PSGR
Krishnammal College for Women **KCW**

Affiliated to Bharathiar University \ Autonomous \ College of Excellence \ Accredited with A++ Grade \ Ranked 9th in NIRF

DEPARTMENT OF DATA SCIENCE

CHOICE BASED CREDIT SYSTEM (CBCS)

&

LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK (LOCF)

SYLLABUS

2025-2028 BATCH

SEMESTER I & II

Programme Learning Outcomes (PLO's)

After Completion of the programme, the student will be able to

PLO1: Apply analytical and critical thinking skills to solve complex real-world problems by implementing different tools in the fields of Data Science, Mathematics and Statistics

PLO2: Develop and implement data analysis strategies based on theoretical principles and problem-solving techniques to meet industry standards.

PLO3: Design solutions by applying analytical skills for socio-economic problems with appropriate ethical considerations.

PLO4: Promote life-long learning to meet the demands of changing trends and the workplace.

PLO5: Articulate the principles of Data Science and its impact on innovation and progress within the local or global context.

Programme Specific Outcomes (PSO)

The students at the time of graduation will

PSO1: Apply technical skills attained through laboratory exercises, projects, internships and value-added programmes to develop and implement customized data analysis methodologies in data science.

PSO2: Apply tools and techniques using Statistical, Machine Learning techniques and Decision Support Systems to support business processes and functions.

PSO3: Excel independently and as a collaborative team member or leader, showcasing strong communication and teamwork by applying programming and technical skills to solve multi-disciplinary problems.

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Bachelor of Science (Data Science)
Choice Based Credit System (CBCS) &
Learning Outcomes Based Curricular Framework (LOCF)
Syllabus and Scheme of Examinations
2025 -2028 Batch

Semester	Part	Course Code	Title of the Course	Course Type	Instruction Hours/Week	Contact Hours	Tutorial Hours	Duration of Examination	CA	ESE	Total	Credits
I	I	TAM2501A/ HIN2501A/ FRE2501A	Tamil Paper I/ Hindi Paper I/ French Paper I	L	4	58	2	3	25	75	100	3
	II	ENG2501A	English Paper I	E	4	58	2	3	25	75	100	3
	III	DS25C01	Fundamentals of Data Science	CC	4	58	2	3	25	75	100	3
	III	CY25C01	Programming in C	CC	4	58	2	3	25	75	100	3
	III	PP22C02	Computational and Algorithmic Thinking for Problem Solving	CC	3	45	-	-	100	-	100	3
	III	TH24A08	Mathematics for Data Science	GE	6	88	2	3	25	75	100	5
	III	DS24CP1	Programming in C Lab	CC	3	45	-	3	15	35	50*	2
	IV	NME25B1 / NME25A1	Basic Tamil I / Advance Tamil I	AEC	2	28	2	-	100	-	100	2
	IV	NME23ES	Introduction to Entrepreneurship	AEC	2	30	-	-	100	-	100	
I	VI	NM25GAW	General Awareness	AECC	SS	-	-	-	100	-	100	Gr
I -II	VI	COM25SER	Community Services 30 Hours	GC	-	-	-	-	-	-	-	-
I-V	VI	24BONL1 24BONL2 24BONL3	Online Course I Online Course II Online Course III	ACC	-	-	-	-	-	-	-	-
II	I	TAM2502A/ HIN2502A/ FRE2502A	Tamil Paper II/ Hindi Paper II/ French Paper II	L	4	58	2	3	25	75	100	3
	II	ENG2502A	English Paper II	E	4	58	2	3	25	75	100	3

