Dwaraka Doss Goverdhan Doss Vaishnav College
[Autonomous]
Shift– II

BACHELOR OF SCIENCE IN DATA SCIENCE
CHOICE BASED CREDIT SYSTEM (CBCS)
WITH
GRADING SEMESTER SYSTEM WITH CREDITS

B.Sc. (Data Science)
Scheme of Examination

(For the students admitted during the academic year 2023 onwards)

UNDER GRADUATE PROGRAMME

REGULATIONS

1. ELIGIBILITY FOR ADMISSION

Candidates for admission to the first year of the B.Sc. (Data Science) programme shall be required to have passed the higher secondary examinations under science stream with Physics, Chemistry, Mathematics and Computer Science (Academic or Vocational Stream) conducted by the Government to of Tamil Nadu or an examination accepted as equivalent thereof by the Syndicate of the University.

COURSE OF STUDY

Part	Course Code	Study Components and Course Title	Instruction Hours /Week	Total Contact Hours	Continuous Internal Assessment (CIA)	End-Semester Examination (ESE)	Total Marks	Credits
Semester-I								
I	23AT1610/ 23AT18101	Language I	4	60	50	50	100	3
II	23AT00101	English I	4	60	50	50	100	3
III	2366101	**CORE-I** Introduction to Python Programming	6	90	50	50	100	6
III	2366103	**CORE Practical I-** Python Lab	6	90	50	50	100	3

III	2366102	**Allied I-** Statistical Methods and its Applicatio ns	6	90	50	50	100	6

IV	2366104	NME I (Open Elective)	2	30	50	50	100	2
IV	2340101	Soft Skills I	2	30	50	50	100	2
Semester-II								
I	23AT16204/ 23AT18202	Language II	4	60	50	50	100	3
II	23AT00201	English II	4	60	50	50	100	3
III	2366205	**CORE II** Object Oriented Programmi ng using Java	6	90	50	50	100	6
III	2366207	**CORE Practical II** – Object Oriented Programmin g using Java Lab	6	90	50	50	100	3
III	2366206	**Allied II-** Probability and Statistics	6	90	50	50	100	6
IV	2366208	NME II (Open Elective)	2	30	50	50	100	2
IV	2340201	Soft Skills II	2	30	50	50	100	2

Semester-III								
III	2366309	**CORE – III** Data Structures and Algorithms using Python	6	60	50	50	100	6

III	2366311	**CORE Practical III** – Data Structures and Algorithms using Python Lab	6	90	50	50	100	3
III		**CORE – IV** R Programming	5	60	50	50	100	6

III		**CORE Practical IV –** R Programming Lab	6	90	50	50	100	3
III	2366310 (A)	**Allied III-** Optimization Techniques	5	90	50	50	100	6
IV	2340301	Soft Skills III	2	30	50	50	100	2
IV	2313412	Environmental Studies	2	30	Examination will be held in Semester IV			
Semester-IV								
III	2366412	**CORE- V** Artificial Intelligence and Expert Systems	6	90	50	50	100	6
III		**CORE Practical V-** Artificial Intelligence Lab	6	90	50	50	100	3
III		**CORE- VI** RDBMS	5	90	50	50	100	6
III		**CORE- Practical VI-** RDBMS Lab	6	90	50	50	100	3
III	2366413(B)	**Allied IV** – Time series Analysis and Forecasting	5	90	50	50	100	6
IV	2313412	Environmental Studies	2	30	50	50	100	1

IV	2340403	Soft Skills IV	2	30	50	50	100	2
Semester-V								
III	2366515	**CORE- VII** Machine Learning	6	90	50	50	100	6
III	2366516	**CORE VIII** - Big Data Analytics	6	90	50	50	100	6
III	2366517 (A)/(B)	ELECTIVE I	6	90	50	50	100	6
III	2366518	**CORE Practical VII** – Machine Learning Lab	6	90	50	50	100	3
III	2366519	**CORE Practical VIII** – Data Analytics using Rapid Miner Lab	6	90	50	50	100	3
IV	2370501	Value Education	-	-	50	50	100	1
Semester-VI								
III	2366620	**CORE IX-** IoT and Cloud Technologies	6	90	50	50	100	6
III	2366621	**CORE X-** Deep Learning	6	90	50	50	100	6
III		MINI PROJECT	6	90	50	50	100	5
III	2366623 (A)/2366623(B)	ELECTIVE II	6	90	50	50	100	6
III		**CORE Practical X-** Deep Learning Lab	6	90	50	50	100	3
IV	2380601	Extension Activity	-	-	-	-	-	1

Abstract of

Scheme of Examination

(For the students admitted during the academic year 2023 onwards)

Part	Course	Papers	Credit	Total Credits	Marks	Total Marks
Part I	Languages	2	3	6	100	200
Part II	English	2	3	6	100	200
Part III	**Core**	10	6	87	100	2300 (1900+ 400)
		9	3			
	Allied	4	6	24	100	
	Electives	2	6	12	100	200
	Mini Project	1	5	5	100	100
PART I+II+III				**140**		**3000**
	NME	2	2	4	100	200
	EVS	1	1	1	100	100
	ValueEd	1	1	1	100	100
PARTIV	Extension Activity	1	1	1	-	-
	Soft Skills	4	2	8	100	200
	TOTAL			**15**		**600**
PART I+II+III+IV				**155**		**3600**

Non- Major Electives (Open Electives)	**Courses offered by the Department to other Programmes**
	Introduction to Programming Concepts Fundamentals of Free Open-Source Software

List of Elective Papers (Can choose any one of the papers as electives)		
Component	**Course Code**	**Course Name**
Elective-I	2366517(A)	Marketing Analytics
	2366517(B)	Data Communication and Computer Networks
Elective-II	2366623(A)	Natural Language Processing
	2366623(B)	Financial Analytics

PROGRAMME EDUCATION OBJECTIVES[PEO'S]:

The programme specific outcomes of B.Sc. [Data Science] are to

PEO1	To progress their career productively in software industry, academia, research, Entrepreneurial pursuit, government, consulting firms and other Information Technology enabled services.
PEO2	To achieve peer-recognition as an individual or in a team; by adopting ethics andprofessionalismandcommunicateeffectivelytoexcelwellincrossculture and inter-disciplinary teams.
PEO3	To continue a lifelong professional development in computing that contributes in self and societal growth.
PEO4	To execute statistical analyses with professional statistical software.
PEO5	To demonstrate skill in data management.
PEO6	To solve problems in real-world contexts and will communicate these solutions effectively

PROGRAM OUTCOMES(PO)

At the end of the programme the student will be able:

PO 1	To undertake/ engage in employment oriented activities, development activities and allied activities particularly in response to the needs of the society.
PO 2	To understand the needs and to acquire the required competencies to support local, regional, and national development.
PO 3	To develop conceptual understanding of the subject, problem solving and application of skills in practical orientation of the subjects.
PO 4	To develop critical and analytical thinking.
PO 5	To instill entrepreneurial spirits among the students along with ethics and business orientation.
PO 6	To kindle curiosity to review upon the diverse environments for enhanced and innovative and best practices.
PO7	To engage in lifelong learning and continuing learning and enduring proficient progress

Mapping of Pos TO PEOs

PEO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
PEO 1	3	3	3	3	3	3	2
PEO 2	3	3	2	3	3	2	2
PEO 3	3	3	2	3	3	3	3
PEO 4	3	3	3	3	2	2	3
PEO 5	3	3	3	3	3	3	1
PEO 6	3	3	2	3	3	3	3

CRITERIA FOR MAPPING
3-STRONG 2-MEDIUM1-LOW

PROGRAMMESPECIFICOUTCOMES[PSO's]

PSO1	Learning the applications of various software elements which help to identify various analysis and design methodologies
PSO2	Demonstrate by developing computer programs in the are related to algorithm, web designing, facilitating efficient design for complex problems.
PSO3	Enables the students to be familiar with the modern-day issues, latest trends in computing and technology and create ideas and solutions to existing problems
PSO4	Building code in Various Programming Languages and applications
PSO5	Detailed Glimpse of Orientation and Interconnection.
PSO6	Gains Knowledge in the various aspects of new Trends and Technologies.

