PYTHON PROGRAMMING		Semester	I/II
Course Code	**1BPLC105B/205B**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:2:0	SEE Marks	50
Total Hours of Pedagogy (Theory and Lab hours)	40 + 24 (Practical)	Total Marks	100
Credits	4	Exam Hours	3
Examination type (SEE)	Theory		

Course outcome (Course Skill Set)

At the end of the course, the student will be able to:

CO1: Develop scripts using primitive language constructs of python.
CO2: Identify the methods to manipulate primitive python data structures.
CO3: Make use of Python standard libraries for programming.
CO4: Build scripts for performing file operations.
CO5: Illustrate the concepts of Object-Oriented Programming as used in Python.

Module-1

The way of the program: The Python programming language, what is a program? What is debugging? Syntax errors, Runtime errors, Semantic errors, Experimental debugging.

Variables, Expressions and Statements: Values and data types, Variables, Variable names and keywords, Statements, Evaluating expressions, Operators and operands, Type converter functions, Order of operations, Operations on strings, Input, Composition, The modulus operator.

Iteration: Assignment, Updating variables, the for loop, the while statement, The Collatz 3n + 1 sequence, tables, two-dimensional tables, break statement, continue statement, paired data, Nested Loops for Nested Data.

Functions: Functions with arguments and return values.

Chapters: 1.1-1.7, 2.1-2.12, 3.3, 4.4, 4.5

Number of Hours:8

Module-2

Strings: Working with strings as single things, working with the parts of a string, Length, Traversal and the for loop, Slices, String comparison, Strings are immutable, the in and not in operators, A find function, Looping and counting, Optional parameters, The built-in find method, The split method, Cleaning up your strings, The string format method.

Tuples: Tuples are used for grouping data, Tuple assignment, Tuples as return values, Composability of Data Structures.

Lists: List values, accessing elements, List length, List membership, List operations, List slices, Lists are mutable, List deletion, Objects and references, Aliasing, cloning lists, Lists and for loops, List parameters, List methods, Pure functions and modifiers, Functions that produce lists, Strings and lists, list and range, Nested lists, Matrices.

Chapter: 5.1, 5.2, 5.3

Number of Hours: 8

Module-3

Dictionaries: Dictionary operations, dictionary methods, aliasing and copying.

Numpy: About, Shape, Slicing, masking, Broadcasting, dtype.

Files: About files, writing our first file, reading a file line-at-a-time, turning a file into a list of lines, Reading the whole file at once, working with binary files, Directories, fetching something from the Web.

Chapter: 5.4, 6.1-6.5, 7.1-7.8

Number of Hours:8

Module-4

Modules: Random numbers, the time module, the math module, creating your own modules, Namespaces, Scope and lookup rules, Attributes and the dot Operator, Three import statement variants.
Mutable versus immutable and aliasing
Object oriented programming: Classes and Objects — The Basics, Attributes, Adding methods to our class, Instances as arguments and parameters, Converting an instance to a string, Instances as return values.

Chapter: 8.1-8.8, 9.1, 11.1

Number of Hours: 8

Module-5

Object oriented programming: Objects are mutable, Sameness, Copying.
Inheritance: Pure functions ,Modifiers, Generalization, Operator Overloading, Polymorphism.
Exceptions: Catching Exceptions, Raising your own exceptions.

Chapter: 11.2.2-11.2.4, 11.3.2-11.3.9, 12.1, 12.2

Number of Hours:8

PRACTICAL COMPONENTS OF IPCC

PART – A: FIXED SET OF EXPERIMENTS

1. a. Develop a python program to read 2 numbers from the keyboard and perform the basic arithmetic operations based on the choice. (1-Add, 2-Subtract, 3-Multiply, 4-Divide).
   b. Develop a program to read the name and year of birth of a person. Display whether the person is a senior citizen or not.
2. a. Develop a program to generate Fibonacci sequence of length (N). Read N from the console.
   b. Write a python program to create a list and perform the following operations
   - Inserting an element
   - Removing an element
   - Appending an element
   - Displaying the length of the list
   - Popping an element
   - Clearing the list
3. a. Read N numbers from the console and create a list. Develop a program to print mean, variance and standard deviation with suitable messages.
   b. Read a multi-digit number (as chars) from the console. Develop a program to print the frequency of each digit with a suitable message.
4. Develop a program to print 10 most frequently appearing words in a text file. [Hint: Use a dictionary with distinct words and their frequency of occurrences. Sort the dictionary in the reverse order of frequency and display the dictionary slice of the first 10 items.
5. Develop a program to read 6 subject marks from the keyboard for a student. Generate a report that displays the marks from the highest to the lowest score attained by the student. [Read the marks into a 1-Dimesional array and sort using the Bubble Sort technique].
6. Develop a program to sort the contents of a text file and write the sorted contents into a separate text file. [Hint: Use string methods strip(), len(), list methods sort(), append(), and file methods open(), readlines(), and write()].