Semester	Part	Course Code	Title of the Course	Course Type	Instruction Hours/Week	Contact Hours	Tutorial Hours	Duration of Examination	Examination Marks			Credits
									CA	ESE	Total	
	III	DS24C04	Python Programming for Data Science	CC	4	58	2	3	25	75	100	3
	III	DS25C05	Data Structures	CC	3	43	2	3	25	75	100	3
	III	DS25CP2	Python Programming and Data Structures Lab	CC	4	60	-	3	15	35	50*	2
	III	DS24CP3	Statistical Analysis Lab	CC	3	45	-	3	15	35	50*	2
	III	TH24A17	Statistics for Data Science	GE	6	88	2	3	25	75	100	5
	IV	NM25UHR	Universal Human Values and Human Rights	AEC	2	30	-	-	100	-	100	2
	IV	NME25B2/ NME25A2	Basic Tamil II / Advanced Tamil II	AEC	-	-	-	-	100	-	100**	Gr.
I-II	VI	NM25GAW	General Awareness	AECC	SS	-	-	-	100	-	100	Gr.
I-II	VI	COM25SER	Community Services 30 Hours	GC	-	-	-	-	-	-	-	-
I-V	VI	24BONL1 24BONL2 24BONL3	Online Course I Online Course II Online Course III	ACC	-	-	-	-	-	-	-	-

L: Language   **AECC:** Ability Enhancement Compulsory Course
E: English   **GC:** General Course
CC: Core Course   **ACC:** Additional Credit Courses
GE: Generic Elective   **CA**: Continuous Assessment
AEC: Ability Enhancement Course   **ESE**: End Semester Examination
SS: Self Study

*CA conducted for 25 and converted into 15, ESE conducted for 75 and converted into 35

Evaluation Pattern 2025-2028 Batch

CA Question Paper Pattern and distribution of marks

Language and English			
Section A	5 x 1 (No choice)	:	5 Marks
Section B	4 x 5 (4 out of 6)	:	20 Marks (250 words)
Section C	2 x 10 (2 out of 3)	:	20 Marks (500 words)
		Total :	**45 Marks**
Core and Allied - (First 3 Units)			
CA Question from each unit comprising of			
One question with a weightage of 2 Marks			:2 x 3 = 6
One question with a weightage of 5 Marks (Internal Choice at the same CLO level) :5 x 3 =15			
One question with a weightage of 5 Marks (Internal Choice at the same CLO level) :8 x 3 =24			
			Total :45 Marks

End Semester Examination – Question Paper Pattern and Distribution of Marks

Language and English			
Section A	10 x 1 (10 out of 12)	:	10 Marks
Section B	5 x 5 (5 out of 7)	:	25 Marks (250 words)
Section A	4 x 10 (4 out of 6)	:	40 Marks (600 - 700 words)
			Total: 75 Marks
Core and Allied courses			
Question from each unit comprising of			
One question with a weightage of 2 Marks			: 2 x 5=10
One question with a weightage of 5 Marks (Internal Choice at the same CLO level): 5 x 5 =25			
One question with a weightage of 8 Marks (Internal Choice at the same CLO level): 8 x 5 =40			
			Total: 75 marks
Practical			
The End Semester Examination will be conducted for a maximum of 75 marks respectively with a maximum 15 marks for the record and other submissions if any.			

Continuous Internal Assessment Pattern

Theory		
CIA Test : 5 Marks (Conducted for 45marks after 50 days		
MODEL Exam : 7 marks (Conducted for 75 marks after 85 days (each Unit 15 Marks))		
Seminar/Assignment/Quiz	:	5 Marks
Class participation	:	5 Marks
Attendance	:	3 Marks
		Total: 25 Marks
Practical		
Lab Performance	:	7 Marks
Regularity	:	5 Marks
Model Exam	:	10 Marks
Attendance	:	3 Marks
		Total: 25 marks

Part IV Introduction to Entrepreneurship		
Quiz	:	50 Marks
Assignment	:	25 Marks
Project / Case study	:	25 Marks
		Total: 100 Marks

SEMESTER I

COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	CREDIT
DS25C01	FUNDAMENTALS OF DATA SCIENCE	Theory	58	2	-	3

Preamble
This course provides a foundational understanding of Data Science, beginning with computer and number system basics. Students will have the knowledge and skills to analyze data, handle heterogeneous datasets, explore big data characteristics, and learn to apply ethical principles in data-driven decision-making.

