Savitribai Phule Pune University
First Year of Engineering (2024 Pattern)
Course Code: PCC-151-ITT Course Name: Programming and Problem Solving

Teaching Scheme	Credit	Examination Scheme
Theory : 02 Hours/Week Practical : 02 Hours/Week	02 02	CCE : 30 Marks End – Semester : 70 Marks Term Work : 25 Marks

Prerequisite Courses, if any:

- Basics of Computers and Basic Mathematics
- Fundamentals of Programming Languages (COM108)

Companion Course, if any: Fundamentals of Programming Languages Lab

Course Objectives:

To understand problem solving aspects and to know python programming with learning data types, decision control statements, function, strings, file handling in Python. To learn features of object oriented programming concepts using python.

Course Outcomes:

On completion of the course, learner will be able to:

CO1: Inculcate and **apply** various skills in problem solving.

CO2: Choose appropriate programming constructs and features to **solve** the problems in diversified domains.

CO3: Exhibit the programming skills for the problem-solving using functions and string manipulations.

CO4: Demonstrate File handling and dictionaries in Python.

CO5: Apply Object Oriented concepts in Python.

Course Contents

Unit I	Unit I : Problem Solving, Programming and Python Programming	(04 Hours)

General Problem Solving Concepts- Problem solving in everyday life, types of problems, problem solving with computers, difficulties with problem solving, problem solving aspects, top down design. Problem Solving Strategies,

Basics of Python Programming: Features of Python, History and Future of Python, Programming Paradigm, Features of Object Oriented Programming, Applications of Python Languages.

Unit II	Advance Data Types and Decision Control Statements	(04 Hours)

Advance data types- Tuples, Lists, Sets and Dictionary. Decision Control Statements: Decision control statements, Selection/conditional branching

Statements: if, if-else, nested if, if-elif-else statements. Basic loop Structures/Iterative

Statements, while loop, for loop, selecting appropriate loop. Nested loops, The break, continue, pass, else statement used with loops.

Unit III	Functions and Strings	(03 Hours)

Need for functions, Function: definition, call, variable scope and lifetime, the return statement. Defining functions, Lambda or anonymous function, documentation string, good programming practices.

Introduction to modules, Introduction to packages in Python, Introduction to standard library modules. Strings and Operations- concatenation, appending, multiplication and slicing. Strings are immutable, strings formatting operator, built in string methods and functions. Slice operation, ord() and chr() functions, in and not in operators, comparing strings, Iterating strings, the string module.

Unit IV	File Handling and Dictionaries	(04 Hours)

Files: Introduction, File path, Types of files, Opening and Closing files, Reading and Writing files. File Positions, Renaming and deleting files. Directory Methods, Dictionaries creating, assessing, adding and updating values. Case Study: Study design, features, and use of any recent, popular and efficient system developed using Python. (This topic is to be excluded for theory examination)

Unit V	Object Oriented Programming	(04 Hours)

Structured and object oriented: Features of Object oriented programming-classes, objects, methods and message passing, inheritance, polymorphism, containership, reusability, delegation, data abstraction and encapsulation.

Classes and Objects: classes and objects, class method and self-argument, __init__() method, class variables and object variables, __del__() method, public and private members, Built in function to check, Get, Set and Delete class attribute, Garbage collection, class methods, Static Method.

List of Laboratory Experiments/Assignments

Group A

Practical on Unit I

Program Design Tools: Algorithms, Flowcharts and Pseudo-codes, implementation of algorithms. Writing and executing Python program, Literal constants, variables and identifiers, Data Types, Input operation, Comments, Reserved words, Indentation, Operators and expressions, Expressions in Python.

1. Installation of Python
2. Program to display data of different types using variable and literal constants.
3. Program to read variables from the user.
4. Program to exhibit indentation errors.
5. Program to perform all operation (addition, multiplication, subtraction, division, modules) and expression.
6. Program to convert degree Fahrenheit into degree Celsius.
7. To calculate salary of an employee given his basic pay (take as input from user). Calculate gross salary of employee. Let HRA be 10 % of basic pay and TA be 5% of basic pay. Let employee pay professional tax as 2% of total salary. Calculate net salary payable after deductions

Practical on Unit II

1. Type Conversion, Type casting, Comment
2. Program to demonstrate operation on lists
3. Program to determine whether a person is eligible to vote or not
4. Program to find whether the given number is even or odd
5. Program to determine whether the character entered is a vowel or not.
6. Program to calculate the sum and average of first 10 numbers
7. Program to find whether the given number is an Amstrong number or not.
8. Program to enter a number and then calculate the sum of its digits.
9. Program to print the multiplication table of n, where n value is entered by user.

Practical on Unit III

1. Program to concatenate two string using + operator.
2. Program to append a string using += operator.
3. Program to display power of a number without using formatting characters.
4. Program to display power of a number using formatting characters.
5. Program to demonstrate slice operation on string objects.
6. Program to understand how characters in a string are accessed using negative indexes.
7. Program to understand ord() and char() function.
8. Program that uses split() to split a multiline string.
9. Program that counts the occurrences of a character in a string. Do not use built in function.
10. Program to reverse of string by user defined function.
11. Write a python program that accepts a string from user and perform following string operations- i. Calculate length of string ii. String reversal iii. Equality check of two strings iii. Check palindrome ii. Check substring

Practical on Unit IV

1. Program to open a file and print its attribute values.
2. Program to access a file after it is closed
3. Program to write a file using the writelines() method.
4. Program to append data to an already existing file.
5. Program to display the contents of a file.
6. Program to split the line into a series of words and use space to perform the split operation.
7. Program that tells and sets the position of the file pointer.
8. Program that reads data from a file and calculates the percentage of vowels and consonants in the file.
9. Program that changes the current directory to our newly created directory.
10. Program to print the absolute path of a file using os.path.join
11. Program that counts the number of tabs, space and newline character in a file.
12. To copy contents of one file to another. While copying a) all full stops are to be replaced with commas b) lower case are to be replaced with upper case c) upper case are to be replaced with lower case.

