PONNAIYAH RAMAJAYAM INSTITUTE OF SCIENCE & TECHNOLOGY (PRIST)

Declared as DEEMED-TO-BE-UNIVERSITY
U/s 3 of UGC Act, 1956

M.C.A.,

SCHOOL OF ARTS AND SCIENCE

DEPARTMENT OF COMPUTER SCIENCE

PG CURRICULUM

FULL TIME

[Regulation 2023]

[Candidates admitted from the academic year 2023-2024 onwards]

PONNAIYAH RAMAJAYAM INSTITUTE OF SCIENCE & TECHNOLOGY (PRIST) **REGULATIONS ON LEARNING OUTCOME-BASED CURRICULUM FRAMEWORK FOR POSTGRADUATE EDUCATION**	
Programme	**M.C.A.,**
Programme Code	**23PGCOAGE**
Duration	**PG - Two Years**
Programme Outcomes (Pos)	**PO1: Problem Solving Skill** Apply knowledge of Management theories and Human Resource practices to solve business problems through research in Global context. **PO2: Decision Making Skill** Foster analytical and critical thinking abilities for data-based decision-making. **PO3: Ethical Value** Ability to incorporate quality, ethical and legal value-based perspectives to all organizational activities. **PO4: Communication Skill** Ability to develop communication, managerial and interpersonal skills. **PO5: Individual and Team Leadership Skill** Capability to lead themselves and the team to achieve organizational goals. **PO6: Employability Skill** Inculcate contemporary business practices to enhance employability skills in the competitive environment. **PO7: Entrepreneurial Skill** Equip with skills and competencies to become an entrepreneur. **PO8: Contribution to Society** Succeed in career endeavors and contribute significantly to society. **PO 9 Multicultural competence** Possess knowledge of the values and beliefs of multiple cultures and a global perspective. **PO 10: Moral and ethical awareness/reasoning** Ability to embrace moral/ethical values in conducting one's life.
Programme Specific Outcomes (PSOs)	**PSO1 – Placement** To prepare the students who will demonstrate respectful engagement with others' ideas, behaviors, and beliefs and apply diverse frames of reference to decisions and actions. **PSO 2 - Entrepreneur** To create effective entrepreneurs by enhancing their critical thinking,

	problem solving, decision making and leadership skill that will facilitate startups and high potential organizations.
	PSO3 – Research and Development
	Design and implement HR systems and practices grounded in research that complies with employment laws, leading the organization towards growth and development.
	PSO4 – Contribution to Business World
	To produce employable, ethical and innovative professionals to sustain in the dynamic business world.
	PSO 5 – Contribution to the Society
	To contribute to the development of the society by collaborating with stakeholders for mutual benefit.

SCHOOL OF ARTS AND SCIENCE
DEPARTMENT OF COMPUTER SCIENCE
MCA (MASTER OF COMPUTER APPLICATION)
REGULATION 2023 – 2024
COURSE STRUCTURE
SEMESTER-I

Course Code	Course Title – MCA	L	T	P	C
THEORY					
23222AEC11	Discrete Mathematics	5	1	0	4
23222AEC12	Linux and shell programming	4	1	0	3
23222AEC13	Python Programming	4	1	0	3
PRACTICAL					
23222SEC14L	Linux and shell programming Lab	0	0	3	3
23222SEC15L	Python Programming Lab	0	0	3	3
23222SEC16	Data Science	2	-	-	2
23222RMC17	Research Methodology	2	-	-	2
	Total	17	3	6	20

SEMESTER – II

Course Code	Course Title – MCA	L	T	P	C
THEORY					
23222AEC21	Data Structures and Algorithms	4	1	0	3
23222AEC22	Big Data Analytics	4	1	0	3
23222DSC23_	Internet of Things	5	0	0	4
23222DSC24_	Cyber Security	5	0	0	4
PRACTICAL					
23222SEC25L	Data Structures and Algorithms Lab	0	0	3	3
23222SEC26L	Big Data Analytics Lab	0	0	3	3
23222SEC27	NME Fundamentals of Human Rights	2	0	0	2
23222BRC28	Participation in Bounded Research	2	0	0	2
23222SEC29	Internship Industrial Activity			0	2
	Total	22	2	6	26

SEMESTER – III

Course Code	Course Title – MCA	L	T	P	C
THEORY					
23222AEC31	Advanced Java Programming	5	2	0	6
23222AEC32	Web Technology	5	2	0	6
23222AEC33	Advanced Machine Learning (AML)	5	2	0	5
PRACTICAL					
23222SEC34L	Advanced Java Programming lab	0	0	3	3
23222SEC35L	Web Technology Lab	0	0	3	3
23222SEC36L	Advanced Machine Learning (AML) Lab	0	0	3	3
23222SEC37	Industrial visit	0	0	0	2
	Total	15	6	9	28

SEMESTER – IV

Course Code	Course Title – MCA	L	T	P	C
THEORY					
23222AEC41	Data Visualization Tools	5	1	0	4
23222AEC42	Mobile Computing	5	1	0	4
23222DSC43_	Social Networks	5	1	0	4
23222PRW44	Project with Viva voce	0	0	10	4
23222SEC45	Skill Enhancement Professional Competency Skill	2	0	0	2
23222SEC46	Internship Industrial Activity	-	-	-	2
	Total	17	3	10	20
	Total Credits for the Programme				91

Discipline Specific Electives

Semester	Discipline Specific Elective Courses-I
II	a) 23222DSC23A- Internet of Things b) 23222DSC23B- Internet of Things Lab c) 23222DSC23C- Computer Vision
	Discipline Specific Elective Courses-II
II	a) 23222DSC24A- Cyber Security b) 23222DSC24B- Cyber Security Lab c) 23222DSC24C- Block chain Technologies
	Discipline Specific Elective Courses-III
IV	a) 23222DSC43A- Social Networks b) 23222DSC43B- Social Networks Lab c) 23222DSC43C- High Performance Computing

Credit Distribution for PG Programme

MCA (MASTER OF COMPUTER APPLICATION)

SEM	AEC	SEC	DSC	RSB Courses	others	Total
I	10	8	-	2	-	20
II	6	10	8	2	-	26
III	17	8	-	-	-	25
IV	8	4	4	-	4	20
Total	**41**	**30**	**12**	**4**	**4**	**91**

Course Code	Course Title – MCA	L	T	P	C
23222AEC11	Discrete Mathematics	5	1	0	4

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

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 Book

1. Kimmo Eriksson & Hillevi Gavel, Discrete Mathematics & Discrete

Models, Student literature AB, 2015.

