M.C.A

SYLLABUS

FROM THE ACADEMIC YEAR
2024 - 2025

M.C.A

First Year

Semester – I

Type of the Course	Title of the Course	Credits	No. of Hours
Core – I	Discrete Mathematics	4	5
Core – II	Python Programming	4	5
Core – III	Linux and Shell Programming	4	4
Core Lab I	Python Programming Lab	3	4
Core Lab II	Linux and Shell Programming Lab	3	4
Elective – I	Advanced OS / Architecture and Frameworks / Data Engineering and Management	3	4
Elective – II	Advanced Computer Networks/Network Protocols/ Cryptography and Network Security	3	4
		24	**30**

Semester-II

Type of the Course	Title of the Course	Credits	No. of Hours
Core – IV	Advanced Java Programming	4	5
Core – V	Advanced Data Structures	4	5
Core Lab III	Advanced Java Programming Lab	3	4
Core Lab IV	Advanced Data Structures Lab	3	4
Elective – III	Artificial Intelligence and Machine Learning / Soft Computing / High Performance Computing	3	4
Elective – IV	Internet of Things / Solution Architecture / Software Development Technologies	3	4
Skill Enhancement Course – I	Web Development using PHP	2	4
		22	**30**

Second Year

Semester – III

Type of the Course	Title of the Course	Credits	No. of Hours
Core – VI	Dot NET Technologies	4	5
Core – VII	Big Data Analytics	4	4
Core – VIII	Mobile Computing	4	4
Core Lab V	Dot NET Technologies Lab	3	4
	Mini Project	6	6
Elective – V	Cyber Security / Block Chain Technologies / Computer Vision	3	4
Skill Enhancement Course – II	Social Networks	2	3
	Internship/ Industrial Visit/ Field Visit/ Research Knowledge Updation Activity	2	-
		28	**30**

Semester - IV

Title of the Course	Credits	No. of Hours
Project with Viva Voce	16	
Extension Activity	1	
	17	

Total Credits : 91

Theory:
Internal – 25 Marks (Assignment – 5, Seminar – 5 &Test – 15), External – 75 Marks

Lab:
Internal – 50 Marks, External – 50 Marks

Internship: The students should submit certificate of attendance from the industry along with report at the end of III semester for external evaluation.

Industrial Visit/ Field Visit/ Research Knowledge Updation Activity: A report should be submitted at the end of III semester for external evaluation.

Internship/ Industrial Visit/ Field Visit/ Research Knowledge Updation Activity:

Internal – 50 Marks, External – 50 Marks

Mini Project & Project: Individual Project report should be submitted at the end of the semester for external evaluation.
Internal – 50 Marks, External – 50 Marks

Extension Activity : Individual report should be submitted at the end of IV semester for external evaluation.
Internal – 50 Marks, External – 50 Marks

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SYLLABUS

FROM THE ACADEMIC YEAR
2023 - 2024

M.C.A
Second Year

Semester – III

Type of the Course	Title of the Course	Credits	No. of Hours
Core – VII	Dot NET Technologies	4	5
Core – VIII	Big Data Analytics	4	4
Core – IX	Mobile Computing	4	4
Lab V	Dot NET Technologies Lab	3	4
	Mini Project	6	6
Elective – V	Cyber Security / Block Chain Technologies / Computer Vision	3	4
Skill Enhancement Course – II	Social Networks	2	3
	Internship/ Industrial Visit/ Field Visit/ Research Knowledge Updation Activity	2	-
		28	**30**

Semester - IV

Title of the Course	Credits	No. of Hours
Project with Viva Voce	14	
Extension Activity	1	
	15	

First Year – 48 Credits & Second Year – 43 Credits ,**Total Credits : 91**

Theory:
Internal – 25 Marks (Assignment – 5, Seminar – 5 &Test – 15), External – 75 Marks

Lab:
Internal – 50 Marks, External – 50 Marks

Internship: The students should submit certificate of attendance from the industry along with report at   the end of III semester for external evaluation.
Industrial Visit/ Field Visit/ Research Knowledge Updation Activity: A report should be submitted at the end of III semester for external evaluation.
Internship/ Industrial Visit/ Field Visit/ Research Knowledge Updation Activity:
Internal – 50 Marks, External – 50 Marks

Mini Project & Project: Individual report should be submitted at the end of the semester for external evaluation.
Internal – 50 Marks, External – 50 Marks

Extension Activity : Individual report should be submitted at the end of IV semester for external evaluation.
Internal – 50 Marks, External – 50 Marks

CORE COURSES

Discrete Mathematics

Course Objective

- To know the concepts of relations and functions
- To distinguish among different normal forms and quantifiers
- To solve recurrence relations and permutations & combinations
- To know and solve matrices, rank of matrix & characteristic equations
- To study the graphs and its types

Unit-I

Relations- Binary relations-Operations on relations- properties of binary relations in a set – Equivalence relations— Representation of a relation by a matrix -Representation of a relation by a digraph – **Functions**-Definition and examples-Classification of functions-Composition of functions-Inverse function

Unit-II

Mathematical Logic-Logical connectives -**Well formed formulas** – Truth table of well formed formula –Algebra of proposition –Quine's method- **Normal forms of well formed formulas**- Disjunctive normal form-Principal Disjunctive normal form-Conjunctive normal form-Principal conjunctive normal form-**Rules of Inference for propositional calculus** – **Quantifiers**- Universal Quantifiers- Existential Quantifiers

Unit-III

Recurrence Relations- Formulation -solving recurrence Relation by Iteration- solving Recurrence Relations-Solving Linear Homogeneous Recurrence Relations of Order Two- Solving Linear Non homogeneous Recurrence Relations. **Permutations**-Cyclic permutation- Permutations with repetitions- permutations of sets with indistinguishable objects- **Combinations**- Combinations with repetition

Unit-IV

Matrices- special types of matrices-Determinants- Inverse of a square matrix-Cramer's rule for solving linear equations-Elementary operations -Rank of a matrix-solving a system of linear equations-characteristic roots and characteristic vectors-Cayley-Hamilton Theorem-problems

Unit-V
Graphs -Connected Graphs -Euler Graphs- Euler line-Hamiltonian circuits and paths –planar graphs – Complete graph-Bipartite graph-Hyper cube graph-Matrix representation of graphs

Text book

1. N.Chandrasekaran and M.Umaparvathi, Discrete mathematics, PHI Learning Private Limited, New Delhi, 2010.

Reference Books

1. Kimmo Eriksson &Hillevi Gavel, Discrete Mathematics & Discrete Models, Studentlitteratur AB, 2015.
2. Kenneth H. Rosen Discrete Mathematics and applications, Mc Graw Hill, 2012

Course Outcomes

On the successful completion of the course, students will be able

CO1:	To understand the concepts of relations and functions distinguish among normal forms	K2	I O
CO2:	To analyze and evaluate the recurrence relations	K4, K5	H O
CO3:	To distinguish among various normal forms and predicate calculus	K5	H O
CO4:	To solve and know various types of matrices	K1	L O
CO5:	To evaluate and solve various types of graphs	K5	H O

K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create

Python Programming

Course Objectives:

- To acquire programming skills in core Python
- To learn Strings and function
- To develop object oriented skills in Python
- To comprehend various Python Packages
- To develop web applications using Django

Unit I

Introduction: Fundamental ideas of Computer Science **-** Strings, Assignment, and Comments - Numeric Data types and Character sets – Expressions – Loops and Selection Statements: Definite iteration: the for Loop - selection: if and if-else statements - Conditional iteration: the while Loop

Unit II

Strings and Text Files: Accessing Characters and substrings in strings - Data encryption -Strings and Number systems- String methods – Text - Lists and Dictionaries: Lists – Dictionaries – Design with Functions: A Quick review - Problem Solving with top-down Design - Design with recursive Functions - Managing a Program's namespace - Higher-Order Functions

Unit III

Design with Classes: Getting inside Objects and Classes – Data-Modeling Examples – Building a New Data Structure – The Two – Dimensional Grid - Structuring Classes with Inheritance and Polymorphism – Graphical User Interfaces - The Behavior of terminal-Based programs
and GUI-Based programs - Coding Simple GUI-Based programs - Windows and Window Components - Command Buttons and responding to events

Unit IV

Working with Python Packages: NumPy Library-Ndarray – Basic Operations – Indexing, Slicing and Iteration – Array manipulation - Pandas –The Series – The Data Frame - The Index Objects – Data Visualization with Matplotlib – The Matplotlib Architecture – pyplot – The Plotting Window – Adding Elements to the Chart – Line Charts – Bar Charts – Pie charts

Unit V

Django: Installing Django – Building an application – Project Creation – Designing the Data Schema - Creating an administration site for models - Working with Query Sets and Managers – Retrieving Objects – Building List and Detail Views

Text Book:

1. K.A. Lambert, "Fundamentals of Python: first programs", Second Edition, Cengage Learning, 2018 **(Unit - I, II and III)**
2. Fabio Nelli, "Python Data Analytics: With Pandas, NumPy, and Matplotlib", Second Edition, Kindle Edition, 2018 **(Unit - IV)**
3. Antonio Mele, "Django 3 By Example", Third Edition, 2020 **(Unit - V)**

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Comprehend the programming skills in python and develop applications using conditional branches and loop	
CO2	Create python applications with strings and functions	
CO3	Understand and implement the Object Oriented Programming paradigm with the concept of objects and classes, Inheritance and polymorphism	K1- K6
CO4	Evaluate the use of Python packages to perform numerical computations and data visualization	
CO5	Design interactive web applications using Django	

K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	M	S	M	S	S	S	S	M	S	S
CO2	S	S	S	M	S	S	S	S	S	S	M	S
CO3	S	M	S	S	M	S	M	S	S	M	S	S
CO4	S	S	S	S	S	S	S	M	S	S	M	S
CO5	S	S	S	S	S	S	S	S	S	M	M	S

S- Strong; M-Medium; L-Low

Linux and Shell Programming

Course Objectives

- To teach principles of operating system including File handling utilities, Basic Linux commands, Scripts and filters.
- To familiarize fundamentals of shell (bash), shell programming, pipes, Control structures, arithmetic in shell interrupt processing, functions, debugging shell scripts.
- To impart fundamentals of file concepts kernel support for file, File structure related system calls (file API's).
- To facilitate students in understanding Inter process communication, semaphore and shared memory.
- To explore real-time problem solution skills in Shell programming.

Unit-I

Basic bash Shell Commands: Interacting with the shell-Traversing the file system-Listing files and directories-Managing files and directories-Viewing file contents. **Basic Script Building:** Using multiple commands-Creating a script file-Displaying messages-Using variables-Redirecting input and output-Pipes-Performing math-Exiting the script. **Using Structured Commands:** Working with the if-then statement-Nesting ifs-Understanding the test command-Testing compound conditions-Using double brackets and parentheses-Looking at case.

(Book-1, Chapters: 3, 11, and 12)

Unit-II

More Structured Commands: Looping with for statement-Iterating with the until statement-Using the while statement-Combining loops-Redirecting loop output. **Handling User Input:** Passing parameters-Tracking parameters-Being shifty-Working with options-Standardizing options-Getting user input. **Script Control:** Handling signals-Running scripts in the background-Forbidding hang-ups -Controlling a Job-Modifying script priority-Automating script execution.

(Book-1, Chapters: 13, 14, and 16)

Unit-III

Creating Functions: Basic script functions-Returning a value-Using variables in functions-Array and variable functions-Function recursion-Creating a library-Using functions on the command line. **Writing Scripts for Graphical Desktops:** Creating text menus-Building text window widgets-Adding X Window graphics. **Introducing sed and gawk:** Learning about the sed Editor-Getting introduced to the gawk Editor-Exploring sed Editor basics.

(Book-1, Chapters: 17, 18, and 19)

Unit-IV

Regular Expressions: Defining regular expressions-Looking at the basics-Extending our patterns-Creating expressions. **Advanced sed:** Using multiline commands-Understanding the hold space-Negating a command-Changing the flow-Replacing via a pattern-Using sed in scripts-Creating sed utilities. **Advanced gawk:** Reexamining gawk-Using variables in gawk-Using structured commands-Formatting the printing-Working with functions.

(Book-1, Chapters: 20, 21, and 22)

Unit-V

Working with Alternative Shells: Understanding the dash shell-Programming in the dash shell-Introducing the zsh shell-Writing scripts for zsh. **Writing Simple Script Utilities:** Automating backups-Managing user accounts-Watching disk space. **Producing Scripts for Database, Web, and E-Mail:** Writing database shell scripts-Using the Internet from your scripts-Emailing reports from scripts. **Using Python as a Bash Scripting Alternative:** Technical requirements-Python Language-Hello World the Python way-Pythonic arguments-Supplying arguments-Counting arguments-Significant whitespace-Reading user input-Using Python to write to files-String manipulation.

 (Book-1, Chapters: 23, 24, 25, and Book-2, Chapter: 14)

Text Book:

1. Richard Blum, Christine Bresnahan, "Linux Command Line and Shell Scripting BIBLE", Wiley Publishing, 3rd Edition, 2015.**Chapters:** 3, 11 to 14, 16 to 25.
2. Mokhtar Ebrahim, Andrew Mallett, "Mastering Linux Shell Scripting", Packt Publishing, 2nd Edition, 2018. **Chapter:** 14.

