Arrays, JavaScript Objects, Accessing and Modifying DOM, Events and Event Handlers - Load, Mouse, Synthetic Events, Key and Form Related Events, Event Bubbling, Cookies. Application: Web Sites, Web Server Applications, Mobile Apps, Games Platform Video Link: https://www.udemy.com/courses/development/web-development/ https://javascript.info/hello-world#modern-markup		
Module-4	**L1,L2,L3**	**8Hours**
PHP Arrays and Superglobals, Arrays, $_GET and $_POST Superglobal Arrays, $_SERVERArray, $_Files Array, Reading/Writing Files, PHP Classes and Objects, Object-Oriented Overview, Classes and Objects in PHP, Object Oriented Design, Error Handling and Validation, What are Errors and Exceptions, PHP Error Reporting, PHP Error and Exception Handling Application: e-Commerce Applications. Web Pages and Web-Based Applications Video Link: http://www.nptelvideos.com/video.php?id=2142&c=27 http://www.nptelvideos.com/video.php?id=2131&c=27 http://www.nptelvideos.com/video.php?id=2116&c=27		
Module-5	**L1,L2,L3**	**8Hours**
Bootstrap: Grid Systems, Layout, Tables and Forms, Buttons and Images, Progress Bar, Navigations. jQuery: Usage, Selecting DOM Elements, Getting and Setting Attributes, Changing Styles, File Handling and System Calls, Arrays, Cookies, Sessions, Database Access. Application: Bootstrap is a front-end framework used to create modern websites and web apps Video Link: https://getbootstrap.com/docs/4.5/examples/ https://www.w3schools.com/bootstrap/bootstrap_buttons.asp		
Practical Experiments: Create a web page with the following. a. Cascading style sheets. b. Embedded style sheets. c. Inline style sheets. Use our college information for the web pages. JavaScript to design a simple calculator Java script to Validate the Registration, user login, user profile and payment by credit card		

pages PHP program to display a digital clock which displays the current time of the server.. PHP program to keep track of the number of visitors visiting the web page and to display this count of visitors

Course outcomes:	
CO1	Outline the basic concepts of information and web architecture.
CO2	Design solutions for programming questions using JavaScript
CO3	Study Hyper Text markup language and create websites using HTML, CSS Codes.
CO4	Setup a web server and host a website with back end support.
CO5	Incorporate the latest HTML features in the web pages designed by them with fallback options wherever required.

Text/Reference Books:	
1.	Jeffrey C.Jackson, "Web Technologies--A Computer Science Perspective", Pearson Education, 2006.
2.	Robert. W. Sebesta, "Programming the World Wide Web", Fourth Edition, Pearson Education
3.	Deitel, Deitel, Goldberg, "Internet & World Wide Web How To Program", Third Edition, Pearson Education, 2006.
4.	Marty Hall and Larry Brown,"Core Web Programming" Second Edition, Volume I and II, Pearson Education, 2001
5.	Bates, "Developing Web Applications", Wiley, 2006.

CIE Assessment:
CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests Quizzes/mini tests (4 marks) Mini Project / Case Studies (8 Marks) Activities/Experimentations related to courses (8 Marks)

SEE Assessment:
Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus. Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students have to answer five full questions. One question must be set from each unit. The duration of examination is 3 hours.

CO-PO Mapping

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

High-3, Medium-2, Low-1

Course Title	ARTIFICIAL INTELLIGENCE LAB	Semester	VI
Course Code	MVJ20CDL66	CIE	50
Total No. of Contact Hours	30	SEE	50
No. of Contact Hours/week	3 (L : T : P :: 0 : 1 : 2)	Total	100
Credits	2	Exam. Duration	3 Hours

Course objective is to:

- Demonstrate PROLOG in AI
- Compare and contrast different AI techniques available.
- Demonstrate learning algorithms

Sl No	Experiment Name	RBT Level	Hours
1	Implementation of travelling salesman problem	L3	3
2	Implementation of chess problem	L3	3
3	Implementation of Tower of Hanoi problem	L3	3
4	Implementation of Water Jug problem	L3	3
5	Implementation of N-Queen problem	L3	3
6	Implementation of Rock-Paper-Scissor problem	L3	3
7	Implementation of VLSI Layout problem	L3	3
8	Implementation of Sudoku problem	L3	3

Course outcomes:

CO1	Demonstrate PROLOG commands
CO2	Apply AI search Models and Generic search strategies.
CO3	Write Logic for representing Knowledge and Reasoning of AI systems
CO4	Design different learning algorithms for improving the performance of AI systems.
CO5	Implement projects using different AI learning techniques.

CO-PO Mapping												
CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
CO1	3	3	3	2	3	0	0	0	0	2	0	0
CO2	3	3	3	2	3	0	0	0	0	2	0	0
CO3	3	3	2	2	3	0	0	0	0	2	0	0
CO4	3	3	2	2	3	0	0	0	0	2	0	0
CO5	3	3	3	2	3	0	0	0	0	2	0	0

High-3, Medium-2, Low-1

Course Title	MACHINE LEARNING LAB	Semester	VI
Course Code	MVJ20CDL67	CIE	50
Total No. of Contact Hours	30	SEE	50
No. of Contact Hours/week	3 (L : T : P :: 0 : 1 : 2)	Total	100
Credits	2	Exam. Duration	3 Hours

Course objective is to:

- Make use of data sets in implementing the machine learning algorithms
- Implementing 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	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
4	Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.	L3	3
5	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
6	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 writethe program. Calculate the accuracy, precision, and recall for your data set.	L3	3
7	Write a program to construct aBayesian 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

8	Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set 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

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 Mapping

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

High-3, Medium-2, Low-1

Course Title	Mini-Project	Semester	VI
Course Code	MVJ20CDP68	CIE	50
Total No. of Contact Hours	15	SEE	50
No. of Contact Hours/week	2 (L : T : P :: 2 : 0 : 0)	Total	100
Credits	2	Exam. Duration	3Hrs

Course objective :

- To support independent learning and innovative attitude.
- To guide to select and utilize adequate information from varied resources upholding ethics.
- To guide to organize the work in the appropriate manner and present information (acknowledging the sources) clearly.
- To develop interactive, communication, organisation, time management, and presentation skills.
- To impart flexibility and adaptability.
- To inspire independent and team working.
- To expand intellectual capacity, credibility, judgement, intuition.
- To adhere to punctuality, setting and meeting deadlines.
- To instil responsibilities to oneself and others.
- To train students to present the topic of project work in a seminar without any fear, face audience confidently, enhance communication skill, involve in group discussion to present and exchange ideas

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

Course outcomes:

- At the end of the course the student will be able to:
- Present the mini-project and be able to defend it.
- Make links across different areas of knowledge and to generate, develop and evaluate ideas and information so as to apply these skills to the project task.
- Habituated to critical thinking and use problem solving skills.
- Communicate effectively and to present ideas clearly and coherently in both the written and oral forms.
- Work in a team to achieve common goal.
- Learn on their own, reflect on their learning and take appropriate actions to improve it.

CIE procedure for Mini - Project:

- The CIE marks awarded for Mini - Project, shall be based on the evaluation of Mini - Project Report, Project Presentation skill and Question and Answer session in the ratio 50:25:25.The marks awarded for
- Mini - Project report shall be the same for all the batch mates.

Semester End Examination :

- SEE marks for the mini-project shall be awarded based on the evaluation of Mini-Project Report, Presentation skill and Question and Answer session in the ratio 50:25:25 by the examiners appointed by the University.

Course Title	IoT for Data Science & Analytics	Semester	VII
Course Code	MVJ20CD71	CIE	50
Total No. of Contact Hours	50 L:T:P::4:0:0	SEE	50
No. of Contact Hours/week	4	Total	100
Credits	4	Exam. Duration	3 Hours

Course objective is to:

This course viz., aims to prepare the students:

- Assess the genesis and impact of IoT applications, architectures in real world.
- Illustrate diverse methods of deploying smart objects and connect them to network.
- Compare different Application protocols for IoT.