Course Code	Course Title – MCA	L	T	P	C
23222AEC12	Linux and shell programming	4	1	0	3

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	IO
CO2:	To analyze and evaluate the recurrence relations	K4,K5	HO
CO3:	To distinguish among various normal forms and predicate calculus	K5	HO
CO4:	To solve and know various types of matrices	K1	LO
CO5:	To evaluate and solve various types of graphs	K5	HO

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

Course Objective

- 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.

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.

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.

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.

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.

Text book:

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

3. **Reference Books:**

   1. ClifFlynt, SarathLakshman, ShantanuTushar, "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	PO 10	PO 11	PO 12
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

23222AEC13	**Python Programming**	4	1	0	3

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 QuerySets 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 vizualization	
CO5	Design interactive web applications using Django	

K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- CreateMapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
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

23222SEC14L	**Linux and shell programming Lab**	0	0	3	3

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	PO 12
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

23222SEC15L	**Python Programming Lab**	0	0	3	3

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	K1- K6
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	
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	PO 11	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

23222SEC16	Data Science	2	-	-	2

Unit – I:

Introduction to Data Science – Evolution of Data Science – Data Science Roles – Stages in a Data Science Project – Applications of Data Science in various fields – Data Security Issues.

Unit – II:

Data Collection and Data Pre-Processing Data Collection Strategies – Data Pre-Processing Overview – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization.

Unit – III:

Exploratory Data Analytics Descriptive Statistics – Mean, Standard Deviation, Skewness and Kurtosis – Box Plots – Pivot Table – Heat Map – Correlation Statistics – ANOVA.

Unit – IV:

Model Development Simple and Multiple Regression – Model Evaluation using Visualization – Residual Plot – Distribution Plot – Polynomial Regression and Pipelines – Measures for In-sample Evaluation – Prediction and Decision Making.

Unit – V:

Model Evaluation Generalization Error – Out-of-Sample Evaluation Metrics – Cross Validation – Over fitting – Under Fitting and Model Selection – Prediction by using Ridge Regression – Testing Multiple Parameters by using Grid Search.

REFERENCES:

 1. Jojo Moolayil, "Smarter Decisions: The Intersection of IoT and Data Science", PACKT, 2216.

2. Cathy O'Neil and Rachel Schutt , "Doing Data Science", O'Reilly, 2215.

3. David Dietrich, Barry Heller, Beibei Yang, "Data Science and Big data Analytics", EMC 2213

4. Raj, Pethuru, "Handbook of Research on Cloud Infrastructures for Big Data Analytics", IGI Global.

23222RMC17	**RESEARCH METHODOLOGY**	2	-	-	2

OBJECTIVES:

- To understand the approaches towards and constraints in good research.
- To identify various statistical tools used in research methodology
- To appreciate and compose the manuscript for publication
- To train in MATLAB platform for basic computational programing and analysis.

OUTCOME:

Ability to develop research questions and the various research strategies and compile research results in terms of journal manual scripts.

UNIT-I Introduction to research methodology Objectives of research – type of research Significance of research. Research methodology – Research and scientific method – Criteria of good research – Problems encountered by research in India.

UNIT-II Data base and Literature Survey Articles – Thesis – Journals – Patents – Primary sources of journals and patens – Secondary sources – Listing of titles – Abstracts –Chemical Abstract Service Reviews – Monographs – Literature search.

UNIT-III Data Analysis: Precision and accuracy – Reliability – Determinate and random errors Distribution of random errors –normal distribution curve – Statistical treatment of finite samples – T test and F test (ANOVA) co – Variance (ANCOVA) correlation and multiple regression.

UNIT-IV Thesis and paper writing: Conventions in writing – General format – Page and chapter format – Use of quotations and footnotes – Preparations of tables and figures – Reference and Appendices.

UNIT-V Application on MATLAB: Numerical Integration – Numerical integration, ordinary differential equations, partial differential equations, and boundary value problems - Fourier analysis – Fourier transforms, convolution.

References:

1. C.R. Kothari, Research Methodology, New Age International publishers. New Delhi, 2224.

2. R.A Day and A.L. Underwood, Quantitative analysis, Prentice Hall, 1999.

3. R. Gopalan, Thesis writing, Vijay Nicole Imprints Private Ltd., 2225.

4. A Guide to MATLAB: For Beginners and experienced Users by Brian R. Hunt (Editor), Ronald L. Lipsman, J. Rosenberg

5. Introduction to MATLAB for Engineers by William J. Palm III.

23222AEC21	**Data Structures and Algorithms**	4	1	0	3

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 Outcome:

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

23222AEC22	**Big Data Analytics**	4	1	0	3

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 No SQL.
- To explore the big data tools such as Hive, H Base 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: No SQL, Comparison of SQL and No SQL, 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 Mapreduce 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

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	PO 10	PO 11	PO1 2
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

23222SEC25L	**Data Structures and Algorithms Lab**	0	0	3	3

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.

      Linear recursion

      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

23222SEC26L	**Big Data Analytics Lab**	0	0	3	3

Course Objectives

- To teach the fundamental techniques for handling the big data tools.
- To familiarize the tools required to manage big data.
- To analyze big data using Hadoop, Map Reduce, Hive, and Pig
- To teach the fundamental principles in achieving big data analytics with scalability and streaming capability
- To enable students to have skills that will help them to solve complex.

