COMPREHENSIVE PYTHON PROGRAMMING FOR DATA SCIENCE

Module 1: Python Basics

Lesson 1 : Introduction to Python

- Installation and Running Python (Jupyter Notebook, .py files from terminal, Google Colab).

Lesson 2 : Basic Data Types and Type Conversion

- Overview of data types: integers, floats, strings, booleans.
- Type conversion techniques.

Lesson 3 : Variables and Operators

- Variable declaration and scope.
- Arithmetic, relational, and logical operators.

Lesson 4 : Flow Control

- Conditional statements: if, elif, else.
- Looping constructs: for and while loops.

Lesson 5 : Python Identifiers and Functions

- Naming conventions and best practices for identifiers.
- Building and using functions: print, type, id, sys, len.

Module 2: Data Structures and Utilities

Lesson 1 : Lists

- Creation, indexing, and slicing.
- List methods: append, pop, insert, remove, sort, reverse.
- List comprehension.

Lesson 2 : Sets

- Set creation and operations: add, remove, union, intersection, difference.

Lesson 3 : Tuples

- Tuple creation and immutability.
- Accessing tuple elements: indexing and slicing.

Lesson 4 : Dictionaries

- Dictionary creation and key-value pairs.
- Common dictionary methods: keys(), values(), items(), get(), pop(), update.

Lesson 5 : Understanding the Range Function

- Using range() in loops.
- Different arguments for range().

Module 3: Functions

Lesson 1 : Types of Functions

- Inbuilt vs User-defined functions.
- Function arguments and return values.

Lesson 2 : Variable Scope

- Global vs Local variables.
- Anonymous functions with lambda.

Module 4: Object-Oriented Programming (OOP)

Lesson 1 : Classes and Objects

- Introduction to built-in classes vs user-defined classes.
- Creating classes and objects, using the __init__ method.

Lesson 2 : Class Attributes and Methods

- Instance vs Class variables.
- Instance, class, and static methods.

Lesson 3 : Inheritance and Polymorphism

- Basics of inheritance and its types.
- Duck typing, operator overloading, method overloading, method overriding.

Lesson 4 : Decorators and Abstract Classes

- Using decorators to modify functions.
- Abstract classes and methods.

Lesson 5 : Iterators and Generators

- Understanding iterators in Python.
- Creating generators for efficient memory use.

Module 5: Error Handling and File Operations

Lesson 1 : Error and Exception Handling

- Try, except, finally blocks.
- Custom exception classes.

Lesson 2 : File Handling

- Reading from and writing to files.
- Understanding file modes and context managers.

Lesson 3 : Documentation

- Writing docstrings and comments for better code readability.

Lesson 4 : Modularization

- Organizing code into modules and packages.
- Introduction to pickling and unpickling.

Module 6: Data Manipulation with Pandas

Lesson 1 : Introduction to Pandas

- Installing Pandas and importing the library.
- Creating and manipulating DataFrames and Series.

Lesson 2 : DataFrame Operations

- Loading different file formats (CSV, Excel).
- Renaming columns, handling missing values.

Lesson 3 : DataFrame Methods

- DataFrame attributes and methods (head(), tail(), groupby(), etc.).
- Sorting and filtering data.

Lesson 4 : Merging and Joining DataFrames

- Concatenating DataFrames and handling duplicate entries.

Lesson 5 : Time Series with Pandas

- Handling date and time data, date indexing, and time series analysis.

Module 7: Numerical Computing with NumPy

Lesson 1 : Introduction to NumPy

- Installation and basic usage.
- Creating and manipulating NumPy arrays.

Lesson 2 : Array Operations

- Mathematical operations, reshaping, and flattening arrays.
- Important NumPy functions (min(), max(), sum(), etc.).

Lesson 3 : Matrix Operations

- Understanding matrices, diagonal matrices, and operations like addition and multiplication.

Lesson 4 : Statistical Functions

- Using NumPy for statistical analysis (mean(), median(), std(), etc.).

Module 8: Data Visualization

Lesson 1 : Introduction to Matplotlib

- Basic plotting with pyplot.
- Creating different types of plots: line, bar, histogram, scatter, pie, and 3D plots.

Lesson 2 : Customizing Plots

- Setting limits, labels, titles, and legends.

Lesson 3 : Introduction to Seaborn

- Creating statistical plots (catplot, stripplot, boxplot).
- Visualizing relationships and distributions with Seaborn.

Module 9: Scientific Computing with SciPy

Lesson 1 : Overview of SciPy

- Introduction and installation.
- Key modules: signal processing, optimization, statistics.

Lesson 2 : Linear Algebra and Integration

- Performing linear algebra operations.
- Basic integration techniques.

Module 10: Statistical Modeling with Statsmodels

Lesson 1 : Linear Regression

- Fitting models using statsmodels.
- Understanding model summaries.

Lesson 2 : Time Series Analysis

- Time series modeling techniques and diagnostics.

Lesson 3 : Statistical Tests

- Performing ANOVA and hypothesis testing.

CAPSTONE PROJECT

Project : Data Analysis and Visualization

- Select a dataset and perform comprehensive analysis using Python libraries.
- Apply data cleaning, manipulation, visualization, and statistical modeling techniques learned in the course.