Module-1	L1,L2	10Hrs.
What is IoT, Genesis of IoT, IoT and Digitization, IoT Impact, Convergence of IT and IoT, IoT Challenges, IoT Network Architecture and Design, Drivers Behind New Network Architectures, Comparing IoT Architectures, A Simplified IoT Architecture, The Core IoT Functional Stack, IoT Data Management and Compute Stack.		

Module-2	L2,L3	10 Hrs.
Smart Objects: The "Things" in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects, Communications Criteria, IoT Access Technologies, IP as the IoT Network Layer, The Business Case for IP, The need for Optimization, Optimizing IP for IoT, Profiles and Compliances.		

Module-3	L3,L4	10Hrs.
Application Protocols for IoT, The Transport Layer, IoT Application Transport Methods, Data and Analytics for IoT, An Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytics Tools and Technology, Edge Streaming Analytics, Network Analytics, Securing IoT, A Brief History of IOT Security,		

Module-4	L3,L4,L5	10 Hrs.
Common Challenges in OT Security, How IT and OT Security Practices and Systems Vary, Formal Risk Analysis Structures: OCTAVE and FAIR, The Phased Application of Security in an Operational Environment, IoT Physical Devices and Endpoints - Arduino UNO: Introduction to Arduino, Arduino UNO, Installing the Software, Fundamentals of Arduino Programming. IoT Physical Devices and Endpoints		

Module-5	L3,L4,L5	10 Hrs.
RaspberryPi: Introduction to RaspberryPi, About the RaspberryPi Board: Hardware Layout, Operating Systems on RaspberryPi, Configuring RaspberryPi, Programming RaspberryPi with Python, Wireless Temperature Monitoring System Using Pi, DS18B20 Temperature Sensor, Connecting Raspberry Pi via SSH, Accessing Temperature from DS18B20 sensors, Remote access to RaspberryPi, Smart and Connected Cities, An IoT Strategy for Smarter Cities, Smart City IoT Architecture, Smart City Security Architecture, 08 Smart City Use-Case Examples.		
Course outcomes:		
CO1	Describe the characteristics and key technologies for IoT system	
CO2	Interfacing Sensor and Actuator with Arduino development board.	
CO3	Implementing IoT device by interfacing communication module and cloud	
CO4	Describe protocols of resource constraint network	
CO5	Elaborate the need for Data Analytics and Security in IoT	

Text Books:	
1.	"IoTFundamentals: Networking Technologies, Protocols, and Use Cases for the Internet ofThings", David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, 1stEdition, Pearson Education (Cisco Press Indian Reprint). (ISBN: 978-9386873743
2.	"Internet of Things",Srinivasa K G,CENGAGE Leaning India,2017

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

High-3, Medium-2, Low-1

course Title	Big Data & Hadoop	Semester	VII
Course Code	MVJ20CD72	CIE	50
Total No. of Contact Hours	50	SEE	50
No. of Contact Hours/week	4 (L : T : P :: 4: 0: 0)	Total	100
Credits	4	Exam. Duration	3 Hours

Course objective is to:

- Understand Hadoop Distributed File system and examine MapReduce Programming
- Explore Hadoop tools and manage Hadoop with Ambari
- Appraise the role of Business intelligence and its applications across industries

Module-1	L1,L2	10Hours

Introduction to big data and Hadoop Types of Digital Data, Introduction to Big Data, Big Data Analytics, History of Hadoop, Apache Hadoop, Analysing Data with Unix tools, Analysing Data with Hadoop, Hadoop Streaming, Hadoop Echo System, IBM Big Data Strategy,

Module-2	L2,L3	10Hours

Introduction to Infosphere BigInsights and Big Sheets. HDFS(Hadoop Distributed File System)The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop file system interfaces, Data flow, Data Ingest with Flume and Scoop and Hadoop archives

Module-3	L3,L4	10Hours

Hadoop I/O: Compression, Serialization, Avro and File-Based Data structures
Map Reduce , Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Types and Formats, Map Reduce Features.

Module-4	L3,L4,L5	10Hours

Hadoop Eco System
Pig : Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User DefinedFunctions, Data Processing operators.
Hive : Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases, HiveQL, Tables, QueryingData and User Defined Functions.

Module-5	L3,L4,L5	10Hours

Hbase :HBasics, Concepts, Clients, Example, Hbase Versus RDBMS.Big SQL : Introduction , Data Analytics with RMachine Learning : Introduction, Supervised Learning, Unsupervised Learning, Collaborative Filtering.

Course outcomes:

CO1	Master the concepts of HDFS and MapReduce framework
CO2	Investigate Hadoop related tools for Big Data Analytics and perform basic Hadoop Administration

CO3	Recognize the role of Business Intelligence, Data warehousing and Visualization in decision making
CO4	Infer the importance of core data mining techniques for data analytics
CO5	Compare and contrast different Text Mining Techniques

Reference Books:	
1.	Tom White," Hadoop: The Definitive Guide",O'reily Media,Third Edition, 2012
2.	Seema Acharya, SubhasiniChellappan," Big Data Analytics",Wiley,2015

CO-PO Mapping

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

High-3, Medium-2, Low-1

Course Title	Professional Elective-IV Data Analytics	Semester	VII
Course Code	MVJ20CD731	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	4(L : T : P :: 3: 0: 0)	Total	100
Credits	3	Exam. Duration	3 Hours

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

- To provide an overview of an exciting growing field of big data analytics.
- To introduce the tools required to manage and analyze big data like Hadoop, NoSql MapReduce.
- To teach the fundamental techniques and principles in achieving big data analytics with scalability and streaming capability..

Module-1	L1,L2	8Hrs.

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.

Module-2	L2,L3	8 Hrs.

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

Module-3	L3,L4	8Hrs.

Fuzzy logic: extracting fuzzy models from data, fuzzy decision trees, Stochastic search methods. 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

Module-4	L3,L4,L5	8 Hrs.

Decaying window - Realtime Analytics Platform(RTAP) applications - case studies - real time sentiment analysis, stock market predictions.. Mining Frequent itemsets - Market based model – Apriori Algorithm – Handling large data sets in Main memory – Limited Pass algorithm – Counting frequent itemsets in a stream

Module-5	L3,L4,L5	8 Hrs.
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.		

Course outcomes:	
CO1	Understand the key issues in big data management and its associated applications in intelligent business and scientific computing.
CO2	Acquire fundamental enabling techniques and scalable algorithms like Hadoop, Map Reduce and NO SQL in big data analytics.
CO3	Interpret business models and scientific computing paradigms and apply software tools for big data analytics.
CO4	Achieve adequate perspectives of big data analytics in various applications like recommender systems, social media applications etc.
CO5	solve complex real-world problems in for decision support.

Text Books:	
1	Michael Berthold, David J. Hand, "Intelligent Data Analysis" Springer,2007
2	Anand Rajaraman and Jeffrey David Ullma, "Mining of Massive Datasets ", Cambridge University Press,2012

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

High-3, Medium-2, Low-1

Course Title	Deep Learning	Semester	VII
Course Code	MVJ20CD732	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	3 (L : T : P :: 2 : 2 : 0)	Total	100
Credits	3	Exam. Duration	3 Hours

Course objective is to:

- Explain the fundamentals of Deep Learning.
- Familiarize with Tensor Flow, Installation of software module.
- Design and build support vector machine.