List of Programs

1. Implement File System Shell Commands for HDFS in Hadoop Environment
2. Write a Map reduce program using single reduce function for finding Maximum and Minimum Number
3. Write a Map reduce program using multiple reduce function for Word Count in an given Text document
4. Implement the following using Pig Latin Input and Output Operations Relational Operations
5. Implement the following using Pig Latin User Defined Functions Advanced Relational Operations
6. Write a Word Count program using Pig Latin Script
7. Write a program to find a maximum temperature using Pig Latin Script
8. Implement the following using Hive commands Handling the Database Creating and Manipulating table
9. Implement Simple Queries for database using Mongo
10. Implement Simple Queries for collections using Mongo

Course Outcomes

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

CO1:	Understand and develop conceptually how Big Data is stored and implement it using different tools	K1-K6
CO2:	Comprehend and implement programs for data storage in HDFS and table manipulation using Big Data tools in Hadoop environment	K1-K6
CO3:	Understand and Critically analyze existing Big Data datasets and implementations the solutions for it using Mongo DB	K1- K6
CO4:	Understand and examine existing Big Data datasets and implementations the solutions using HIVE database	K1- K6
CO5:	Comprehend and review existing datasets and implementations the solutions to handle it using PIG	K1- K6

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

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	S	S	M		M	S	-	-	-	-	-	-
CO2	S	M	S	S	S	M	-	-	-	-	-	-
CO3	S	S	S	S	S	S	-	-	-	-	-	-
CO4	S	M	S	S	S	M	-	-	-	-	-	-
CO5	S	S	S	S	S	S	-	-	-	-	-	-

23222DSC23A	**Internet of Things**	5	0	0	4

Course Objectives:

- 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

UNIT I: FUNDAMENTALS OF IOT Evolution of Internet of Things – Enabling Technologies – IOT Architectures: oneM2M, IOT World Forum (IOTWF) and Alternative IOT models – Simplified IOT Architecture and Core IOT Functional Stack -– Fog, Edge and Cloud in IOT – Functional blocks of an IOT ecosystem – Sensors, Actuators, Smart Objects and Connecting Smart Objects.

UNIT II: IOT PROTOCOLS IOT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN – Network Layer: IP versions, Constrained Nodes and Constrained Networks – Optimizing IP for IOT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks – Application Transport Methods: Supervisory Control and Data Acquisition – Application Layer Protocols: CoAP and MQTT.

UNIT – III: DESIGN AND DEVELOPMENT Prototyping Embedded Devices: Electronics - Embedded Computing Basics – Arduino - Raspberry Pi - Beagle Bone Black - Electric Imp. Prototyping the Physical Design: Non digital Methods - Laser Cutting - 3D printing - CNC Milling - Repurposing/Recycling.

UNIT – IV: Prototyping Online Components: Getting started with an API - Writing a New API - Real-Time Reactions - Other Protocols. Techniques for Writing Embedded Code: Memory Management - Performance and Battery Life – Libraries - Debugging.

UNIT – V: Business Models: History of Business Models – Model – Internet of Starting up – Lean Startups. Moving to Manufacture: Designing Kits - Designing Printed circuit boards – Certification – Costs - Scaling up Software. Ethics: Privacy – Control – Environment – Solutions.

Text Books:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, ―IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, Cisco Press, 2017 (UNIT I and II)

2. Adrian McEwen and Hakim Cassimally, "Designing the Internet of Things", Wiley, 2014. (UNIT III, IV and V)

Reference Books:

1. Ovidiu Vermesan and Peter Friess, "Internet of Things – From Research and Innovation to Market 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 BeagleBoneBlack", McGraw Hill, 2015.

Course Outcomes

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

CO1:	Comprehend the IoT evolution with its architecture and sensors	
CO2:	Understand the networking concepts for communication and underlying IoT protocols	
CO3:	Assess the embedded technologies and develop prototypes for the IoT products	K1- K6
CO4:	Evaluate the use of Application Programming Interface and design an API for IoT in real-time	
CO5:	Recognize the ethics of business models and perform security analysis	

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	S	S	S
CO2	S	S	S	S	S	S	S	M	S	S	M	S
CO3	S	M	S	S	S	S	M	S	S	M	S	S
CO4	S	S	S	S	S	S	S	S	S	S	M	S

S- Strong; M-Medium; L-Low

23222DSC23B	Internet of Things Lab	0	0	3	3

Course Objectives:

- To create IoT program to turn ON/OFF LED
- To implement IoT program for object detection
- To develop IoT programs for agricultural purpose
- To create web server program for local hosting
- To design IoT application for health monitoring

1. To develop an IoT program to turn ON/OFF LED light (3.3V)
2. To develop an IoT program using IR sensor (Smart Garbage Monitoring, Detecting Parking Availability, etc.)
3. To develop an IoT program using Humidity and Temperature Monitoring (Forest fire Detection, Weather Monitoring)
4. To develop an IoT web server program for local hosting
5. To develop an IoT program using Soil Moisture Sensor
6. To develop an IoT program using Ultrasonic Sensor (Distance Measurement, etc.)
7. To develop an real-time IoT program using Relay Module (Smart Home Automation with 230V)
8. To develop an IoT program for Fire Detection (Home, Industry,etc.)
9. To develop an IoT program for Gas Leakage detection (Home, Industry, etc.)
10. To develop an IoMT program using Heartbeat Sensor

Course Outcomes

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

CO1	Implement IoT programs to turn ON/OFF LED	
CO2	Develop IoT programs for object detection	
CO3	Create IoT programs for agricultural purpose	K1 - K6
CO4	Implement web server program for local hosting	
CO5	Design IoT application for health monitoring	

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	M	S	S	S	S	S
CO2	S	S	S	S	S	S	S	M	S	S	M	S
CO3	S	M	S	S	S	S	M	S	S	M	S	S
CO4	S	S	S	S	S	S	S	S	S	L	M	S
CO5	S	S	S	S	M	S	L	S	S	M	M	S

S- Strong; M-Medium; L-Low

23222DSC23C	Computer Vision	5	0	0	4

Course Objectives:

- This involves identifying and classifying objects, people, and scenes within images or videos.

