

A1 : Programming Fundamentals Using Python

Course Objective

This course is designed to introduce programming concepts using Python to students. The course aims to develop structured as well as object-oriented programming skills using Python. The course also aims to achieve competence amongst its students to develop correct and efficient Python programs to solve problems spanning multiple disciplines.

Course Learning Outcomes

On successful completion of this course, a student will be able to:

1. Write simple programs using built-in data types of Python.
2. Implement arrays and user defined functions in Python.
3. Solve problems spanning multiple disciplines using suitable programming constructs in Python.
4. Solve problems spanning multiple disciplines using the concepts of object oriented programming in Python.

Syllabus

Unit 1 Introduction to Python Programming: Problem solving strategies; Structure of a Python program; Syntax and semantics; Python interpreter/shell, indentation; Executing simple programs in Python.

Unit 2 Creating Python Programs: Identifiers and keywords; literals, numbers, and strings; Operators and expressions; Input and output statements; control structures (conditional statements, loop control statements, break, continue and pass), Errors and exception handling.

Unit 3 User Defined Functions: Defining functions, passing arguments and returning values, default arguments

Unit 4 Built-in data structures: Strings, Lists, Tuples, Sets, Dictionaries; their built-in functions, operators and operations.

References

1. Kamthane, A. N., & Kamthane, A.A. *Programming and Problem Solving with Python*, McGraw Hill Education. 2017.
2. Balaguruswamy E., “*Introduction to Computing and Problem Solving using Python*”, 2nd Edition, McGraw Hill Education, 2018.
3. Taneja, S., Kumar, N. *Python Programming- A modular Approach*. Pearson Education India, 2018.

Additional References

- (i) Guttag, J. V. *Introduction to computation and programming using Python*. MIT Press. 2018
- (ii) Downey, A. B. *Think Python–How to think like a Computer Scientist* 2nd Edition. O’Reilly 2015

Suggested Practical List

1. WAP to calculate total marks, percentage and grade of a student. Marks obtained in each of three subjects are to be input by the user. Assign grades according to the following criteria:

Grade A : if Percentage ≥ 80
Grade B : if Percentage ≥ 60 and Percentage < 80
Grade C : if Percentage ≥ 40 and Percentage < 60
Grade D : if Percentage ≤ 40

2. WAP to print factors of a given number.
3. WAP to add N natural numbers and display their sum.
4. WAP to print the following conversion table (use looping constructs):

Height(in Feet)	Height(in inches)
5.0ft	60 inches
5.1ft	61.2inches

5.8ft	69.6inches
5.9ft	70.8inches
6.0ft	72inches

5. WAP that takes a positive integer n and the produce n lines of output as shown:

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(for n =4)

6. Write a menu driven program using user defined functions to print the area of rectangle, square, circle and triangle by accepting suitable input from user.

7. Write a function that calculates factorial of a number n.

8. WAP to print the series and its sum: (use functions)

$1/1! + 1/2! + 1/3! + \dots + 1/n!$

9. WAP to perform the following operations on an input string

a. Print length of the string

b. Find frequency of a character in the string

c. Print whether characters are in uppercase or lowercase

10. WAP to create two lists: one of even numbers and another of odd numbers. The program should demonstrate the various operations and methods on lists.

11. WAP to create a dictionary where keys are numbers between 1 and 5 and the values are the cubes of the keys.
12. WAP to create a tuple $t1 = (1,2,5,7,2,4)$. The program should perform the following:
 - a. Print tuple in two lines, line 1 containing the first half of tuple and second line having the second half.
 - b. Concatenate tuple $t2 = (10,11)$ with $t1$.

A2 : Data Visualization using Python

Course Objective

This course introduces students to data visualization in the field of exploratory data science using Python.

Course Learning Outcomes

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

1. Import and export data using files
2. Perform data handling using Numpy arrays.
3. Load data in Pandas data frames and its manipulation.
4. Visualize data using Matplot library.

Syllabus

Unit 1 Introduction : Motivation for using Python for Data Visualization, Essential Python Libraries: NumPy, Pandas, Matplotlib, Import and Export of Data, Import and Export of data using files.

Unit 2 Array manipulation using Numpy: Numpy array: Creating Numpy arrays , Data Types for Numpy arrays, Arithmetic with NumPy Arrays Basic Indexing and Slicing, swapping axes, transposing arrays.

Unit 3 Data Manipulation using Pandas: Data Structures in Pandas: Series, DataFrame, Index objects, Loading data into Pandas data frame. Working with Data frames. Grouped and aggregate calculations