Module-1	L1,L2	8Hours

Feedforward Neural networks. Gradient descent and the backpropagation algorithm. Unit saturation, aka the vanishing gradient problem, and ways to mitigate it. RelU Heuristics for avoiding bad local minima. Heuristics for faster training. Nestors accelerated gradient descent. Regularization. Dropout. Convolutional Neural Networks Architectures, convolution / pooling layers

Module-2	L2,L3	8Hours

Recurrent Neural Networks , LSTM, GRU, Encoder Decoder architectures,
Deep Unsupervised Learning , Autoencoders (standard, sparse, denoising, contractive, etc), Variational Autoencoders, Adversarial Generative Networks, Autoencoder and DBM.

Module-3	L3,L4	8Hours

Applications of Deep Learning to Computer Vision , Image segmentation, object detection, automatic image captioning, Image generation with Generative adversarial networks, video to text with LSTM models. Attention models for computer vision tasks. Applications of Deep Learning to NLP: Introduction to NLP and Vector Space Model of Semantics.

Module-4	L3,L4,L5	8Hours

Word Vector Representations: Continuous Skip-Gram Model, Continuous Bag-ofWords model (CBOW), Glove, Evaluations and Applications in word similarity, analogy reasoning Named Entity Recognition, Opinion Mining using Recurrent Neural Networks , Parsing and Sentiment Analysis using Recursive Neural Networks ,

Module-5	L3,L4,L5	8Hours

Sentence Classification using Convolutional Neural Networks , Dialogue Generation with LSTMs , Applications of Dynamic Memory Networks in NLP , Recent Research in NLP using Deep Learning: Factoid Question Asnwering, similar question detection, Dialogue topic tracking, Neural Summarization, Smart Reply

Course outcomes:	
CO1	Basics of Deep Learning
CO2	Understand TensorFlow and Reinforcement Learning.
CO3	Explain state vector machine
CO4	Explain RNN and Unsupervised Feature Learning
CO5	Explain Architecture of CNNs .

Reference Books:	
1.	Bengio, Yoshua, Ian J. Goodfellow, and Aaron Courville,"Deep learning",An MIT Press book in preparation,2015
2.	Bengio, Yoshua," Learning deep architectures for AI " . Foundations and trends in Machine Learning 2.1,2009: 1127

CO-PO Mapping

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

High-3, Medium-2, Low-1

Course Title	Block Chain Technology	Semester	VII
Course Code	MVJ20CD733	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	3(L : T : P :: 3 : 0 : 0)	Total	100
Credits	3	Exam. Duration	3 Hours

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

- Understand how blockchain systems (mainly Bitcoin and Ethereum) work.
- To securely interact with them.
- Design, build, and deploy smart contracts and distributed applications.

Module-1	L1,L2	8Hrs.
Distributed Database, Two General Problem, Byzantine General problem and Fault Tolerance, Hadoop Distributed File System, Distributed Hash Table, ASIC resistance, Turing Complete. Cryptography: Hash function, Digital Signature - ECDSA, Memory Hard Algorithm, Zero Knowledge Proof.		
Module-2	**L2,L3**	**8 Hrs.**
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.		
Module-3	**L3,L4**	**8Hrs.**
Nakamoto consensus, Proof of Work, Proof of Stake, Proof of Burn, Difficulty Level, Sybil Attack, Energy utilization and alternate., Introducing modeling language for business resources and transactions, Introduction to key concepts related to smart contracts, accounts, transaction events, patterns and examples		
Module-4	**L3,L4,L5**	**8 Hrs.**
History, Distributed Ledger, Bitcoin protocols - Mining strategy and rewards, Ethereum - Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Sidechain, Namecoin		
Module-5	**L3,L4,L5**	**8 Hrs.**
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., Overview of how IoT can benefit from Blockchain implementation		

Course outcomes:	
CO1	Learn design principles of Bitcoin and Ethereum and Nakamoto consensus.
CO2	Explain the Simplified Payment Verification protocol.
CO3	Interact with a blockchain system by sending and reading transactions.
CO4	Design, build, and deploy a distributed application.
CO5	Evaluate security, privacy, and efficiency of a given blockchain system.

Text Books:	
1	"Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction,",Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder,Princeton University Press,July 19, 2016
2	"Mastering Bitcoin: Unlocking Digital Cryptocurrencies" ,Antonopoulos

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

High-3, Medium-2, Low-1

Course Title	Business Intelligence	Semester	VII
Course Code	MVJ20CD734	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	3 (L : T : P :: 3 : 0: 0)	Total	100
Credits	3	Exam. Duration	3 Hours

Course objective is to:

- Explain the complete life cycle of BI/Analytical development
- Explain the various project activities
- Explain the Differences in Database Design Philosophies
- Illustrate technology and processes associated with Business Intelligence framework
- Business View of Information technology Applications

Module -1	L1,L2,L3	8 Hours
Development Steps, BI Definitions, BI Decision Support Initiatives, Development Approaches, Parallel Development Tracks, BI Project Team Structure, Business Justification, Business Divers, Business Analysis Issues, Cost – Benefit Analysis, Risk Assessment, Business Case Assessment Activities, Roles Involved In These Activities, Risks Of Not Performing Step, Hardware, Middleware, DBMS Platform, Non Technical Infrastructure Evaluation.		
Module -2	**L1,L2,L3**	**8 Hours**
Managing The BI Project, Defining And Planning The BI Project, Project Planning Activities, Roles And Risks Involved In These Activities, General Business Requirement, Project Specific Requirements, Interviewing Process.		
Module - 3	**L1,L2,L3**	**8 Hours**
Differences in Database Design Philosophies, Logical Database Design, Physical Database Design, Activities, Roles And Risks Involved In These Activities, Incremental Rollout, Security Management, Database Backup And Recovery.		
Module-4	**L1,L2,L3**	**8 Hours**
Growth Management, Application Release Concept, Post Implementation Reviews, Release Evaluation Activities, The Information Asset and Data Valuation, Actionable Knowledge – ROI, BI Applications, The Intelligence Dashboard.		
Module-5	**L1,L2,L3**	**8 Hours**

Business View of Information technology Applications: Business Enterprise excellence, Key purpose of using IT, Type of digital data, basics of enterprise reporting, BI road ahead	
Course outcomes:	
CO1	Understand the complete life cycle of BI/Analytical development
CO2	Explain the various project activities
CO3	Illustrate the Differences in Database Design Philosophies
CO4	Illustrate technology and processes associated with Business Intelligence framework
CO5	Understand Business View of Information technology Applications
Text/Reference Books:	
1.	Larissa T Moss and ShakuAtre"Business Intelligence Roadmap : The Complete Project Lifecycle for Decision Support Applications" Addison Wesley Information Technology Series 2003.
2.	R N Prasad, SeemaAcharya" Fundamentals of Business Analytics" Wiley India 2011.
3.	David Loshin" Business Intelligence: The Savvy Manager's Guide" Morgan Kaufmann
4.	Brian Larson" Delivering Business Intelligence with Microsoft SQL Server 2005" McGraw Hill 2006
5.	Lynn Langit" Foundations of SQL Server 2008 Business Intelligence" Apress 2011
CIE Assessment:	
CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests Quizzes/mini tests (4 marks) Mini Project / Case Studies (8 Marks) Activities/Experimentations related to courses (8 Marks)	
SEE Assessment:	
Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus. Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students have to answer five full questions. One question must be set from each unit. The duration of examination is 3 hours.	

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

High-3, Medium-2, Low-1

Course Title	Natural Language Processing	Semester	VII
Course Code	MVJ20CD741	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	3 (L : T : P :: 3 : 0 : 0)	Total	100
Credits	3	Exam. Duration	3 Hours

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

- Expose students to the concepts of n-grams and Language Modelling with n-gram
- Expose students to the Natural Language Processing pipeline
- Expose students to the Information Extraction problems and end to end Natural Language Generation problems as applications of Natural Language Processing

Module-1	L1,L2	8Hrs.