- Going beyond simple classification, object detection aims to locate specific objects within an image and draw bounding boxes around them.

- This involves following the movement of identified objects across a sequence of video frames.

Unit 1: Image Fundamentals and Basic Image Processing

Introduction to computer vision and its applications. Digital image formation and representation pixels, color spaces).Basic image processing techniques: Image enhancement (brightness, contrast, histogram equalization).Spatial filtering (smoothing, sharpening, edge detection).Image transformations (scaling, rotation).

Unit 2: Feature Detection and Description

Feature detection: Edge detection (Canny, Sobel).Corner detection (Harris, Shi-Thomas).Feature description: SIFT (Scale-Invariant Feature Transform).SURF (Speeded up Robust Features).ORB (Oriented FAST and Rotated BRIEF).Feature matching.

Unit 3: Image Segmentation and Object Recognition

Image segmentation: Thresholding.Region-based segmentation.Clustering (K-means).Object recognition: Template matching. Introduction to machine learning for object recognition**.**

Unit 4: Camera Models and 3D Vision

Camera geometry and models (pinhole camera).Camera calibration. Stereo vision and depth perception.

3D reconstruction. Learning Objectives: Understand camera geometry and calibration.

Explore 3D vision concepts and techniques.

Unit 5: Deep Learning for Computer Vision

Convolutional Neural Networks (CNNs): Architectures and applications. Object detection:

R-CNN family (R-CNN, Fast R-CNN, Faster R-CNN).YOLO (You Only Look Once).

Semantic segmentation. Image classification.

Text Books:

"Computer Vision: A Modern Approach" by David Forsyth and Jean Ponce

"Learning OpenCV 4 with Python" by Joseph Howse, Joe Minichino, and Prateek Joshi:

Reference Books:

"Computer Vision: Algorithms and Applications" by Richard Szeliski

"Multiple View Geometry in Computer Vision" by Richard Hartley and Andrew Zisserman:

Course Outcomes

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

CO1:	Students will be able to explain the principles of digital image formation, representation, and basic image processing techniques.	
CO2:	Students will be able to describe different color spaces and their applications.	
CO3:	Students will be able to explain and implement various feature detection algorithms	K1- K6
CO4:	Students will be able to understand and apply feature descriptors	
CO5:	Students will be able to explain the pinhole camera model and camera calibration.	

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	S	S	S
CO2	S	S	S	S	S	S	S	M	S	S	M	S
CO3	S	M	S	S	S	S	M	S	S	M	S	S
CO4	S	S	S	S	S	S	S	S	S	S	M	S

S- Strong; M-Medium; L-Low

23222DSC24A	**Cyber Security**	5	0	0	4

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

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-smartphone security guidelines – purses, wallets, smart phones – platforms, setup and installation-communicating securely with a smartphone.

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. Anthony reyes, 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" Ein Einblickfur 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

	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

23222DSC24B	Cyber Security Lab	5	0	0	4

COURSE OBJECTIVES

- To learn and implement to Change the wireless device mode as monitor mode
- To develop in multiple vulnerabilities webserver
- To understand and implement the open ports in the network
- To acquire programming skills in Implement various wireless device modes
- To comprehend related to find the sub domains of webpage

Implement the following using any cyber security tools

1. Install virtual box (kali Linux)
2. Generate a secure password using keepass
3. Change the wireless device mode as monitor mode
4. Find the known and open vulnerabilities of system using metaspolit
5. Identify the multiple vulnerabilities webserver using nikto tool
6. Identify the open ports in the network using nmap tools
7. List all the network around us and display the information about the networks
8. Sniff and capture the packet sent over HTTP requests
9. Find the owners of internet resources using Whois Lookup tool
10. Find the subdomains of webpage using knock tool

Course Outcomes

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

CO1:	Comprehend the programming skills in Change the wireless device mode as monitor mode	K1-K6
CO2:	Understand and implement multiple vulnerabilities webserver	K1-K6
CO3:	Evaluate the use of different wireless device modes	K1-K6
CO4:	Design to Solve related to find the subdomains of webpage	K1-K6
CO5:	Create and apply open ports in the network	K1-K6

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

Mapping Course outcomes with Programme outcomes

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
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

23222DSC24C	Block chain Technologies	5	0	0	4

COURSE OBJECTIVES

- To understand about Block chain is an emerging technology platform for developing decentralized applications and data storage.
- To comprehend fundamentals of Public Key Cryptography technology and Consensus Algorithms.

Unit I: Block chain, Decentralization

Block chain: The growth of block chain technology - Distributed systems - The history of block chain and Bit coin – Block chain - Consensus - CAP theorem and block chain. **Decentralization:** Decentralization using block chain - Methods of decentralization -Routes to decentralization – Block chain 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 block chain 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: Bit coin

Bit coin: Bit coin—an overview - Cryptographic keys - Transactions – Block chain – Mining. **Bit coin Network and Payments:** The Bit coin network - Wallets – Bi tcoin payments -Innovation in Bit coin - Advanced protocols - Bitcoin investment and buying and selling Bitcoin. **Bit coin Clients and APIs:** Bitcoin client installation - Experimenting further with bit coin-cli – Bit coin 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 – Ethereum Virtual Machine (EVM) - Smart contracts. - Blocks and block chain - 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 BOOKS

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

REFERENCES

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 block chain, bit coin 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 block chain.	K1-K6
CO3:	Understand and analyses the elements of trust in a Block chain: 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

COs	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

23222SEC27	NME Fundamentals of Human Rights	2	0	0	2

Unit I: Introduction:

Meaning and Definitions of Human Rights – Characteristics and Importance of Human Rights – Evolution of Human Rights – Formation, Structure and Functions of the UNO - Universal Declaration of Human Rights – International Covenants – Violations of Human Rights in the Contemporary Era.