Reference Books:

1. Clif Flynt, Sarath Lakshman, Shantanu Tushar, "Linux Shell Scripting Cookbook ", Packt Publishing, 3rd Edition, 2017.
2. Stephen G. Kochan, Patrick Wood, "Shell Programming in Unix, Linux, and OS X", Addison Wesley Professional, 4th Edition, 2016.
3. Robert Love, "Linux System Programming", O'Reilly Media, Inc, 2013
4. W.R. Stevens, "Advanced Programming in the UNIX environment", 2nd Edition, Pearson Education, 2013
5. Graham Glass, King Ables, " UNIX for Programmers and Users", 3rd Edition, Pearson Education, 2003

Course Outcomes

On the successful completion of the course, students will be able

CO1:	To understand, apply and analyze the concepts and methodology of Linux shell programming	K1-K6
CO2:	To comprehend, impart and apply fundamentals of control structure and script controls	K1-K6

CO3:	To understand, analyses and evaluate the functions, graphical desktop interface and editors	K1-K6
CO4:	To collaborate, apply and review the concepts and methodology of regular expression and advanced gawk	K1-K6
CO5:	To comprehend, use and illustrate the advance concepts such as alternate shell script, data connectivity and bash scripting using python	K1-K6

K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	-	S	L	-	M	M	M	M	S
CO2	S	S	M	-	S	L	-	M	M	M	M	S
CO3	S	S	M	-	S	L	-	M	M	S	S	S
CO4	S	S	M	-	S	L	-	M	M	M	M	S
CO5	S	S	M	-	S	L	-	M	M	M	M	S

S- Strong; M-Medium; L-Low

Python Programming Lab

Course Objectives:

This course enables the students:

- To master the fundamentals of writing Python scripts

- To create program using elementary data items

- To implement Python programs with conditionals and loops

- To use functions for structuring Python programs

- To develop web programming with Django

Implement the following in Python:

1. Program using elementary data items, lists, dictionaries and tuples
2. Program using conditional branches, loops
3. Program using functions
4. Program using classes and objects
5. Program using inheritance
6. Program using polymorphism
7. Program using Numpy
8. Program using Pandas
9. Program using Matplotlib
10. Program for creating dynamic and interactive web pages using forms

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Comprehend the programming skills in python and write scripts	
CO2	Create python applications with elementary data items, lists, dictionaries and tuples	
CO3	Implement the Object Oriented Programming concepts such as objects and classes, Inheritance and polymorphism	**K1- K6**
CO4	Assess the use of Python packages to perform numerical computations and perform data visualization	
CO5	Create interactive web applications using Django	

K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	M	S	S	S	S	S	S	M	S	S
CO2	S	S	S	S	S	S	S	S	S	S	M	S
CO3	S	S	S	S	S	S	M	S	S	M	L	S
CO4	S	S	S	S	S	S	S	M	S	S	S	S
CO5	S	S	S	S	L	S	M	S	S	M	M	S

S- Strong; M-Medium; L-Low

Linux and Shell Programming Lab

Course Objectives

- To enable the students to study and understand the efficiency of Linux shell script.
- To demonstrate the File Backup process.
- To develop and implement the shell script for GUI processing.
- To develop and implement the shell script for IPC and Networking.
- To demonstrate PostgreSQL.

List of Programs

1. Write a Shell Script program to calculate the number of days between two dates.
2. Write a Shell Script program to check systems on local network using control structures with user input.
3. Write a Shell Script program to check systems on local network using control structures with file input.
4. Write a Shell Script program to demonstrate the script control commands.
5. Write a Shell Script program to demonstrate the Shell script function.
6. Write a Shell Script program to demonstrate the Regular Expressions.
7. Write a Shell Script program to demonstrate the sed and awk Commands.
8. Write a Shell Script program to demonstrate the File Backup process through creating a daily archive location.
9. Write a Shell Script program to create a following GUI tools.

   a) Creating text menus

   b) Building text window widgets

10. Write a Shell Script program to demonstrate to connect a PostgreSQL database and performing CRUD operations.

Course Outcomes

On the successful completion of the course, students will be able to

CO1:	To understand, apply and analyze the concepts and methodology of Linux shell programming	K1-K6
CO2:	To comprehend, impart and apply fundamentals of control structure and script controls	K1-K6
CO3:	To understand, analyses and evaluate the functions, graphical desktop interface and editors	K1-K6

CO4:	To collaborate, apply and review the concepts and methodology of regular expression and advanced gawk	K1-K6
CO5:	To comprehend, use and analyze the advance concepts such as alternate shell script, dy and bash scripting using PostgreSQL	K1-K6

K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	-	S	-	-	-	M	-	-	-
CO2	S	S	S	-	S	-	-	-	M	-	-	-
CO3	S	S	S	-	S	-	-	-	M	S	S	S
CO4	S	S	S	-	S	-	-	-	M	-	-	-
CO5	S	S	S	-	S	-	-	-	M	S	S	S

S- Strong; M-Medium; L-Low

Advanced Java Programming

Course Objectives:

The main objectives of this course are to

1. Enable the students to learn the basic functions, of advanced java programming.
2. Provide knowledge on concepts needed for distributed Application Architecture.
3. Learn JDBC, Servlet packages, JQuery, Java Server Pages and JAR file format.

Unit:1 Basics of Java

Java Basics Review: Components and event handling–Threading concepts– Networking features –Media techniques

Unit:2 Remote Method Invocation

Remote Method Invocation-Distributed Application Architecture Creating stubs and skeletons-Defining Remote objects- Remote Object Activation- Object Serialization-Java Spaces

Unit:3 Database
Java in Databases-JDBC principles–database access-Interacting-database search–Creating multimedia databases – Database support in web applications

Unit:4 Servlets

Java Servlets: Java Servlet and CGI programming- A simple java Servlet- Anatomy of a java Servlet-Reading data from a client-Reading http request header-sending data to a client and writing the http response header-working with cookies

Java Server Pages: JSP Overview-Installation-JSP tags-Components of   a JSP page-Expressions- Scriptlets-Directives-Declarations-A complete example

Unit:5 Advanced Techniques

JAR file format creation–Internationalization–Swing Programming–Advanced java techniques

Text Books
1.JimKeogh,"The Complete ReferenceJ2EE",TataMcGrawHill Publishing Company Ltd,2010.
2.Campione, Walrath and Huml, "The Java Tutorial", Addison Wesley,1999.

Reference Books

1. Jamie Jaworski, "Java Unleashed", SAMS Tech media Publications,1999.

2. David Sawyer McFarland,"Java Script and JQuery-The Missing Manual" Oreilly Publications,3rd Edition,2011.

3. Deitel and Deitel, "Java How to Program", Third Edition, PHI/Pearson Education Asia.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

https://www.javatpoint.com/servlet-tutorial

https://www.tutorialspoint.com/java/index.htm

https://onlinecourses.nptel.ac.in/noc19_cs84/preview

Expected Course Outcomes:		
On the successful completion of the course, student will be able to		
1	Understand the advanced concepts of Java Programming	K1,K2
2	Understand JDBC and RMI concepts	K2,K3
3	Apply and analyze Java in Database	K3,K4
4	Handle different event in java using the delegation event model, event listener and class	K5
5	Design interactive applications using Java Servlet, JSP and JDBC	K5,K6
K1-Remember;**K2**-Understand;**K3**-Apply; **K4**-Analyze;**K5**-Evaluate; **K6**-Create		

Mapping with Programming Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	M	M	M	S
CO2	S	S	S	S	S	S	S	M	S	S
CO3	S	S	S	S	S	S	S	M	S	S
CO4	S	S	S	S	S	S	S	M	S	S
CO5	S	S	S	S	S	S	S	M	S	S

Advanced Data Structures

Course Objectives:

- To get a clear understanding of various ADT structures.
- To understand how to implement different ADT structures with real-time scenarios.
- To analyze the various data structures with their different implementations.
- To get an idea of applying right models based on the problem domain.
- To realize, and understand how and where to implement modern data structures with Python language.

Unit-I

Abstract Data Types: Introduction-Date Abstract Data Type-Bags-Iterators. **Arrays**: Array Structure-Python List-Two Dimensional Arrays-Matrix Abstract Data Type. **Sets, Maps:** Sets-Maps- Multi-Dimensional Arrays.

Unit-II

Algorithm Analysis: Experimental Studies-Seven Functions-Asymptotic Analysis. **Recursion:** Illustrative Examples-Analyzing Recursive Algorithms-Linear Recursion- Binary Recursion-Multiple Recursion.

Unit-III

Stacks, Queues, and Deques: Stacks- Queues- Double-Ended Queues Linked. **Lists:** Singly Linked Lists-Circularly Linked Lists-Doubly Linked Lists. **Trees:** General Trees-Binary Trees-Implementing Trees-Tree Traversal Algorithms.

Unit-IV

Priority Queues: Priority Queue Abstract Data Type- Implementing a Priority Queue- Heaps-Sorting with a Priority Queue. **Maps, Hash Tables, and Skip Lists:** Maps and Dictionaries-Hash Tables- Sorted Maps-Skip Lists-Sets, Multisets, and Multimaps.

Unit-V

Search Trees: Binary Search Trees-Balanced Search Trees-AVL Trees-Splay Trees. **Sorting and Selection:** Merge sort-Quick sort-Sorting through an Algorithmic Lens- Comparing Sorting Algorithms-Selection. **Graph Algorithms:** Graphs-Data Structures for Graphs-Graph Traversals-Shortest Paths-Minimum Spanning Trees.

Text book:

1. Rance D. Necaise, "Data Structures and Algorithms Using Python", John Wiley & Sons, 2011. (Unit – 1) **Chapters:** 1, 2, 3.
2. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, "Data Structures and Algorithms in Python", John Wiley & Sons, 2013. (Unit – 2, 3, 4, and 5) **Chapters:** 3 to 12, and 14.

Reference books:

1. Dr. Basant Agarwal; Benjamin Baka, "Hands-On Data Structures and Algorithms with Python: Write complex and powerful code using the latest features of Python 3.7", Packt Publishing, 2018.
2. Magnus Lie Hetland, "Python Algorithms: Mastering Basic Algorithms in the Python Language", Apress, 2014.

Course Outcomes:

On the successful completion of the course, students will be able to

CO1	Understand various ADT concepts	
CO2	Familiar with implementation of ADT models with Python language and understand how to develop ADT for the various real-time problems	
CO3	Apply with proper ADT models with problem understanding	K1-K6
CO4	Apply and analyze right models based on the problem domain	
CO5	Evaluate modern data structures with Python language	

K1- Remember, K2 - Understand, K3 - Apply, K4 - Analyze, K5 - Evaluate, K6 -Create

Mapping with Programme Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M	L	L	L	L	S	S	S	L	M	M
CO2	S	M	S	M	M	L	L	L	L	L	M	M
CO3	S	S	S	L	L	L	M	M	M	M	M	L
CO4	S	S	S	L	L	L	M	M	M	L	L	L
CO5	S	S	S	L	M	M	S	S	S	S	M	L

L - Low, M- Medium, S - Strong

Course Objectives:

The main objectives of this course are to

1 Enable the students to implement the simple programs using JSP, JAR
2 Provide knowledge on using Servlets, Applets
3 Introduce JDBC and navigation of records
4 Understand RMI & its implementation
5 Introduce to Socket programming

LIST OF PROGRAMS

1. Display a welcome message using Servlet.
2. Design a Purchase Order form using Html form and Servlet.
3. Develop a program for calculating the percentage of marks of a student using JSP.
4. Design a Purchase Order form using Html form and JSP.
5. Prepare a Employee pay slip using JSP.
6. Write a program using JDBC for creating a table, Inserting, deleting records and list out the records.
7. Write a program using Java servlet to handle form data.
8. Write a simple Servlet program to create a table of all the headers it receives along with their associated values.
9. Write a program in JSP by using session object.
10. Write a program to build a simple Client Server application using RMI.
11. Create an apple for a calculator application.
12. Program to send a text message to another system and receive the text message from the system (use socket programming).

Expected Course Outcomes:		
On the successful completion of the course, student will be able to:		
1	Understand to the implement concepts of Java using HTML forms ,JSP & JAR	K1,K2
2	Must be capable of implementing JDBC and RMI concepts	K3,K4
3	Able to write Applets with Event handling mechanism	K4,K5
4	To Create interactive web based applications using servlets and jsp	K5,K6
K1-Remember;**K2**-Understand;**K3**-Apply;**K4**-Analyze;**K5**-Evaluate; **K6**-Create		

Mapping with Programming Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	S	M	M	S	M
CO2	S	S	S	S	S	S	S	M	S	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S

Advanced Data Structures Lab

Course Objectives:

- To understand Stack , Queue and Doubly Linked ADT structures.

- To implement different ADT structures with real-time scenarios.

- To analyze the recursion concepts.

- To apply different sorting and tree techniques.