Text Normalization, Morphology and Finite State Transducer: Concept/ Types of Ambiguity
in Natural Language Processing, Empirical Laws: Zipf's Law, Heap's Law. Text Normalization: Content and Function Words, Type vs. Token, Unix Tools for Crude Tokenization and Normalization, Word Tokenization and Normalization, Lemmatization and Stemming, Sentence Segmentation. Morphology and Finite State Transducers: Survey of English Morphology, Finite State Morphological Parsing, Combining FST Lexicon and Rules, Lexicon - Free FST - The Porter Stemmer, Human Morphological Parsing

Module-2	L2,L3	8 Hrs.

N-Grams, Edit Distance and Language Modelling: n-grams, Evaluating Language Models - Perplexity, Generalization and Zeros, Smoothing - Kneser-Ney Smoothing, Web and Stupid Back Off, Perplexity's Relation to Entropy. Spelling Correction and Noisy Channel: Noisy Channel Model, Real World Spelling Error, Minimum Edit Distance Algorithm, Improved Edit Models. Word Classes and Part-of-Speech (POS) Tagging: English Word Classes, Penn Tagsets for English, Rule-Based Part-of-Speech Tagging, Transformation-Based Tagging, POS Tagging using Hidden Markov Model, Maximum Entropy Model and Conditional Random Fields, Neural Language Models with Deep Artificial Neural Network

Module-3	L3,L4	8Hrs.

Parsing: Context Free Grammar. Syntactic Parsing: Ambiguity Presented By Parse Trees, CKY Parsing, Chart Parsing and Earley Parser. Partial Parsing: Chunking. Statistical Parsing: Probabilistic Context Free Grammar, Probabilistic CKY Parsing of PCFG, Problems with PCFG, Probabilistic Lexicalized PCFG. Introduction to Dependency Parsing: Dependency Relations, Dependency Formalisms, Dependency Tree Banks, Evaluating Parsers.		
Module-4	**L3,L4,L5**	8 Hrs.
Semantics - Lexical semantics: Word Senses and Relations Between Word Senses, WordNet: A Database of Lexical Relations, Word Sense Disambiguation - Overview, Supervised Word Sense Disambiguation, WSD - Dictionary and Thesaurus Methods, Semi- Supervised WSD, Unsupervised Word Sense Induction. Word Similarity or Semantic Relatedness Based On Thesaurus: Resnik Similarity, Lin Similarity, Jiang-Conrath Distance, Extended Gloss Overlap And Extended Lesk Method. Lexicons For Sentiment and Affect Extraction: Available Sentiment Lexicons, Using Wordnet Synonyms And Antonyms - Sentiwordnet, Supervised Learning of Word Sentiments, Using Lexicon For Sentiment Recognition, Lexicons For Emotions And Other Affective States.		
Module-5	**L3,L4,L5**	8 Hrs.
Information Retrieval, Natural Language Generation and Neural Network Methods for Natural Language Processing - Information retrieval: Information Extraction vs. Retrieval, Information Extraction Sub-Problems, Named Entity Recognition - Practical NER Architectures. Natural Language Generation: An Architecture, Question Answering System - IR Based Factoid Question Answering, Knowledge Based Question Answering, IBM's Watson, Dialogue System And Chatbot - Rule Based And Corpus Based Chatbots.		

Course outcomes:	
CO1	Implement meaningful course or research projects using current Natural Language Processing technology
CO2	Analyze the natural language text.
CO3	Define the importance of natural language.
CO4	Understand the concepts Text mining.
CO5	Illustrate information retrieval techniques

Text Books:	
1	Daniel Jurafsky and James H Martin, "Speech and Natural Language Processing"http://web.stanford. edu/~jurafsky/slp3/,3rd Edition Draft
2	Yoav Goldberg "Neural Network Methods for Natural Language Processing",Morgan and Claypool Publishers

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

High-3, Medium-2, Low-1

Course Title	Neural Network	Semester	VII
Course Code	MVJ20CD742	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	3(L : T : P :: 3 : 0 : 0)	Total	100
Credits	3	Exam. Duration	3 Hours

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

- To provide the student with the basic understanding of neural networks fundamentals
- To demonstrate programs, related algorithms
- To Design the required and related systems.

Module-1	L1,L2	8Hrs.

Neural Network Basics

Classical AI and Neural Networks, characteristics of neural networks, Historical perspective, Thebiological inspiration, models of artificial neuron & activation functions, Artificial Neuron Model andLinear Regression, Nonlinear Activation Units and Training of artificial neural networks.

Module-2	L2,L3	8 Hrs.

Learning Mechanisms: Gradient Descent Algorithm, Learning Mechanisms-Hebbian, Competitive, Boltzmann, Universal function approximation. Single Layer and Multi layerPerceptrons: Representation of perceptron, Linear separability, Perceptron Learning, Single-Layer Perceptions

Module-3	L3,L4	8Hrs.

Unconstrained Optimization: Gauss-Newton's Method, Linear Least Squares Filters, Least Mean Squares Algorithm , Perceptron Convergence Theorem , Back Propagation Algorithm, Practical Consideration inBack Propagation Algorithm Training of single layer and multi-layer, back propagation training algorithm, Applications of back propagation,

Module-4	L3,L4,L5	8 Hrs.

Solution of Non-Linearly Separable Problems Using MLP, Heuristics For Back-Propagation, Multi- Class Classification Using Multi-layered Perceptrons. Associative Memory Networks:- Associative Memory Model, Conditions for perfect Recall in Associative memory, Radial Basis Function Networks: Introduction ,Separability and Interpolation, Learning Mechanisms in RBF, Comparison Between MLP and RBF.

Module-5	L3,L4,L5	8 Hrs.
Introduction to Principal Components and Analysis, Dimensionality reduction Using PCA, Hebbian- Based Principal Component Analysis. Self OrganizingMaps :Introduction to Self Organizing Maps, Cooperative and Adaptive Processes in SOM, Vector-Quantization Using SOM, Competitive learning, Maxican Hat networks.		
Course outcomes:		
CO1	Identify and describe Neural Network techniques in building intelligent machines	
CO2	Apply Neural Network models to handle uncertainty and solve engineering problems.	
CO3	Recognize the feasibility of applying a Neuro-Fuzzy model for a particular problem	
CO4	solve practical problems via implementation of neural network techniques via simulation	
CO5	design single and multi-layer feed-forward neural networks	

Text Books:	
1	"Neural Networks, fuzzy Logic, and Genetic Algorithms" ,Rajasekaran&VijayalakhmiPai ,Pearson,2011
2	"Principles of Soft Computing", Sivanandam, DeepaWiley,2014

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

High-3, Medium-2, Low-1

Course Title	Data Visualization	Semester	VII
Course Code	MVJ20CD743	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	3 (L : T : P :: 3 : 0 : 0)	Total	100
Credits	3	Exam. Duration	3 Hours

Course objective is to:

- Understanding R for data science
- Learn about requirement of data analysis
- Can understand how machine learning algorithm works
- How to visualize the data
- Real world data analysis

Module -1	L1,L2,L3	8 Hours

What You Will Learn – What You Won't Learn – Prerequisites – Running R Code.
Data Visualization: Introduction – First Steps – Aesthetic mapping – Common Problems – Facets – Geometric Objects – Statistical Transformations – Position adjustments – Coordinate systems – Layered Grammar of Graphics.
Workflow Basics: Coding Basics – What's in a name? – Calling Functions – Exercises.
Data Transmission: Introduction – Filter rows with filter() – Arrange rows with arrange() – Select Columns with select() – Add new variables with mutate() – Grouped summaries with summarise() – Grouped mutates.
Workflow: Scripts.
Application: Data visualization can be used in storytelling of insight obtained from Bigdata.
Video Link:
https://nptel.ac.in/courses/111/104/111104100/