Unit II: Human Rights in India:

Development of Human Rights in India – Constituent Assembly and Indian Constitution – Fundamental Rights and its Classification – Directive Principles of State Policy – Fundamental Duties.

Unit III:

Rights of Marginalized and other Disadvantaged People: Rights of Women – Rights of Children – Rights of Differently Abled – Rights of Elderly - Rights of Scheduled Castes – Rights of Scheduled Tribes – Rights of Minorities – – Rights of Prisoners – Rights of Persons Living with HIVAIDS – Rights of LGBT.

Unit IV:

Human Rights Movements: Peasant Movements (Tebhaga and Telangana) – Scheduled Caste Movements (Mahar and Ad-Dharmi) – Scheduled Tribes Movements (Santhal and Munda) – Environmental Movements (Chipko and Narmada BachaoAndolan) – Social Reform Movements (Vaikom and Self Respect).

Unit V:

Redressal Mechanisms: Protection of Human Rights Act, 1993 (Amendment 2019) – Structure and Functions of National and State Human Rights Commissions – National Commission for SCs – National Commission for STs – National Commission for Women – National Commission for Minorities – Characteristics and Objectives of Human Rights Education.

References

1. Sudarshanam Gankidi, Human Rights in India: Prospective and Retrospective, Rawat Publications, Jaipur, 2019.

2. SatvinderJuss, Human Rights in India, Routledge, New Delhi, 2020.

3. Namita Gupta, Social Justice and Human Rights in India, Rawat Publications, Jaipur, 2021.

4. Mark Frezo, the Sociology of Human Rights, John Willy & Sons, U.K. 2014.

23222AEC31	**Advanced Java Programming**	4	1	-	4

Course Objectives

- To gain knowledge of Object Oriented Programming Concept in Java
- To understand usages of String functions in Java
- To familiarize with the applet and swing
- To grasp the concepts on Java Beans
- To comprehend the connection between Relational Database and Java.

Unit – I

An Overview of Java: Object Oriented Programming- Data Types, Variables, and Arrays: Primitive Types-Literals Variables - Type Conversion and Casting- Arrays-Operators: Control Statements-Classes and Methods – Inheritance- Exception Handling.

Unit – II

String Handling: The String Constructors - String Length - Special String Operations - Character Extraction - String Comparison - Searching Strings - Modifying a String - Input/Output: The I/O Classes and Interfaces – File - Byte Streams - Character Streams.

Unit – III

The Applet Class: Basic Architecture - Applet Skeleton - Display methods - Status Window – Passing Parameters. Introducing GUI Programming with Swing– Introducing Swing - Swing Is Built on the AWT- Two Key Swing Features - The MVC Connection - Components and Containers - The Swing Packages - A Simple Swing Application - Exploring Swing.

Unit- IV

Java Beans: Introduction - Advantages of Beans – Introspection - The JavaBeans API - A Bean Example. Servlets: Life Cycle Simple Servlet-Servlet API-Packages-Cookies session tracking.

Unit – V

Network Programming: Working with URLs- Working with Sockets - Remote Method Invocation. Introduction to Database Management Systems - Tables, Rows, and Columns - Introduction to the SQL SELECT Statement - Inserting Rows - Updating and Deleting Existing Rows - Creating and Deleting Tables - Creating a New Database with JDBC - Scrollable Result Sets.

Text Books:

1. Herbert Schildt, "Java the Complete Reference", 10th edition, McGraw Hill Publishing Company Ltd, New Delhi, 2017.
2. Tony Goddis, "Starting out with Java from Control Structures Through Objects" 6th Edition, Pearson Education Limited, 2016

Reference books:

1. Herbert Schildt, Dale Skrien, "Java Fundamentals – A Comprehensive Introduction", TMGH Publishing Company Ltd, New Delhi, 2013
2. John Dean, Raymond Dean, "Introduction to Programming with JAVA – A Problem Solving Approach", TMGH Publishing Company Ltd, New Delhi, 2012.

Course Outcomes   **On the successful completion of the course, students will be able**

CO1:	Understand the Object Oriented Program including classes and methods; inheritance and exception handling	K1-K6
CO2:	Complete comprehension of String functions and I/O Streams	K1-K6
CO3:	Creation of graphical representation using Applet	K1-K6
CO4:	Application of Servlets for designing Web based 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	S	-	M	S	-	-	-	S	M	-
CO2	S	S	S	-	M	S	-	-	-	L	M	-
CO3	S	S	M	-	L	S	-	-	-	M	M	-
CO4	M	S	M	-	S	S	-	-	-	M	S	-
CO5	S	M	M	-	M	L	-	-	-	M	M	-

S- Strong; M-Medium; L-Low

23222AEC32	**Web Technology**	5	2	0	6

COURSE OBJECTIVES:

- Understand the fundamentals of the web and thereby develop web applications using various development languages and tools.
- Enrich knowledge about XHTML control and Cascading Style Sheets.
- Provide in- depth knowledge about JavaScript.

UNIT –I

WEB FUNDAMENTALS AND HTML: A Brief Introduction to the Internet - The World Wide Web - Web Browsers - Web Servers -URLs, MIME, HTTP, Security- Introduction to HTML- Origins and Evolution of HTML and HTML - Basic Syntax - Standard HTML Document Structure - Basic Text Markup - Images- Hypertext Links - Lists, Tables, Forms, The Audio Element, The Video Element - Organization Elements, The Time Element

UNIT – II

INTRODUCTION TO XHTML AND CSS: Basic syntax, Standard structure, Basic text-markup, Images, Hypertext Links. Lists, Tables, Forms, Frames, syntactic differences between HTML and XHTML-Introduction, Levels of style sheets, Style specification formats, Selector forms, Property value forms, Font properties, List properties, Color, Alignment of text, The box model, Background images, The<span> and <div>tags, Conflict resolution.