- To implement modern data structures with Python language.

Implement the following problems using Python 3.4 and above

1. Recursion concepts.
      - i) Linear recursion
      - ii) Binary recursion.
2. Stack ADT.
3. Queue ADT.
4. Doubly Linked List ADT.
5. Heaps using Priority Queues.
6. Merge sort.
7. Quick sort.
8. Binary Search Tree.
9. Minimum Spanning Tree.
10. Depth First Search Tree traversal.

Course Outcome:

On the successful completion of the course, students will be able to

CO1	Strong understanding in various ADT concepts	
CO2	To become a familiar with implementation of ADT models	
CO3	Apply sort and tree search algorithms	K1-K6
CO4	Evaluate the different data structure models	
CO5	Learn how to develop ADT for the various real-time problems	

K1- Remember, K2 - Understand, K3 - Apply , K4 - Analyze, K5 - Evaluate, K6 -Create

Mapping with Programme Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M	L	L	L	L	S	S	M	M	S	S
CO2	S	M	S	M	M	L	S	M	S	L	M	M
CO3	S	S	S	L	L	L	M	M	M	M	S	L
CO4	S	S	S	M	M	S	M	M	S	S	S	L
CO5	S	S	S	S	L	M	S	M	M	M	M	L

L - Low, M- Medium, S - Strong

Dot Net Technologies

Course Objectives:

- To get strong understanding of .NET Framework and C# programming.
- To get advanced programming skills in Visual Studio with C# language.
- To get advanced methods of manipulating data using Microsoft SQL Server.
- To get clear idea of how to developing real-time standalone, web applications using .NET Technologies.
- To get clear understanding and get experience in Microsoft Azure.

Unit-I

Introducing C#: .NET Framework - C# language - Visual Studio 2017 - Writing a C# Program: Visual Studio 2017 Development Environment - Console Applications - Desktop Applications - Variables and Expressions: Basic C# Syntax - Basic C# Console Application Structure - Variables - Expressions - Flow Control: Boolean Logic – Branching - Looping.

Unit-II

More About Variables: Type Conversion - Complex Variable Types - String Manipulation – Functions: Defining and Using Functions - Variable Scope - The Main Function - Struct Functions - Overloading Functions - Using Delegates - Debugging and Error Handling: Debugging in Visual Studio - Error Handling - Introduction to Object Oriented Programming: Object-Oriented Programming - OOP Techniques - OOP in Desktop Applications.

Unit-III

Defining Classes: Class Definitions in C# - System .Object - Constructors and Destructors - OOP Tools in Visual Studio - Class Library Projects - Interfaces Versus Abstract Classes - Struct Types - Shallow Copying Versus Deep Copying - Defining Class Members: Member Definitions - Additional Class Member Topics - Interface Implementation - Partial Class Definitions - Partial Method Definitions - The Call Hierarchy Window - Basic Cloud Programming: Cloud, Cloud Computing, and the Cloud Optimized Stack - Cloud Patterns and Best Practices - Using Microsoft Azure C# Libraries to Create a Storage Container - Creating an ASP.NET 4.7 Web Site That Uses the Storage Container - Advanced Cloud Programming and Deployment: Creating an ASP.NET Web API - Deploying and Consuming an ASP.NET Web API on Microsoft Azure - Scaling an ASP.NET Web API on Microsoft Azure.

Unit-IV

.NET Standard and .NET Core: Cross-Platform Basics and Must Know Terms – Need of .NET - Referencing and Targeting Frameworks - .NET Core - Building and Packaging a.NET Standard Library - Building a .NET Core Application with Visual Studio - Porting from .NET Framework to .NET Core - ASP.NET and ASP.NET Core: Overview of Web Applications – Use of ASP.NET - ASP.NET Web Forms - Creating ASP.NET Core Web Applications – Files: File Classes for Input and Output – Streams - Monitoring the File System - XML and JSON: XML Basics - JSON Basics - XML Schemas - XML Document Object Model - Converting XML to JSON - Searching XML with XPath.

Unit-V

LINQ: LINQ to XML - LINQ Providers - LINQ Query Syntax - LINQ Method Syntax - Ordering Query Results - Understanding the order by Clause - Querying a Large Data Set -Using Aggregate Operators - Using the Select Distinct Query - Ordering by Multiple Levels -Using Group Queries - Using Joins – Databases: Using Databases - Installing SQL Server - Express - Entity Framework - Code First Database - Finding the Database - Navigating Database Relationships - Handling Migrations - Creating and Querying XML from an Existing Database - Universal Apps: Windows Universal Apps - App Concepts and Design - App Development - Common Elements of Windows Store Apps - Windows Store.

Text book:

1. Benjamin Perkins, Jacob Vibe Hammer, Jon D. Reid, "Beginning C#7 Programming with Visual Studio 2017", Wiley Publishing, 2018.Chapters: 1 to 10, 16 to 23, and 25.

Reference books:

1. Nagel, Christian, "Professional C 7 and .NET Core 2.0   ", Wrox Publishing, 2018.
2. Mehboob Ahmed Khan, Ovais, "C# 7 and .NET Core 2.0 High Performance", Packt Publishing, 2018

Course Outcomes:

On the successful completion of the course, students will be able to,

CO1	Understand and learn .NET Framework and C# .NET	K1, K2	LO
CO2	Apply the concepts to develop the applications for real-time problem in C# .NET and ASP .NET	K3	IO
CO3	Analyse the feasibility of using .NET for real time problems	K4,K5	HO

K1- Remember, K2 - Understand, K3 - Apply, K4 - Analyze, K5 - Evaluate, K6 -Create

 Mapping with Programme Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	L	M	L	L	L	-	-	-	-	-	L
CO2	S	M	L	M	M	L	-	L	-	L	-	L
CO3	S	S	S	M	M	L	-	L	-	L	-	L

L - Low, M- Medium, S - Strong

Big Data Analytics

Course Objectives

- To introduce big data tools & Information Standard formats.
- To understand the basic concepts of big data.
- To learn Hadoop, HDFS and Map Reduce concepts.
- To teach the importance of NoSQL.
- To explore the big data tools such as Hive, HBase and Pig.

UNIT I

Big Data and Analytics: Classification of Digital Data: Structured Data- Semi Structured Data and Unstructured Data.

Introduction to Big Data: Characteristics – Evolution – Definition - Challenges with Big Data - Other Characteristics of Data - Big Data - Traditional Business Intelligence versus Big Data - Data Warehouse and Hadoop.

Environment Big Data Analytics: Classification of Analytics – Challenges - Big Data Analytics important - Data Science - Data Scientist - Terminologies used in Big Data Environments – Basically Available Soft State Eventual Consistency - Top Analytics Tools

UNIT II

Technology Landscape: NoSQL, Comparison of SQL and NoSQL, Hadoop -RDBMS Versus Hadoop - Distributed Computing Challenges – Hadoop Overview - Hadoop Distributed File System - Processing Data with Hadoop - Managing Resources and Applications with Hadoop YARN - Interacting with Hadoop Ecosystem

UNIT III

Mongodb and Map reduce Programming: MongoDB: Mongo DB - Terms used in RDBMS and Mongo DB - Data Types - MongoDB Query Language.

MapReduce: Mapper – Reducer – Combiner – Partitioner – Searching – Sorting – Compression

UNIT IV

Hive: Introduction – Architecture - Data Types - File Formats - Hive Query Language Statements – Partitions – Bucketing – Views - Sub- Query – Joins – Aggregations - Group by and Having – RCFile - Implementation - Hive User Defined Function - Serialization and Deserialization.

UNIT V

Pig: Introduction - Anatomy – Features – Philosophy - Use Case for Pig - Pig Latin Overview - Pig Primitive Data Types - Running Pig - Execution Modes of Pig - HDFS Commands - Relational Operators - Eval Function - Complex Data Types - Piggy Bank - User-Defined Functions - Parameter Substitution – Diagnostic Operator - Word Count Example using Pig - Pig at Yahoo! - Pig Versus Hive

Text Book:

1. Seema Acharya, Subhashini Chellappan, "Big Data and Analytics", Wiley Publications, First Edition,2015

Reference Book:

1. Judith Huruwitz, Alan Nugent, Fern Halper, Marcia Kaufman, "Big data for dummies", John Wiley & Sons, Inc. (2013)
2. Tom White, "Hadoop The Definitive Guide", O'Reilly Publications, Fourth Edition, 2015
3. Dirk Deroos, Paul C. Zikopoulos, Roman B. Melnky, Bruce Brown, Rafael Coss, "Hadoop For Dummies", Wiley Publications, 2014
4. Robert D.Schneider, "Hadoop For Dummies", John Wiley & Sons, Inc. (2012)
5. Paul Zikopoulos, "Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data, McGraw Hill, 2012 Chuck Lam, "Hadoop In Action", Dreamtech Publications, 2010

Course Outcomes

On the successful completion of the course, students will be able to

CO1:	To understand, illustrate and evaluate the concepts and techniques of Data Science, Big Data Analytics and its tools	K1-K6
CO2:	To collaborate, apply and review the computing for big data in Hadoop, and NoSQL environment.	K1-K6
CO3:	To comprehend, implement and review the concepts of data science and big data analytics projects using MapReduce, and MongoDB	K1-K6
CO4:	To understand, use and analyze the concepts of big data analytics projects using HIVE database.	K1-K6
CO5:	To illustrate, develop and review the concepts of PIG database in Hadoop environment.	K1-K6

K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5 Evaluate, K6- Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	-	-	-	-	L	-	-	-	-	-	-
CO2	S	-	M	-	M	L	-	-	-	-	-	-
CO3	S	-	S	-	S	L	-	-	-	S	S	S
CO4	S	-	S	-	S	L	-	-	-	S	S	S
CO5	S	-	S	-	S	L	-	-	-	S	S	S

S- Strong; M-Medium; L-Low

Mobile Computing

Course Objective:

- To introduce the concepts of wireless devices with signal, Antenna, Radio Frequencies, Signal Propagation.
- To introduce wireless communication and networking principles, that support connectivity to cellular networks, Wireless LAN, GSM, CDMA.
- To introduce the WAP Architecture, MANET and Routing

Unit-I

Introduction – Applications – History of wireless communication – A Simplified reference model - Wireless transmission – Frequencies for radio transmission – Regulations – Signals –Antennas - Signal propagation: Path loss of radio signals - Additional signal propagation effects - Multi-path propagation – Multiplexing –Modulation Chapters: 1, 2.1 to 2.6

Unit-II

Spread spectrum – Direct sequence spread spectrum – Frequency hopping spread spectrum – Cellular systems. Medium access control: Hidden and exposed terminals – Near and far terminals – SDMA, FDMA, TDMA, Fixed TDM, Classical Aloha, slotted Aloha, Carrier sense multiple access – Reservation TDMA – Multiple access with collision avoidance – Polling – CDMA – Spread Aloha multiple access. Chapters: 3.1 to 3.3, 3.4.1 to 3.4.4, 3.4.7 to 3.4.9, 3.5.1

Unit-III

GSM - Mobile services – System architecture – Radio interface – Protocols – Localization and calling – Handover – Security – New Data services. UMTS and IMT-2000 - Satellite Systems: Applications – Basics – Routing – Localization – Handover. Chapters: 3.6, 4.1.1 to 4.1.8, 4.4, 5.2 to 5.6

Unit-IV

Wireless LAN: Infrared vs. radio transmission – Infrastructure and ad-hoc network – IEEE 802.11 – System architecture – Protocol architecture – Physics layer – Medium access control layer – MAC management – Blue tooth. Mobile network layer: Mobile IP: Goals, assumptions and requirements – entities and terminology – packet delivery – Agent discovery – Registration – Tunneling and encapsulation Recent technologies Chapters: 7.1 to 7.3.5, 7.5, 8.1.1 to 8.1.6

Unit-V

WAP: Architecture – wireless datagram Protocol, Wireless transport layer security, Wireless transaction protocol, Wireless session protocol, Wireless application environment, Mobile ad-hoc networks – MANET Characteristics – Classification of MANETs, Routing of MANETs, Proactive Routing Protocol - DSDV, Reactive Routing Protocols – DSR, AODV.Chapter10.3.1 to 10.3.6 (Text Book 2- 6.1, 6.2, 6.4, 6.5, 6.6)

Text Books:

1. Jochen Schiller, "Mobile Communications", Second Edition, Pearson Education, 2013.
2. Kum Kum Garg, "Mobile Computing Theory and Practice", Pearson Education, 2014.

Reference Books:

1. Rifaat A. Dayen, "Mobile Data & Wireless LAN Technologies", Prentice Hall,1997.
2. Steve Mann and Scoot Schibli, "The Wireless Application Protocol", John Wiley & Inc., 2000.