Prerequisite
- NIL

Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	Recall the fundamental concepts of computer systems, data, information, and database technologies.	K1
CLO2	Understanding the basic concepts of Data Science, databases, data preparation and methods.	K2
CLO3	Apply data analysis techniques using SQL and data preprocessing methods.	K3
CLO4	Analyze data science methodologies and ethical issues related to big data and algorithmic decisions.	K4

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	M	S	M
CLO2	S	S	S	S	M
CLO3	S	S	S	M	M
CLO4	M	S	S	S	M

Unit I 11 Hrs.
Introduction: Generations of Computer, Types of Computers - Functional units of a computer system- Input Devices -Output devices – Memory – Storage Devices. Number Systems: Decimal, Binary, Octal and Hexadecimal – Conversion –Computer Codes- Binary Addition, Subtraction-Complements.

Unit II 12 Hrs.
Data Science: Data, information, and Knowledge- Data Science: the art of data Exploration-Data Science tasks- Data Science objectives- Applications of Data Science. Importance of Data Science:

Need for Data Science - Data Science Process – Business Intelligence and Data Science – Prerequisites for a Data Scientist – Tools and Skills Required.

Unit III   **12 Hrs.**
Data, sources, and generation: Introduction-Data attributes -Data-storage Formats-Data Sources-Data generation. Databases for Data Science: Structured Query Language (SQL): Basic Statistics, Data Munging, Filtering, Joins, Aggregation, No-SQL: Document Databases, Wide-column Databases and Graphical Databases.
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Unit IV   **12 Hrs.**
Data Preparation: Data preprocessing- Data cleaning- Handling missing values- Ignoring and discarding data- Data reduction- Sampling- Data transformation- Discretization- Data normalization - Min–max normalization- Z-score normalization- Decimal-scaling normalization- Data integration.
Data Science Methodology: Big Data analysis: Introduction-Characteristics of Big Data- Types of Big Data -Examples of Big Data.

Unit V   **11 Hrs.**
Introduction to Data Ethics – History and Evolution of Data Ethics – Data Privacy and Protection – Data Security and Anonymization – Bias and Fairness in Algorithms – Discrimination and Social Impact – Transparency and Explainability – Accountability in Data Science – Ethical Decision-Making Frameworks **–** Legal and Regulatory Aspects

Text Books:

S. No	Author	Title of the Book	Publisher	Year of Publication / Edition
1	Jugal K. Kalitha, Dhruba K. Bhattacharyaa, Swarup Roy	Fundamentals of Data Science: Theory and Practice	Academic Press	2023, 1st Edn.
2	Sanjeev J. Wagh, Manisha S. Bhende, Anuradha D. Thakare	Fundamentals of Data Science	CRC Press	2021, 1st Edn

Reference Books:

S. No	Author	Title of the Book	Publisher	Year of Publication / Edition
1	Joel Grus	Data Science from Scratch: First Principles with Python	O'Reilly Publications	2019, 2nd Edn.
2	Lillian Pierson	Data Science for Dummies	Wiley Publications	2021, 3rd Edn.

Reference Link :
- "Data Science Ethics" by University of Michigan on Coursera - https://www.coursera.org/learn/data-science-ethics/home/

Pedagogy
- Chalk and talk PPT, Discussion, Assignment, Demo, Quiz

Course Designer
1. Dr. S. Poongodi

COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	CREDIT
CY25C01	PROGRAMMING IN C	THEORY	58	2	-	3

Preamble

This course introduces fundamental programming constructs in C. It covers the concepts such as arrays, functions, structures, pointers and file handling. It provides comprehensive coverage on industry 4.0.

Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	Recall the programming constructs and structure of C programming and Industry 4.0 technologies	K1
CLO2	Understand the purpose of arrays, strings, structures, pointers and files to solve problems	K2
CLO3	Apply functions to solve problems using procedure-oriented approach	K3
CLO4	Analyze the problems and solve it by applying appropriate logic	K4

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	S	S	S
CLO2	S	S	M	S	M
CLO3	S	S	S	S	S
CLO4	S	S	S	S	S

S- Strong; M-Medium

Unit I   **12 Hrs.**

Overview of C - Constants, Variables and Data types - Operators and Expressions - Managing Input and Output Operations - Sulba Sutras-Decision Making and Branching - Decision Making and Looping.