Semester	**I**
Subject	**CORE I – INTRODUCTION TO PYTHON PROGRAMMING**
Maximum Marks	CIA-50Marks ESE-50 Marks
Credits/Instruction Hours	6Credits/ 90Hours
Exam Duration	3Hours

Objectives

1. To understand the basic concepts of Data Science
2. To understand the principles of algorithms, flowchart and source code
3. To acquire a solid foundation in Python.
4. To visualize data using plots in python

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	To explain the basic concepts of data science and its applications	K1, K2, K3,K4,K5
CO2	To explain the Features of Python To demonstrate Control Statements and Looping Statements	K1, K2, K3,K4,K5
CO3	To understand Python Functions To create and illustrate Numpy Libraries To perform Data Manipulation using Pandas.	K1, K2, K3 &K4
CO4	To understand the File Concepts Apply Exception Handling Techniques	K1, K2, K3,K4,K5
CO5	To Create and manipulate Database To create Data Visualization using Mat plot lib	K1, K2, K3,K4,K5

Mapping of Course Outcomes to Program Outcome:

PO/ PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	3	3	3	3	3	3	3	3	3
CO2	2	3	3	3	2	3	3	3	3	3	3
CO3	3	3	3	3	2	2	2	2	3	3	3
CO4	3	3	3	3	2	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3
Average	**2.8**	**3.00**	**3.00**	**3.00**	**2.4**	**2.8**	**2.8**	**2.8**	**3.00**	**3.00**	**3.00**
Criteria for Mapping	**3=Strong2=Medium 1=Low**										

UNIT-1 Introduction to Data Science

Introduction: Data Science - Big Data and Data Science hype – getting past the hype - Datafication - Current landscape of perspectives - Skill sets needed - Statistical Inference - Exploratory Data Analysis and the Data Science Process - Basic tools (plots, graphs and summary statistics) of EDA – Applications of Data Science - Data Science in Business - Business Intelligence vs Data Science–Data Analytics Life Cycle-Machine Learning

UNIT II Introduction to Python

Features of Python - How to Run Python – Identifiers- Reserved Keywords- Variables - Comments in Python - Indentation in Python - Multi-Line Statements- Input, Output and Import Functions-Operators. Data Types and Operations: Numbers -Strings -List-Tuple-Set -Dictionary-Mutable and Immutable Objects-Data Type Conversion. Flow Control: Decision Making- Loops-Nested Loops-Control Statements- Types of Loops-List Comprehensions-SetComprehensions-DictionaryComprehensions-Nested Dictionaries.

UNIT III Functions

Function Definition-Function Calling-Function Arguments-Anonymous Functions(Lambda Functions) - Recursive Functions - Modules and Packages: Built-in Modules -Creating Modules - import Statement- Namespaces and Scope - The dir() function – The reload() function -Packages in Python - Date and Time Modules – Numpy Libraries and Data Manipulation Using Pandas.

UNIT IV File Handling and Object Oriented Programming

Opening a File-Closing a File - Writing to a File - Reading from a File - File Methods – Renaming a File-Deleting a File-Directories in Python. Regular Expressions.ClassDefinition-CreatingObjects-Built-inAttributeMethods-Built-inClassAttributes-Destructors in Python - Encapsulation - Data Hiding – Inheritance-Method Overriding –Polymorphism -Exception Handling.

UNIT V Database Programming and Visualizations

Connecting to a Database- Creating Tables-INSERT Operation-UPDATE Operation-DELETE Operation-READ Operation-Transaction Control-Disconnecting from a Database -Exception Handling in Databases-GUI Programming-CGI Programming-Data Visualizations using Matplotlib– histograms, bar charts, pie charts.

TEXTBOOKS

1. Doing Data Science, Straight Talk From The Frontline, Cathy O' Neil and Rachel Schutt, O' Reilly(2014).
2. Big Data Analytics, paperback 2nded., Seema Acharya, Subhasini Chellappan, Wiley(2019).
3. Dr. Jeeva Jose(2018) ,Taming Python By Programming, Khanna Publishers
4. Jake Vanderplas. Python Data Science Handbook: Essential Tools for Working withData1st Edition.

REFERENCES

1. Ljubomir Perkovic (2012),Introduction to Computing Using Python:An Application Development Focus, JohnWiley & Sons
2. John V Guttag (2013), Introduction to Computation and Programming Using Python", Revised and expanded Edition, MIT Press.
3. Kenneth A. Lambert (2012),Fundamentals of Python: First Programs, Cengage Learning.

Semester	**I**
Subject	**CORE PRACTICAL I– PYTHON LAB**
Maximum Marks	CIA-50Marks ESE-50 Marks
Credits/Instruction Hours	3Credits/90Hours
Exam Duration	3Hours

OBJECTIVES

- To build websites and software, automate tasks and conduct data analysis.
- Open Source and Community Development.

LISTOFPROGRAMS

1. Demonstrate the working of "id"and"type"functions.
2. Find all prime numbers within a given range.
3. Print "n" terms of Fibonacci series using iteration.
4. Demonstrate use of slicing in string.
5. Compute the frequency of the words from the input. The output should output after sorting the key alphanumerically.
6. Write a program that accepts a comma separated sequence of words as input and prints the words in a comma-separated sequence after sorting them alphabetically.
7. Demonstrate use of list & related functions.
8. Demonstrate use of Dictionary& related functions.
9. Demonstrate use of tuple & related functions.
10. Implement stack using list.
11. Implement queue using list.
12. Read and write from a file.
13. Copy a file.
14. Demonstrate the working of classes and objects.
15. Demonstrate class method & static method.
16. Demonstrate constructors.
17. Demonstrate Inheritance.
18. Demonstrate aggregation/composition.
19. Create a small GUI application for insert, update and delete in a table.
20. Bar charts, histograms, and pie charts.

Semester	**II**
Subject	**CORE II-OBJECT ORIENTED PROGRAMMING USING JAVA**
Maximum Marks	CIA-50Marks ESE-50Marks
Credits/Instruction Hours	6Credits/90Hours
Exam Duration	3Hours

Objectives

1. Understand the concepts of Object Oriented Programming
2. Become proficient programmers through the Java Programming language.
3. Give insight into real world applications.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Use the syntax and semantics of java programming language and basic concepts of OOP.	K1, K2, K3,K4,K5
CO2	Develop reusable programs using the concepts of inheritance, polymorphism, interfaces, and packages	K1, K2, K3,K4,K5
CO3	Apply the concepts of Multithreading and Exception handling to develop efficient and error free codes.	K1, K2, K3 &K4
CO4	Design event driven GUI and web related applications which mimic the real word scenarios	K1, K2, K3 &K4
CO5	Build the internet-based dynamic applications using the concept of applets	K1, K2, K3,K4,K5

Mapping of Course Outcomes to Program Outcomes:

PO/ PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	3	3	3	3	2	3	2	2	3
CO2	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	2	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	2	2	3	2	3	3
Average	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**2.8**	**2.60**	**3.00**	**2.40**	**2.80**	**3.00**
Criteria for Mapping	**3=Strong2=Medium 1=Low**										

UNIT-I

Introduction

Introduction to Java-Features of Java-Object Oriented Concepts-Software Evolution-Software Development, SDLC Models – SDLC steps – Software Testing – Software Quality – Lexical Issues-Data Types–Variables–Arrays–Operators- Control Statements–Classes–Objects –Constructors-Overloadingmethod-Accesscontrol-staticandfixedmethods-Innerclasses -Inheritance-Overriding Methods-Using super-Abstract class.

UNIT-II

Packages & Threads

Packages-Access Protection-Importing Packages -Interfaces-Exception Handling-Throw and Throws-Thread-Synchronization-Messaging-Runnable Interface-Inter thread communication - Deadlock-suspending, resuming, and stopping threads-Multithreading.

UNITIII

Input/ Output &Collection API

I/O Streams-File Streams-String Objects-String Buffer-Char Array-Java Utilities-Collections interface-Collection classes- Enumeration– Vector-Stack –Hash tables - String class.

UNIITIV

Networking

Networking–Networking basics–Java and the Net–Inet Address-TCP/IP Client Sockets– URL-URL Connection – TCP/IP Server Sockets– Datagrams.

UNITV

Graphical User Interface in Java

Working with windows using AWT Classes - Class Hierarchy of Window and Panel –AWT controls - Layout Managers – Menus- Menu bars - Dialog Boxes- File Dialog- Applets-Lifecycle of Applet-Types of Applets-Event handling-Applet tags - JDBC and connecting to Databases– CRUD operations.

TEXTBOOKS

1. P. Naughton and H. Schildt(1999), Java2 (The Complete Reference), Third Edition, Tata MC Graw Hill Edition

2. K.K.Aggarwal&YogeshSing(2008),SoftwareEngineering,RevisedThirdEdition,NewAgeInternational Publishers

REFERENCEBOOKS

1. CayS. Horstmann, Gary Cornell(2012),Core Java2 Volume I, Fundamentals-Ninth Edition Addision Wesley

2. K. Arnold and J. Gosling, The Java Programming Language-Second Edition, ACM Press/Addison-Wesley Publishing Co. New York

Semester	**II**
Subject	**CORE PRACTICAL II** OBJECT ORIENTED PROGRAMMING USING JAVA LAB
Maximum Marks	CIA-50Marks ESE-50Marks
Credits/Instruction Hours	3Credits/90Hours
Exam Duration	3Hours

OBJECTIVES

- Use an integrated development environment to write, compile, run, and test simple object-oriented Java programs.
- Read and make elementary modifications to Java programs that solve real-world problems.

LISTOFPROGRAMS

Application

1. Program to illustrate i)constructors ii) inheritance iii)overloading and overriding.
2. Implementation of Packages, interfaces, Exception handling
3. Implementation of concurrent and synchronized threads.
4. Implementation of string and string buffer classes and methods.
5. Implementation of stack and vector.
6. Implementation of file read and writes operation.

