Mathematics Practical
Python Programming Language-I

Semester: III	Credits: 2	Subject Code: BSP32109	Lectures: 48

Course Outcomes:

At the end of this course, the learner will be able to:

- Relate and demonstrate the use of built-in data structures "list" and "tuples".
- Compare and apply various control structures in Programming.
- Explain the basic concepts of Linear algebra in Python.
- Practice Linear Algebra problems using Python.
- Apply and analyze concepts of Python programming to solve problems based on Numerical Methods and Numerical Integration.
- Compare and contrast the rate of convergence of numerical methods using Python Programming.

Practical 1: Introduction to Python

- Installation of Python
- Values and types: int, float and str,
- Variables: assignment statements, printing variable values, types of variables.
- Operators, operands and precedence:+, -, /, *, **, % PEMDAS(Rules of precedence)
- String operations: + : Concatenation, * : Repetition
- Boolean operator:
- Comparison operators: ==, !=, >, =, <=
- Logical operators: and, or, not
- Mathematical functions from math, cmath modules.
- Keyboard input: input () statement

Practical 2: Python Data Types

- Strings:
  - Length (Len function)
  - String traversal: Using while statement, Using for statement
  - String slice
  - Comparison operators (>, <, ==)
- Lists:
  - List operations
  - Use of range function
  - Accessing list elements
  - List membership and for loop
  - List operations
  - Updating list: addition, removal or updating of elements of a list

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• Tuples:
  ○ Defining a tuple,
  ○ Index operator,
  ○ Slice operator,
  ○ Tuple assignment,
  ○ Tuple as a return value	

Practical 3: Control statements in Python-I	
• Conditional and alternative statements, Chained and Nested Conditionals: if, if-else, if-elif-else, nested if, nested if-else • Looping statements such as while, for etc, Tables using while.	

Practical 4: Control statements in Python-II	

• Functions:
  ○ Calling functions: type, id
  ○ Type conversion: int, float, str
  ○ Composition of functions
  ○ User defined functions, Parameters and arguments	

Practical 5: Applications: Matrices, Determinants	
• Matrix construction, eye(n), zeros(n, m) matrices • Addition, Subtraction, Multiplication of matrices, powers, and inverse of a matrix. • Accessing Rows and Columns, Deleting and Inserting Rows and Columns • Determinant, reduced row echelon form, nullspace, columnspace, Rank	

Practical 6: System of Equations	
• Solving systems of linear equations (Gauss Elimination Method, Gauss Jordan Method, LU- decomposition Method) • Eigenvalues , Eigenvectors, and Diagonalization	

Practical 7: RSA Encryption	
• Ceaser Cipher • Problem based on RSA algorithm	

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Practical 8: Roots of equations	
• Roots of Equations • Newton-Raphson Method • False Position (Regula Falsi) Method	

Practical 9: Numerical integration	

• Numerical Integration:
  ○ Trapezoidal Rule,
  ○ Simpson's 1/3rd Rule,
  ○ Simpson's 3/8th Rule	

Recommended Text Books:

- Downey, A. et al., *How to think like a Computer Scientist: Learning with Python*, John Wiley, 2015.
  - Sections: 1, 2, 3 2
- Robert Johansson, *Introduction to Scientific Computing in Python*
  - Section: 4

Reference Books:

- Guzdial, M. J., Introduction to Computing and Programming in Python, Pearson
- India.
- Lambert K. A., Fundamentals of Python - First Programs, Cengage Learning
- India, 2015.
- Perkovic, L., Introduction to Computing Using Python, 2/e, John Wiley, 2015.
- Sandro Tosi, Matplotlib for Python Developers, Packt Publishing Ltd.(2009)
- Zelle, J., Python Programming: An Introduction to Computer Science, Franklin, Beedle & Associates Inc

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