Unit II   **12 Hrs.**

Shloka Arrays: One-Dimensional - Two Dimensional - Multidimensional Arrays-Character Arrays and Strings: Declaring and Initializing String Variables - Reading Strings from Terminal - Writing Strings to Screen - String Handling Functions.

Unit III 12 Hrs.

Chandas -User-Defined Functions: Need - Return Values and Types - Function Calls – Function declaration - Category of Functions - No Arguments and No Return Values - Arguments but No Return Values - Arguments with Return Values - Recursion - Scope Visibility and Life time of Variables Structures and Unions - Definition: Structure Initialization - Comparison of Structure Variables - Arrays of Structures - Arrays within Structures - Unions.

Unit IV 12 Hrs.

Pointers: Understanding Pointers - Accessing the Address of a Variable - Declaring and Initializing Pointers - Accessing a Variable through its Pointers - Pointers and Arrays. File Management in C: Defining and Opening a File - Closing File - I/O Operations on Files - Dynamic Memory allocation MALLOC, CALLOC, REALLOC.

Unit V 10 Hrs.

Introduction to Industry 4.0 - Need - Reasons for Adopting Industry 4.0 - Definition - Goals and Design Principles - Technologies of Industry 4.0 - Skills required for Industry 4.0 - Advancements in Industry Impact of Industry 4.0 on Society, Business, Government and People - Introduction to 5.0.

Text Book

S. No	Author	Title of the Book	Publisher	Year and Edition
1	E.Balagurusamy	Programming In ANSI C	Tata Mc Graw Hill	2019, 8th Edn.
2	P. Kaliraj, T. Dev	Higher Education for Industry 4.0 and Transformation To Education 5.0	CRC Press - Taylor & Francis Group	2021,1st Edn.

Reference Books

S. No	Author	Title of the Book	Publisher	Year and Edition
1	Byron Gottfried	Programming with C	Tata McGraw Hill	2018, 4th Edn.
2	Yashwant Kanektar	Let Us C: Authentic Guide to C Programming Language	BPB Publications	2020, 17th Edn.

Pedagogy
- Lectures, Group discussions, Demonstrations

Course Designer
Dr. Sabitha Banu A

COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	CREDIT
PP22C02	COMPUTATIONAL AND ALGORITHMIC THINKING FOR PROBLEM SOLVING	Theory	45	-	-	3

Preamble

This course aims to kindle young minds to think like a computer scientist, with the idea that Computing and computers will enable the spread of computational thinking. Computational thinking is thinking recursively, reformulating a seemingly difficult problem into one which we know how to solve and taking an approach to solving problems, designing systems, and understanding human behavior that draws on concepts fundamental to computer science.

Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	Define the basic principles of logical reasoning, problem solving in computational thinking	K1
CLO2	Understanding the applications of propositional logic, problem representation and techniques	K2
CLO3	Apply algorithmic thinking to problem solving using tools	K3
CLO4	Apply and analyze to solve domain specific problems using computational thinking concepts	K4

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	M	S	S	S	S
CLO2	S	S	S	M	S
CLO3	S	M	S	S	S
CLO4	S	S	M	S	S

S – Strong, M - Medium

Unit I   **7 Hrs.**
Basics: Introduction to Computational Thinking- Data Logic - History of Computational Thinking- Applications of Computational Thinking.

Unit II   **8 Hrs.**
Data- Information and Data - Data Encoding - Logic - Boolean logic - Applications of simple Propositional Logic. Tool: Flow algorithm and Scratch.

Unit III   **10 Hrs.**
Problem Solving and Algorithmic Thinking: Problem definition- Logical reasoning- Problem

decomposition- Abstraction- Problem representation via Algorithmic thinking: Name binding- Selection- Repetition and Control Abstraction- Simple Algorithms – Comparison of performance of Algorithms.