Applet programs

1. Working with Frames and various controls
2. Working with Dialogs and Menus
3. Working Panel and Layout
4. Incorporating Graphics
5. Working with applets
6. Working with Images
7. Network Programming

Semester	**III**
Subject	**CORE III - DATA STRUCTURES AND ALGORITHMS USING PYTHON**
Maximum Marks	CIA- 50 Marks ESE-50 Marks
Credits/ Instruction Hours	6 Credits / 90 Hours
Exam Duration	3 Hours

Objectives

1. Understand the meaning asymptotic time complexity analysis and various data structures
2. To enhancing the problem solving skills and thinking skills
3. To write efficient algorithms and Programs

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	• To understand the asymptotic notations and analysis of time and space complexity • To understand the concepts of Linked List, Stack and Queue.	K1,K2,K3,K4,K5
CO2	• To understand the Concepts of Trees and Graphs • Perform traversal operations on Trees and Graphs. • To enable the applications of Trees and Graphs.	K1,K2,K3,K4,K5
CO3	• To apply searching and sorting techniques.	K1,K2,K3&K4
CO4	• To understand the concepts of Greedy Method • To apply searching techniques.	K1,K2,K3&K4
CO5	• To understand the concepts of Backtracking Method • To enable the applications.	K1,K2,K3,K4,K5

Mapping of Course Outcomes to Program Outcomes:

PO/ PSO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**
CO1	3	3	3	3	3	3	2	3	2	2	3
CO2	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	2	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	2	2	3	2	3	3
Average	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**2.8**	**2.60**	**3.00**	**2.40**	**2.80**	**3.00**
Criteria for Mapping	**3= Strong 2= Medium 1= Low**										

UNIT I

Arrays and ordered Lists

Abstract data types – asymptotic notations – complexity analysis- Linked lists: Singly linked list – doubly linked lists - Circular linked list, General lists- stacks – Queues – Circular Queues – Evaluation of expressions

UNIT – II

Trees and Graphs

Trees – Binary Trees – Binary Tree Traversal – Binary Tree Representations – Binary Search

Trees - threaded Binary Trees - Application of trees (Sets). Representation of Graphs – Graph implementation – graph Traversals - Minimum Cost Spanning Trees – Shortest Path Problems- Application of graphs

UNIT-III

Searching and Sorting

Sorting – Bubble Sort, Insertion Sort, Quick Sort , Merge Sort, Selection Sort. Searching – Linear search, Binary search

UNIT IV

Greedy Method and Dynamic programming

Greedy Method : Knapsack problem– Job Sequencing with deadlines – Optimal storage on tapes.General method – Multistage Graph Forward Method– All pairs shortest path – Single source shortest path – Search Techniques for Graphs – DFS – Connected Components – Bi-Connected Components

UNIT V

Backtracking

General Method – 8-Queen‟s – Sum Of Subsets – Graph Colouring – Hamiltonian Cycles – Branch And Bound: General Method – Travelling Sales Person Problem

TEXT BOOK

1. Seymour Lipshutz(2011), Schaum‟s Outlines - Data Structures with C, Tata McGraw Hill publications
2. Ellis Horowitz and SartajSahni (2010), Fundamentals of Computer Algorithms, Galgotia Publications Pvt., Ltd.
3. Dr. K. Nagesware Rao, Dr. Shaik Akbar, ImmadiMurali Krishna, Problem Solving and Python Programming(2018)

REFERENCE BOOKS

1. Gregory L.Heileman(1996), Data Structures, Algorithms and Object-Oriented Programming, McGraw Hill International Edition, Singapore.
2. A.V.Aho, J.D. Ullman, J.E.Hopcraft(2000). Data Structures and Algorithms, Addison Wesley Publication.
3. Ellis Horowitz and SartajSahni, Sanguthevar Raja sekaran (2010) ,Fundamentals of Computer Algorithms, Galgotia Publications Pvt.Ltd.

Semester	**III**
Subject	**CORE PRACTICAL III – DATA STRUCTURES AND ALGORITHMS USING PYTHON LAB**
Maximum Marks	CIA- 50 Marks ESE-50 Marks
Credits/ Instruction Hours	3 Credits / 90 Hours
Exam Duration	3 Hours

Objectives

- To predict the performance of different algorithms in order to guide design decisions.
- To provide theoretical estimation for the required resources of an algorithm to solve a specific computational problem

LIST OF PROGRAMS

1. Perform stack operations
2. Perform queue operations
3. Perform tree traversal operations
4. Search an element in an array using linear search.
5. Search an element in an array using binary search
6. Sort the given set of elements using Merge Sort.
7. Sort the given set of elements using Quick sort.
8. Search the Kth smallest element using Selection Sort
9. Find the Optimal solution for the given Knapsack Problem using Greedy Method.
10. Find All pairs shortest path for the given Graph using Dynamic Programming method
11. Find the Single source shortest path for the given Travelling Salesman problem using Dynamic Programming method
12. Find all possible solution for an N Queen problem using backtracking method
13. Find all possible Hamiltonian Cycle for the given graph using backtracking method

Semester	**III**
Subject	**CORE IV- R Programming**
Maximum Marks	CIA-50Marks ESE-50Marks
Credits/Instruction Hours	6 Credits/90 Hours
Exam Duration	3 Hours

Objectives

- Explain critical R programming concepts
- Demonstrate how to install and configure R Studio
- Analyze data and generate reports based on the data
- Apply various concepts to write programs in R

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Understand the fundamentals, standards of Functions and capabilities of R Language.	K1, K2, K3,K4,K5
CO2	Learning the basic R-Language Constructs	K1, K2, K3,K4,K5
CO3	To demonstrate Simulation in R-Language, Math functions and files processing.	K1, K2, K3 &K4
CO4	To know the Principals of Graphics and R-Base Graphics	K1, K2, K3 &K4
CO5	To develop applications and Performing T-Testing	K1, K2, K3,K4,K5

Mapping of Course Outcomes to Program Outcomes:

PO/ PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	3	3	3	3	2	3	2	2	3
CO2	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	2	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	2	2	3	2	3	3
Average	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**2.8**	**2.60**	**3.00**	**2.40**	**2.80**	**3.00**
Criteria for Mapping	**3=Strong2=Medium 1=Low**										

UNIT I GETTTING START WITH R

Installing R – The R Environment – R Packages – Basics of R – Data Structures – Reading Data into R – Graphics in R

UNIT II FUNCTIONS AND STATEMENTS

Writing R functions - Control Statements (if and else, switch, if else, compound tests) - Loops in R (for, while, controlling loops) - Applications using the functions and loops.

UNIT III DATA MANIPULATION AND ANALYSIS

Group manipulation - Data Reshaping - Manipulating Strings - Basic Statistics using R (Summaries, Correlation, t-tests, ANOVA

UNIT IV LINEAR MODELS USING R

Linear Models - Simple and Multiple regression, GLM - Logit Regression, Model diagnostics - Residuals, Cross validation, Boot strapping

UNIT V NON-LINEAR MODELS, TIME SERIES AND CLUSTERING USING R

Nonlinear Models - Non-Linear least square, Splines, Generalized Additive Models, Decision trees, Random forests. Time Series - Autoregressive moving average, VAR, GARCH. Clustering - K means, PAM and Hierarchical Clustering

TEXT BOOK

1. R for Data Science" by Hadley Wickham and Garrett Grolemund
2. An Introduction to Statistical Learning with Applications in R" by Gareth James, Daniela Witten, Trevor Hastie, and Robert Tibshirani

REFERENCE BOOKS

1. R in Action" by Robert Kabac off A.V. Aho,J.D. Ullman, J.E. Hopcraft(2000).
2. Hands-On Unsupervised Learning Using R" by Giuseppe Ciaburro and Balaji Venkateswaran

Semester	**III**
Subject	**CORE PRACTICAL IV- R Programming Lab**
Maximum Marks	CIA-50Marks ESE-50Marks
Credits/Instruction Hours	3Credits/90Hours
Exam Duration	3Hours

OBJECTIVES

- To perform techniques for writing efficient R code
- Emphasizing best practices for branching and collaborative coding.

LISTOFPROGRAMS

1. Write a R program to take input from the user and display the values. Also print the version of R installation.
2. Write a R program to get the details of the objects in memory.
3. Write an R program to create a sequence of numbers from 20 to 50 and find the mean of numbers from 20 to 60 and sum of numbers from 51 to 61.
4. Write a R program to create a simple bar plot on four subject marks.
5. Write a R program to get the unique elements of a given string and unique numbers of vector.
6. Write a R program to create three vectors a, b, c with 3 integers. Combine the three vectors to become a 3 x 3 matrix where each column represents a vector. Print the content of the matrix.
7. Write a R program to create a 5 x 4 matrix, 3 x 3 matrix with labels and fill the matrix by rows and 3 x 3 matrix with labels and fill the matrix by columns.
8. Write a R program to combine three arrays so that the first row of the first array is followed by the first row of the second array and then first row of the third array.
9. Write a R program to create a two-dimensional 5x3 array of sequence of even integers greater than 50.
10. Write a R program to create an array using four given columns, three given rows, and two given tables and display the content of the array.
11. Write a R program to create an empty data frame.
12. Write a R program to create a data frame from four given vectors.
13. Write a R program to create a data frame using two given vectors and display the duplicated elements and unique rows of the said data frame.
14. Write a R program to save the information of a data frame in a file and display the information of the file.