Course Outcomes:

On the successful completion of the course, students will be able to

CO1	Understand the basic concepts of Mobile and Wireless Communication	K1, K2	LO
CO2	Understand the basic concepts of Spread Spectrum. Analysing the concepts of Medium Access Control.	K3	IO
CO3	Analyse the concepts of Global System for Mobile Communication and Satellite Communications. Understanding the basic concepts of Wireless LAN	K4	HO
CO4	Understand the basic concepts of Wireless LAN. Evaluate the performance of Mobile Network Layer	K2, K5	HO
CO5	Understand the basic concepts of Wireless Application Protocol and create a Mobile App with real time application. Analysing the concepts of Routing Protocols in MANET	K2, K4, K6	HO

K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5- Evaluate, K6- Create

Mapping Course outcomes with Programme outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	L	-	-	-	-	-	-	-	-	-	-	-
CO2	S	M	M	M	M	-	M	-	-	-	-	-
CO3	S	M	M	M	M	-	M	-	-	L	-	M
CO4	S	M	M	M	M	-	M	-	-	L	-	M
CO5	S	M	M	M	M	-	M	-	-	L	-	M

S- Strong; M-Medium; L-Low

Dot Net Technologies Lab

Course Objectives:

- To get strong understanding of .NET Framework and C# programming.
- To get advanced programming skills in C# .NET OOPs Concepts
- To get advanced methods of manipulating data using Microsoft SQL Server.
- To get clear idea of how to developing real-time standalone, web applications using ASP .NET.
- To get clear understanding and get experience in Microsoft Azure.

Implement the following problems using C# with Visual Studio 2017

1. Demonstrate method overloading and method overriding
2. Class and Objects
3. Multilevel Inheritance
4. Interfaces
5. Demonstrate multiple type of Exceptions
6. Azure Storage Container Using the Microsoft Azure Storage Client Library
7. Demonstrate Read and Write a Data using Random Access Files
8. Employee management database using LINQ
9. Student management system using ASP.NET
10. Demonstrates simple Universal App.

Course Outcomes:

- Get a strong understanding of .NET Visual Studio platform
- Become a strong knowledge in C# .NET.
- Getting real-time application developing using .NET Cloud Technologies.

ELECTIVE COURSES

SEMESTER I

Advanced Operating Systems

Course Objectives:

The main objectives of this course are to:

1. Enable the students to learn the different types of operating systems and their functioning.
2. Gain knowledge on Distributed Operating Systems
3. Gain insight into the components and management aspects of real time and mobile operating systems.
4. Learn case studies in Linux Operating Systems

Unit:1 Basics of Operating Systems

Basics of Operating Systems: What is an Operating System? – Main frame Systems –Desktop Systems – Multiprocessor Systems – Distributed Systems – Clustered Systems –Real-Time Systems – Handheld Systems – Feature Migration – Computing Environments -Process Scheduling – Cooperating Processes – Inter Process Communication- Deadlocks –Prevention – Avoidance – Detection – Recovery.

Unit:2 Distributed Operating Systems

Distributed Operating Systems: Issues – Communication Primitives – Lamports Logical Clocks –Deadlock handling strategies – Issues in deadlock detection and resolution-distributed file systems –design issues

Unit:3 Real Time Operating System

Realtime Operating Systems : Introduction – Applications of Real Time Systems – Basic Model of Real Time System – Characteristics – Safety and Reliability - Real Time Task Scheduling

Unit:4 Handheld System

Operating Systems for Handheld Systems: Requirements–Technology Overview–Handheld Operating Systems–Palm OS-Symbian Operating System-Android–Architecture of android– Securing handheld systems

Unit:5 Case Studies

Case Studies : Linux System: Introduction – Memory Management – Process Scheduling – Scheduling Policy - Managing I/O devices – Accessing Files- iOS :Architecture and SDK Framework - Media Layer - Services Layer - Core OS Layer - File System.

Text Books

1. Abraham Silberschatz; Peter Baer Galvin; Greg Gagne, "Operating System Concepts", Seventh Edition, John Wiley & Sons, 2004.

2. Mukesh Singhal and Niranjan G. Shivaratri, "Advanced Concepts in Operating Systems –Distributed, Database, and Multiprocessor Operating Systems", Tata McGraw-Hill, 2001.

Reference Books

1	Rajib Mall, "Real-Time Systems: Theory and Practice ",Pearson Education, India,2006
2	Pramod Chandra P. Bhatt, An introduction to operating systems, concept and practice, PHI,Third edition, 2010.
3	Daniel.P.Bovet&MarcoCesati,"UnderstandingtheLinuxkernel",3rdedition,O" Reilly,2005
4	Neil Smyth, "iPhone iOS 4Development Essentials–Xcode", Fourth Edition, Payload media,2011.

Related Online Contents [MOOC, SWAYAM,NPTEL, Websites etc.]

1   https://onlinecourses.nptel.ac.in/noc20_cs04/preview
2   https://www.udacity.com/course/advanced-operating-systems--ud189
3   https://minnie.tuhs.org/CompArch/Resources/os-notes.pdf

Expected Course Outcomes:

Understand the design issues associated with operating systems	K1,K2
Master various process management concepts including scheduling, deadlocks and distributed file systems	K3,K4
Prepare Real Time Task Scheduling	K4,K5
Analyze Operating Systems for Handheld Systems	K5
Analyze Operating Systems like LINUX and IOS	K5,K6
K1-Remember;**K2**-Understand;**K3**-Apply;**K4**-Analyze;**K5**-Evaluate; **K6**-Create	

Mapping with Programming Outcomes									
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	S	S	S	M	M	M	M
CO2	S	M	S	S	S	S	S	M	S	M
CO3	S	M	S	S	S	S	S	M	S	M
CO4	S	M	S	S	S	S	S	M	S	M
CO5	S	M	S	S	S	S	S	M	S	M

*S-Strong; M-Medium; L-Low

Architecture and Frameworks

Course Objectives

- To understand the basics, benefits and purpose of software architecture

- Understand the quality attributes to fulfil the software requirements and relates the software with an organization

- Explore the design patterns, best practice and paradigms of efficient software development

- Understand the performance and security measures of software architecture

- Enable the developers to advance their carrier in software domain

Unit – I

Software architecture introduction – Importance of Software architecture –Software architecture consumers – Architect role - software architecture in an organization – Types of software architects – Software development methodologies – Project management – Office politics – Software risk management – Configuration management – Software product lines

Unit – II

Domain Knowledge – Developing business acumen – Domain-driven design – requirement engineering – requirement elicitation –Software Quality attributes: Maintainability – Usability –Availability – Portability – Interoperability - Testability

Unit – III

Software Architectures design – Importance - Top-down Versus bottom-up design approaches – Architectural drivers – Documenting the Software architecture design – Systematic approach - Attribute-driven design – Microsoft's technique for architecture and design –Architecture-centric design method – Architecture development method – Tracking the progress of the software architecture's design.

Unit – IV

Designing orthogonal software systems – Minimizing complexity – SOLID design principles – Software architecture patterns – layered – Event-driven architecture – Model-View patterns – Service-oriented architecture

Unit – V

Architecting Modern Applications.- Importance of Performance – Performance improvement - Server side caching – Web application performance – Database performance -Securing software systems – Threat modelling – Secure by design

Text Book

1. Joseph Ingeno, "Software Architect's Handbook" Packt Publishing 2018.

Reference books

1. Oliver Vogel, Indo Arnold, ArifChughtai and TImoKehrer, "Software Architecture" Springer-Verlag, 2011.
2. Ian Gorton, "Essential Software architecture", Second Edition, Springer, 2011
3. Len Bass, Paul Clements and Rick Kazman, "Software architecture in practice", Third edition, Addison-Wesley, 2013

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Understand, analyze and evaluate the purpose of Software architecture and development methodologies with consideration of risk management	K1-K6
CO2	Comprehend, apply and evaluate the domain knowledge for software development process and determine the impact of quality attributes.	K1-K6
CO3	Understand, track and examine the systematic approach for various software design models with effective document process	K1-K6
CO4	Illustrate and summarize the functions of orthogonal systems with complexity, design principles and design pattern for software architecture	K1-K6
CO5	Comprehend, analyze and evaluate the performance and security measures for Server, Web and Database applications in order to create the secure software systems for various domain applications	K1-K6

K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5- evaluate and K6- Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	S	-	L	M	S	M	M	L	S	-	-
CO2	M	S	-	M	M	L	S	S	M	M	S	-
CO3	S	M	-	S	S	M	S	M	M	S	M	-
CO4	S	M	L	S	M	L	S	L	S	M	S	M
CO5	M	S	M	L	S	L	M	S	L	S	-	M

S- Strong; M-Medium; L-Low

Data Engineering and Management

Course Objectives:

- To understand Data Management concepts
- To get brief knowledge on Data Modeling
- To analyze the techniques used in Distributed Databases
- To assess Distributed database and Business Modelling
- To get familiar with CRM tools

Unit-I

Database Development: Database architecture of an information system-Overview of the database development process-Conceptual data modeling-Relational data analysis-Roles of a data model-Physical database design. Data Management: Problems encountered without data management-Data management responsibilities-Data management activities-Roles within data management-Benefits of data management-Relationship between data management and enterprise

Unit-II

Corporate Data Modelling: Need for a corporate data model-Nature of a corporate data model- Develop a corporate data model - Corporate data model principles. Data Definition and Naming: Elements of a data definition-Data naming conventions. Data Quality: Issues associated with poor data quality-Causes of poor data quality-Dimensions of data quality-Data model quality-Improving data quality. Data Accessibility: Data security-Data integrity-Data recovery

Unit-III:

Use Of Packaged Application Software: Application software packages-Impact on data management. Distributed Data and Databases: Rationale for distributing data-Perfect distributed database system-Top down fragmentation and partitioning. Bottom up integration-The management of replication. Business Intelligence: Data ware housing-Multidimensional model of data-Standard reporting tools-Online analytical processing OLAP-Relational schema for a data warehouse.

Unit-IV:

CRM: Three main pillars of CRM. Getting To Know Your Customer: 360-degree client view. Utilizing Artificial Intelligence and Machine Learning in Your CRM Strategy: Evolution of AI-Current state of AI-Teaming up AI with people-Applying AI to your CRM solution-ethical aspects of AI-An example of AI in CRM processes.

Unit-V:

Cloud Versus On Premise Versus Hybrid: Factors influencing vendor selection-Hybrid deployment-what are your options. CRM Differentiators: It's not about the feature list; it's about the ecosystem-Fourth industrial revolution and CRM-AI and smart cloud-To cloud or not to cloud-Leveraging smart cloud into CRM-Big data-Social selling and advertising-Implementation tools-Sustainable CRM platform.

Advanced Computer Networks

Course Objectives:

The main objectives of this course are to:

Text Books:

1. Keith Gordon, "Principles of Data Management Facilitating Information Sharing", BCS Learning, 2013. (Chapters:1-5, 7,8,12,13,14)
2. Max Fatouretchi, "The Art of CRM", Packt Publishing, 2019.(Chapters: 1,2,5,8,9)

Reference Books:

1. Peter Ghavami, "Big Data Management_ Data Governance Principles for Big Data Analytics", De Gruyter, 2020.
2. Francis Buttle, Stan Maklan, Customer Relationship Management Concepts and Technologies, Routledge, 2019.

Course Outcome:

On the successful completion of the course, students will be able to,

Course Outcome	Description	Knowledge Level
CO1	Comprehend the Data Management concepts and analyse the relationship with the enterprise	K1- K6
CO2	Analyse Data Modelling concepts and assess its quality	
CO3	Understand and implement business modelling techniques	
CO4	Evaluate the use of Artificial Intelligence and Machine Learning in CRM	
CO5	Develop CRM applications in cloud	

K1- Remember, K2 - Understand, K3 - Apply, K4 - Analyze, K5 - Evaluate, K6 -Create

Mapping with Programme Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	M	S	M	S	S	S	S	M	S	S
CO2	S	S	S	M	S	S	S	S	S	S	M	S
CO3	S	M	S	S	M	S	M	S	S	M	S	S
CO4	S	S	S	S	S	S	S	M	S	S	M	S
CO5	S	S	S	S	S	S	S	S	S	M	M	S

L - Low, M- Medium, S – Strong

1. Have a detailed knowledge on the concept of networks
2. Know the idea on protocols, OSI layers and its functions.
3. Get knowledge on protocols used in different layers.
4. Know about the function of Internet

Unit:1   INTRODUCTION
Introduction- data communications – networks – The internet – Protocols and standards OSI
model - layers in OSI model – TCP/IP protocol suite – addressing – guided media – Unguided media.