Unit IV   **8 Hrs.**
Activities in Class: Sudoku -Towers of Hanoi- Graph Coloring - Geographical Map reading- Poem reading - Novel reading - Data analysis on news.

Unit V   **12 Hrs.**
Problem Solving Techniques- Factoring and Recursion Techniques- Greedy Techniques-Divide and Conquer- Search and Sort Algorithms- Text Processing and Pattern matching. Tool: iPython

Text Books

S. No	Author	Title of the Book	Publisher	Year of Publication / Edition
1	David Riley and Kenny Hunt	Computational Thinking for Modern Solver	Chapman & Hall/CRC	2014, 1st Edn.
2	Paolo Ferragina, FabrizioLuccio	Computational Thinking First Algorithms	Springer International Publishing	2018
3	Karl Beecher	Computational Thinking – A beginner's guide to problem solving	BSC publication	2017

Pedagogy

Lectures, Simulation exercises, Demonstration, PPT, Case Study

Evaluation Pattern:

Assessment	Number	Marks
Quiz (online or offline)	5	50
Class Activity	5	25
Group Project (Domain Specific)	1	25
Total		100

COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	CREDIT
DS24CP1	**PROGRAMMING IN C LAB**	**PRACTICAL**	-	-	45	2

Preamble

This course offers practical training in C Programming, enhancing the skill set through hands-on experience. By completing the course, learners will gain the ability to craft logical solutions for various problems. The course involved compiling, linking, and debugging code, as well as tackling more intricate programming tasks.

Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	Outline the logic using a flowchart for a given problem and develop Programs using conditional and looping statements.	K1
CLO2	Differentiate built-in functions and apply user-defined functions to solve problems	K2
CLO3	Construct programs with features of Arrays, Structures, and Pointers.	K3
CLO4	Design and develop programs to solve real-world problems.	K4

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	S	S	M
CLO2	S	S	S	S	S
CLO3	S	S	S	S	M
CLO4	S	S	S	M	S

S- Strong, M-Medium

- Exercise using different data types
- Exercise using operators
- Exercise to implement control structures
- Exercise using loop statements
- Exercise to implement arrays
- Exercise using built-in functions
- Exercise to generate user-defined function
- Exercise using structures
- Exercise using pointers
- Exercise to work with files

Pedagogy

- Demonstration of working environment / Tools / Software/Program

Course Designer

1. Dr. M. Sasikala

COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	CREDIT
DS24C04	**PYTHON PROGRAMMING FOR DATA SCIENCE**	**THEORY**	5 8	2	-	3

Preamble

This course comprehensively introduces Python programming and its applications in data analysis, covering fundamental programming concepts, data manipulation techniques, and visualization tools.

Pre-requisite
- Programming Fundamentals
- Problem Solving Silks

Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	Recall Python programming basics, including syntax, data types, operators, and control structures.	K1
CLO2	Understand Python's concepts of functions, strings, lists, tuples, sets, and dictionaries.	K2
CLO3	Apply Python programming concepts to work with data structures such as strings, lists, tuples, sets, and dictionaries to solve computational problems.	K3
CLO4	Analyse and utilize advanced Python libraries, including NumPy, Pandas, and Matplotlib, for efficient data manipulation and visualization.	K4

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	S	S	M
CLO2	S	S	M	S	M
CLO3	S	S	S	S	S
CLO4	S	S	S	S	S

S- Strong, M-Medium

Unit I (11 Hrs.)

Introduction: History, Executing Python programs, commenting in Python, Basics of Python Programming: Character Set, Tokens, data Types, Variables, Print, Input and Eval Function, Formatting number and Strings. Operators and Expressions: Arithmetic Operators, Operator Precedence and Associativity, Bitwise Operators, Boolean Operators.

Unit II (11 Hrs.)

Decision Statements: Conditional (if), Alternative (if-else), Chained Conditional (if-elif-else). Loop Control Structures: While, For, Break, Continue, Range Function. Functions: Introduction, Inbuilt Functions, User-Defined functions, passing Parameters, Return Values, Recursion.