UNIT - III

THE BASICS OF JAVASCRIPT: Overview of JavaScript, Object orientation and JavaScript, general Syntactic characteristics, Primitives, operations, and expressions, Screen output and keyboard input, Control statements, Object creation and modification, Arrays, Functions, Constructors, Pattern matching using regular expressions, Errors in scripts. JAVASCRIPT AND XHTML DOCUMENTS: The JavaScript Execution Environment, The Document Object Model, Elements Access in Java Script, Events and Event Handling, Handling Events from Body Elements, Handling Events from Text Box and password Elements, The DOM2 Model

UNIT- IV

DYNAMIC DOCUMENTS WITH JAVASCRIPT AND XML: Introduction, Positioning Elements, Moving Elements, Element Visibility, Changing Color and Fonts, Dynamic Content, Stacking Elements, Locating the Mouse Cursor, Reacting to a Mouse Click, Slow Movement of Elements, Dragging and Dropping Elements. Introduction to XML, Syntax of XML, XML Document Structure, Document type definitions, Namespaces, XML schemas, displaying raw XML documents, Displaying XML documents with CSS, XSLT Style Sheets, Web services.

UNIT - V

PHP, ANGULAR JS AND JQUERY: Introduction to PHP: Overview of PHP -General Syntactic Characteristics - Primitives, Operations, and Expressions - Output - Control Statements - Arrays - Functions - Pattern Matching - Form Handling - Cookies - Session Tracking - Introduction to JQuery, Syntax, selectors, events, JQuery HTML, JQuery Effects, JQuery CSS. Introduction to Angular JS, Directives, Expressions, Controllers, Filters, Services, Events, Forms, Validations, Examples.

TEXT BOOKS:

1. Robert W. Sebesta: Programming the World Wide Web, Eighth Edition, Pearson education, 2015. **UNITS:** 1,2,3,4
2. Dayley Brad, Dayley Brendan ,"AngularJS, JavaScript, and jQuery All in One", Sams Teach Yourself 1st Edition, Kindle Edition, 2015.**UNIT**: 5

REFERENCE BOOKS:

1. M. Srinivasan: Web Programming Building Internet Applications, 3rdEdition, Wiley India, 2009.
2. Jeffrey C. Jackson: Web Technologies-A Computer Science Perspective, Pearson Education, 7thImpression,2012.
3. Chris Bates: Web Technology Theory and Practice, Pearson Education, 2012.
4. Raj Kamal: Internet and Web Technologies, McGraw Hill Education.

COURSE OUTCOMES:

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

CO1	Design dynamic web pages using JavaScript, Jquery and Angular Java script	K1	LO
CO2	Develop Web pages using HTML, CSS and XML	K2	IO
CO3	Create web application using PHP and MySQL	K3, K4	HO
CO4	To design dynamic web pages using Angular JavaScript	K2,K3	HO
CO5	Develop interactive web pages using Jquery	K4,K5	HO

MAPPING WITH PROGRAMME OUTCOMES

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

S- STRONG; M-MEDIUM; L-LOW

23222AEC33	**Advanced Machine Learning (AML)**	5	2	0	5

Course Objectives

- To understand the concepts of Machine Learning.
- To understand the theoretical and practical aspects of types of machine learning
- To teach and get familiarized with supervised learning and their applications.
- To teach and get familiarized with the concepts and algorithms of unsupervised learning.
- To appreciate the concepts and algorithms of deep learning.

Unit I:

Introducing Machine Learning: The Origins of Machine Learning, Uses and Abuses of Machine learning _ Basics of Machine Learning Algorithm Model Works - Steps to apply Machine Learning - Choosing a Machine Learning Algorithm - Using Machine Learning concepts. Managing and Understanding Data: Data Structures, Vectors and Factors: Lists, Data frames, Matrixes and arrays - Managing Data - Exploring and Understanding Data: Exploring the Structure of Data, Exploring Numeric variables - Exploring Categorical Variables- Exploring Relationships between Variables.

Unit II:

Lazy Learning – **Classification Using Nearest Neighbors:** The kNN Algorithm- Diagnosing Breast Cancer with the kNN Algorithm- Probabilistic Learning – Classification Using Naive Bayes: Basic concepts of Bayesian Methods- The Naïve Bayes Algorithm- Example – filtering Mobile Phone Spam with the Naive Bayes Algorithm. Divide and Conquer – **Classification Using Decision Trees and Rules:** Understanding Decision Trees- Example – Identifying Risky Bank Loans using C5.0 Decision Trees- Understanding Classification Rules- Example – Identifying Poisonous Mushrooms with Rule Learners.

Unit III:

Forecasting Numeric Data – **Regression Methods:** Understanding Regression- Example – Predicting Medical Expenses using Linear Regression- Understanding Regression Trees and Model Trees- Example – Estimating the Quality of Wines with Regression Trees and Model Trees. Black Box Methods Neural Networks and Support Vector Machines: Understanding Neural Networks, from Biological to Artificial Neurons, Activation Functions, Network Topology, Training Neural Networks with Back propagation - Modeling the Strength of Concrete with ANNs- Understanding Support Vector Machines- Performing OCR with SVMs- Finding Patterns – Market Basket Analysis Using Association Rules: Understanding Association Rules- Example – Identifying Frequently Purchased Groceries with Association Rules.

Unit IV:

Finding Groups of Data – **Clustering with K-Means:** Understanding Clustering- The k-means Algorithm for clustering- Finding teen market segments using k-means Clustering- Evaluating Model Performance: Measuring Performance for Classification- beyond Accuracy – other Measures of Performance, Visualizing Performance Tradeoffs.

Improving Model Performance: Tuning Stock Models for Better Performance-Using Caret for Automated Parameter Tuning- Creating a simple Tuned Model- Customizing the Tuning Process- Improving Model Performance with meta-learning- Understanding Ensembles- Bagging- Boosting- Random forests.