Unit:2 DATA LINK LAYER
Switching – Circuit switched networks – datagram networks – virtual circuit networks – Framing
–Flow and error control Multiple access – random access – wired Lan – wireless Lan – Cellular
telephony – satellite networks

Unit:3 NETWORK LAYER
Network layer – IP V4 addressing – IPV6 addressing – ICMP – IGMP –Network layer
delivery –forwarding – unicast and multicast routing protocols

Unit:4 TRANSPORT LAYER
Transport layer – Process to process delivery – UDP -TCP -Congestion – congestion
control – QOS– Techniques to improve QOS

Unit:5 APPLICATION LAYER
Domain name system – name space – domain name space – distribution of name space – DNS in the
internet – remote logging - email – file transfer -Network management system – SNMP Protocol

Text Book

1.Data communications and networking – Behrouz A Forouzan McGraw Hill 4th   Reprint

Reference Books

1.Computer Networks – Tenenbaum -Pearson -2022
2.Computer networking –Kurose James F, Ross Keith W -Pearson – 2017
3.Data and computer communications – William Stallings – Pearson 2017
4.Computer networks and Internet – Douglas E Comer – Pearson - 2018

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]
https://nptel.ac.in/courses/106105080
https://www.tutorialspoint.com/computer-networks/index.asp
1https://www.javatpoint.com/computer-network-tutorial

Expected Course Outcomes:	
On the successful completion of the course, student will be able to:	
1 Understand fundamental underlying principles of computer networking	K1,K2
2 Understand details and functionality of layered network architecture.	K2,K3
3 Apply mathematical foundations to solve computational problems in computer Networking	K3,K4
4 Analyze and evaluate performance of various communication protocols.	K4,K5,K 6
5 Compare and create new routing algorithms.	K6
K1-Remember; **K2**-Understand; **K3**-Apply; **K4**-Analyze; **K5**-Evaluate; **K6**-Create	

Mapping with Programming Outcomes										
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	M	M	M	M	M	S	L	M	L
CO2	S	M	M	S	M	M	S	L	M	L
CO3	S	S	M	S	S	M	S	M	M	M
CO4	S	S	S	S	S	M	S	M	M	M
CO5	S	S	S	S	S	S	S	M	M	M

Network Protocols

Course Objectives

- To understand the basic concepts of Transmission Control Protocol/Internet Protocol and associated functions
- Explore to describe the internet architecture and its processes associated with the data transfer and to provide the quality of service
- To understand technologies and services associated with network protocols along with the challenges of data transfer.
- Learners will understand the importance and functioning of Routing Protocols over communication service.
- Empower the learners to comprehend and manage the issues associated with IP protocols like data traffic problems, security and mobility.

Unit I

Transmission Control Protocol/Internet Protocol: Fundamental Architecture - Internet Protocol Basics - Routing - Transport-Layer Protocols : Transmission Control Protocol - User Datagram Protocol - Stream Control Transmission Protocol - Real-Time Transport Protocol.

Unit II

Internet Architecture: Internet Exchange Point - History of Internet Exchange Points - Internet Service Provider Interconnection Relationships - Peering and Transit - IP Routing Protocols: Overview of Routing Protocols - Routing Information Protocol - Open Shortest Path First - Border Gateway Protocol - Multiprotocol Label Switching.

Unit III

IP Quality of Service: Introduction - Quality of Service in IP Version 4 - Integrated Services - Differentiated Services - Quality of Service with Nested Differentiated Services Levels - IP Multicast and Any cast: Addressing - Multicast Routing - Routing Protocols –Any casting- IPv6 Any cast Routing Protocol: Protocol Independent Any cast—Sparse Mode - Transport over Packet: Draft-Martini Signaling and Encapsulation - Layer-2 Tunneling Protocol.

Unit IV

Virtual Private Wired Service - Types of Private Wire Services - Generic Routing Encapsulation - Layer-2 Tunneling Protocol - Layer-3 Virtual Private Network 2547bis, Virtual Router - IP and Optical Networking: IP/Optical Network Evolution - Challenges in Legacy Traditional IP/Optical Networks - Automated Provisioning in IP/Optical Networks - Control Plane Models for IP/Optical Networking - Next-Generation Multilayer Network Design Requirements - Benefits and Challenges in IP/Optical Networking - IP Version 6: Addresses in IP Version 6 - IP Packet Headers - IP Address Resolution - IP Version 6 Deployment: Drivers and Impediments.

Unit V

IP Traffic Engineering: Models of Traffic Demands - Optimal Routing with Multiprotocol Label Switching - Link-Weight Optimization with Open Shortest Path First - Extended Shortest-Path-Based Routing Schemes - IP Network Security: Introduction - Detection of Denial-of-Service Attack - IP Trace back- Edge Sampling Scheme - Advanced Marking Scheme - Mobility Support for IP: Mobility Management Approaches - Security Threats Related to IP Mobility - Mobility Support in IPv6 - Reactive Versus Proactive Mobility Support - Relation to Multihoming - Protocols Supplementing.

Text Book :

1. "Advanced Internet Protocols, Services and Applications", Eiji Oki, Roberto Rojas-Cessa, Mallikarjun Tatipamula, Christian Vogt, Copyright © 2012 by John Wiley & Sons, Inc.

Reference Books :

1. "TCP/IP Protocol Suite", Behrouz A.Forouzan, Fourth Edition, Tata Mcgraw-Hill Edition 2010.
2. "Computer Communications and Networking Technologies" - Michael A. Gallo & William M. Hancock- BROOKS&COLE
3. "Computer Networks and Internets" -Douglas E. Comer- PEARSON.
4. Data and Computer Communications- Eighth Edition- William Stallings- Pearson Education.
5. Network Security Bible, 2nd edition, Eric Cole, Wiley Publishers.
6. Data communication and networks –James Irvine and David Harley- Publishers: Wiley India

Course Outcomes:

On the successful completion of the course, students will be able to

CO1	Understand, analyse and examine the concepts of Communication Protocols with its architecture and functions	K1- K6
CO2	Illustrate and apply the appropriate internet architecture along with efficient protocol models for the user defined communication environment	K1- K6
CO3	Comprehend, categorize and formulate the appropriate IP routing protocol to establish a efficient data transfer	K1- K6
CO4	Comprehend, analyse and evaluate the concepts of Virtual wired service and IP/optical networking with its functions and deployment	K1- K6
CO5	Elucidate, analyse and inspect the IP traffic engineering and its models along with the security mechanisms	K1- K6

K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5- evaluate and K6- Create

Mapping with Programme Outcome

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	S	-	L	M	S	M	M	-	S	-	-
CO2	S	M	-	S	M	L	M	S	-	M	-	-
CO3	S	S	-	M	S	S	S	M	-	S	-	-
CO4	S	M	L	S	M	L	S	L	-	M	L	-
CO5	M	S	M	L	S	L	M	S	-	S	L	

S- Strong; M-Medium; L-Low

Cryptography and Network Security

Course Objectives

- To familiarize classical encryption techniques and advanced encryption standards
- To explore the working principles and utilities of various cryptographic algorithms including secret key cryptography, hashes and message digests, and public key algorithms
- To recognize different encryption and decryption techniques to solve problems related to confidentiality and authentication
- To develop the ability to use existing cryptographic utilities to build programs for secure communication.
- To learn the need of digital signatures to secure the document with key management

Unit-I

Overview: Computer Security Concepts – The OSI Security Architecture – Security Attacks – Security Services – Security Mechanisms –A Model for Network Security – Classical Encryption Techniques: Symmetric Cipher Model – Substitution Techniques – Transposition Techniques – Rotor Machines – Steganography.

Unit-II

Block Ciphers and the Data Encryption Standard: Traditional Block Cipher Structure –The Data Encryption Standard – The DES Example – The Strength of DES – Block Cipher Design Principles –Basic Concepts in Number Theory and Finite Fields: Divisibility and the Division Algorithm – The Euclidean Algorithm – Modular Arithmetic – Groups, Rings, and Fields – Finite Fields of the Form GF(p) – Polynomial Arithmetic.

Unit-III

Advanced Encryption Standard: Finite Field Arithmetic– AES Structure – AES Transformation Functions – AES Key Expansion –Block Cipher Operation: Multiple Encryption and Triple DES – Stream Ciphers – RC4 – Public-Key Cryptography and RSA: Principles of Public-Key Cryptosystems – The RSA Algorithm –Diffe-Hellman Key Exchange – Elgamal Cryptographic System – Elliptic Curve Arithmetic – Elliptic Curve Cryptography – Pseudorandom Number Generation Based on an Asymmetric Cipher.

Unit-IV

Cryptographic Hash Functions: Applications of Cryptographic Hash Functions - Two Simple Hash Functions – Requirements and Security – Hash Functions Based on Cipher Block Chaining – Secure Hash Algorithm(SHA) – SHA-3 – Message Authentication Codes: Requirements – Functions – Security of MACs – MACs Based on Hash Functions: HMAC – MACs based on Block Ciphers: DAA and CMAC – Authenticated Encryption: CCM and GCM – Key Wrapping.

Unit-V

Digital Signatures – Elgamal Digital Signature Scheme – Schnorr Digital Signature Scheme – NIST Digital Signature Algorithm – Elliptic Curve Digital Signature Algorithm – RSA-PSS Digital Signature Algorithm – Key Management and Distribution: Symmetric Key Distribution Using Symmetric Encryption – Symmetric Key Distribution Using Asymmetric Encryption – Distribution of Public Keys – X.509 Certificates – Public-Key Infrastructure.

Text Books

1. William Stallings, "Cryptography and Network Security – Principles and Practices", Pearson Education PHI, 7th Edition.
2. Behrouz A Forouzan, Debdeep Mukhopadhyay, "Cryptography And Network Security", McGraw Hill Education, 3rd Edition.

Reference Books

1. Bernard Menezes, "Network Security and Cryptography", Cengage,1st Edition, 2010.
2. William Stallings, "Cryptography and Network Security", Pearson Education India, Sixth Edition, 2016.
3. V.K. Jain, "Cryptography and Network Security", Khanna Book Publishing, New Delhi, 2016.
4. C.K. Shyamala, N. Harini, Dr. T. R. Padmanabhan, "Cryptography and Security", Wiley India Pvt. Ltd.,2011

Course Outcomes :

On the successful completion of the course, students will be able to:

CO1:	Comprehend and analyze the security concepts to apply and evaluate the encryption techniques in various models	K1-K6
CO2:	Understand and examine the various data encryption standards and number theory. Illustrate and evaluate the various techniques in different applications	K1-K6
CO3:	Grasp the knowledge of AES techniques and apply to evaluate the performance with different key types	K1-K6
CO4:	Comprehend and analyze the basics of hash function and MAC that helps to develop the encryption models in various application	K1-K6
CO5:	Understand and illustrate the need of digital signature to examine the method of providing good security to the document. And also learn the concept of key management	K1-K6

K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5- evaluate and K6- Create

Mapping with Programme Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	S	-	L	M	S	M	M	-	S	-	-
CO2	M	S	-	M	M	L	M	S	-	M	-	-
CO3	S	S	-	M	S	M	S	M	-	S	-	-

CO4	S	M	L	S	M	L	S	M	-	M	-	-
CO5	M	S	M	L	S	L	M	S	-	S	-	-

S – Strong, M – Medium, L - Low

SEMESTER II

Artificial Intelligence & Machine Learning

Course Objectives:

The main objectives of this course are to

1. Enable the students to learn the basic functions of AI, Heuristic Search Techniques.
2. Provide knowledge on concepts of Representations and Mappings and Predicate Logic.
3. Introduce Machine Learning with respect Data Mining, Big Data and Cloud.
4. Study about Applications & Impact of ML.

Unit:1   INTRODUCTION

Introduction: AI Problems - Al techniques - Criteria for success. Problems, Problem Spaces, Search: State space search - Production Systems - Problem Characteristics - Issues in design of Search.

Unit:2 SEARCH TECHNIQUES

Heuristic Search techniques: Generate and Test - Hill Climbing- Best-First, Problem Reduction, Constraint Satisfaction, Means-end analysis. Knowledge representation issues: Representations and mappings - Approaches to Knowledge representations - Issues in Knowledge representations - Frame Problem.

Unit:3 PREDICATE LOGIC

Using Predicate logic: Representing simple facts in logic - Representing Instance and Isa relationships - Computable functions and predicates - Resolution – Natural deduction. Representing knowledge using rules: Procedural Vs Declarative knowledge- Logic programming-Forward Vs Backward reasoning - Matching-Control knowledge.

Unit:4 MACHINE LEARNING

Understanding Machine Learning: What Is Machine Learning? - Defining Big Data - Big Data in Context with Machine Learning - The Importance of the Hybrid Cloud - Leveraging

the Power of Machine Learning - The Roles of Statistics and Data Mining with Machine Learning-Putting Machine Learning in Context-Approaches to Machine Learning.

Unit:5 APPLICATIONS OF MACHINE LEARNING

Looking Inside Machine Learning: The Impact of Machine Learning on Applications – Data Preparation - The Machine Learning Cycle.

Text Books

1   Elaine Rich and Kevin Knight, "Artificial Intelligence", Tata McGraw Hill Publishers company Pvt Ltd, Second Edition, 1991.