Semester	**IV**
Subject	**CORE V ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS**
Maximum Marks	CIA- 50 Marks ESE- 50 Marks
Credits/ Instruction Hours	6 Credits / 90 Hours
Exam Duration	3 Hours

Objectives

1. Describe the concepts of Artificial Intelligence
2. Understand the method of solving problems using Artificial Intelligence
3. Understand natural language processing.
4. Introduce the concept of Expert system, Fuzzy logic.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	• Design user interfaces to improve human–AI interaction and real-time decision-making. • Evaluate the advantages, disadvantages, challenges, andramifications of human–AI augmentation.	K1, K2, K3, K4, K5
CO2	• Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning.	K1, K2, K3, K4, K5
CO3	• Demonstrate awareness and a fundamental understanding of variousapplications of AI techniques in intelligent agents, expert systems, artificial neural networks, and other machine learning models.	K1, K2, K3 & K4
CO4	• Extract information from text automatically using concepts and methods from natural language processing (NLP), including stemming, n-grams, POS tagging, and parsing	K1, K2, K3, K4, K5
CO5	• Develop robotic process automation to manage business processes and to increase and monitor their efficiency and effectiveness.	K1, K2, K3, K4, K5

Mapping of Course Outcomes to Program Outcomes:

PO/ PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	3	3	3	3	2	3	2	2	3
CO2	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	2	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	2	2	3	2	3	3
Average	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**2.8**	**2.60**	**3.00**	**2.40**	**2.80**	**3.00**
Criteria for Mapping	**3= Strong 2= Medium 1= Low**										

UNIT I

INTRODUCTION

Introduction–Definition - Future of Artificial Intelligence – Characteristics of Intelligent Agents–Typical Intelligent Agents – Problem Solving approach to Typical AI problems

UNIT II

PROBLEM SOLVING METHODS

Problem solving Methods - Search Strategies- Uninformed - Informed - Heuristics – Local Search Algorithms and Optimization Problems - Searching with Partial Observations – Constraint Satisfaction Problems – Constraint Propagation - Backtracking Search - Game Playing – Optimal Decisions in Games – Alpha - Beta Pruning - Stochastic Games.

UNIT III

KNOWLEDGE REPRESENTATION

First Order Predicate Logic – Prolog Programming – Unification – Forward Chaining & Backward Chaining – Resolution – Knowledge Representation - Ontological Engineering- Categories and Objects – Events - Mental Events and Mental Objects - Reasoning Systems for Categories Reasoning with Default Information**.**

UNIT IV

SOFTWARE AGENTS

Architecture for Intelligent Agents – Agent communication – Negotiation and Bargaining Argumentation among Agents – Trust and Reputation in Multi-agent systems.

UNIT V

APPLICATIONS

AI applications – Language Models – Information Retrieval- Information Extraction – Natural Language Processing - Machine Translation – Speech Recognition – Robot – Hardware –Perception – Planning – Moving.

.

TEXTBOOKS

1. Elaine Rich, Kevin Knight (2008), Shivsankar B Nair, Artificial Intelligence, Third Edition, Tata McGraw Hill Publication,

REFERENCE BOOKS

1. Russel S, Norvig P (2010), Artificial Intelligence: A Modern approach,Third Edition, Pearson Education
2. Dan W Patterson (2007), Introduction to Artificial Intelligence and Expert System, Second Edition, Pearson Education Inc.
3. Jones M (2006), Artificial Intelligence application Programming, Second Edition, Dreamtech Press
4. Nilsson (2000), Artificial Intelligence: A new synthesis, Nils J Harcourt Asia PTE Ltd.

Semester	**IV**
Subject	**CORE VI -RDBMS**
Maximum Marks	CIA-50Marks ESE-50 Marks
Credits/Instruction Hours	6Credits/90Hours
Exam Duration	3Hours

Objectives

1. To understand the different issues involved in the design and implementation of a database system.
2. To study the physical and logical database designs, database modeling, relational, hierarchical, and network models
3. To understand and use data manipulation language to query, update, and manage a database
4. To develop an understanding of essential DBMS concepts such as: database security, integrity, concurrency
5. To design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	To demonstrate the characteristics of Database Management Systems. To study about the concepts and models of database. To impart the concepts of System Development Life cycle and E-R Model.	K1,K2,K3, K4,K5
CO2	To classify the keys and the concepts of Relational Algebra. To impart the applications of various Normal Forms Classification of Dependency.	K1,K2,K3, K4,K5
CO3	To elaborate the different types of Functions and Joins and their applications. Introduction of Views, Sequence, Index and Procedure.	K1,K2,K3 &K4
CO4	Representation of PL-SQL Structure. To impart the knowledge of Sub Programs, Functions and Procedures.	K1,K2,K3, K4,K5
CO5	Representation of Exception and Pre-Defined Exception. To Point out the Importance of Triggers, Implicit and Explicit Cursors.	K1,K2,K3, K4,K5

Mapping of Course Outcomes to Program Outcomes:

PO/ PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	3	3	3	3	2	3	2	2	3
CO2	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	2	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	2	2	3	2	3	3
Average	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**2.8**	**2.60**	**3.00**	**2.40**	**2.80**	**3.00**

Criteria for Mapping	3=Strong2=Medium 1=Low

UNIT I

INTRODUCTION

Database System-Characteristics of Database Management Systems- Architecture of Database Management Systems-Database Models-System Development Life Cycle-Entity Relationship Model.

UNIT II

Relational Database Model

Structure of Relational Model-Types of keys. Relational Algebra: Unary operations-Set operations Join operations. Normalization: Functional Dependency- First Normal form-Second Normal Form-Third Normal form- Boyce-Codd Normal Form-Fourth Normal Form.

UNIT III

SQL:

Introduction. Data Definition Language: Create, alter, drop, rename and truncate statements. Data Manipulation Language: Insert, Update and Delete Statements. Data Retrieval Language: Select statement. Transaction Control Language: Commit, Rollback and Save point statements. Single row functions using dual: Date, Numeric and Character functions. Group/Aggregate functions: count, max, min, avg and sum functions. Set Functions: Union, union all, intersect and minus. Subquery: Scalar, Multiple and Correlated subquery. Joins: Inner and Outer joins. Defining Constraints: Primary Key, Foreign Key, Unique, Check, Not Null.

UNIT IV

PL/SQL:

Introduction-PL/SQL Basic-Character Set- PL/SQL Structure-SQL Cursor Subprograms-Functions Procedures.

UNIT V

Exception Handling:

Introduction-Predefined Exception-User Defined Exception-Triggers-Implicit and Explicit Cursors-Loops in Explicit Cursor.

.

TEXT BOOKS

1. **Pranab Kumar Das Gupta and P. Radha Krishnan,** "Database Management System Oracle SQL and PL/SQL", Second Edition, 2013, PHI Learning Private Limited.

REFERENCE BOOKS

1. **Ramez Elmasri and Shamkant B. Navathe**, "*Fundamentals of Database Systems*", Seventh Edition, Pearson Publications.
2. **Abraham Silberschatz, Henry Korth, S. Sudarshan**, "*Database System Concepts*", Seventh Edition, TMH.

Semester	**IV**
Subject	**CORE PRACTICAL V** **ARTIFICIAL INTELLIGENCE LAB**
Maximum Marks	CIA-50Marks ESE-50 Marks
Credits/Instruction Hours	3Credits/90Hours
Exam Duration	3Hours

OBJECTIVES

- To design and implement search strategies.
- To implement game playing techniques.
- To implement CSP Techniques.
- To develop System with Logical and Probabilistic reasoning.

LIST OF PROGRAMS

1. Implementation Basic search strategies – 8-Puzzle,8-Queens problems, Crypt arithmetic.
2. Implement A* and memory bounded A* algorithm.
3. Implement Minimax algorithm for game playing (Alpha-Beta pruning).
4. Solve Constraint Satisfaction problems.
5. Implement propositional model checking algorithms.
6. Implement forward chaining, backward chaining and resolution strategies.
7. Build Naïve Bayes models.
8. Implement Bayesian networks and perform inferences.

Semester	**IV**
Subject	**CORE PRACTICAL VI** **RDBMS LAB**
Maximum Marks	CIA-50Marks ESE-50 Marks
Credits/Instruction Hours	3Credits/90Hours
Exam Duration	3Hours

OBJECTIVES

1. To explain basic database concepts, applications, data models, schemas and instances.
2. To demonstrate the use of constraints and relational algebra operations
3. Describe the basics of SQL and construct queries using SQL.
4. To emphasize the importance of normalization in databases

.