Unit V:

Introduction to Deep Learning: Introduction to Deep Learning, Single Layer Perceptron Model (SLP), Multilayer Perceptron Model (MLP), Convolutional Neural Networks (CNNs), Recurrent Neural Networks (RNNs),Restricted Boltzmann Machines (RBMs).

Convolutional Neural Networks (CNNs): Structure and Properties of CNNs - Components of CNN Architectures- Convolutional Layer, Pooling Layer, Rectified Linear Units (ReLU) Layer, Fully Connected (FC) Layer, Loss Layer - Tuning Parameters ,Notable CNN Architectures, Regularization- Recurrent Neural Networks (RNNs): Fully Recurrent Networks, Training RNNs with Back- Propagation Through Time (BPPT)- Elman Neural Networks, Neural History Compressor, Long Short-Term Memory (LSTM), Traditional and Training LSTMs - Structural Damping Within RNNs, Tuning Parameter Update Algorithm.

Text Books:

1. Brett Lantz, "Machine Learning with R", Addison-Wesley Packt Publishing, 2013.
2. TawehBeysolow, "Introduction to Deep Learning Using R: A Step-by-Step Guide to Learning and Implementing Deep Learning Models Using R", San Francisco, California, USA, 2017.

Reference Books:

1. Daniel T. Larose, Chantal D. Larose, "Data mining and Predictive analytics", Second Ed., Wiley Publication, 2015.
2. Bertt Lantz, "Machine Learning with R: Expert techniques for predictive modeling", 3rd Edition, April 15,2019,
3. Jason Bell, "Machine Learning: Hands-On for Developers and Technical Professionals", Wiley Publication,2015.

Course Outcomes

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

CO1	To understand, impart and analyze the concepts and of Machine Learning Techniques and types of data	**K1-K6**
CO2	To comprehend, apply and evaluate the classification techniques for real-world applications	**K1-K6**
CO3	To understand, use and perform evaluation of Regression methods	**K1-K6**
CO4	To recognize, implement and analyse the unsupervised techniques for real-world applications	**K1-K6**
CO5	To understand, identify, implement and review the deep learning techniques for real-time 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	PO 11	PO 12
CO1	S	S	-	-	S	L	-	S	-	-	-	-
CO2	S	S	M	-	S	L	-	S	-	-	-	-
CO3	S	S	S	-	S	L	-	S	-	S	S	S
CO4	S	S	M	-	S	L	-	S	-	-	-	-
CO5	S	S	S	-	S	L	-	S	-	S	S	S

S- Strong; M-Medium; L-Low

23222SEC34L	**Advanced Java Programming lab**	0	0	3	3

COURSE OBJECTIVES:

- To implement object oriented concepts in JAVA
- Develop the program using concepts Network programme
- Learn how to create a program in java beans.
- Learn how to connect relational database to Java
- Develop the program using concepts Applet

List of Experiments:

1. Implementation of and Exception handling concepts with different type of Exception.
2. Build a Swing application to implement metric conversion.
3. Use Grid Layout to design a calculator and simulate the functions of a simple calculator.
4. Create a Color palette with a matrix of buttons using Applet.
5. To invoke a servlet from HTML forms.
6. To invoke servlet from Applets.
7. To invoke servlet from JSP.
8. Implement message communication using Network Programming.
9. Write a program to connect databases using JDBC.
10. Implementation of Java Beans.

Course Outcomes

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

CO1:	Implement classes, objects, members of a class and the relationships among them needed for a finding the solution to specific problem	K1, K2	LO
CO2:	Apply Applets and Swing programs	K3	IO
CO3:	Develop Servlets and JSP for creating Web based applications using JDBC	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	M	S	S	S	S	M	M	S	M	M	S	S
CO2	S	S	M	S	S	S	M	S	S	S	S	S
CO3	S	S	S	M	S	S	M	M	S	M	M	S

S- Strong; M-Medium; L-Low

23222SEC35L	Web Technology Lab	0	0	3	3

COURSE OBJECTIVES:

At the end of the course, the student should be able to do:

- Learn how to create web pages using HTML, CSS and Java script.
- Implement dynamic web pages using Java script, J query and Angular Java script
- To create web applications using PHP and MySQL
- Create web pages using XML and Cascading Style Sheets
- Create XML documents and Schemas.

PROGRAM LIST

1. Develop a web page to display your education details in a tabular format. 2. Develop a web page to display your CV on a web page.

3. Design a Homepage having three links: About Us, Our Services and

   Contact Us. Create separate web pages for the three links.

4. Design a web page to demonstrate the usage of inline CSS, internal CSS

   And external CSS.

 5. Design an XML document and create a style sheet in CSS & display the

   Document in the browser.

6. Develop a web page to Create image maps.

7. Design a web page to perform input validation using Angular Java script.

8. Develop a web page in PHP to fetch details from the database.

9. Design a web page to hide paragraph using J Query

10. Create a web page and add Java script to handle mouse events and form events

COURSE OUTCOMES:

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

CO1	Design dynamic web pages using JavaScript, J query and Angular Java script	K1	LO
CO2	Develop Web pages using HTML, CSS and XML	K2	IO
CO3	Create web application using PHP and MySQL	K3, K4	HO
CO4	Develop interactive web pages using J query	K2,K3	HO
CO5	To design dynamic web pages using Angular java script	K4,K5	HO

MAPPING WITH PROGRAMME OUTCOMES

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

S- STRONG; M-MEDIUM; L-LOW

23222SEC36L	Advanced Machine Learning Lab	0	0	3	3

Course Objectives

- To formulate machine learning problems corresponding to different applications.
- To understand a range of machine learning algorithms along with their strengths and weaknesses.
- To apply machine learning algorithms to solve problems of moderate complexity.
- To apply CNN to solve problems of moderate complexity.
- To apply LSTM and RNN to solve problems.