Practical on Unit V

1. Program to access class variable using class object.
2. Program to access class members using class object.
3. Program to illustrating the use of __int__() method.
4. Program to differentiate between class and object variable.
5. Program to illustrating the use of __del__() method.
6. Program to illustrating the difference between public and private variable.
7. The program should subtract the DOB from todays date to find out whether a person is eligible to vote or not.
8. Create class EMPLOYEE for storing details (Name, Designation, gender, Date of Joining and Salary). Define function members to compute a)total number of employees in an organization b) count of male and female employee c) Employee with salary more than 10,000 d) Employee with designation “Asst Manager”

Group B

Teachers should frame assignments from Mechanical Engineering, Civil Engineering, Electrical Engineering application domains.

Faculty from these course branches to design and conduct the practical sessions.

Electrical Engineering:

1. Develop algorithms, draw flow chart, and write a program to solve electrical network (KVL/KCL) using python.
2. Develop algorithms, draw flow chart, and write a program for star delta conversion using python.
3. Develop algorithm, draw flow chart, and write a program to calculate the impedance of RLC circuit using python.
4. Develop algorithm, draw flow chart, and write a program to calculate efficiency of single-phase transformer using python.

Civil Engineering:

1. A concentrated load of 1000KN is applied at the ground surface. Write a program to compute the vertical pressure (i) at a depth of 4m below the load , (ii) at a distance of 3m at the same depth. Use Boussinesq's equation.
2. A Filtered water discharge of 1MLD has a chlorine demand of 4.8 mg/l. It is required to maintain a chlorine residual of 0.2 mg/l. Write a program to determine the quantity of bleaching powder necessary of 6 months (Chlorine Available-25%).
3. A simply supported beam AB having spam of 4 meters loaded with following cases: Case 1) 100 KN at centre. Case 2) 50 KN at 1 meter from A support. Write a program to determine support reactions at A and B.
4. Two forces P and Q acting on a body 180 KN and 240 KN respectively. The angle between the two forces is 60 degrees. Determine the resultant of force P and Q and it's direction with respect to Q force.

Mechanical Engineering:

1. On a certain planet a correctly calibrated spring balance shows the weight of a body 12 N, the mass of which is 4.893 kg. Write a program to find the value of gravity on this planet.
2. Write a program to estimate the heat loss through a red brick wall of length 5m, height 4m and thickness 0.25m, if the temperatures of the wall surfaces are maintained at 110 degree centigrade and 40 degree centigrade respectively. K for red brick is 0.70 W/mk.
3. Assume five liters of Oil weigh 61.80 N. Write a program to calculate i) Specific Weight ii) Specific mass using python.

Guidelines for Student's Lab Journal

The laboratory assignments are to be submitted by student in the form of journal. Journal consists of prologue, Certificate, table of contents, and handwritten write-up of each assignment (Title, Objectives, Problem Statement, Outcomes, software & Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign, Theory Concept in brief, features of tool/framework/language used, Design, test cases, conclusion.

Program codes with sample output of all performed assignments are to be submitted as softcopy. As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers as part of write-ups and program listing to journal may be avoided. Use of DVD containing students programs maintained by lab In-charge is highly encouraged. For reference one or two journals may be maintained with program prints at Laboratory.

Guidelines for Lab /TW Assessment

Continuous assessment of laboratory work is done based on overall performance and lab assignments performance of student. Each lab assignment assessment will assign grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include- timely completion, performance, innovation, efficient codes, punctuality and neatness.

All students should submit the term work consisting of 14 programming assignments. At least 2 assignments from each unit for Group A. Faculty can select any 4 assignments from Group B.

Learning Resources

Text Books:

1. Reema Thareja, “Python Programming Using Problem Solving Approach”, Oxford University Press, ISBN 13: 978-0-19-948017-6
2. R. Nageswara Rao, “Core Python Programming”, Dreamtech Press; Second edition ISBN10:938605230X, ISBN-13: 978-9386052308 ASIN: B07BFSR3LL

Reference Books:

1. R. G. Dromey, “How to Solve it by Computer”, Pearson Education India; 1st edition, ISBN10: 8131705625, ISBN-13: 978-8131705629 Maureen Spankle, “Problem Solving and Programming Concepts”, Pearson; 9th edition, ISBN-10: 9780132492645, ISBN-13: 978-0132492645
2. Romano Fabrizio, “Learning Python”, Packt Publishing Limited, ISBN: 9781783551712, 1783551712
3. Paul Barry, “Head First Python- A Brain Friendly Guide”, SPD O’Reilly, 2nd Edition, ISBN:978-93-5213-482-3
4. Martin C. Brown, “Python: The Complete Reference”, McGraw Hill Education, ISBN-10:9789387572942, ISBN-13: 978-9387572942, ASIN: 9387572943
5. Jeeva Jose, P. Sojan Lal, “Introduction to Computing & Problem Solving with Python”, Khanna Computer Book Store; First edition, ISBN-10: 9789382609810, ISBN-13: 978-9382609810