Unit III (12 Hrs.)

Strings: Basic Inbuilt Python Functions for String, Index Operator, Immutability, String Methods and Operations. Lists: Creating Lists, Accessing Lists, List Slicing, List Comprehension. Sets: Creating Sets, Set Operations

Unit IV (12 Hrs.)

Tuples: Creating Tuples, Inbuilt Functions for Tuples, Operations on Tuples. Dictionaries: Need, Basics of Dictionaries, Creation, Adding and Replacing Values, Operations and Methods, Nested Dictionaries. Introduction to NumPy: NumPy Standard Data Types, Basics of NumPy Arrays, Aggregations.

Unit V (12 Hrs.)

Data Manipulation with Pandas: Introduction to Pandas, installation and usage, data indexing and selection, operating on data, handling missing data. Visualization with Matplotlib: Introduction to Matplotlib, simple line plots, scatter plots, and histograms.

Text Books

S. No.	Author	Title of the Book	Publisher	Year and Edition
1	Ashok N. Kamthane, Amit Ashok Kamthane	Programming and Problem Solving with Python	McGraw-Hill	2020, 2nd Edn.
2	Jake VanderPlas	Python Data Science Handbook - Essential Tools for Working with Data	O'Reilly	2023, 2nd Edn

Reference Books

S. No.	Author	Title of the Book	Publisher	Year and Edition
1	Allen B. Downey	Think Python: How to Think like a Computer Scientist	O'Reilly Publishers	2016, 2nd Edition
2	Wesley J Chun	Core Python Applications Programming	Prentice Hall	2012, 3rd Edition

Pedagogy

Lectures, Demonstrations, Case studies.

Course Designers

1. Dr. S. Poongodi

2. Dr. M. Sasikala

COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	CREDIT
DS25C05	DATA STRUCTURES	THEORY	43	2	-	3

Preamble

This course introduces the concepts of Abstract data type (ADTs), linear data structures which includes lists, stacks, and queues. The course covers various sorting, searching and hashing algorithms and applications of linear data structures

Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	Recall fundamental concepts of data structures, types, and their real-life applications.	K1
CLO2	Understand the working and applications of linear and non-linear data structures.	K2
CLO3	Apply appropriate data structures to solve computational problems using algorithms.	K3
CLO4	Analyze algorithm efficiency and the suitability of data structures for optimization..	K4

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	M	M	M	S
CLO2	S	S	M	M	S
CLO3	S	S	S	M	M
CLO4	S	S	S	S	M

 S- Strong; M-Medium

Unit I **(8 Hrs.)**

Data Structures: Need of Data Structure –Different Types of Data Structures –Selecting and implementing a Data Structure – Real-life scenarios for Data Structures – Difference between Data Structures and Database Management Systems. Abstract Data Types and Analysis: Complexity – Asymptotic Notation - Working of Recursion.

Unit II **(9 Hrs.)**

Linear Data Structures: Arrays - Declaration of Arrays – Implementation of arrays - Applications of Arrays - Stack – Working of Stack - Applications of Stacks - Queues - Single Ended Queues – Enqueue – Dequeue – Front Operation – Implementation of Single Ended Queues using lists – Applications of Queues.

Unit III (9 Hrs.)

Linked Lists: Singly Linked List - Insert Node – Delete Node – Value at Operation – Implementation of Singly Linked List – Doubly Linked List - Insert Node – Delete Node – Value at Operation – Implementation of Doubly Linked List - Applications of Linked List.

Unit IV (9 Hrs.)

Non-Linear Data Structures: Trees - Definitions – Types of Binary Trees – Implementation of Binary Trees - Pointer-based - Array-based – Linked List based – Traversal - In Order – Pre Order – Post Order – Level Ordered – Basic Operations - Application of Trees – Graphs - Components of a Graph - Graph Representation - Types of Graphs –Working – Traversal.

Unit V (8 Hrs.)

Sorting and Searching: Importance of Sorting Algorithm – Exchange Sort - Selection Sort - Insertion Sort – Divide and conquer – Linear Search - Binary Search.