LIST OF PROGRAMS

SQL:

1. DDL commands.
2. Specifying constraints-Primary Key, Foreign Key, Unique, Check, Not Null.
3. DML commands.
4. Set Operations.
5. Joins.
6. Sub-queries.

PL/SQL:

7. Control Constructs.
8. Exception Handlers.
9. Implicit Cursor.
10. Explicit Cursor.
11. Procedures.
12. Functions.
13. Triggers.
14. TCL Commands usage (Commit, Rollback, Savepoint)

Semester	**V**
Subject	**CORE VII–MACHINE LEARNING**
Maximum Marks	CIA-50Marks ESE-50 Marks
Credits/Instruction Hours	6Credits/90Hours
Exam Duration	3Hours

Objectives

1. To Learn about Machine Intelligence and Machine Learning applications
2. To implement and apply machine learning algorithm store real-world applications.
3. To identify and apply the appropriate machine learning technique to classification, pattern recognition, optimization and decision problems.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Appreciate the importance of visualization in the data analytics solution	K1,K2,K3, K4,K5
CO2	Apply structured thinking to unstructured problems	K1,K2,K3, K4,K5
CO3	Understandaverybroadcollectionofmachinelearningalgorithmsandproblems	K1, K2, K3 &K4
CO4	Learn algorithmic topic soft machine learning and mathematically deep enough to introduce the required theory	K1,K2,K3, K4,K5
CO5	Develop an appreciation for what is involved in learning from data.	K1,K2,K3, K4,K5

Mapping of Course Outcomes to Program Outcomes:

PO/ PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	3	3	3	3	2	3	2	2	3
CO2	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	2	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	2	2	3	2	3	3
Average	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**2.8**	**2.60**	**3.00**	**2.40**	**2.80**	**3.00**
Criteria for Mapping	**3=Strong2=Medium 1=Low**										

UNIT I

Introduction

Machine Learning - Difference between AI, Machine Learning and Big data. Supervised and unsupervised learning, parametric vs non- parametric models, parametric models for classification and regression- Linear Regression, Logistic Regression, Naïve Bayes classifier, simple non-parametric classifier-K-nearest neighbour, support vector machines.

UNIT II

Neural networks and Genetic algorithms

Neural Network Representation–Problems–Perceptrons–Multilayer Networks and Back Propagation Algorithms

UNIT III

Bayesian and Computational learning

Bayes Theorem -Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier – Bayesian Belief Network – EM Algorithm – Probability Learning

UNIT IV

Instant based learning

K- Nearest Neighbour Learning – Locally weighted Regression – Radial Basis Functions – Case Based Learning.

UNIT V

Advanced Learning

Recommendation systems – Opinion Mining, Sentiment Analysis. Learning Sets of Rules – Learning Rule Set – First Order Rules – Sets of First Order Rules -Analytical Learning-Explanation Base Learning – Reinforcement Learning

TEXTBOOKS

1. Tom M. Mitchell,―MachineLearning,McGraw-HillEducation(India)PrivateLimited,2013.
2. Bengio, Yoshua, IanJ. Good fellow and Aaron Courville."Deep learning"2015,MIT Press.

REFERENCEBOOK

1. Ethem Alpaydin, ―Introduction to Machine Learning (Adaptive Computation and Machine Learning),TheMIT Press 2004.

Semester	**V**
Subject	**CORE PRACTICAL VII- MACHINE LEARNING LAB**
Maximum Marks	CIA-50Marks ESE-50 Marks
Credits/Instruction Hours	3Credits/90Hours
Exam Duration	3Hours

OBJECTIVES

- To discover patterns in the user data and then make predictions based on these and intricate patterns for answering business questions and solving business problems.

LIST OF PROGRAMS

Write a Python Implementation:

1. Reading and writing into .csv files
2. Implement the Find –S algorithm.
4. Implement the Candidate-Elimination algorithm.
5. Classify a sample using ID3 algorithm.
6. Build an artificial neural network by implementing back propagation algorithm.
7. Construct the naïve Bayesian classifier for classification.
8. Construct a naive Bayesian classifier and evaluate the classifier with accuracy, precision and recall metrics.
9. Applying EM algorithm for clustering using K-means algorithm.
10. Implement the k-Nearest Neighbour algorithm to classify the dataset.
11. Implement the non-parametric Locally Weighted Regression algorithm.

Semester	**V**
Subject	**CORE VIII –BIG DATA ANALYTICS**
Maximum Marks	CIA-50Marks ESE-50 Marks
Credits/Instruction Hours	6Credits/90Hours
Exam Duration	3Hours

Objectives

1. Understand the Big Data Platform and its Use cases
2. Provide an overview of Apache Hadoop
3. Provide HDFS Concepts and Interfacing with HDFS
4. Working with Tableau

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Understand Big Data and its analytics in the real world	K1, K2, K3,K4,K5
CO2	Design of Algorithms to solve Data Intensive Problems using Map Reduce Paradigm	K1, K2, K3,K4,K5
CO3	Analyze the Big Data framework like Hadoop and NOSQL to efficiently store and process Big Data to generate analytics	K1, K2, K3 &K4
CO4	Design and Implementation of Big Data Analytics using pig and spark to solve data intensive problems and to generate analytics	K1, K2, K3,K4,K5
CO5	Implement Big Data Activities using Hive	K1, K2, K3,K4,K5

Mapping of Course Outcomes to Program Outcomes:

PO/ PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	3	3	3	3	2	3	2	2	3
CO2	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	2	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	2	2	3	2	3	3
Average	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**2.8**	**2.60**	**3.00**	**2.40**	**2.80**	**3.00**
Criteria for Mapping	**3=Strong2=Medium 1=Low**										

UNIT I

Big data Introduction

Big Data introduction - definition and taxonomy - Big data value for the enterprise – The Hadoop ecosystem - Introduction to Distributed computing- Hadoop ecosystem – Hadoop Distributed File System (HDFS) Architecture - HDFS commands for loading/getting data – Accessing HDFS through Java program.

UNITII

Map Reduce

Introduction to Map Reduce frame work - Basic Map Reduce Programming: - Advanced Map Reduce programming: Basic template of the Map Reduce program, Word count problem-Chaining Map Reduce jobs

UNITIII

Pig and Hive

Applications on Big Data Using Pig and Hive – Data processing operators in Pig – Hive services– Hive QL– Querying Data in Hive - fundamentals of HBase and Zoo Keeper.

UNITIV

MongoDB

No SQL databases: Mongo DB: Introduction – Features - Data types - Mongo DB Query language - CRUD operations – Arrays - Functions: Count – Sort – Limit – Skip – Aggregate – Map Reduce. Cursors –Indexes-Mongo Import –Mongo Export.

UNITV

Cassandra

Introduction–Features - Datatypes–CQLSH-Key spaces-CRUD operations–Collections –Counter–TTL-Alter commands – Import and Export –Querying System tables.

TEXTBOOKS

1. J Seema Acharya,Subhashini Chellappan,“Big Data and Analytics”, Wiley Publication,2015.
2. Ramesh Sharda, Dursun Delen, Efraim Turban(2018), Business Intelligence,Pearson EducationServices Pvt Ltd.

REFERENCEBOOK

1. Judith Hurwitz, Alan Nugent, Dr.Fern Halper, Marcia Kaufman,“Big Data for Dummies”, John Wiley & Sons, Inc., 2013.
2. Tom White, “Hadoop:The Definitive Guide”,O‟Reilly Publications,2011.
3. Kyle Banker, “MongoDB in Action”, Manning Publications Company, 2012.
4. Russell Bradberry, Eric Blow, “Practical Cassandra A developers Approach“ ,Pearson Education, 2014.

Semester	**V**
Subject	**CORE PRACTICAL VIII - DATA ANALYTICS USING RAPID MINER LAB**
Maximum Marks	CIA-50Marks ESE-50Marks
Credits/Instruction Hours	3Credits/90Hours
Exam Duration	3Hours

OBJECTIVES

- To enable everything from data mining to model deployment, and model operations.
- To offer all the data preparation and machine learning capabilities needed to drive an organization.