Module -2	L1,L2,L3	8Hours

Exploratory Data Analysis: Introduction – Questions – Variation – Covariation – Patterns and models.
Introduction: What is Data science? Big Data and Data Science Hype – Getting Past the Hype – Why Now: Datafication– The Current Landscape – A Data science Profile – Thought Experiment: Meta-Definition – What is a Data Scientist, Really? In Academia – In Industry
Application: Banking, Health care, Transport, Manufacturing, Agriculture etc
Video Link:

https://www.digimat.in/nptel/courses/video/106106179/L08.html		
Module - 3	**L1,L2,L3**	**8 Hours**
Statistical Thinking in the Age of Big Data – Exploratory Data Analysis – The Data Science Process – Thought Experiment: How Would you Simulate Chaos? Algorithms: Machine Learning Algorithms – Three Basic Algorithms – Exercise: Basic Machine Learning Algorithms – Summing It All Up – Though Experiment: Automated Statistician. Application: Recommendation Systems(You tube) Video Link: https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-cs28/		
Module-4	**L1,L2,L3**	**8Hours**
Thought Experiment: Learning by Example – Naïve Bayes – Fancy It Up: Laplace Smoothing – Comparing Naïve Bayes to K-NN – Sample Code in Bash – Scraping the Web: API and Other Tools – Jake's Exercise: Naïve Bayes for Article Classification. Data Visualization and Fraud Detection: Data Visualization History - What Is Data Science, Redux? - A Sample of Data Visualization Projects - Mark's Data Visualization Projects - Data Science and Risk - Data Visualization at Square - Ian's Thought Experiment - Data Visualization for the Rest of Us Application: Spam filter can be applied to get rid of unwanted spam messages in Email and SMS. Video Link: https://www.youtube.com/watch?v=9YXojHh_ZPY		
Module-5	**L1,L2,L3**	**8 Hours**
Social Network Analysis at Morning Analytics - Social Network Analysis - Terminology from Social Networks - Thought Experiment – Morning side Analytics - More Background on Social Network Analysis from a Statistical Point of View - Data Journalism Data Engineering: MapReduce, Pregel, and Hadoop Application: To find out the trending news for the day, Trending hash tags in face book or Twitter Video Link: https://www.youtube.com/watch?v=uEFbdGlSAfQ		
Practical Experiments: YouTube Data Analysis Machine Learning algorithms – Hands-On Training Share Market Analysis - Hands-On Training Fraud Analysis of Trade document using Data Science Identifying Revenue drop from customer behavior pattern in Banking Industry		

Course outcomes:	
CO1	R programming for data science.
CO2	Analyze the data.
CO3	Machine learning algorithms.
CO4	Visualize the different data with different form.
CO5	Interpret, analytic and visualize read world data.
Text/Reference Books:	
1.	Hadley Wickham and Garrett Grolemund , R for Data Science, Publisher: O'Reilly Media
2.	Cathy O'Neil and Rachel Schutt, Doing Data Science Straight Talk from the Frontline, Publisher: O'Reilly Media
3.	Ricardo Anjoleto Farias, Nataraj Dasgupta, Vitor Bianchi Lanzetta, Hands-On Data Science with R, O'reilly, 2018.

CIE Assessment:

CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests
Quizzes/mini tests (4 marks)
Mini Project / Case Studies (8 Marks)
Activities/Experimentations related to courses (8 Marks)

SEE Assessment:

Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.
Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students have to answer five full questions. One question must be set from each unit. The duration of examination is 3 hours.

CO-PO Mapping

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

CO4	3	3	2	2	3					2		
CO5	3	3	3	2	3					2		

High-3, Medium-2, Low-1

Course Title	Cyber Security, Law & Ethics	Semester	VII
Course Code	MVJ20CD744	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	3 (L : T : P :: 3 : 0 : 0)	Total	100
Credits	3	Exam. Duration	3 Hours

Course objective is to:

- Explain the fundamental definitions of different security issues.
- Familiarize cybercrimes happening with mobile and wireless devices.
- Use cybercrime tools to analyze the security gaps.
- Familiarize with different OSI layers and security aspects.
- Explain legal aspects and Indian IT Act.

Module-1	L1,L2,L3	8Hours

Syllabus Content:
Cybercrime definition and origins of the world, Cybercrime and information security, Classifications of cybercrime, Cybercrime and the Indian ITA 2000, A global Perspective on cybercrimes, How criminal plan the attacks, Social Eng., Cyber fraud vs. Cybercrime Cyber stalking, Cybercafe and Cybercrimes, Botnets, Attack vector, Cloud computing.
Application:
security services that are invoked at the interface between an application
Video Link:
https://www.youtube.com/watch?v=gfFKuiZ9Y7s

Module-2	L1,L2,L3	8 Hours

Syllabus Content:
Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Devices-Related Security Issues, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.
Application:
the usage of small wireless mobile devices such as PDAs, Blackberrys and smartphones
Video Link:

https://www.youtube.com/watch?v=frM_7UMD_-A		
Module-3	L1,L2,L3	8 Hours
Syllabus Content: Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Steganography, DoS Attacks, SQL Injection, Buffer Over Flow, Attacks on Wireless Networks, Phishing, Identity Theft (ID Theft), Case Study. Application: Application-level gateway Video Link: https://www.youtube.com/watch?v=6MvRi2Gqh_Y		
Module-4	L1,L2,L3	8 Hours
Syllabus Content: Historical Background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyberforensics and Digital Evidance, Forensics Analysis of Email, Digital Forensics Lifecycle, Chain of Custody Concept, Network Forensics, Approaching a Computer Forensics Investigation, Setting of a Computer Forensics Laboratory: Understanding the Requirements, Computer Forensics and Steganography, Relevance of the OSI 7 Layer Model to the Computer Forensics and Social Networking Sites: The Security/Privacy Threats, Forensics Auditing, Anti Forensics. Application: Application of Digital Forensics With increasing digital crime in each branch Video Link: https://www.youtube.com/watch?v=2ESqwX3qb94		
Module-5	L1,L2,L3	8Hours
Syllabus Content: Cyber law: The Indian Context, The Indian IT Act, Digital Signature and the Indian IT Act, Amendments to the Indian IT Act, Cybercrime and Punishment, Cyber law, Technology and Students: Indian Scenario. Application: Case IV: Ownership of Program Video Link: https://www.youtube.com/watch?v=ZFHCZt5VnMs		

Hands on Experiments:
Cyber fraud vs Cybercrime stalking, Cybercafé and Cybercrimes. Mobile Devices: Security Implementation for organizations. Phishing, Password cracking, Dos Attacks. Cyber forensics and digital Evidence.

Course outcomes:	
CO1	Understand Cybercrime and Cyber offenses
CO2	Explain cybercrime happening with Mobile and Wireless Devices.
CO3	Analyze cybercrimes using different tools and methods.
CO4	Cyber forensics and Digital forensics
CO5	Legal aspects of cybercrimes.

Text/Reference Books:	
1.	"Cyber Security", Nina Godbole, Sunit Belapure, Wiley India, New Delhi, 2011.
2.	"Information Systems Security", Nina Godbole, Wiley India, New Delhi, 2017.
3.	"Cyber Security & Global Information Assurance", Kennetch J. Knapp, Information Science Publishing, 2009.
4.	"Cryptography and Network Security", William Stallings, Pearson Publication, 2005.
5.	"Cyber Security", Avantika Yadav, Narosa Publishing, 2017.

CIE Assessment:
CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests Quizzes/mini tests (4 marks) Mini Project / Case Studies (8 Marks) Activities/Experimentations related to courses (8 Marks)
SEE Assessment:
Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus. Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students have to answer five full questions.

One question must be set from each unit. The duration of examination is 3 hours.

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

High-3, Medium-2, Low-1

Course Title	Open Elective II-Principles of OS	Semester	VII
Course Code	MVJ20CD751	CIE	50
Total No. of Contact Hours	40(L : T : P :: 3 : 0 : 0)	SEE	50
No. of Contact Hours/week	3	Total	100
Credits	3	Exam. Duration	3 Hours

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

- Provide an understanding on the various components of an Operating System.
- The course focuses on fundamental problems and optimal solutions for resource management in operating systems such as process, disk and memory management.
- The course will introduce design principles and trade-offs in the design of Operating Systems.