7. Develop a function named DivExp which takes TWO parameters a, b, and returns a value c (c=a/b). Write a suitable assertion for a>0 in the function DivExp and raise an exception for when b=0. Develop a suitable program that reads two console values and calls the function DivExp.
8. Define a function that takes TWO objects representing complex numbers and returns a new complex number with the sum of two complex numbers. Define a suitable class 'Complex' to represent the complex number. Develop a program to read N (N >=2) complex numbers and to compute the addition of N complex numbers.
9. Text Analysis Tool: Build a tool that analyses a paragraph: frequency of each word, longest word, number of sentences, etc.
10. Develop Data Summary Generator: Read a CSV file (like COVID data or weather stats), convert to dictionary form, and allow the user to run summary queries: max, min, average by column.
11. Develop Student Grade Tracker: Accept multiple students' names and marks. Store them in a list of tuples or dictionaries. Display summary reports (average, topper, etc.).
12. Develop a program to display contents of a folder recursively (Directory) having sub-folders and files (name and type).

Suggested Learning Resources: (Text Book/ Reference Book/ Manuals):

Text books:

1. Peter Wentworth, Jeffrey Elkner, Allen B. Downey and Chris Meyers- How to think like a computer scientist: learning with python 3. Green Tea Press, Wellesley, Massachusetts,2020 https://media.readthedocs.org/pdf/howtothink/latest/howtothink.pdf

Reference books / Manuals:

1. Al Sweigart," Automate the Boring Stuff with Python, 2nd Edition: Practical Programming for Total Beginners",2nd Edition, No Starch Press, 2022. (Available under CC-BY-NC-SA license at https://automatetheboringstuff.com/)
2. Kyla McMullen, Elizabeth Matthews and June Jamrich Parsons, Programming with Python, Cengage, 2023.

Web links and Video Lectures (e-Resources):

https://www.learnbyexample.org/python/

https://www.learnpython.org/

https://pythontutor.com/visualize.html#mode=edit

Teaching-Learning Process (Innovative Delivery Methods):

The following are sample strategies that educators may adopt to enhance the effectiveness of the teaching-learning process and facilitate the achievement of course outcomes.

1. Chalk and talk
2. PPT presentation
3. Demonstration
4. Problem-Based Learning (PBL)
5. Case-Based Teaching

Assessment Structure (IPCC): (Circular**-**Ref.: VTU/BGM/IPCC 2025/3748, DATED: 24TH Oct 2025)

The assessment for each course is equally divided between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each component carrying **50% weightage** (i.e., 50 marks each).

The CIE Theory component will be **25 marks** and CIE Practical component will be **25 marks**.

The CIE Theory component consists of IA tests for **25 marks**. The CIE Practical component for continuous assessments will be for **15 marks** through rubrics and for lab Internal Assessment will be conducted for **10 marks** through rubrics.

- To qualify and become eligible to appear for SEE, in the **CIE theory component**, a student must score at least **40% of 25 marks**, i.e., **10 marks**.
- To qualify and become eligible to appear for SEE, in the **CIE Practical component**, a student must secure **a minimum of 40% of 25marks**, i.e., **10marks**.
- To pass the **SEE**, a student must secure **a minimum of 35% of 50 marks**, i.e., **18 marks**.

A student is deemed to have **completed the course** if the **combined total of CIE and SEE is at least 40 out of 100 marks**.

Component & CO-PO Mapping	Outstanding (5)	Exceeds Expectations (4)	Meets Expectations (3)	Needs Improvement (2)	Unsatisfactory (1)
Identification of real-life problem and its relevance [CO1] [PO2]	Clearly defined and contextually relevant problem; innovative approach	Relevant and well-described problem	Partially relevant with limited context	Vague or not fully relevant problem	No identifiable or valid problem
Use of primitive constructs (variables, loops, functions, conditionals) [CO1] [PO1]	All constructs used correctly with proper logic and flow	Most constructs used properly	Basic constructs applied with some errors	Minimal construct usage with logical flaws	Incorrect or missing constructs
Manipulation of Python data structures (lists, tuples, dictionaries, sets) [CO2] [PO1]	Effective and optimized usage of Data Structures	Mostly appropriate usage	Some usage with basic understanding	Incorrect or limited use	Not used or misused entirely
Use of standard libraries and file operations (if applicable) [CO3, CO4] [PO5]	Libraries and file operations used correctly and meaningfully	Minor issues in usage	Limited or partially correct use	Attempted but faulty implementation	Not attempted or irrelevant
Code structure, modularity, and documentation [CO4] [PO9, PO11]	Modular, structured code with comments and output samples	Structured code with basic documentation	Limited comments or unclear structure	Poor documentation and readability	No documentation, disorganized code

Rubrics for CIE – Continuous assessment:

Component & CO-PO Mapping	Outstanding (5)	Exceeds Expectations (4)	Meets Expectations (3)	Needs Improvement (2)	Unsatisfactory (1)
Fundamental Knowledge: Understanding the problem statement [CO1-5] [PO1, PO2]	The student has in depth knowledge of the topics related to the problem. Student is able to completely understand the problem definition.	Student has good knowledge of some of the topics related to problem. Student is able to understand the problem definition.	Student is capable of narrating the answer but not capable to show in depth knowledge and the problem definition.	Student has not understood the concepts partially. Student is able to partially understand the problem definition	Student has not understood the concepts and the problem definition clearly.
Design of algorithm/flow chart and program [CO1-5] [PO2, PO3]	Student is capable of discussing more than one design for his/her problem statement and capable of proving the best suitable design with proper reason.	Student is capable of discussing few designs for his/her problem statement but not capable of selecting best.	Student is capable of discussing single design with its merits and de-merits.	Student is capable of explaining the design.	Student is capable of explaining the design partially.
Implementation (Program coding) with suitable tools [CO1-5] [PO5, PO8]	Student is capable of implementing the design with best suitable language structure considering optimal solution/optimal efficiency.	Student is capable of implementing the design with best suitable language structure and should be capable of explaining it.	Student is capable of implementing the design with proper explanation.	Student is capable of implementing the design.	Student is capable of implementing the design with errors.
Program debugging and testing with suitable tools [CO1-5] [PO5, PO8]	Student is capable to compile and debug the program with no errors (syntax, semantic and logical).	Student is able to compile and debug the program with errors (syntax, semantic and logical) and rectified errors with full understanding of error descriptions.	Student is able to compile and debug the program with errors (syntax, semantic and logical) and rectified errors with partial understanding of error descriptions.	Student is able to compile and debug the program with errors (syntax, semantic and logical) and rectified errors with no understanding of error descriptions.	Student is able to compile and debug the program with errors (syntax, semantic and logical) and rectified errors with assistance.
Results & interpretation /analysis [CO1-5] [PO4]	Student is able to run the program on various cases and compare the result with proper analysis.	Student is able to run the program for all the cases.	Student is able to run the code for few cases and analyze the result.	Student is able to run the program but not able to analyze the result.	Student is able to run the program but not able to verify the correctness of the result.
Demonstration and documentation [CO1-4] [PO8, PO9, PO11]	Demonstration and lab record is well-organized, with clear sections.	Demonstration and lab record is organized, with clear sections, but some	Demonstration and lab record lacks clear organization or structure. Some sections are	Demonstration and lab record is poorly organized, with missing or unclear sections.	Demonstration and lab record is poorly organized, with missing sections. Record

	The record is well structured with suitable formatting (e.g: font, spacing, labelling of figures and tables, equations numbered and etc).	sections are not well-defined. The record is structured with formatting (e.g: font, spacing, labelling of figures and tables, equations numbered and etc).	unclear or incomplete. The record is partially structured with formatting (e.g: font, spacing, labelling of figures and tables, equations numbered and etc).	The record is not properly structured with suitable formatting (e.g: font, spacing, labelling of figures and tables, equations numbered and etc).	not submitted on time. The record is not structured with minimum formatting (e.g: font, spacing, labelling of figures and tables, equations numbered and etc).

Rubrics for CIE Test:

Component & CO-PO Mapping	Excellent (5)	Good (4)	Fair (3)	Marginal (2)	Unsatisfactory (1)
Fundamental Knowledge (2) [CO1, CO2] [PO1]	The student has well depth knowledge of the topics related to the problem & course	Student has good knowledge of some of the topics related to problem & course	Student has average knowledge of some of the topics related to problem & course	Student is capable of narrating the answer but not capable to show in depth knowledge	Student has not understood the concepts clearly
Understanding of problem definition (1) [CO1, CO2] [PO2]	Student is able to completely understand the problem definition	Student is able to understand the problem definition but not clearly	Student has a basic understanding of the problem definition that is partial or superficial	Student is able to Shows minimal or unclear understanding of the problem definition	Student is not able to understand the problem definition
Design and Implementation (3) [CO1, CO2] [PO3]	Student is capable of design and implementing with best suitable construct for the given problem definition	Student is capable of design and implementing with some construct for the given problem definition	Student is capable of design and implementing the core part of the construct for the given problem definition	Student is partially capable of design and implementing with some algorithm for the given problem definition	Student is not capable of design and implementing
Result & Analysis (2) [CO1, CO2] [PO4]	Student is able to run the program on various data inputs and compare the result with proper inference.	Student will be able to run the program on various data inputs and fair knowledge in comparing the result with proper inference	Student will be able to run the code for few data/datasets and analyze the output.	Student will be able to run the code for few data inputs but not analyze the output.	Student will be not able to run the program and not able to analyze the result.
Communication (Viva voce) (2) [CO3] [PO8, PO9]	Good Verbal & nonverbal communication skills with precise and correct terminologies/ answers.	Good verbal Communication skills with precise and correct terminologies/ answers.	Average Communication but with precise and correct terminologies/ answers.	Average Communication but with imprecise and incorrect terminologies/ answers	Poor Communication (Minimal interaction/answers)