2   George F Luger, "Artificial Intelligence", 4ᵗʰEdition,Pearson Education Publ,2002.

Reference Book

1   Machine Learning For Dummies ®,IBM Limited Edition by Judit Hurwitz, Daniel Kirsch.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1   https://www.ibm.com/downloads/cas/GB8ZMQZ3

2   https://www.javatpoint.com/artificial-intelligence-tutorial

3   https://nptel.ac.in/courses/106/105/106105077/

Expected Course Outcomes:	
On the successful completion of the course, student will be able to	
1 Demonstrate AI problems and techniques	K1,K2
2 Understand machine learning concepts	K2,K3
3 Apply basic principles of AI in solutions that require problem solving inference, perception, knowledge representation, and learning	K3,K4
4 Analyze the impact of machine learning on applications	K4,K5
5 Analyze and design are all world problem for implementation and understand the dynamic behavior of a system	K5,K6
K1-Remember; **K2**-Understand; **K3**-Apply; **K4**-Analyze; **K5**-Evaluate; **K6**-Create	

Mapping with Programming Outcomes									
CO	PO1	PO2	PO3	PO4	PO 5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	M	S
CO2	S	S	S	S	S	S	S	M	S	S
CO3	S	S	S	S	S	S	S	M	S	S
CO4	S	S	S	S	S	S	S	M	S	S
CO5	S	S	S	S	S	S	S	M	S	S

Soft Computing

COURSE OBJECTIVES:

- Develop the skills to gain a basic understanding of neural network theory and fuzzy logic theory.
- To understand supervised and unsupervised learning algorithms
- To enable the students to gain a basic understanding of neural networks.
- To know about fuzzy logic, fuzzy inference systems, and their functions.
- To impart basic knowledge on Genetic algorithms and their applications.

UNIT-I

INTRODUCTION TO SOFT COMPUTING: Artificial Neural Networks- Biological Neurons- Basic Models of Artificial Neural Networks-Connections-Learning-Activation Functions- Important Terminologies of ANNs- Muculloch and Pitts Neuron-Linear Separability- Hebb Network-Flowchart of Training Process-Training Algorithm.

UNIT - II

SUPERVISED LEARNING NETWORK : Perceptron Networks–Perceptron Learning Rule-Architecture-Flowchart for Training Process-Perceptron Training Algorithms for Single Output Classes-Perceptron Training Algorithm for Multiple Output Classes-Perceptron Network Testing Algorithm - Adaptive Linear Neuron-Delta Rule for Single Output Unit-Flowchart for training algorithm-Training Algorithm – Testing Algorithm - Multiple Adaptive Linear Neurons-Architecture-Flowchart of Training Process-Training Algorithm-Back Propagation Network-Architecture-Flowchart for Training Process-Training Algorithm-Learning Factors of Back-Propagation Network-Radial Basis Function Network- Architecture-Flowchart for Training Process-Training Algorithm.

UNIT-III

UNSUPERVISED LEARNING NETWORK: Associative Memory Networks - Auto Associative Memory Network-Architecture-Flowchart for Training Process-Training Algorithm-Testing Algorithm- Bidirectional Associative Memory- Architecture-Discrete Bidirectional Associative Memory-Iterative Auto Associative Memory Networks - Linear Auto Associative Memory-Kohonen Self-Organizing Feature Map- Architecture-Flowchart for Training Process-Training Algorithm.

UNIT-IV

INTRODUCTION TO FUZZY LOGIC: Classical Sets –Operations on Classical Sets-Fuzzy sets - Fuzzy Sets- Properties of Fuzzy Sets- Fuzzy Relations –Membership Functions: Fuzzification- Methods of Membership Value Assignments – Defuzzification – Lambda-Cuts for Fuzzy sets and Fuzzy Relations – Defuzzification Methods–Max-Membership Principle-Centroid Method-Weighted Average Method-Mean Max Membership-Center of Sums-Center of Largest Area-First of Maxima - Fuzzy Set Theory - Fuzzy Arithmetic And Fuzzy Measures: Fuzzy Measures – Belief and Plausibility Measures-Probability Measures-Possibility and Necessity Measures- Formation of Rules –Fuzzy Inference Systems (FIS) – Fuzzy Decision Making – Fuzzy Logic Control Systems.

UNIT-V

GENETIC ALGORITHM: Introduction - Biological Background - Traditional Optimization and Search Techniques -Gradient Based Local Optimization Method-Random Search-Stochastic Hill Climbing-Simulated Annealing-Symbolic Artificial Intelligence-Operators in Genetic Algorithm -Encoding-Selection-Crossover-

Mutation - Stopping Conditions for Genetic Algorithm Flow-Genetic Programming-Working of Genetic Programming-Characteristics of Genetic Programming-Data Representation.

TEXT BOOKS

1. Principles of Soft Computing, S.N. Sivanandam, S.N.Deepa, Wiley, Third Edition, 2019.

   UNIT I: Chapter 1: 2.1,2.3,2.4,2.5,2.6,2.7

   UNIT II: Chapter 2: 3.2,3.3,3.4,3.5,3.6

   UNIT III: Chapter 3: 4.3,4.4,4.7,5.3

   UNIT IV: Chapter 4: 7.2,7.3,8.4,9.3,9.4,10,10.2,10.3,10.4,11.4,12.8,14

   UNIT V: Chapter 5: 15,15.2,15.3,15.4,15.9,15.10

REFERENCE BOOKS

1. Das, A. (2018). Artificial Intelligence and Soft Computing for Beginners.
2. Amit, K. (2018). Artificial intelligence and soft computing: behavioral and cognitive modeling of the human brain. CRC press.
3. Rajasekaran, S., &Pai, G. V. (2011). Neural networks, fuzzy logic and genetic algorithm: synthesis and applications (with cd). PHI Learning Pvt. Ltd.
4. Jang, J. S. R., Sun, C. T., &Mizutani, E. (2004). Neuro-fuzzy and soft computing-a computational approach to learning and machine intelligence [Book Review]. IEEE Transactions on automatic control, 42(10), 1482-1484.
5. Gupta, M. M. (2004). Soft computing and intelligent systems: theory and applications. Elsevier.
6. Jang, J. S. R., Sun, C. T., &Mizutani, E. (1997). Neuro-fuzzy and soft computing-a computational approach to learning and machine intelligence [Book Review]. IEEE Transactions on automatic control, 42(10), 1482-1484.

COURSE OUTCOMES:

- On the successful completion of the course, students will be able to

CO1	To provide an introduction to the basic principles, techniques, and applications of soft computing	K1- K2	LO
CO2	To get familiar with Neural network architectures and supervised learning algorithms	K3	IO
CO3	To understand the architectures and algorithms of Unsupervised Learning techniques	K3-K4	HO
CO4	Develop the skills to gain a basic understanding of fuzzy logic theory and fuzzy inference systems	K4	IO
CO5	Ability to learn traditional optimization and search techniques and genetic programming	K5	HO

MAPPING WITH PROGRAMME OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M	S	M	S	S	S	M	S	M	S	S
CO2	M	S	M	S	M	M	M	S	M	S	S	M
CO3	M	M	S	S	S	M	M	S	S	S	S	S
CO4	S	S	M	M	M	S	S	S	S	M	M	M
CO5	S	S	S	S	S	M	S	M	M	S	S	M

S- STRONG; M-MEDIUM; L-LOW

High Performance Computing

Course Objectives:

- To get a clear idea of High Performance Computing concept.
- To get brief knowledge about how to function the HPC systems.
- To get idea of what techniques used in HPC models.
- To understand a Parallel computing concepts.
- To get familiar with OpenMP technology that is widely used in HPC technology.

Unit-I

Modern processors: Stored-program computer architecture-General purpose cache based microprocessor architecture-Memory hierarchies-Multi core processors-Multithreaded processors-Vector processors. **Basic optimization techniques for serial code:** Scalar profiling-Common sense optimizations-Simple measures, large impact-The role of compilers-C++ optimizations.

Unit-II

Data access optimization: Balance analysis and light speed estimates-Storage order-Algorithm classification and access optimizations-The Jacobi algorithm-Algorithm classification and access optimizations-Sparse matrix-vector multiply. **Parallel computers:** Taxonomy of parallel computing paradigms-Shared-memory computers-Distributed memory computers-Hierarchical systems-Networks.

Unit-III

Basics of parallelization: Introduction to Parallelism -Parallel scalability. **Shared memory parallel programming with OpenMP:** Short introduction to OpenMP-OpenMP-parallel Jacobi algorithm.

Unit-IV

Efficient OpenMP programming: Profiling OpenMP programs-Performance pitfalls-Parallel sparse matrix-vector multiply. **Locality optimizations on ccNUMA architectures:** Locality of access on ccNUMA-ccNUMA optimization of sparse MVM-Placement pitfalls-ccNUMA issues with C++.

Unit-V

Distributed-memory parallel programming with MPI: Message passing-A short introduction to MPI-MPI parallelization of a Jacobi solver. **Efficient MPI programming:** MPI performance tools-Communication parameters-Synchronization, serialization, contention-Reducing communication overhead-Understanding intranode point-to-point communication.

Text book:

1. Georg Hager, Gerhard Wellein "Introduction to High Performance Computing for Scientists and Engineers", CRC Press, 2011. **Chapters:** 1 to 10.

Reference books:

1. Michael W. Berry, Kyle A. Gallivan, Efstratios Gallopoulos, Ananth Grama, Bernard Philippe, Yousef Saad, Faisal Saied, "High-performance scientific computing: algorithms and applications", Springer, 2012.
2. Victor Eijkhout, "Introduction to High Performance Scientific Computing", MIT Press, 2011.

Course Outcome:

On the successful completion of the course, students will be able to,

CO1	Understand of the HPC and ccNUMA concepts	
CO2	Design and develop a parallel programming with modern C, C++ and new version of FORTRAN	
CO3	Apply with parallel computing	K1 - K6
CO4	Develop an efficient OpenMP programming	
CO5	Evaluate an efficient MPI programming	

K1- Remember, K2 - Understand, K3 - Apply , K4 - Analyze, K5 - Evaluate, K6 -Create

Mapping with Programme Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	L	M	L	L	L	S	S	S	S	M	L
CO2	S	M	L	M	M	L	S	L	S	L	S	L
CO3	S	S	S	M	M	L	M	L	M	L	S	L
CO4	S	S	S	M	S	L	M	L	M	S	S	S
CO5	S	S	S	M	M	L	M	M	M	M	S	L

L - Low, M- Medium, S - Strong

Internet 0f Things

Course Objectives:

The main objectives of this course are to

- To get familiar with the evolution of IOT with its design principles.
- To outline the functionalities and protocols of internet communication.
- To analyze the hardware and software components needed to construct IOT applications.
- To identify the appropriate protocol for API construction and writing embedded code.
- To realize various business models and ethics in Internet of Things.

Unit:1 INTRODUCTION

Internet of Things: An Overview : IoT Conceptual Framework - IoT Architectural View -   Technology Behind IoT - Sources of IoT - M2M Communication - Examples of IoT - Design Principles for Connected Devices : IoT/M2M Systems Layers and Designs Standardization - Communication Technologies - Data Enrichment, Data Consolidation and Device Management at Gateway

Unit:2 Design Principles for Web Connectivity

Communication Protocols for Connected Devices– Message Communication Protocols for Connected Devices – Web Connectivity for Connected   Devices–Network   Using Gateway , SOAP, REST, HTTP, RESTful and Web Sockets -Internet Connectivity Principles Internet Connectivity   Internet   Based Communication – IP Addressing in the IoT – Media Access Control – Application Layer Protocols: HTTP, HTTPS, FTP, Telnet and Others

Unit:3 Data Acquiring, Organizing, Processing and Analytics

Data Acquiring and Storage – Organizing the Data – Transactions, Business Processes, Integration and Enterprise Systems – Analytics – Knowledge Acquiring, Managing and Storing Processes – Data Collection, Storage and Computing Using a Cloud Platform: Cloud Computing Paradigm for Data Collection, Storage and Computing – Everything as a Service and Cloud Service Models.

Unit:4 SENSORS AND ACTUATORS

Sensors, Participatory Sensing, RFIDs, and Wireless Sensor Networks : Sensor Technology –Wireless Sensor Networks Technology - Prototyping the Embedded Devices for IoT and M2M :Embedded Computing Basics – Embedded Platforms for Prototyping.

Unit:5 Prototyping and Designing the Software for IoT Applications

Prototyping Embedded Device Software - Devices, Gateways, Internet and Web/ Cloud Services Software Development – Prototyping online Component APIs and Web APIs – Security for IoT :Vulnerabilities, Security Requirements and Threat Analysis – IoT Security Tomography and Layered Attacker Model – Security Models, Profiles and Protocols for IoT – IoT Application Case Study : Design Layers, Design Complexity and Designing using Cloud PaaS – IoT / IoT Applications in the premises, Supply – Chain and Customer Monitoring – Connected Car and its Applications and Services.

Text Book

1 Raj Kamal , " Internet of Things Architecture and Design Principles", McGraw Hill, 2017

Reference Books

1 Ovidiu Vermesan and Peter Friess, "Internet of Things – From Research and Innovation to Mark Deployement" , River Publishers, 2014.

