Code No.: **MDS 551**

Course Title:**Programming with Python**   Full Marks: 75

Nature: Theory +Practical **(Compulsory)**   Credit: 3

Course Description:

Python is a popular language for data science related activities. This course covers the concept of computer programming with python as an implementation language with focus on data processing, visualization and analysis.

Course Objectives:

This course is designed to familiarize students to the techniques of programming in python.

Course Contents:

Unit 1: Introduction to Programming   [6 Hrs.]

Problem analysis, Algorithms and Flowchart, Coding, Compilation and Execution modern computer systems: hardware architecture, data representation in computers, software and operating system.

Installing Python; basic syntax, interactive shell, editing, saving, and running a script.

Unit 2:Data Types and Operators   [6Hrs.]

Arithmetic Operators, Comparison Operators, Logical Operators, Logical Expressions Involving Boolean Operands, Logical Expressions Involving Non-Boolean Operands, Chained Comparisons, Bitwise Operators, Identity Operators, Operator Precedence, Augmented Assignment Operators.

Data Types: Python numbers, Strings, Lists, Dictionaries, Tuples, Sets, Using data type methods.

Unit 3:Control Statement   [5 Hrs.]

Conditions, Boolean logic,ranges; Control statements: Decision Making with branching (if-else), Decision making with loops (for, while); short-circuit (lazy) evaluation.

Unit 4:String and Text files   [6Hrs.]

Strings and text files; manipulating files and directories, os and sys modules; text files: reading/writing text and numbers from/to a file; creating and reading a formatted file (csv or tab-separated).

String manipulations: subscript operator, indexing, slicing a string; strings and number system: converting strings to numbers and vice versa.

Unit 5: List and Dictionaries   [6Hrs.]

List Literals and Basic Operators: Replacing an Element in a List, List Methods for Inserting and Removing Elements, Searching a List, Sorting a List. Example program with List.

Dictionary Literals Adding Keys and Replacing Values Accessing Values Removing Keys Traversing a Dictionary, Example Program with Dictionary.

Unit 6:Functions   [6 Hrs.]

Design with functions: hiding redundancy, complexity; arguments and return values; formal vs actual arguments, named arguments, Program structure and design.

Recursive functions: Tracing a Recursive Function, Using Recursive Definitions to Construct Recursive Functions, Infinite Recursion.

Unit 7: Python Libraries for Data Sciences   [11Hrs.]

Numpy: Introduction, Environment Setup, Data Types, Array Attributes, Array Creation, I/O with Numpy, Array from Existing Data, Array from Numerical Ranges, Indexing & Slicing, Broadcasting, Iterating Over Array, Statistical Functions Sort, Search & Counting Functions.

Scipy: Introduction, Basic Functionality Cluster Constants Integrate Interpolate Input and Output Linalg.

Pandas: Series and DataFrames, Creating DataFrames from scratch (using list, Dictionaries, Numy array and another DataFrame) , Reading data from CSV and JSON, DataFrame Operations: Head and tail, Attributes and underlying data, handling of missing data, slicing, fancy indexing, and subsetting , merging and joining DataFrames.

Unit 8: Data Visualization with Matplotlib   [2Hrs.]

Matplotlib: Setting up environment, Pyplot API, Simple Plot, Multi-plots, Subplots () Function, Subplot2grid () Function, Grids Formatting Axes. Setting Limits, Bar Plot, Histogram, Pie Chart, Scatter Plot, Contour Plot.

Laboratory Works:

Each programing concept is implemented as a laboratory work. This course should be carried out as practical based course.

References:
1. Kenneth A Lampart:*Fundamental of Python*, Cengage Learning Publishing.
2. Cody Jackson (2018):*Learn Programming in Python with Cody Jackson*, Packt Publishing, Wesley.

***