LIST OF PROGRAMS

1. Data cleaning and pre-processing
2. Hadoop Programming: Word Count Map Reduce Program Using Eclipse
3. Implementing Matrix Multiplication Using One Map-Reduce Step.
4 Implementing Relational Algorithm on Pig.
5. Implementing database operations on Hive.
6. Implementing Bloom Filter using Map-Reduce
7. Implementing Frequent Item set algorithm using Map-Reduce.
8. Implementing Clustering algorithm using Map-Reduce
9. Implementing Page Rank algorithm using Map-Reduce
10. Sentiment Analysis
11. Opinion mining
12. Predictive modeling

Semester	**VI**
Subject	**CORE IX –IOT AND CLOUD TECHNOLOGIES**
Maximum Marks	CIA-50Marks ESE-50 Marks
Credits/Instruction Hours	6Credits/90Hours
Exam Duration	3Hours

Objectives

1. Learn basic concepts of Cloud Computing.
2. To get an overview of Map Reduce Concepts.
3. To learn about infrastructure security, Data Security and Privacy.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Design an IoT system with cloud infrastructure.	K1,K2,K3, K4,K5
CO2	Implement the M2M Communication protocols in a prototype	K1,K2,K3, K4,K5
CO3	Understand the basic concepts of the main sensors used in electro mechanical systems	K1, K2, K3 &K4
CO4	Understand/implement computer models of common engineering information types.	K1,K2,K3, K4,K5
CO5	Understand storage mechanisms/analysis algorithms for data management in distributed& data intensive applications.	K1,K2,K3, K4,K5

Mapping of Course Outcomes to Program Outcomes:

PO/ PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	3	3	3	3	2	3	2	2	3
CO2	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	2	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	2	2	3	2	3	3
Average	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**2.8**	**2.60**	**3.00**	**2.40**	**2.80**	**3.00**
Criteria for Mapping	**3=Strong2=Medium 1=Low**										

UNIT I

IoT Introduction

Introduction to IoT – IoT definition – Characteristics – IoT Complete Architectural Sensors and Hardware for IoT – Hardware Platforms– Arduino, Raspberry Pi, Node MCU

UNIT II

Introduction to Cloud Computing

Cloud Computing–Definition–SPI Framework–Software Model–Cloud Services Delivery Model – Deployment Models – Key drivers – Impact on Users

UNIT III

Virtual Machines Provisioning and Migration Services

Introduction and Inspiration -Background and Related Work- Virtual Machines Provisioning and Manageability-Virtual Machine Migration Services- VM Provisioning and Migration in Action -Distributed Management of Virtual Infrastructures

UNIT IV

Data Security, Identity and Access Management

Data security and storage: Aspects of Data Security -Data Security Mitigation -Provider Data and Its Security. Identity and Access Management: Trust Boundaries and IAM -Why IAM? -IAM Challenges- IAM Definitions- IAM Architecture IAM Practices in the Cloud

UNIT V

Security and Privacy

Security Management: Standards–Security Management in the Cloud–Availability Management – Access Control. Privacy: What is Privacy – Data Life Cycle – Key Privacy Concerns–Who is responsible for protecting Privacy – Privacy Risk Management–

TEXTBOOK

1. "The Internet of Things: Enabling Technologies, Platforms and Use Cases", by Pethuru Raj and Anupama C. Raman, CRC Press.
2. Adrian McEwen, Designing the Internet of Things, Wiley,2013.
3. Tim Mather, Subra Kumaraswamy, Shahed Latif (2010), Cloud Security and Privacy, OREILLY Media.
4. Rajkumar Buyya, James Broberg, Andrzej Goscinski (2011),CLOUD COMPUTING Principles and Paradigms, John Wiley &Sons, Inc., Hoboken, New Jersey.

REFERENCEBOOK

1. RonaldL.Krutzand Russell Dean Vines(2010), Cloud Security, Wiley–India.

Semester	**VI**
Subject	**CORE X –DEEP LEARNING**
Maximum Marks	CIA-50Marks ESE-50 Marks
Credits/Instruction Hours	6Credits/90Hours
Exam Duration	3Hours

Objectives

1. Identify the deep learning algorithms which are more appropriate for various types of learning tasks in various domains.
2. To understand the theory behind deep learning methods such as Convolutional Neural Networks, Auto encoders and Boltzmann Machines
3. To have a grasp of the open issues and trends in deep learning research.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Design user interfaces to improve human–AI interaction and real-time decision-making. Evaluate the advantages, disadvantages, challenges, and ramifications of human–AI augmentation.	K1,K2,K3, K4,K5
CO2	Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning.	K1,K2,K3, K4,K5
CO3	Demonstrate awareness and a fundamental understanding of various applications of AI techniques in intelligent agents, expert systems, artificial neural networks, and other machine learning models.	K1, K2, K3 &K4
CO4	Extract information from text automatically using concepts and methods from natural language processing (NLP), including stemming, n-grams, POS tagging, and parsing	K1,K2,K3, K4,K5
CO5	Develop robotic process automation to manage business processes and to increase and monitor their efficiency and effectiveness. Determine the framework in which artificial intelligence and the Internet of things may function, including interactions with people, enterprise functions, and environments.	K1,K2,K3, K4,K5

Mapping of Course Outcomes to Program Outcomes:

PO/ PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	3	3	3	3	2	3	2	2	3
CO2	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	2	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	2	2	3	2	3	3
Average	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**2.8**	**2.60**	**3.00**	**2.40**	**2.80**	**3.00**
Criteria for Mapping	**3=Strong2=Medium 1=Low**										

UNIT I

Introduction

Overview of machine learning, linear classifiers, loss functions What Are Neural Networks: History, Artificial and biological neural networks, Artificial intelligence and neural networks Neurons and Neural Networks: Biological neurons, Models of single neurons, Different neural network models Single Layer Perceptron: Least mean square algorithm, Learning curves, Learning rates.

UNIT II

Multilayer perceptron

The XOR problem, Back-propagation algorithm, Heuristic for improving the back-propagation algorithm, Some examples- Radial-Basis Function Networks : Interpolation, Regularization

UNIT III

Convolutional Neural Network (CNN)

Introduction to CNNs, Kernel filter, Principles behind CNNs, Multiple Filters, problem and solution of under fitting and overfitting

UNIT IV

Recurrent Neural Networks

Introduction to RNNs, Unfolded RNNs, Seq2Seq RNNs, LSTM, GRU, Encoder Decoder architectures.

UNIT V

Deep Learning applications

Image segmentation, Object detection, Attention model for computer vision tasks, Natural Language Processing, Speech Recognition, Video Analytics. Tools: Tensor Flow, Keras, PyTorch, Caffe, Theano, MXNet.

TEXTBOOKS

1. Good fellow, I., Bengio,Y.,and Courville,A.,Deep Learning, MIT Press, 2016.
2. Josh Patterson, Adam Gibson, Deep Learning: A Practitioner's Approach,OReilly,2017.

REFERENCEBOOK

1. Bishop, C.M., Pattern Recognition and Machine Learning ,Springer, 2006.
2. Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd,2009.
3. Golub,G., H.,and VanLoan,C.,F., Matrix Computations,JHUPress,2013.
4. Satish Kumar, Neural Networks: A Classroom Approach, Tata McGraw-HillEducation,2004.

Semester	**VI**
Subject	**CORE PRACTICAL X** **DEEP LEARNING LAB**
Maximum Marks	CIA-50Marks ESE-50Marks
Credits/Instruction Hours	3Credits/90Hours
Exam Duration	3Hours

OBJECTIVES

1. Understand the principles of neural networks, activation functions, loss functions, optimization algorithms, and back propagation.
2. Implement deep learning algorithms using popular frameworks like Tensor Flow or PyTorch.

LIST OF PROGRAMS

1. Implement a simple linear classifier using Python and numpy.
2. Write code to implement a single-layer perceptron using the least mean square algorithm.
3. Solve the XOR problem using a multilayer perceptron with backpropagation.
4. Implement an RBF network for interpolation tasks.
5. Code a SOM algorithm for clustering tasks.
6. Create a computational graph in Tensor Flow for a simple regression example.
7. Implement gradient descent from scratch and apply it to a simple optimization problem.
8. Implement a basic CNN using Tensor Flow/Keras for image classification tasks.
9. Implement a basic RNN using Tensor Flow/Keras for sequence prediction tasks.
10. Code an LSTM network and compare its performance with a basic RNN on a sequential dataset.
11. Implement an encoder-decoder architecture using RNNs for sequence-to-sequence tasks like language translation.
12. Write code to perform image segmentation using a pre-trained CNN model like U-Net.

Semester	**V**
Subject	**ELECTIVE I – 1.MARKETING ANALYTICS**
Maximum Marks	CIA-50Marks ESE-50 Marks
Credits/Instruction Hours	6 Credits/90Hours
Exam Duration	3Hours

Objectives

1. Recognize challenges in dealing with datasets in marketing.
2. Identify and apply appropriate algorithms for analyzing social media and web data.
3. Make choices for a model for new machine learning tasks.

Course Outcomes : At the end of the Course, the Student will be able to:

CO1	Criticallyevaluatethekeyanalyticalframeworksandtoolsusedinmarketing. Apply key marketing theories, frameworks, and tools to solve Marketing problems.	K1, K2, K3,K4,K5
CO2	Utilize information of a firm's external and internal marketing environment to identify and prioritize appropriate marketing strategies.	K1, K2, K3,K4,K5
CO3	Exercise critical judgement through engagement and reflection with existing marketing literature and new developments in the marketing environment	K1, K2, K3 &K4
CO4	Critically evaluate the marketing function and the role it plays in achieving organizational success both in commercial and non-commercial settings.	K1, K2, K3 &K4
CO5	Evaluate and act upon the ethical and environmental concerns linked to marketing activities.	K1, K2, K3,K4,K5

Mapping of Course Outcomes to Program Outcomes:

PO/ PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	3	3	3	3	2	3	2	2	3
CO2	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	2	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	2	2	3	2	3	3
Average	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**2.8**	**2.60**	**3.00**	**2.40**	**2.80**	**3.00**
Criteria for Mapping	**3=Strong2=Medium 1=Low**										

UNIT I Marketing Analytics

Introduction to marketing research, Research design setup, qualitative research, quantitate research, Concept development, scale development, Exploring Data, Descriptive Statistics. Product analytics- features, attributes, benefits, Price analytics, Promotion analytics, Channel analytics, Multiple Discriminate analysis.