2 Peter Waher, "Learning Internet of Things" , Packt Publishing, 2015.

3 Donald Norris, "The Internet of Things: Do-It-Yourself at Home Projects for Arduino, Raspberry Pi and Beagle Bone Black", Mc Graw Hill, 2015

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1 https://onlinecourses.nptel.ac.in/noc20_cs66/preview

2 https://www.javatpoint.com/iot-internet-of-things

3 https://www.tutorialspoint.com/internet_of_things/index.htm

Expected Course Outcomes:	
On the successful completion of the course, student will be able to	
1 Understand about IoT, its Architecture and its Applications	K1,K2
2 Comprehend the IoT evolution with its architecture and sensors	K2,K3
3 Assess the embedded technologies and develop prototypes for the IoT products	K4
4 Evaluate the use of Application Programming Interface and design an API for IoTin real-time	K5,K6
5 Design IoT in real time applications using today's internet & wireless Technologies	K6
K1-Remember;**K2**-Understand;**K3**-Apply;**K4**-Analyze;**K5**-Evaluate; **K6**-Create	

Mapping with Programming Outcomes										
CO	P1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	M	M	S	M	S	M	M	S	M
CO2	M	S	M	S	M	S	M	S	S	S
CO3	S	S	S	S	M	S	M	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

Solution Architecture

Course Objectives:

- To get familiar with the evolution of solution architecture

- To outline the functionalities of Solution Architecture Design

- To assess the Performance Considerations of Solution Architecture

- To analyze the Architectural Reliability Considerations

- To identify the design principles for cost optimization

UNIT I

Evolution of solution architecture - The benefits of solution architecture - Solution architecture in the public cloud - Solution Architects in an Organization - Types of solution architect role - Understanding a solution architect's responsibilities - Attributes of the Solution Architecture - Scalability and elasticity - Security and compliance - Cost optimization and budget

UNIT II

Principles of Solution Architecture Design - Scaling workload - Building resilient architecture - Design for performance - Using replaceable resources - Cloud Migration and Hybrid Cloud Architecture Design - Benefits of cloud-native architecture - Creating a cloud migration strategy - Steps for cloud migration - Creating a hybrid cloud architecture - Designing a cloud-native architecture

UNIT III

Solution Architecture Design Patterns - Building an n-tier layered architecture - Creating multi-tenant SaaS-based architecture - Building stateless and stateful architecture designs - Understanding SOA - Performance Considerations - Design principles for architecture performance - Technology selection for performance optimization - Managing performance monitoring

UNIT IV

Architectural Reliability Considerations - Design principles for architectural reliability - Technology selection for architecture reliability - Improving reliability with the cloud - Operational Excellence Considerations - Designing principles for operational excellence - Selecting technologies for operational excellence - Achieving operational excellence in the public cloud

UNIT V

Cost Considerations - Design principles for cost optimization - Techniques for cost optimization - Cost optimization in the public cloud - Architecting Legacy Systems - Learning the challenges of legacy systems - Defining a strategy for system modernization - Looking at legacy system modernization techniques - Defining a cloud migration strategy for legacy systems

Text Book:

1. Saurabh Shrivastava and Neelanjali Srivastav, " Solutions Architect's Handbook", Packt Publishing, 2020

Reference Books:

1. Alan McSweeney , "Introduction to Solution Architecture", Kindle Edition, 2019
2. Bernard, Scott A. An introduction to holistic enterprise architecture. Author House, 2020.

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Comprehend the types, benefits and attributes of solution architecture	K1- K6
CO2	Assess the cloud architecture and create hybrid cloud architecture	
CO3	Analyse the design patterns for solution architecture	
CO4	Understand Architecture Reliability and Operational Excellence	
CO5	Optimize the cost in cloud and assess the legacy system	

K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	S	S	S	S	S	S	M	S	S
CO2	S	S	S	S	S	S	S	S	S	S	M	S
CO3	S	M	S	S	S	S	M	S	S	S	S	S
CO4	S	S	S	M	S	S	S	S	S	S	M	S
CO5	S	S	S	S	M	S	S	S	S	M	M	S

S- Strong; M-Medium; L-Low

Software Development Technologies

Course Objectives

- To learn and Implementing Micro services
- To analyze the Azure Kubernetes Service
- To learn and analyze .NET DevOps for Azure and its applications
- To build code for .NET core applications
- To get familiarized with Azure pipelines

Unit -I

Implementing Microservices: Client to microservices communication, Interservice communication, data considerations, security, monitoring, microservices hosting platform options. Azure Service Fabric: Introduction, core concepts, supported programming models, service fabric clusters, develop and deploy applications of service fabric. Monitoring Azure Service Fabric Clusters: Azure application, resource manager template, Adding Application Monitoring to a Stateless Service Using Application Insights, Cluster monitoring, Infrastructure monitoring.

Unit-II

Azure Kubernetes Service (AKS): Introduction to kubernetes and AKS, AKS development tools, Deploy applications on AKS. Monitoring AKS: Monitoring, Azure monitor and analytics, monitoring AKS clusters, native Kubernetes dashboard, Prometheus and Grafana. Securing Microservices: Authentication in microservices, Implementing security using API gateway pattern, Creating application using Ocrlot and securing APIs with Azure AD. Database Design for Microservices: Data stores, monolithic approach, Microservices approach, harnessing cloud computing, database options on MS Azure, overcoming application development challenges. Building Microservices on Azure Stack: Azure stack, Offering IaaS, PaaS on-premises simplified, SaaS on Azure stack.

Unit-III

.NET DevOps for Azure: DevOps introduction, Problem and solution. Professional Grade DevOps Environment: The state of DevOps, professional grade DevOps vision, DevOps architecture, tools for professional DevOps environment, DevOps centered application. Tracking work: Process template, Types of work items, Customizing the process, Working with the process. Tracking code: Number of repositories, Git repository, structure, branching pattern, Azure repos configuration, Git and Azure.

Unit-IV

Building the code: Structure of build, using builds with .NET core and Azure pipelines, Validating the code: Strategy for defect detection, Implementing defect detection. Release candidate creation: Designing release candidate architecture, Azure artifacts workflow for release candidates, Deploying the release: Designing deployment pipeline, Implementing deployment in Azure pipelines. Operating and monitoring release: Principles, Architectures for observability, Jumpstarting observability.

Unit-V

Introduction to APIs: Introduction, API economy, APIs in public sector. API Strategy and Architecture: API Strategy, API value chain, API architecture, API management. API Development: Considerations, Standards,

kick-start API development, team orientation. API Gateways: API Gateways in public cloud, Azure API management, AWS API gateway. API Security: Request-based security, Authentication and authorization.

Text Books

1. Harsh Chawla and Hemant Kathuria, Building Microservices Applications on Microsoft Azure-Designing, Developing, Deploying, and Monitoring, Apress, 2019.
2. Jeffrey Palermo , NET DevOps for Azure A Developer's Guide to DevOps Architecture the Right Way, Apress, 2019.
3. Thurupathan and Vijayakumar, Practical API Architecture and Development with Azure and AWS - Design and Implementation of APIs for the Cloud, Apress, 2018.

Reference Books

1. Karl Matthias and Sean P. Kane, Docker: Up and Running, O'Reilly Publication, Second Edition 2018.
2. Len Bass,IngoWeber, Liming Zhu,"DevOps, A Software Architects Perspective", AddisonWesley-Pearson Publication, First Ediiton 2015.
3. John Ferguson Smart, "Jenkins, The Definitive Guide", O'Reilly Publication, First Ediiton 2011.

Course Outcomes

On the successful completion of the course, students will be able to

CO1:	Understand, apply and summarize the basic concepts of Micro services communication Microsoft Azure and Dev Ops for software development life cycle	K1-K6
CO2:	Illustrate, and implement Azure Kubernetes Service tools for software development life cycle	K1-K6
CO3:	Recognize, analyze and summarize the functionalities of .NET Dev Ops for Azure applications	K1-K6
CO4:	Understand, design and evaluate the principles and architecture service tools for software development life cycle.	K1-K6
CO5:	Comprehend, implement and review the functionalities of API and API gateways for cloud and Azure applications	K1-K6

K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6-   Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	M	-	M	-	-	-	S	-	-	-
CO2	S	S	M	-	M	-	-	-	S	-	-	-
CO3	S	S	S	-	S	-	-	-	S	S	S	S
CO4	S	S	M	-	M	-	-	-	S	-	-	-

| CO5 | S | S | M | - | M | - | - | - | S | - | - | - |

S- Strong; M-Medium; L-Low

SEMESTER III

Cyber Security

Course Objectives:

- To understand the basics of Cybercrime and Computer forensics with protecting mechanism

- To explore the working principles of WLAN, Email and Smartphone along with security mechanism and guidelines

- To gain the ability to understand the importance of cyber investigations with its functioning role and learn the basics of WiFi and its security measures

- To understand and learn the method of seize the digital evidence
- To learn and analyze the concepts of digital forensics with cybercrime prevention techniques

Unit – I

Introduction to cybercrime: Classification of cybercrimes – reasons for commission of cybercrime – malware and its type – kinds of cybercrime – authentication – encryption – digital signatures – antivirus – firewall – steganography – computer forensics – why should we report cybercrime – introduction counter cyber security initiatives in India – generating secure password – using password manager-enabling two-step verification – security computer using free antivirus.

Unit – II

Tips for buying online: Clearing cache for browsers – wireless LAN-major issues with WLAN-safe browsing guidelines for social networking sites – email security tips – introduction-smart phone security guidelines – purses, wallets, smart phones – platforms, setup and installation-communicating securely with a smart phone.

Unit – III

Cyber investigation roles**:** Introduction – role as a cybercrime investigator – the role of law enforcement officers – the role of the prosecuting attorney – incident response: introduction-post mortem versus live forensics – computer analysis for the hacker defender program-network analysis – legal issues of intercepting Wi-Fi transmission – Wi-Fi technology – Wi-Fi RF-scanning RF – eavesdropping on Wi-Fi – fourth amendment expectation of privacy in WLAN.

Unit – IV

Seizure of digital information: introduction – defining digital evidence – digital evidence seizure methodology – factors limiting the wholesale seizure of hardware – other options for seizing digital evidence – common threads within digital evidence seizure – determining the most appropriate seizure method– conducting cyber investigations–demystifying computer/cybercrime – IP addresses – the explosion of networking – interpersonal communication.

Unit – V

Digital forensics and analyzing data: introduction – the evolution of computer forensics–phases of digital forensics-collection – examination-analysis – reporting – Cybercrime prevention: Introduction – crime targeted at a government agency.

Text books:

1. Dr. JeetendraPande, **"**Introduction to Cyber Security" Published by Uttarakhand Open University, 2017.(Chapter: 1.2-6.4,9.3-12.2)
2. Anthonyreyes, Kevin o'shea, Jim steele, Jon R. Hansen, Captain Benjamin R. Jean Thomas Ralph, "Cyber-crime investigations" - bridging the gaps between security professionals, law enforcement, and prosecutors, 2007.(Chapter: 4, 5, 6, 7, 8, 9,10)

Reference Books:

1. Sebastian Klipper, "Cyber Security" EinEinblickfur Wirtschafts wissens chaftler Fachmedien Wiesbaden,2015
2. John G.Voller Black and Veatch, "Cyber Security" Published by John Wiley & Sons, Inc., Hoboken, New Jersey Published simultaneously in Canada ©2014.

Course Outcomes

On the successful completion of the course, students will be able to

CO1:	Understand, describe, analyze and examine the basics of Cyber security concepts and its implementation in India	K1- K6
CO2:	Comprehend and demonstrate the security tips in browsers, WLAN, social networks, Email security and Smart phone. Apply the investigations in post mortem and Forensics	K1- K6
CO3:	Understand, apply and evaluate the various investigation roles and Wi Fi protecting mechanisms.	K1- K6
CO4:	Understand, illustrate and evaluate the method of seize the digital information and evidences forensics data and evaluate the forensics reports	K1- K6
CO5:	Comprehend, apply and appraise the methods digital forensics with cybercrime prevention techniques	K1- K6

K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	L	-	L	M	L	M	M	-	M	-	-
CO2	M	S	-	L	M	L	M	M	-	M	-	-
CO3	M	S	L	L	M	L	M	M	-	M	M	L
CO4	S	M	L	S	M	L	S	M	-	M	-	-

| CO5 | M | S | M | L | S | L | M | S | - | S | - | - |

S- Strong; M-Medium; L-Low

Blockchain Technologies

COURSE OBJECTIVES

- To understand about Blockchain is an emerging technology platform for developing decentralized applications and data storage.
- To comprehend fundamentals of Public Key Cryptography technology and Consensus Algorithms.
- To familiarize with Bitcoin Network, Bitcoin Clients, APIs and Payments technology of blockchain operations.
- To engage with Components of the Ethereum ecosystem.
- To grasp about Development Tools and Frameworks.

Unit I: Blockchain, Decentralization

Blockchain : The growth of blockchain technology - Distributed systems - The history of blockchain and Bitcoin - Blockchain - Consensus - CAP theorem and blockchain. **Decentralization:** Decentralization using blockchain - Methods of decentralization -Routes to decentralization - Blockchain and full ecosystem decentralization - Pertinent terminology - Platforms for decentralization - Innovative trends.

Unit II: Public Key Cryptography, Consensus Algorithms and Smart Contracts

Public Key Cryptography: Asymmetric cryptography - Cryptographic constructs and blockchain technology. **Consensus Algorithms:** Introducing the consensus problem -Analysis and design - Classification - Algorithms - Choosing an algorithm. **Smart Contracts:** History - Definition - Ricardian contracts - Smart contract templates – Oracles - Deploying smart contracts – DAO.