Module-1	L1,L2	8Hrs.
Overview of Operating Systems: Role, purpose, design issues of modern OSes., Assembly Level Machine Organization : Von Neumann Machine, X86 Assembly Instructions, Heap, Stack, Code Subroutine Calls, I/O and Interrupts Operating System Principles: Processes, Process Control, Threads, Process Control Blocks, Process States, Interrupts, Context-Switching		
Module-2	**L2,L3**	**8 Hrs.**
CPU scheduling, scheduling policies, deadlines, real-timeConcerns Case Study : Windows and Linux Inter-Process Communication; Process Synchronization, Critical Solution Problem and Solutions; Deadlocks Threads, pthreads interface		
Module-3	**L3,L4**	**8Hrs.**
Introduction to Storage Technologies, Memory Hierarchy, Cache Memories Memory Management: Memory Partitioning, Paging, Segmentation, Combined Paging and Segmentation Working Sets and Thrashing; Latencies, Caching, Locality, Cache Consistency Dynamic Memory Management, Garbage Collection		
Module-4	**L3,L4,L5**	**8 Hrs.**
Rationale for protection and predictable performance, levels of indirection Methods for implementing Virtual Memory, Paging and Virtual Memory Virtual Machines: Virtual File Systems, Virtual Devices and I/O Hypervisors, Sandboxes, Emulators.		

Module-5	L3,L4,L5	8 Hrs.
Files : metadata, operations, organization, etc. ; File Access and Security Concerns File Storage Management, Root File system,Disk Allocation Methods; Free Space Management Techniques. File System Partitioning; Virtual Filesystems; Memory Mapped Files, Journaling and Log Structured File Systems.		
Course outcomes:		
CO1	Recognize the important computer system resources and the role of operating system in their management policies and algorithms.	
CO2	Understand various scheduling algorithms.	
CO3	To familiar with principles of deadlock and its prevention. To understand the concepts of file system interface.	
CO4	Identify use and valuate the storage management policies with respect to different storage Management technologies	
CO5	Identify various issues of Linux Operating System	

Text Books:	
1	"Operating Systems:Internals and DesignPrinciples",WilliamStallings ,Prentice Hall, 2012,ISBN-13: 978-0-13-230998-1,7th Edition-2012
2	"Computer Systems: A Programmer's Perspective", 2nd Edition, AddisonWesley, ISBN 97801361080473,BryantandO'Hallaron,2010

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

High-3, Medium-2, Low-1

Course Title	OPEN ELECTIVE II: Information & Network Security	Semester	VII
Course Code	MVJ20CD752	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	3(L : T : P :: 3 : 0 : 0)	Total	100
Credits	3	Exam. Duration	3 Hours

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

- To understand the fundamentals of Cryptography.
- To acquire knowledge on standard algorithms used to provide confidentiality, integrity and authenticity.
- To understand the various key distribution and management schemes.

Module-1	L1,L2	8Hrs.
Definitions & challenges of security, OSI security architecture, attacks & services. Cryptography & cryptanalysis. Classical encryption techniques, substitution techniques, transposition techniques. Block ciphers, DES, AES structure, multiple encryption-triple DES.		
Module-2	**L2,L3**	**8 Hrs.**
Number theory fundamentals, principles of pubic key crypto systems, RSA algorithm, Strength of RSA, Diffie-Hellman key exchange, Elliptic curve cryptography. Symmetric key distribution using symmetric and asymmetric encryptions, distribution of public keys, X.509 Certificates, PKI.		
Module-3	**L3,L4**	**8Hrs.**
Cryptographic hash functions, applications, security requirements, hash function based on block chaining, SHA-512. MAC, security requirements, HMAC, CMAC, key wrapping, Digital signatures.		
Module-4	**L3,L4,L5**	**8 Hrs.**
Remote user authentication, symmetric and asymmetric encryptions for user authentications, Kerberos, identity management & verification. Web security, Secure Socket Layer (SSL), Transport Layer Security (TLS), Secure Shell (SSH), HTTPS, E-mail security, PGP, S/MIME		

Module-5	L3,L4,L5	8 Hrs.
IP Security, Policy, encapsulating security payload, combining security association, internet key exchange. Wireless security, Security, IEEE 802.11i services, IEEE 802.11i phases of operation, discovery phase, Authentication phase, key management phase, and protected data transfer phase		

Course outcomes:	
CO1	Analyze the vulnerabilities in any computing system and hence be able to design a security solution.
CO2	Identify the security issues in the network and resolve it.
CO3	Evaluate security mechanisms using rigorous approaches, including theoretical
CO4	Compare and Contrast different IEEE standards and electronic mail security
CO5	Design security applications in the field of Information technology

Text Books:	
1	"Cryptography & Network Security- Principles and Practices" William Stallings ,Pearson Publishers Sixth Edition,2014
2	"Understanding cryptography" Christof Paar& Jan Pelz,Heidelberg [u.a.] Springer ,2014

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

High-3, Medium-2, Low-1

Course Title	Principles of Programming Language	Semester	VII
Course Code	MVJ20CD753	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	3 (L : T : P :: 3 : 0 : 0)	Total	100
Credits	3	Exam. Duration	3 Hours

Course objective is to:

- Learn constructs in a language.
- Understand data, data types, and basic statements and understand call-return Statements, ways of implementing them.
- Design a new construct/ language.
- Choose appropriate language for real world problem solving, based on the required features.
- Evaluate various language design features considering the programming paradigm.

Module -1	L1,L2,L3	8Hours

Reasons for Studying, Concepts of Programming Languages, Programming Domains, Language Evaluation Criteria, Influences on Language Design, Language Categories, Programming Paradigms – Imperative, Object Oriented, Functional Programming, Logic Programming, Programming Language Implementation – Compilation and Virtual Machines, Programming Environments. Names, Binding, Type Checking and Scopes: Names, Variables, Binding of Attributes to Variables, Type Bindings, Type Inferencing, Type Checking, Strong Typing

Application: Developing application or System Software's.

Video Link:

https://www.freecodecamp.org/news/what-exactly-is-a-programming-paradigm/

https://nptel.ac.in/courses/106/102/106102067/

Module -2	L1,L2,L3	8 Hours

Type Equivalence, Scope, Scope and Lifetime, Referencing Environments. Data types: Introduction, Primitives, Character, User Defined, Array, Associative, Record, Union, Pointer and Reference Types, Design and Implementation Issues Related to These Types, Names, Variable, Concept of Binding, Type Checking, Strong Typing, Type Compatibility,

Named Constants, Variable Initialization. Expressions and Statements: Short Circuit Evaluation, Mixed Mode Assignment, Assignment Statements, Cascading Operators. Application: Developing application or System Software's Video Link: https://www.digimat.in/nptel/courses/video/106102067/L40.html		
Module - 3	**L1,L2,L3**	**8Hours**
Statement Level, Compound Statements, Selection, Iteration, Unconditional Statements, Guarded Commands. Subprograms and Blocks: Fundamentals of Subprograms, Scope and Lifetime of Variable, Static and Dynamic Scope, Design Issues of Subprograms and Operations, Local Referencing Environments, Parameter Passing Methods, Overloaded Subprograms, Generic Subprograms, Parameters that are Subprogram Names. Application: Developing application or System Software's Video Link: https://www.digimat.in/nptel/courses/video/106102067/L22.html		
Module-4	**L1,L2,L3**	**8Hours**
Design Issues for Functions, User Defined Overloaded Operators, Co-Routines and Function Closures. Abstract Data types: Abstractions and Encapsulation, Introduction to Data Abstraction, Design Issues, Object Oriented Concepts with Reference to Java and Python. Application: Developing application or System Software's Video Link: https://nptel.ac.in/courses/106/105/106105153/		
Module-5	**L1,L2,L3**	**8Hours**
Exception handling: Exceptions, Specifications, Exception Propagation. Logic Programming Language: Introduction and Overview of Logic Programming, Basic Elements of Prolog, Application of Logic Programming. Functional Programming Languages: Introduction, Fundamentals of FPL, Applications of Functional Programming Languages and Exploration of the Features, Comparison of Functional and Imperative Languages. Application: Developing application or System Software's Video Link: https://nptel.ac.in/courses/106/105/106105191/ https://www.vssut.ac.in/lecture_notes/lecture1424085009.pdf		
Practical Experiments:		

- Programs on Array
- Programs on Function
- Programs on Control Structure
- Programs on overloaded operators
- Programs on Object Oriented Concepts with Reference to Java and Python.