UNIT II Customer Analytics

Customer Analytics, Analyzing customer satisfaction, Prospecting and Targeting the Right Customers, Covariance and Correlation analysis, Developing Customers, Retaining Customers, Customer lifetime value case, Factor analysis. Market Segmentation & Cluster Analysis, Scatter plots& Correlation Analysis, Linear Regression Model Validation & Assessment, Positioning analytics, Cross tabulation.

UNIT III Social Media Analytics(SMA)

Social media landscape, Need for SMA; SMA in Small organizations; SMA in large organizations; Application of SMA in different areas Network fundamentals and models: The social networks perspective - nodes, ties and influencers, Social network and web data and methods. Graphs and Matrices- Basic measures for individuals and networks. Information visualization.

UNIT IV Facebook Analytics

Introduction, parameters, demographics. Analyzing page audience. Reach and Engagement analysis. Post-performance on FB. Social campaigns. Measuring and Analyzing social campaigns, defining goals and evaluating outcomes, Network Analysis.9(LinkedIn, Instagram, YouTube Twitter etc. Google analytics. Introduction. (Websites)

UNIT V Web Analytics and making connections

Link analysis. Random graphs and network evolution. Social contexts: Affiliation and identity. Web analytics tools: Clickstream analysis, A/B testing, online surveys, Web crawling and Indexing.

TEXTBOOKS

1. Digital Marketing Analytics: Making Sense of Consumer Dataina Digital World, Chuck Hemann & Ken Burbary, Pearson,ISBN 9780789750303
2. Predictive Analytics: The Power to Predict Who Will Click, Buy, Lie ,or Die, Eric Siegel, Pearson,
3. Marketing Analytics: Optimize Your Business with Data Science in R, Python,and SQL, Dave Jacobs
4. Matthew Ganis, Avinash Kohirkar.Social Media Analytics: Techniques and Insights for Extracting Business Value Out of social media. Pearson 2016.
5. Jim Sterne. Social Media Metrics: How to Measure and Optimize Your Marketing Investment.Wiley, 2020.
6. Marshall Sponder. Social Media Analytics. Mc Graw Hill Latest edition.

REFERENCEBOOKS

1. Marketing Analytics: A practical guide to real marketing science, Mike Grigs by, Kogen Page,ISBN 9780749474171
2. Marketing Metrices3e,Bendle,Farris,Pferfery,Reibstein,
3. Cutting Edge Marketing Analytics:Real World Cases and DataSets for Handson Learning,Raj Kumar Venkatesan, Paul Farris,Ronald T. Wilcox.

Semester	**V**
Subject	**ELECTIVE I–2.DATA COMMUNICATION AND COMPUTER NETWORKS**
Maximum Marks	CIA-50Marks ESE-50Marks
Credits/Instruction Hours	6Credits/90Hours
Exam Duration	3Hours

Objectives

- To introduce the fundamental network architecture concepts and their core principle issues in the emerging communication / data networks.
- To have a complete picture of the data and computer networks systematically
- To provide a strong foundation in networking concepts and technology

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Understand the basics of data communication, networking, internet, and their importance.	K1, K2, K3,K4,K5
CO2	Analyze the services and features of various protocol layers in data networks.	K1, K2, K3,K4,K5
CO3	Differentiate wired and wireless computer networks	K1, K2, K3 &K4
CO4	Analyze TCP/IP and their protocols.	K1, K2, K3 &K4
CO5	Recognize the different internet devices and their functions.	K1, K2, K3,K4,K5

Mapping of Course Outcomes to Program Outcomes:

PO/ PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	3	3	3	3	2	3	2	2	3
CO2	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	2	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	2	2	3	2	3	3
Average	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**2.8**	**2.60**	**3.00**	**2.40**	**2.80**	**3.00**
Criteria for Mapping	**3=Strong2=Medium 1=Low**										

UNITI

Data Communications

Introduction– Networks – The Internet – Protocols and Standards- Network Models: OSI model–TCP/IP protocol suite –Transmission Media: Guided media–Unguided Media.

UNITII

Data Link Layer

Error Detection and Correction: Introduction- Block coding – Linear block codes – Cyclic Codes – Checksum. Framing – Flow and Error Control: Protocols –Noiseless Channels: Stop-and–Wait –Noisy Channel: Stop-and Wait Automatic Repeat Request-Go-Back –N.

UNITIII

Medium Access and Network Layer

Multiple Access: Random Access–Controlled access-Channelization. Network Layer Logical addressing: IPv4 addresses – IPv6 addresses. Transport Layer: Process – to Process delivery: UDP–TCP. Congestion Control– Quality of Service

UNITIV

Application Layer

Domain Naming System: Name Space - Domain Name Space - Distribution of Name Space – DN Sonthe INTERNET-Resolution–Remote logging–e-mail –FTP.

UNITV

Wireless Networks

WirelessCommunications–PrinciplesandFundamentals.WLANs–WPAN-SatelliteNetworks-Ad-hocNetworks.

TEXTBOOKS

1. Forouzan, A. Behrouz. (2006), Data Communications & Networking, Fourth Edition, Tata McGraw Hill Education.
2. Nicopolitidis, Petros, Mohammad Salameh Obaidat, G. L. Papadimitriou (2018),Wireless Networks, John Wiley & Sons.

REFERENCEBOOKS

1. Fred Halsall (1996), Data Communications Computer Networks and Open Systems, Fourth Edition, Addison Wesley.

Semester	**VI**
Subject	**ELECTIVE II – 1. NATURAL LANGUAGE PROCESSING**
Maximum Marks	CIA-50Marks ESE-50Marks
Credits/Instruction Hours	6Credits/90Hours
Exam Duration	3Hours

Objectives

1. Understand approaches to syntax and semantics in NLP.
2. Understand approaches to discourse, generation, dialogue and summarization within NLP.
3. Understand current methods for statistical approaches to machine translation.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Describe the fundamental concepts and techniques of natural language processing. Explain the advantages and disadvantages of different NLP technologies and their applicability in different business situations.	K1,K2,K3, K4,K5
CO2	Distinguish among the various techniques, considering the assumptions, strengths, and weaknesses of each. Use NLP technologies to explore and gain abroad understanding of text data.	K1,K2,K3, K4,K5
CO3	Use appropriate descriptions, visualizations and statistics to communicate the problems and their solutions. Use NLP methods to analyze sentiment of a text document.	K1,K2,K3 &K4
CO4	Analyze large volume text data generated from a range of real-world applications. Use NLP methods to perform topic modelling.	K1,K2,K3, K4,K5
CO5	Develop robotic process automation to manage business processes and to increase and monitor their efficiency and effectiveness. Determine the framework in which artificial intelligence and theInternetofthingsmayfunction,includinginteractionswithpeople,enterprise functions, and environments.	K1,K2,K3, K4,K5

Mapping of Course Outcomes to Program Outcomes:

PO/ PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	3	3	3	3	2	3	2	2	3
CO2	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	2	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	2	2	3	2	3	3
Average	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**2.8**	**2.60**	**3.00**	**2.40**	**2.80**	**3.00**
Criteria for Mapping	**3=Strong2=Medium 1=Low**										

UNITI

Introduction

Natural Language Processing tasks in syntax, semantics and pragmatics–Issue-Applications – The role of machine learning–Probability Basics–Informationtheory–Collocations-N-gramLanguageModels–Estimatingparametersandsmoothing–Evaluatinglanguagemodels.

UNITII

Word level and syntactic analysis

Word Level Analysis: Regular Expressions-Finite-State Automata-Morphological Parsing-Spelling Error Detection and correction-Words and Word classes-Part-of Speech Tagging. Syntactic Analysis :Context-free Grammar-Constituency-Parsing-Probabilistic Parsing.

UNITIII

Semantic analysis and Discourse processing

Semantic Analysis: Meaning Representation-LexicalSemantics-Ambiguity-WordSenseDisambiguation. Discourse Processing: cohesion-Reference Resolution- Discourse Coherence and Structure.

UNITIV

Natural Language Generation

Architecture of NLG Systems- Generation Tasks and Representations- Application of NLG. Machine Translation: Problems in Machine Translation. Characteristics of Indian Languages-Machine Translation Approaches-Translation involving Indian Languages.

UNITV

Information retrieval and lexical resources

Information Retrieval: Design features of Information Retrieval Systems-Classical, Non-classical, Alternative Models of Information Retrieval–valuation Lexical Resources: World Net-Frame Net Stemmers-POS Tagger-Research Corpora.

TEXTBOOKS

1. Daniel Jurafsky, JamesH. Martin," Speech & language processing", Pearson publications.
2. Allen, James. Natural language understanding. Pearson,1995.