List of Programs

1. Write a python program to compute the Central Tendency Measures:Mean,Median,Mode,

   Measure of Dispersion: Variance, Standard Deviation

2. Implement a Linear Regression and Multiple Linear Regression with a Real Dataset

3. Implementation of Logistic Regression using sklearn

4. Implement a binary classification model.

5. Classification with Nearest Neighbours and Navie Baye Algorithm

6. Implementation Decision tree for classification using sklearn and its parameter tuning

7. Implement the k-means algorithm.

8. Implement an Image Classifier using CNN in Tensor Flow/Keras.

9. Implement an Autoencoder in TensorFlow/Keras.

10. Implement a Simple LSTM using Tensor Flow/Keras.

Course Outcomes

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

CO1	To understand and implement the mathematical and statistical prospective of machine learning algorithms through python programming	**K1-K6**
CO2	To recognize and develop the machine learning models through python in built functions	**K1-K6**
CO3	To understand, impart and develop the machine learning models for real-time dataset	**K1-K6**
CO4	To comprehend , impart and implement the deep learning models for real-time applications	**K1-K6**
CO5	To identify and evaluate the performance machine learning models for real-time dataset	**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	-	-	-

S- Strong; M-Medium; L-Low

23222AEC41	Data Visualization Tools	5	1	0	4

COURSE OBJECTIVES

Today's fast world requires the data to be presented in an abstract and appealing way to attract the audience. Most of the websites like social media, ecommerce use info graphics and dashboards to engages their visitors. The use of different data visualization techniques make all these requirements possible through this four weeks Data Visualization Course. This course predominantly uses Python libraries for creating charts, interactive figures and animations.

COURSE OUTCOMES:

- By the end of this course, the learners will be able to

- Use python libraries for data visualization
- Conduct exploratory data analysis using Python
- Interpret results of exploratory data analysis
- Paraphrase the results for documentation

COURSE CONTENTS:

Module 1

Basic Plotting Line plot - Bar plot - Pie Chart - Scatter Plot - Histogram - Stacked Bar Charts - Sub Plots - Matplotlib, Searborn, Plotly - Seaborn Styles

Module 2

Applied Visualizations Box plot - Density Plot - Area Chart - Heat map - Tree map - Graph Networks

Module 3

Interactive Visualizations and Animations Dynamic charts - Dynamic maps - Animation types - 2D, 3D, Motion Animation - Animation Principles - Altair Package - Statistical Visualizations

Module4

 Principles of Information Visualization Visual Perception and Cognition - Gestalt's Principles - Tuft's Principles - Applications of Principles of Information Visualization - Dashboard Design

Reference Books:

1. "Information Dashboard Design" by Stephen Few

2. A Data Visualization Guide for Business Professionals" by Cole Nussbaum Knifelike

23222AEC42	Mobile Computing	5	1	0	4

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, and CDMA.

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, and 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)

Course Outcomes:

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

- Understanding the basic concepts of Wireless Communication

- Understanding the basic concepts of Spread Spectrum

- Analyzing the concepts of Medium Access Control

- Analyzing the concepts of Global System for Mobile Communication

- Understanding the basic concepts of Wireless LAN

- Understanding the basic concepts of Mobile Network Layer

- Understanding the basic concepts of Wireless Application Protocol

- Analyzing the concepts of Routing Protocols in MANET

Text Book:

1. Jochen Schiller, "Mobile Communications", Second Edition, Pearson Education, 2013.
2. KumKumGarg, "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	Understanding the basic concepts of Mobile and Wireless Communication	K1, K2	LO
CO2	Understanding the basic concepts of Spread Spectrum. Analyzing the concepts of Medium Access Control.	K3	IO
CO3	Analyzing the concepts of Global System for Mobile Communication and Satellite Communications. Understanding the basic concepts of Wireless LAN	K4	HO
CO4	Understanding the basic concepts of Wireless LAN. Evaluate the performance of Mobile Network Layer	K2, K5	HO
CO5	Understanding the basic concepts of Wireless Application Protocol and create a MoileApp with real time application. Analyzing 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

  3. S- Strong; M-Medium; L-Low

23222DSC43A	Social Networks	5	1	0	4

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

23222DSC43B	Social Networks Lab	0	0	3	3

Course Objectives

- To familiarize the tools required to manage social network applications
- To analyze social networks like Facebook, LinkedIn, Google+, GitHub
- To teach the fundamental techniques and principles in achieving social networking environment.
- To enable students to have skills that will help them to solve real time applications.
- To get explore in the Github API.

List of Programs

1. Creating and Exploring Twitter's API
2. To analyzing and visualizing tweets and tweet entities with frequency analysis
3. Creating and Exploring Facebook's Social Graph API
4. To analyzing the Facebook's Social Graph connections
5. Creating and Exploring LinkedIn API
6. To downloading LinkedIn connections as a CSV file
7. Creating and Exploring Google+ API
8. To create and querying Human Language Data with TF-IDF
9. Creating and Exploring GitHub's API
10. To analyzing GitHub interest graph

Course Outcomes

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

CO1:	To understand, implement and review the fundamental techniques and principles for social networks.	K1-K6
CO2:	To design and develop the programs using the tools required to develop and manage social network like Facebook, LinkedIn, Google+, GitHub	K1-K6
CO3:	To create and explore the functionality of social networking tools such as GitHub	K1-K6
CO4	To understand, implement and review the fundamental principles for social network graph.	K1-K6
CO5	To comprehend and critically analyze the existing API for social networks	K1-K6

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

Mapping with Programme Outcomes

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

S- Strong; M-Medium; L-Low

23222DSC43C	High Performance Computing	5	1	0	4

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 Open MP technology that is widely used in HPC technology.

Unit-I

Modern processors: Stored-program computer architecture-General purpose cache based microprocessor architecture-Memory hierarchies-Multicore 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 Open MP:** Short introduction to Open MP-Open MP-parallel Jacobi algorithm.

Unit-IV

Efficient Open MP programming: Profiling Open MP 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 internode 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, EfstratiosGallopoulos, 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 Open MP 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	PO 11	PO 12
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

23222PRW44	Project with Viva voce	0	0	10	4

Each student will develop and implement individually developed application software based on any of the latest technologies.