PMDS508L - Python Programming

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Course Objectives

1. To introduce the basic building blocks of algorithmic problem-solving.
2. To introduce core programming basics using Python language.
3. To introduce the data structures of Python and their applications.
4. To introduce the modules for data manipulation and visualisation.

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

1. Classify various algorithmic approaches and categorize the appropriate data representation.
2. Build programs using control structures.
3. Develop solutions to problems using ordered and un-ordered collection of data types.
4. Utilise the in-built functions and modules and develop user defined functions and modules.
5. Demonstrate array operations, mathematical analysis and graphical representation of data.

Course Outline

Module 1: Algorithmic Problem Solving
- ► Basic introduction about algorithmic problem solving

Module 2: Introduction to Python
- ► Python Strengths and Weakness, Structure and Basic Operations

Module 3: Control Structures
- ► List, Control Flow in Python - if-else, for, while

Module 4: Data Collections
- ► Strings, List, Tuples, Sets and Dictionaries

Course Outline

Module 5: Functions and Modules
> ► User-defined functions, generators and decorators

Module 6: Multidimensional Data Handling and Visualisation
> ► NumPy, Matplotlib Modules in Python

Module 7: Scientific Data Analysis
> ► SciPy, Pandas Modules in Python

Module 8: Contemporary Issues: Industry Expert Lecture

- ▶ Building blocks of algorithms:
    - ▶ Statements
    - ▶ State
    - ▶ Control flow
    - ▶ Functions
- ▶ Developing an Algorithm
    - ▶ Flowchart
    - ▶ Pseudo code

- ► Python introduction - Strengths and Weakness
- ► Indentation, variables, reserved words
- ► Basic data types: Integer, Floating point, Complex and Boolean
- ► Operators ((Relational, Logical, Bit-wise) and their precedence
- ► Expressions
- ► Mutability and Immutability
- ► Built-in Functions, importing from Packages

► Control Flow - if statement, indenting in Python

► While loop; For loop

► Else clauses in loops

► Break, continue and pass statements

Module 4: Data Collections

► Strings - Comparison, formatting, slicing, stripping
► Regular expressions - Matching, search and replace patterns
► List; Tuples; Sets; Dictionaries
► List comprehension

► User-defined functions in Python
► Local and global scope of function parameters
► Parameters and arguments
  ► Passing collections to a function, Variable arguments, Passing functions to a function
► Lambda function
► Map, Filter
► Recursive functions
► Generators and Decorators
► Modules - Built-in modules and user-defined modules

► NumPy Module
  ► 1-d, 2-d and multidimensional arrays and matrices
  ► Difference between lists and arrays
  ► Mathematical operations with arrays
  ► Slicing and addressing arrays
  ► Boolean masks
  ► Broadcasting in NumPy
► Matplotlib Module
  ► Basic plotting
  ► Logarithmic plots
  ► Plots with multiple axes

- ▶ SciPy Module
  - ▶ Scientific computing in Python
  - ▶ Basic and Special functions of SciPy module
  - ▶ scipy.stats, scipy.integrate, scipy.optimize, scipy.interpolate
- ▶ Pandas Module
  - ▶ Series, DataFrame, Panel
  - ▶ Slicing data
  - ▶ Reading and writing CSV,XLS and JSON files
  - ▶ Working with missing data
  - ▶ Categorical data
  - ▶ Data visualisation with Pandas

► Research and Development problems related to various fields of Data Analysis

► Eric Matthes, Python Crash course: A Hands-On, Project-Based Introduction to Programming, 2023, 3rd edition, No Starch Press.

► Martic C Brown, Python: The Complete Reference, 2018, 4th Edition, McGraw Hill Publishers.

► Wes McKinney, Python for Data Analysis, 2022, 3rd Edition, O'Reilly Media.

Assessment Rubrics

Assessment Methods, Rubrics and Other Guidelines for Theory

Assessment Type	Date	Max. Marks	Weightage	Remarks	Course Outcome
Quiz – 1	Before CAT–I	10	10		CO1, CO2
Quiz – 2	Before CAT–II	10	10		CO3, CO4
Assignment	Submission before 10-Nov-2024	50	10	Softcopy and Hardcopy need to be submitted	CO2, CO3, CO4, CO5
CAT – I	As per the announcement by the University	50	15	University will announce the schedule	CO1, CO2
CAT – II		50	15		CO3, CO4, CO5
FAT		100	40		All

"It is my passion, as well as duty to educate you the best I can, but it is your responsibility to try hard to learn from me."

► Attend all classes, and listen attentively to what the Instructor says in the lectures.

► Do not hesitate to ask questions in the classes.
Never pretend that you understand what is being said in the lecture.

► Do all homework problems if possible, and understand how they are done.

► Make sure to let the Instructor know your problems in learning whenever they occur.

► Make use of Instructor's office hours for questions and advice.

► Above all; take a proactive attitude of ENJOYING what you are learning from this course.

You will be successful if you do all the above