Course outcomes:	
CO1	Choose a particular language for problem solving depending on the application domain.
CO2	Analyze and compare programming language concepts.
CO3	Analyze the implementation issues related to a language design.
CO4	Identify the language design features of any language and evaluate them.
CO5	Identify language features required for supporting various paradigms.

Text/Reference Books:	
1.	Concepts of Programming Languages", Robert W Sebesta, Pearson Education, 10th Edition, 2012
2.	Programming Language Pragmatics", Michael L Scott, Elsevier, 3rd Edition, 2009.
3.	Programming Languages Design and Implementation", Pratt, Zelkowitz, Prentice Hall/ Pearson Education, 4th Edition, 2001.

CIE Assessment:

CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests
Quizzes/mini tests (4 marks)
Mini Project / Case Studies (8 Marks)
Activities/Experimentations related to courses (8 Marks)

SEE Assessment:

Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.
Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students have to answer five full questions.

One question must be set from each unit. The duration of examination is 3 hours.												
CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	3					2		
CO2	3	3	3	2	3					2		
CO3	3	3	2	2	3					2		
CO4	3	3	2	2	3					2		
CO5	3	3	3	2	3					2		

High-3, Medium-2, Low-1

Course Title	Machine Learning	Semester	VII
Course Code	MVJ20CD754	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	3 (L : T : P :: 3: 0: 0)	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

Module-1	L1,L2,L3	8 Hours

Syllabus Content:
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.
Application:
Designing Supervised Learning Problems
Video Link:
http://web4.cs.ucl.ac.uk/staff/D.Barber/textbook/091117.pdf
http://www.cs.huji.ac.il/~shais/UnderstandingMachineLearning/index.html

Module-2	L1,L2,L3	8Hours

Syllabus Content
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.

Application:
Designing Supervised Learning Problems
Video Link:
http://web4.cs.ucl.ac.uk/staff/D.Barber/textbook/091117.pdf
http://www.cs.huji.ac.il/~shais/UnderstandingMachineLearning/index.html

Module-3	L1,L2,L3	8Hours
Syllabus Content: Artificial Neural Networks: Introduction, Neural Network representation, Appropriate problems, Perceptron's, Backpropagation algorithm Application: Solving real time problems like Automatic Vehicle Design etc. Video Link: https://becominghuman.ai/understanding-decision-trees-43032111380f https://onlinecourses.science.psu.edu/stat507/node/59/		
Module-4	**L1,L2,L3**	**8Hours**
Syllabus Content: Bayesian Learning: Introduction, Bayes theorem, Bayes theorem and concept learning, ML and LS error hypothesis, ML for predicting probabilities, MDL principle, Naive Bayes classifier, Bayesian belief networks, EM algorithm. Application: Cognitive detection, Sentimental analysis Video Link: https://onlinecourses.science.psu.edu/stat507/node/59/ https://towardsdatascience.com/naive-bayes-in-machine-learning-f49cc8f831b4		
Module-5	**L1,L2,L3**	**8Hours**
Syllabus Content: Evaluating Hypothesis: Motivation, estimating hypothesis accuracy, Basics of sampling theorem, General approach for deriving confidence intervals, Difference in error of two hypothesis, Comparing learning algorithms. Instance Based Learning: Introduction, k-nearest neighbor learning, locally weighted regression, radial basis function, cased-based reasoning, Reinforcement Learning: Introduction, Learning Task, Q Learning . **Application:** Understanding and designing Unsupervised learning Problems. **Video Link:** https://becominghuman.ai/understanding-decision-trees-43032111380f https://towardsdatascience.com/naive-bayes-in-machine-learning-f49cc8f831b4		
Course outcomes:		
CO1	Identify the problems for machine learning. And select the either supervised, unsupervised or reinforcement learning.	
CO2	Explain theory of probability and statistics related to machine learning	

CO3	Investigate concept learning, ANN, Bayes classifier, k nearest neighbor, Q, Question
CO4	Identify and apply Machine Learning algorithms to solve real world problems
CO5	Perform statistical analysis of machine learning techniques.
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

CIE Assessment:
CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests Quizzes/mini tests (4 marks) Mini Project / Case Studies (8 Marks) Activities/Experimentations related to courses (8 Marks)
SEE Assessment:
Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus. Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students have to answer five full questions. One question must be set from each unit. The duration of examination is 3 hours.

CO-PO Mapping

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

High-3, Medium-2, Low-1

Course Title	IoT Lab	Semester	VII
Course Code	MVJ20CDL76	CIE	50
Total No. of Contact Hours	20	SEE	50
No. of Contact Hours/week	3 (L : T : P :: 0 : 1 : 2)	Total	100
Credits	2	Exam. Duration	3 Hours

Course objective is to:

- Install IoT applications and handling IoT tools.
- Illustrate the methods of deploying smart objects and connect hem to network
- Compare different application protocols for IoT
- Inter the role of Data Analytics and Security in IoT.
- Identify sensor technologies for sensing real world entities and understand the role of IoT in various domains of Industry

Sl No	Experiment Name	RBT Level	Hours
1.	Create a program that blinks the LED on the Arduino development board.	L2	3
2.	Create a program for displaying data from the sensor in regular intervals.	L1	3
3.	Create a program that Arduino can able to communicate with the attached PC.	L3	3
4.	Write a program to interface LDR (Module) Sensor using Arduino Uno	L1	3
5.	Temperature monitoring using LM35 and Arduino.	L1	3
6.	MQ2 sensor data accessing using Arduino.	L2	3
7.	Ultrasonic sensor interfacing with Arduino.	L3	3
8.	Create a program to blink LED in the following manner:- 1010, 1100, 1001,1011	L2	3
9.	Playing Piezo buzzer using Arduino.	L1	3
10.	Display “hello world” message using arduino LCD display.	L3	3

Course outcomes:

CO1	Learn and understand IoT applications and tools
CO2	Interfacing sensor and Actuator with Arduino and Raspberry Pi development modules
CO3	Implementing IoT device by interfacing communication modules
CO4	Developing real time examples using Python
CO5	Elaborate the use of smart objects for designing smart systems

CIE Assessment:
Regular Lab work :20 Record writing :5 Lab Tests(Minimum 2 tests shall be conducted for 15 marks and average of two will be taken) Viva 10 marks
SEE Assessment:
Examinations will be conducted for 100 marks and scaled-down to 50. The weightage shall be, Write-up : 20 marks Conduction : 40 marks Analysis of results : 20 marks Viva : 20 marks

Course Title	Big Data & Hadoop Lab	Semester	VII
Course Code	MVJ20CDL77	CIE	50
Total No. of Contact Hours	30	SEE	50
No. of Contact Hours/week	3 (L : T : P :: 0 : 1 : 2)	Total	100
Credits	2	Exam. Duration	3 Hours

Course objective is to:

- Understand Hadoop Distributed File system and examine MapReduce Programming
- Explore Hadoop tools and manage Hadoop with Ambari
- Appraise the role of Business intelligence and its applications across industries

