TELANGANA UNIVERSITY

Department of Computer Science & Engineering

B.Sc Data Science

Revised Common Core Syllabusof B.Sc. Data Science Three-Year Degree under Choice Based Credit System(CBCS) framework for all Colleges under Telangana University with effect from the Academic Year 2026-27

Course Structure

B.Sc Data Science

Syllabus and Credits Structure under Choice Based Credit System (CBCS) General Degree for the Three Years B.Sc. with Data Science Undergraduate Programme with effect from 2026-27

I YEAR

Semester	Type of Course	Paper Title	Teaching Hours / Week			Credits	Examination Scheme			Duration of the Examination
			T	P	Total	Theory / Practical	Max. Marks			
							IA	EE	Total	
I	DSC-1	Python Programming	4		4	4	20	80	100	3
	DSC-1 Lab	Python Programming Lab		2	2	1		25	25	2
2	DSC-2	Data Structures and Algorithms	4		4	4	20	80	100	3
	DSC-2 Lab	Data Structures Using Python Lab		2	2	1		25	25	2

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Semester – I

PYTHON PROGRAMMING

(With effect from 2026-27)

Theory: 4 Hours/Week	**Credits:** 4	**Internal Marks=20**	**External Marks=80**

Unit I

Introduction, Data types:
Introduction to Python - Advantages of using Python-Executing Python Programs – Python's Core data types -Numeric Types - String Fundamentals.

Unit II

Lists, Tuples, Dictionaries:

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing – list comprehension.

Unit III

Control Flow, Functions, Modules:
Python Statements: Assignments - Expressions – If condition - While and for loops. Functions: Definition, Calls - Scopes - Arguments - Recursive Functions-Functional Programming tools. Classes and Object Oriented programming with Python - Modules and Packages: Purpose, using packages
Exception Handling with Python.

Unit IV Packages

Packages, File Handling:
NumPy, Pandas, Scikit learn - Machine learningwith Python - Cleaning up, Wrangling, Analysis, Visualization - Matplotlib package - Plotting Graphs.

Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions

TEXT BOOKS:

1. Mark Lutz, "Learning Python", Fifth Edition, O'Reilly, 2013.
2. Daniel Liang, "Introduction to programming using Python", Pearson, First edition, 2021.
3. Wes Mc Kinney, "Python for Data Analysis", O'Reilly Media, 2012.

REFERENCE BOOKS:

1. Tim Hall and J-P Stacey, "Python 3 for Absolute Beginners", Apress, First Edition
2. Magnus Lie Hetland, "Beginning Python: From Novice to Professional", Apress, Second Edition, 2005

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Semester – I
Python Programming Lab

(**With effect from 2026-27**)

Theory: 2 Hours/Week	**Credits:** 1	**Marks=25**

1. Installation and Environment setup of python.
2. Write a program to demonstrate the use of basic Data Types
3. Write a program to demonstrate the Operators and Expressions
4. Write a program to demonstrate the Functions and parameter passing Techniques.
5. Write a program to exchange the values of two variables
6. Write a program to find minimum among n variables
7. Write a program to perform simple sorting.
8. Write a program to Generate Students' marks statement.
9. Write a program to find square root, GCD, exponentiation.
10. Write a program to Perform linear search, binary search.
11. Write a program to Perform Matrix operations using NumPy .
12. a) Write a Program to implement i. Packages ii. Modules iii. Built-in Functions

    b) Write a Program to implement i. List ii. Tuple iii. Dictionaries

    c) Programs on Strings, String Operations and Regular Expressions

13.a) Write a Program to implement Class and Object

b) Write a Program to implement Static and Instance methods, Abstract Classes and Interfaces.

14 a) Write a program to compute distance between two points taking input from the user (Pythagorean Theorem)

b) Write a program to convert a given decimal number to other base systems

15 a) Write a program to implement Inheritance

b) Write a program to implement Polymorphism

16 a) Write a program to implement Files

b) Write a program to demonstrate Exception Handling

17. Writes a recursive function that generates all binary strings of n-bit length

18. Use Matplotlib on dataset and visualize

19. Perform Word count, copy file operations

20. Perform Dataframe operations using Pandas

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Semester – II

Data Structures and Algorithms
(**With effect from 2026-27**)

Theory: 4 Hours/Week	**Credits:** 4	**Internal Marks=20**	**External Marks=80**

UNIT–I

Fundamental Concepts: Introduction to Data Structures, Types of Data Structures, Introduction to Algorithm, Pseudo-code, Flow Chart, Analysis of Algorithms. Linear Data Structure Using Arrays: 1-D Arrays, 2-D Arrays, N-D Arrays, Memory Representation and Address Calculation of 1-D, 2-D, N-D Arrays, Concept of Ordered List, String Manipulation, Pros and Cons of Arrays. Stacks: Concept, Primitive Operations, Abstract Data Type, Representation Stacks Using Arrays, Prefix, Infix, Postfix Notations for Arithmetic Expression, Applications of Stacks– Converting Infix Expression to Postfix Expression, Evaluating the Postfix Expression, Checking Well-formed (Nested) Parenthesis, Processing of Function Calls, Reversing a String.