Text Books

S. No.	Author	Title of the Book	Publisher	Year and Edition
1	Shriram K Vasudevan, Abhishek S Nagarajan, Karthick Nanmaran .	Data Structures Using Python	Oxford University Press	2021, 1st Edn.

Reference Books

S. No.	Author	Title of the Book	Publisher	Year and Edition
1	Rance D Necaise	Data Structures and Algorithms using Python	John willey &sons	2011, 1st Edn.
2	Ellis Horowitz & Sartaj Sahani	Fundamentals of Data Structures	Galghotia Book Source	2003, 1st Edn.

Pedagogy

Lectures, Demonstrations, Case studies.

Course Designers

1. Dr. M. Sasikala
2. Dr. S. Poongodi

COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	CREDIT
DS25CP2	**PYTHON PROGRAMMING AND DATA STRUCTURES LAB**	**PRACTICAL**	-	-	60	2

Preamble

This course provides integrated hands-on training in Python programming and the implementation of fundamental data structures. Students will practice problem-solving using Python constructs and apply them to organize, process, and analyse data efficiently.

Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	Recall Python programming constructs including data types, operators, control statements, and functions.	K1
CLO2	Understand Python libraries (NumPy, Pandas, Matplotlib) and data structures (lists, tuples, dictionaries, sets) to solve basic problems.	K2
CLO3	Implement linear and non-linear data structures (arrays, stacks, queues, linked lists, trees, and graphs) using Python.	K3
CLO4	Analyze searching and sorting algorithms in terms of efficiency when applied to structured data.	K4

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	S	S	M
CLO2	S	S	S	S	M
CLO3	S	S	S	S	M
CLO4	S	S	S	S	S

S- Strong, M-Medium

Exercises to understand and implement the following concepts:

1. Python Programming Basics – Data types, operators, control structures, functions, and string/list/tuple/set/dictionary manipulations.

2. Data Handling with Libraries – NumPy arrays and operations, data manipulation with Pandas (indexing, selection, cleaning), and visualization with Matplotlib.

3. Linear Data Structures – Arrays, stacks, and queues using Python, including applications of stacks and queues.

4. Non-Linear Data Structures – Linked lists (singly and doubly), trees (creation and traversals), and graph representation with traversals.

5. Algorithms – Searching and sorting techniques

Pedagogy

Demonstration of working Environment / Tools / Software/Program

Course Designers

1. Dr. M. Sasikala
2. Dr. S. Poongodi

COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	CREDIT
DS24CP3	STATISTICAL ANALYSIS LAB	PRACTICAL	-	-	45	2

Preamble

This course provides practical experience in using PSPP to apply statistical techniques. Students will learn to analyze data, create visualizations, and interpret results. They will work with concepts such as frequency distributions, central tendency, regression analysis, and probability. The course helps students develop the skills to analyze real-world data and make data-driven decisions.

Prerequisite

- Basic Knowledge on Statistics

Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	Recall and describe key statistical concepts such as frequency distribution, measures of central tendency, variance, correlation, and regression.	K1
CLO2	Understand the principles of statistical techniques and their significance in data analysis.	K2
CLO3	Apply various statistical methods and techniques, including frequency distribution, regression analysis, and probability calculations.	K3
CLO4	Analyze data sets using statistical tools to identify patterns and relationships.	K4

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	S	S	M
CLO2	S	S	S	S	M
CLO3	S	S	S	S	S
CLO4	S	S	S	M	S

S- Strong, M-Medium

Exercises to understand and implement the following concepts:

- Program to find the Frequency Distribution of given data.
- Program to plot Graphs and Charts for data visualization.
- Program to calculate Measures of Central Tendency (Mean, Median, Mode).

- Program to compute Standard Deviation and Variance for a dataset.
- Program to analyse and compute Correlation between two datasets.
- Program to perform Simple Linear Regression on a given dataset.
- Program to calculate the Probability of events in a dataset.
- Program to simulate and analyse Theoretical Distributions.

Pedagogy

Demonstration of working environment / Tools

Course Designers

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