Unit III: Bitcoin

Bitcoin: Bitcoin—an overview - Cryptographic keys - Transactions - Blockchain – Mining. **Bitcoin Network and Payments:** The Bitcoin network - Wallets - Bitcoin payments -Innovation in Bitcoin - Advanced protocols - Bitcoin investment and buying and selling Bitcoin. **Bitcoin Clients and APIs:** Bitcoin client installation - Experimenting further with bitcoin-cli - Bitcoin programming.

Unit IV: Alternative Coins

Alternative Coins: Theoretical foundations - Difficulty adjustment and retargeting algorithms - Bitcoin limitations - Extended protocols on top of Bitcoin -Development of altcoins. **Ethereum: Ethereum** – an overview - Ethereum network - Components of the Ethereum ecosystem - EthereumVirtual Machine (EVM) - Smart contracts. - Blocks and blockchain - Wallets and client - Nodes and miners - APIs, tools, and DApps - Supporting protocols - Programming languages.

Unit V: Development Tools and Frameworks, Use Cases & Security

Development Tools and Frameworks : Languages - Compilers - Tools and libraries - Frameworks - Contract development and deployment - Layout of a Solidity source code file - Solidity language. **Use Cases:** IoT – Government - Health -Finance – Media. **Scalability and Other Challenges:** Scalability - Privacy - Security - Other challenges.

TEXT BOOK

Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, Steven Goldfeder. Bitcoin and Crypto currency Technologies. Princeton University Press, 2016. ISBN 978-0691171692

REFERENCE BOOK

Andreas Antonopoulos. Mastering Bitcoin: Programming the open block chain. Oreilly Publishers, 2017. ISBN 978-9352135745

Course Outcomes

On the successful completion of the course, students will be able to

CO1:	Understand, apply and examine the characteristics of blockchain, bitcoin and consensus algorithm in centralized and decentralized methods.	K1-K6
CO2:	Comprehend and demonstrate the application of hashing and public key cryptography in protecting the blockchain.	K1-K6
CO3:	Understand and analyze the elements of trust in a Blockchain: validation, verification, and consensus.	K1-K6
CO4	Comprehend and evaluate the alternate coin, Ethereum and smart contract.	K1-K6
CO5	Grasp and apply the knowledge of Tools and languages for applications	K1-K6

K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5-Evaluate, K6- Create

Mapping Course outcomes with Programme outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO 6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO 1	S	-	-	-	-	L	-	-	-	-	-	-
CO 2	S	-	M	-	M	L	-	-	-	-	-	-
CO 3	S	-	S	-	S	L	-	-	-	S	S	S

CO 4	S	-	S	-	S	L	-	-	-	S	S	S
CO 5	S	-	S	-	S	L	-	-	-	S	S	S

S- Strong; M-Medium; L-Low

Computer Vision

Course Objectives:

- To get understanding about Computer vision techniques behind a wide variety of real- world applications.
- To get familiar with various Computer Vision fundamental algorithms and how to implement and apply.
- To get an idea of how to build a computer vision application with Python language.
- To understand various machine learning techniques that are used in computer vision tasks.
- To incorporate machine learning techniques with computer vision systems.

Unit-I

Basic Image Handling and Processing: PIL – the Python Imaging Library-Matplotlib-NumPy-SciPy-Advanced example: Image de-noising. **Local Image Descriptors:** Harris corner detector-SIFT - Scale-Invariant Feature Transform-Matching Geotagged Images.

Unit-II

Image to Image Mappings: Homographies-Warping images-Creating Panoramas. **Camera Models and Augmented Reality:** The Pin-hole Camera Model-Camera Calibration-Pose Estimation from Planes and Markers-Augmented Reality.

Unit-III

Multiple View Geometry: Epipolar Geometry-Computing with Cameras and 3D Structure-Multiple View Reconstruction-Stereo Images. **Clustering Images:** K-means Clustering-Hierarchical Clustering-Spectral Clustering.

Unit-IV

Searching Images: Content based Image Retrieval-Visual Words-Indexing Images- Searching the Database for Images-Ranking Results using Geometry-Building Demos and Web Applications. **Classifying Image Content:** K-Nearest Neighbors-Bayes Classifier-Support Vector Machines-Optical Character Recognition.

Unit-V

Image Segmentation: Graph Cuts-Segmentation using Clustering-Variational Methods. **OpenCV:** Python Interface-OpenCV Basics-Processing Video-Tracking.

Course Outcomes:

On the successful completion of the course, students will be able

CO1	To understand and recall computer vision and its application areas	
CO2	To develop build a computer vision system	
CO3	To apply and analyse a design range of algorithms for image processing and computer vision	K1-K6
CO4	To develop incorporate machine learning techniques with computer vision system	
CO5	To apply and analyse image segmentation and image registration	

K1- Remember, K2 - Understand, K3 - Apply , K4 - Analyze, K5 - Evaluate, K6 -Create

Mapping with Programme Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	L	M	L	L	L	M	M	M	S	S	L
CO2	S	M	L	M	M	L	S	L	S	L	S	L
CO3	S	S	S	M	M	L	M	L	M	L	M	L
CO4	S	S	S	M	M	L	M	L	M	L	S	L
CO5	S	S	S	M	M	L	S	L	S	L	S	L

L - Low, M- Medium, S - Strong

Skill Enhancement Courses

Web Development using PHP

UNIT I
Introduction to PHP as a programming Language: - Advantages of PHP, the server side architecture, overview of PHP, history, object oriented support, benefits in running PHP as a server side script.

The basics of PHP: - data types, variables, constants, operators, Conditional statements (if statement, Executing Multiple Statements, else if clause and switch statement), Iterations (for loop, while loop, Arrays, controlling an array using a while loop, do while statement.

UNIT II
Functions, user defined functions, functions with arguments, built in functions (print(), includer(), header(), phpinfo()), Working with Strings.

Working with files and directories: reading files, writing files, processing directories and performing other file and directory operations.

UNIT III
Working with Cookies and Sessions: setting, reading and removing cookies, creating and removing sessions and session variables, Handling errors: handling script errors and using exceptions

UNIT IV
Working with forms, form elements (Text Box, Text Area, Password, Radio Button, Checkbox, The Combo Box, Hidden Field and image), adding elements to a form

UNIT V
Data base connectivity using PHP (MySQL, ODBC, ORACLE, SQL) Performing, executing Commands, different types of Data Base Operations like Insertion, deletion, update and query on data.

Reference Books:

1. Mastering PHP, WebTech Solutions, Khanna Publishing House
2..The Complete Reference PHP, Steven Holzner, McGraw Hill Professional, 2008.
3. Learning PHP, Ramesh Bangia, Khanna Publishing House

Social Networks

Course Objectives

- To learn about Social media, Social networking and Webcasts
- To understanding and building a Word Press Powered Website
- To analysis the Social Networking & Micro-Blogging.
- To learn and analysis the Widgets & Badges.
- To explore the importance of Website optimization.

UNIT I: Introduction: Social Media Strategy-Important First Decisions -Websites, Blogs - RSS Feeds Mapping -Preparation - Multimedia Items Gathering Content for Blog Posts RSS Feeds & Blogs-RSS Feeds-The Feed Reader-The Feed-Options for Creating an RSS Feed-Planning Feed-Blogs-Options for Starting. Blog and RSS Feed-Feed or Blog Content-Search Engine Optimization (SEO)-Feed Burner-RSS Feed and Blog Directories-An Optimization Plan for Blog or RSS Feed

UNIT II: Building a Word Press Powered Website: Word Press as A CMS - Diversity of Word Press Sites-The Anatomy of a Word Press Site -a Brief Look at the Word Press Dashboard Planning - Site Themes Plug-ins setting up Sidebars Building Pages- Posting Blog Entries. Podcasting, Vidcasting, & Webcasting- Publishing Options for Podcast-Creating and Uploading Podcast Episodes-Publishing Podcast Optimizing Podcast-Webcasting

UNIT III: Social Networking & Micro-Blogging: Facebook-The Facebook Profile -Myspace LinkedIn-Twitter-Niche Social Networking Sites-Creating Own Social Network-Promoting Social Networking Presence- Social Bookmarking & Crowd-Sourcing - Social Bookmarking-A Social Bookmarking Strategy- Crowd-Sourced News Sites- Preparation And Tracking Progress Media Communities-Image Sharing Sites-Image Sharing Strategy-Video Sharing Sites-Video Sharing Strategy-Searching And Search Engine Placement-Connecting With Others.

UNIT IV: Widgets & Badges: Highlighting Social Web Presence-Sharing and Syndicating Content Making Site More Interactive-Promoting Products and Making Money-Using Widgets In Word Press-Widget Communities And Directories- Working Widgets Into Strategy Social Media Newsrooms-Building Social Media Newsroom - Populating The Newsroom-Social Media News Releases-Social Media Newsroom Examples. More Social Tools-Social Calendars-Social Pages Wikis-Social Search Portals-Virtual Worlds.

Unit V: Website optimization: A Website Optimization Plan-Streamlining Web Presence-An Integration Plan- Looking to the Future-Life streaming: The Future of Blogging-Distributed Social Networking-Social Ranking, Relevancy, and ─Defriending-Web 3.0 or The Semantic Web-Mobile Technology- Measuring Your Success-A Qualitative Framework-A Quantitative Framework-Tools to Help You Measure-Come to Your Own Conclusions

Text Book:

1. Deltina hay ―A Survival Guide To social Media and Web 2.0 Optimization‖, Dalton Publishing, 2009

Reference Books:

1. Miriam Salpeter ―Social Networking for Career Success‖ Learning Express, 2011.
2. Miles, Peggy, ―Internet world guide to webcasting‖ Wiley, 2008
Professionals", Wiley Publication,2015.

Course Outcomes:

On the successful completion of the course, students will be able to

CO1:	To understand, impart and summarize the concepts of Social media, Social networking and Webcasts	K1-K6
CO2:	To comprehend, design and develop a Word Press Powered Website	K1-K6
CO3:	To understand, implement and perform evaluation of Social Networking and Micro-Blogging	K1-K6
CO4	To collaborate, implement and analyze the Widgets and Badges in social networking environment	K1-K6
CO5	To understand, illustrate and perform evaluation of web optimization for social networks	K1-K6

K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6-Create

Mapping with Programme Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	-	S	L	-	S	-	S	S	S
CO2	S	S	S	-	S	L	-	S	-	S	S	S
CO3	S	S	S	-	S	L	-	S	-	S	S	S
CO4	S	S	S	-	S	L	-	S	-	S	S	S
CO5	S	S	S	-	S	L	-	S	-	S	S	S

S- Strong; M-Medium; L-Low

Course Objectives

- To understand the concept of Linear optimization
- To develop mathematical models of transportation and assignment Problems
- To understand the Networking models
- To study non-linear optimization models
- To develop optimization algorithms based on Evolutionary concepts

Unit – I : Linear Programming Problem

Linear Programming Problem (LPP): Mathematical Formulation of Linear Programming Problem - Graphical Solution of LPP - canonical and standard forms of linear programming problem- Simplex method for solving LPP

Unit – II : Transportation and Assignment Problems

Transportation Model: North West corner Method, Least cost method, and Vogel's Approximation Method. Assignment Model : Hungarian assignment model – Travelling Sales Man Problem.

Unit – III : CPM/PERT

Project Scheduling PERT/CPM Networks – Fulkerson's Rule – Measure of Activity –PERT Computation – CPM Computation – Resource Scheduling.

Unit – IV : Non-Linear Optimization Models

Simplex Method – Gradient of function – Steepest Descent method – Conjugate Gradient method

Unit – V : Evolutionary Algorithms

Particle Swarm Optimization method – Ant Colony optimization algorithm – Fruit Fly method – Fire Fly method

Text Book

1. Kanti Swarup, P. K. Gupta and Man Mohan, Operations Research, Sultan Chand and Sons, New Delhi, 2014. (Unit 1, 2, and 3)

2. S. S. Rao, Engineering Optimization: Theory and Practice, JOHN WILEY & SONS, INC., 2009. (Unit 4)

3. Bo Xing and Wen-Jing Gao, Innovative Computational Intelligence: A Rough Guide to Clever Algorithms, Springer, 2014.(Unit 5)

Reference Book

1. Hamdy A. Taha, Operations Research: An Introduction, Pearson, 2010

Course outcome:

CO1 Develop Linear Programming models for industrial problems

CO2 Formulation of Transportation and Assignment problems for real life problems

CO3 Critical path estimation can be done for a project

CO4 Non-Linear optimization models can be solved

CO5 Evolutionary Optimization algorithms can be used to solve any optimization problems to overcome the issues in the traditional optimization models

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	M	S	S	S	M	S	S	S	S	S
CO2	S	S	S	S	S	L	S	M	S	S	M	S
CO3	S	M	S	S	M	S	M	S	S	L	S	M
CO4	S	S	S	S	S	S	S	S	S	S	M	S
CO5	S	S	S	S	M	L	S	S	S	M	M	S

S- Strong; M-Medium; L-Low