Sl No	Experiment Name	RBT Level	Hours
1	Performing Data Operations	L3	3
2	Hadoop MapReduce Program	L3	3
3	Monitoring and Debugging a Hadoop MapReduce Job	L3	3
4	Hadoop Streaming	L3	3
5	Program related to Hbase,	L3	3
6	Program related to Hive	L3	3

Course outcomes:

CO1	Master the concepts of HDFS and MapReduce framework
CO2	Investigate Hadoop related tools for Big Data Analytics and perform basic Hadoop Administration
CO3	Recognize the role of Business Intelligence, Data warehousing and Visualization in decision making
CO4	Infer the importance of core data mining techniques for data analytics
CO5	Compare and contrast different Text Mining Techniques

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

CO1	3	3	3	2	3	0	0	0	0	2	0	0
CO2	3	3	3	2	3	0	0	0	0	2	0	0
CO3	3	3	2	2	3	0	0	0	0	2	0	0
CO4	3	3	2	2	3	0	0	0	0	2	0	0
CO5	3	3	3	2	3	0	0	0	0	2	0	0

High-3, Medium-2, Low-1

Course Title	Project Phase - 1	Semester	VII
Course Code	MVJ20CDP78	CIE	50
Total No. of Contact Hours	-	SEE	-
No. of Contact Hours/week	(L : T : P :: 0 : 0 : 4)	Total	50
Credits	2	Exam. Duration	3Hrs

Course objective :

- To support independent learning and innovative attitude.
- To guide to select and utilize adequate information from varied resources upholding ethics.
- To guide to organize the work in the appropriate manner and present information (acknowledging the sources) clearly.
- To develop interactive, communication, organisation, time management, and presentation skills.
- To impart flexibility and adaptability.
- To inspire independent and team working.
- To expand intellectual capacity, credibility, judgement, intuition.
- To adhere to punctuality, setting and meeting deadlines.
- To instil responsibilities to oneself and others.
- To train students to present the topic of project work in a seminar without any fear, face audience confidently, enhance communication skill, involve in group discussion to present and exchange ideas

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

Course outcomes:

- Present the project and be able to defend it.
- Make links across different areas of knowledge and to generate, develop and evaluate ideas and information so as to apply these skills to the project task.
- Habituated to critical thinking and use problem solving skills.
- Communicate effectively and to present ideas clearly and coherently in both the written and oral forms.
- Work in a team to achieve common goal.
- Learn on their own, reflect on their learning and take appropriate actions to improve it

CIE procedure for Mini - Project:

CIE procedure for Project Work Phase - 1:

1. (i)Single discipline:The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide.
2. The CIE marks awarded for the project work phase -1, shall be based on the evaluation of project work phase -1 Report, project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded for the project report shall be the same for all the batch mates.
3. (ii) Interdisciplinary:Continuous Internal Evaluation shall be group wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable.

The CIE marks awarded for the project work phase -1, shall be based on the evaluation of project work phase -1 Report, project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded for the project report shall be the same for all the batch mates.

Course Title	PROJECT PHASE - II	Semester	VIII
Course Code	MVJ20CDP81	CIE	50
Total No. of Contact Hours	15	SEE	50
No. of Contact Hours/week	(L : T : P :: : 0 : 16)	Total	100
Credits	8	Exam. Duration	3Hrs

Course objective :

- To support independent learning and innovative attitude.
- To guide to select and utilize adequate information from varied resources maintaining ethics.
- To guide to organize the work in the appropriate manner and present information (acknowledging the sources) clearly.
- To develop interactive, communication, organisation, time management, and presentation skills.
- To impart flexibility and adaptability.
- To inspire independent and team working.
- To expand intellectual capacity, credibility, judgement, intuition.
- To adhere to punctuality, setting and meeting deadlines.
- To instil responsibilities to oneself and others.
- To train students to present the topic of project work in a seminar without any fear, face audience confidently, enhance communication skill, involve in group discussion to present and exchange ideas

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

Course outcomes:

- Present the project and be able to defend it.
- Make links across different areas of knowledge and to generate, develop and evaluate ideas and information so as to apply these skills to the project task.
- Habituated to critical thinking and use problem solving skills
- Communicate effectively and to present ideas clearly and coherently in both the written and oral forms.
- Work in a team to achieve common goal.

- Learn on their own, reflect on their learning and take appropriate actions to improve it.

CIE procedure for Mini - Project:

CIE procedure for Project Work Phase - 2:

1. Single discipline:The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide.
2. The CIE marks awarded for the project work phase -2, shall be based on the evaluation of project work phase -2 Report, project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded for the project report shall be the same for all the batch mates.
3. (ii) Interdisciplinary:Continuous Internal Evaluation shall be group wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable.

The CIE marks awarded for the project work phase -2, shall be based on the evaluation of project work phase -2 Report, project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded for the project report shall be the same for all the batch mates.

Course Title	INTERNSHIP	Semester	VIII
Course Code	MVJ20CD182	CIE	50
Total No. of Contact Hours	Industrial Oriented	SEE	50
No. of Contact Hours/week	-	Total	100
Credits	3	Exam. Duration	3 Hours

Course Objective:

- To get the field exposure and experience
- To apply the theoretical concept in field application
- To prepare the comparison statement of difference activities

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

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

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

Scheme of Evaluation :

Internal Marks: The Internal marks (50 marks) evaluation shall be based on midterm and final presentation of the activities undertaken during the internship, to a panel comprising internship guide, a senior faculty from the department and head of the department. Each student should submit the internship report at the end of semester with internship certificate.

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

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

High-3, Medium-2, Low-1

Course Title	SEMINAR	Semester	VIII
Course Code	MVJ20CDS83	CIE	50
Total No. of Contact Hours	-	SEE	50
No. of Contact Hours/week	-	Total	100
Credits	1	Exam. Duration	3Hrs

Course objective :

- The objective of the seminar is to inculcate self-learning, face audience confidently, enhance communication skill, involve in group discussion and present and exchange ideas.
- Each student, under the guidance of a Faculty, shall choose, preferably, a recent topic of his/her interest relevant to the Course of Specialization.
- Carryout literature survey, organize the seminarcontent in a systematic manner.
- Prepare the report with own sentences, avoiding cut and paste act.
- Type the matter to acquaint with the use of Micro-soft equation and drawing tools or any such facilities.
- Present the seminar topic orally and/or through power point slides.
- Answer the queries and involve in debate/discussion.
- Submit typed report with a list of references.
- The participants shall take part in discussion to foster friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident

Course outcomes:

- Attain, use and develop knowledge in the field of engineering and other disciplines through independent learning and collaborative study.
- Identify, understand and discuss current, real-time issues.
- Improve oral and written communication skills.
- Explore an appreciation of the self in relation to its larger diverse social and academic contexts.
- Apply principles of ethics and respect in interaction with others

Evaluation Procedure:

- The CIE marks for the seminar shall be awarded (based on the relevance of the topic, presentation skill, participation in the question and answer session and quality of

report) by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three teachers from the department with the senior most acting as the Chairman.

Marks distribution for CIE of the course:

- Seminar Report:50 marks
- Presentation skill:25 marks
- Question and Answer:25 marks

Course Title	CERTIFICATION	Semester	VIII
Course Code	MVJ20CDC84	CIE	-
Total No. of Contact Hours	-	SEE	-
No. of Contact Hours/week	-	Total	-
Credits	2	Exam. Duration	3 Hours

Course Objective:

- To inculcate self-learning, enhance the skill in different field of Engineering

Certification: Each student, under the guidance of a Faculty, is required to undergo online certification course minimum of 30 hours (number of courses is not limited) preferably, a recent topic of his/her interest. Each student should submit the Course details and Qualification Certificates at the end of semester.

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

CO1	Develop knowledge in different fields of Engineering
CO2	Develop the skills to enable life-long learning.