UNIT–II

Recursion: Introduction, Recurrence, Use of Stack in Recursion, Variants of Recursion, Execution of Recursive Calls, Recursive Functions, Iteration versus Recursion. Queues: Concept, Primitive Operations, Abstract Data Type, Representation Queues Using Arrays, Circular Queue, Double-Ended Queue, Applications of Queues. Linked Lists: Introduction, Concept, Terminology, Primitive Operations-creating, inserting, deleting, traversing, Representation of Linked Lists, Linked List Abstract Data Type, Linked List Variants - Singly Linked List, Doubly Linked List, Linear and Circular Linked List, Representation Stacks and Queues Using Linked Singly Lists, Application of Linked List–Garbage Collection.

UNIT–III

Trees: Introduction, Representation of a General Tree, Binary Tree Introduction, Binary Tree Abstract Data Type, Implementation of Binary Trees, Binary Tree Traversals – Preorder, Inorder,PostorderTraversals,ApplicationsofBinaryTreesBriefly.Graphs:Introduction,Graph
Abstract Data Type, Representation of Graphs, Graph Traversal – Depth-First Search, Breadth-First Search, Spanning Tree – Prim's Algorithm, Kruskal's Algorithm. Hashing: Introduction, Hash Functions, and Collision Resolution Strategies.

UNIT–IV

Searching and Sorting Algorithms: Sequential (Linear) Search, Binary Search, Bubble Sort, Insertion Sort, Selection Sort, Quick Sort, Merge Sort, and Comparison of Sorting Techniques. Heaps: Concept, Implementation, Abstract Data Type, Heap Sort.

References

1. “Computer Algorithms”- Ellis Horowitz, Sartaj Sahniand S. Rajasekaran
2. “Data Structure and Algorithmic Thinking with Python” –Narasimha Karumanchi
3. “Data Structures and Algorithms in Python”-Robert o Tamassia, M.H. Gold wasser, M.T. Goodrich.
4. “Problem Solving in Data Structures & Algorithms Using Python”-Hemant Jain

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Semester – II
Data Structures and Algorithms Lab
(**With effect from 2026-27**)

Theory: 2 Hours/Week	**Credits:** 1	**Marks=25**

1. Write programs to implement the following using an array: a) Stack ADT b) Queue ADT.
2. Write a program to convert the given infix expression to postfix expression using stack.
3. Write a program to evaluate a postfix expression using stack.
4. Write a program to ensure the parentheses are nested correctly in an arithmetic expression.
5. Write a program to find following using Recursion a) Factorial of +ve Integer b) nth term of the Fibonacci sequence (c) GCD of two positive integers
6. Write a program to create a single linked list and write functions to implement the following operations. a) Insert an element at a specified position b) Delete a specified element in the list c) Search for an element and find its position in the list d) Sort the elements in the list ascending order
7. Write a program to create a double linked list and write functions to implement the following operations. a) Insert an element at a specified position b) Delete a specified element in the list c) Search for an element and find its position in the list d) Sort the elements in the list ascending order
8. Write a program to create singular circular linked lists and function to implement the following operations. a) Insert an element at a specified position b) Delete a specified element in the list c) Search for an element and find its position in the list
9. Write programs to implement the following using a single linked list: a) Stack ADT b) Queue ADT.
10. Write a program to implement Binary search technique using Iterative method and Recursive methods.
11. Write a program for sorting the given list numbers in ascending order using the following technique: Bubble sort and Selection sort
12. Write a program for sorting the given list numbers in ascending order using the following technique: Insertion sort and Quick sort.

13. Write a program for sorting the given list numbers in ascending order using the following technique: Merge sort and Heap sort

14. Write a program to traverse a binary tree in following way. a) Pre-order b) In-order c)Post-order 15 Write a program to the implementation graph traversals – BFS and DFS.

15. Write a program to find the minimum spanning tree for a weighted graph using a) Prim's Algorithm b) Kruskal's Algorithm.

Note: Write the Pseudo Code, flowcharts and Python program code for the above problems/methods/ algorithms with different possibilities like with and without oops, functions, etc. is mandatory.