REFERENCEBOOK

1. Pierre M.Nugues,"An Introduction to Language Processing with Perl and Prolog",Springer.

Semester	**VI**
Subject	**ELECTIVE II–2. FINANCIAL ANALYTICS**
Maximum Marks	CIA-50Marks ESE-50Marks
Credits/Instruction Hours	6Credits/90Hours
Exam Duration	3Hours

Objectives

1. To provide a solid foundation in business.
2. To acquire logical& analytical skills in financial analytics

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Interpret and discuss the outputs of given financial models and create their own models.	K1, K2, K3,K4,K5
CO2	Design and create visualizations that clearly communicate financial data insights.	K1, K2, K3,K4,K5
CO3	Gain essential knowledge and hands-on experience in the data analysis process, including data scraping, manipulation, exploratory data analysis.	K1,K2,K3 &K4
CO4	Be prepared for more advanced applied financial modelling courses	K1,K2,K3 &K4
CO5	Improve leadership, teamwork and critical thinking skills for financial decision making.	K1, K2, K3,K4,K5

Mapping of Course Outcomes to Program Outcomes:

PO/ PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	3	3	3	3	2	3	2	2	3
CO2	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	2	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	2	2	3	2	3	3
Average	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**2.8**	**2.60**	**3.00**	**2.40**	**2.80**	**3.00**
Criteria for Mapping	**3=Strong2=Medium 1=Low**										

UNITI

Financial Analytics

Introduction: Meaning-Importance of Financial Analytics uses-Features-Documents used in Financial Analytics: Balance Sheet, Income Statement, Cash flow statement-Elements of Financial Health: Liquidity, Leverage, Profitability. Financial Securities: Bond and Stock investments - Housing and Euro crisis - Securities Datasets and Visualization – Plotting multiple series.

UNIT II

Descriptive Analytics

Data Exploration, Dimension Reduction and Data Clustering Geographical Mapping, Market Basket Analysis. Predictive Analytics, Fraud Detection, Churn Analysis, Crime Mapping, Content Analytics, Sentiment Analysis. Analyzing financial data and implement financial models. Process of Data analytics: obtaining publicly available data, refining such data, implement the models and generate typical output, Prices and individual security returns, Portfolio returns, Risks, Factor Models.

UNIT III

Forecasting Analytics

Estimating Demand Curves and Optimize Price, Price Bundling, Non Linear Pricing and Price Skimming, Forecasting, Simple Regression and Correlation Multiple Regression to forecast sales. Modelling Trend and Seasonality Ratio to Moving Average Method, Winter‟s Method

UNIT IV

Business Intelligence & Tableau

Definition of BI – A Brief History of BI – The Architecture of BI. The origin and Drivers of BI. Successful BI Implementation–Analytics Overview–Descriptive, Predictive and Perspective Analytics. Business reporting and Visualization – components - A brief history of data visualization–Different types of charts and graphs–The emergence of data visualization and visual analytics–Performance dashboards–Dashboard design–Best practices in dashboard design – Business performance management – Balanced Scorecards – Six sigma as a performance measurement system.

Unit

Visualizations

Using Tableau to Summarize Data, Slicing and Dicing Financial Data, Charts to Summarize Marketing Data. Functions to Summarize Data, Pricing Analytics, Risk based pricing, Fraud Detection and Prediction, Recovery Management, Loss Risk Forecasting, Risk Profiling, Portfolio Stress Testing.

TEXTBOOKS

1. Analysis of Economic Data, Gary Koop,(4thEdition),Wiley.
2. Statistics and Data Analysis for Financial Engineering: with R examples; David Ruppert, David S. Matteson, Springers.

REFERENCEBOOKS

1. Analyzing Financial Data and Implementing Financial Models Using „R‟, Ang Clifford, Springers.
2. Microsoft Excel 2013: Data Analysis and Business Modeling, Wayne L. Winston, Microsoft Publishing

Semester	I
Subject	NON-MAJOR ELECTIVE I INTRODUCTION TO PROGRAMMING CONCEPTS
Maximum Marks	CIA-50 Marks ESE-50 Marks
Credits/Instruction Hours	2 Credits/30Hours
Exam Duration	3 Hours

Objectives

1. To express algorithms and draw flowcharts in a language independent manner.
2. To teach how to write modular, efficient and readable C programs.
3. To impart knowledge in creating and using Arrays of the C datatypes.
4. To describe the techniques for creating program modules in creating using functions and recursive functions.

UNIT-I

Introduction to the C Language– Algorithm, Pseudocode ,Flowchart ,Background , C Programs,Identifiers,DataTypes,Variables,Constants,Input/Output,Operators(Arithmetic, relational, logical, bitwise etc.),Expressions, Precedence and Associatively, Expression Evaluation, Type conversions.

UNIT-II

Statements- Selection Statements (making decisions) – if and switch statements, Repetition statements(loops)-while, for, do-while statements , Loop examples, other statements related to looping– break, continue, go to, Simple C Program examples.

UNIT-III

Functions-Introduction to Structured Programming, Functions-basics, user defined functions, inter function communication (call by value, call by reference), Standard functions. Storage classes-auto, register, static, extern, scope rules, arrays to functions, recursive functions, example C programs.

UNIT– IV

Arrays– Basic concepts, one-dimensional arrays, two – dimensional arrays, multidimensional arrays, C programming examples Pointers–Introduction(Basic Concepts),pointers to pointers, compatibility, Pointer Applications, Arrays and Pointers, Pointer Arithmetic, memory allocation functions, array of pointers, pointers to void, pointers to functions, command –linear arguments, Introduction to structures and unions.

UNIT-V

Strings – Concepts, C Strings, String Input / Output functions, string manipulation functions, string/data conversion .Input and Output–Concept of a file, streams, text files and binary files, Differences between text and binary files, State of a file, Opening and Closing files,file input /output functions(standard library input/output functions for files),file status functions(error handling),Positioning functions.

TEXTBOOKS

1. Computer Science: A Structured Programming Approach Using C,B.A.Forouzan and R.F.Gilberg, Third Edition, Cengage Learning.
2. The C Programming Language by Brian Kernighan and Dennis Ritchie 2nd edition

REFERENCEBOOKS

1. Let Us C Yashavant kanetkar BPB.
2. Absolute beginner's guide to C, Greg M. Perry, Edition2, Publisher:SamsPub.,1994.
3. Computer Programming and Data Structures by E Balagurusamy, Tata McGraw Hill

Semester	**II**
Subject	**NON-MAJOR ELECTIVES - II** **FUNDAMENTALS OF FREE OPEN SOURCE SOFTWARE**
Maximum Marks	CIA-50Marks ESE-50Marks
Credits/Instruction Hours	2Credits/30Hours
Exam Duration	3Hours

Objectives

1. To expose students to free open source software environment and introduce them to use open source packages.
2. Demonstrate different open source technologies like Linux, PHP & MySQL with different packages.
3. To understand open source software practices and tools.
4. To use the open source software in operating systems, Programming and web framework in approaching real time applications.

UNITI
Introduction to Open Source

Introduction to open sources–Need of open sources–advantages of open sources–application of open sources. Open source operating systems: LINUX: Introduction–general overview– Kernel mode and user mode–process–advanced concepts–scheduling–personalities–cloning– signals–developmentwithLinux.

UNIT II
MYSQL

MySQL: Introduction – setting up account – starting, terminating, and writing your own SQL programs-record selection Technology–working with strings–Date and Time–sorting Query results–generating summary –working with meta data–using sequences–MySQL and Web.

UNIT
III PHP

PHP: Introduction–programminginwebenvironment–variables-constants–datatypes–operators – statements – functions – arrays – OOP – string manipulations and regular expression –file handling and data storage – PHP and SQL database – PHP and LDAP – PHP connectivity – sending and receiving E-mails–debugging and error handling–security –templates.

UNITIV
Python

Syntax and style–Python objects–numbers–sequences–strings–lists and tuples–dictionaries– conditional loops–files–input and output–errors and exceptions–functions
–modules–classes and OOP–execution environment.

UNIT V
Perl

Pert backgrounder – pert overview – pearl parsing rules – variables and data – statements and control structures–subroutines-packages and modules–working with files–data manipulation.

UNIT VI

Contemporary Issues

Expert lectures, online seminars–webinars

TEXT BOOKS

1. The Linux Kernel Book, Remy Card, Eric and Frank Mevel, Wiley Publications2003.
2. MySQL Bible, Steve Suchring,JohnWiley2002.

REFERENCE BOOKS

1. Programming PHP,RasmusLerdorfandLevinTatroe,O_Reilly,2002
2. Core Python Programming, WesleyJ.Chun,PrenticeHall,200
3. Perl: The Complete Reference, 2nd Edition,MartinC.Brown, TMH,2009
4. MySQL: The Complete Reference, 2nd Edition, Vikram Vaswani, TMH,2009
5. PHP: TheCompleteReference,2nd Edition, Steve Holzner,TMH,2009.