Functional programming

Semester III	Subject Code: MSE31905	Lectures: 60

Objectives:

The syllabus aims in equipping students with,

- Know how to implement functional languages and what optimizations are important;
- To acquire programming skills in core Python.
- To acquire Object Oriented Skills in Python
- To develop the skill of designing Graphical user Interfaces and database applications in Python
- To be familiarized with Python web frameworks

Unit 1: Introduction to FP & Mathematical Functions	07
Chapter 1 : Introduction to FP & Mathematical Functions • Principles of FP, History, Varieties of FP languages, • Declarative style of programming, • Why functional programming Mathematical functions • definition, lambda expression, • Functional Forms or a higher-order function :- Function Composition, Construction, Apply-to-all • Disadvantages of FP	3
Chapter 2 : Introduction to Lambda calculus • Benefits of lambda notation, • Lambda calculus as a formal system – ➢ Lambda terms (Variables, Constants, Combinations, Abstractions), Free and bound variables, Substitution, Conversions (Alpha conversion, Beta conversion, Eta conversion), Lambda equality, Lambda reduction, Reduction strategies, Combinators ➢ Evaluation in a strongly typed language, What is reduction?, types of reduction rules,	4

Sr. No.	BOS member		Sign
1	Dr. Razak Sayyed	Subject Expert	
2	Prof. Abhijit Sathe	Subject Expert	
3	Prof. Sonali Deshmukh	Subject Expert	
4	Mr. Sumeet Kakroo	Industry Expert	
5	Ms. Jyoti Sharma	Alumni	
6	Prof. Ashwini Kulkarni	Chairman and Internal Faculty	
7	Prof. Smita Borkar	Internal Faculty	

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Unit 2: Introduction to Python	**09**
Chapter 3 : Introduction to Python • **Python Data Types** Declaring and using Numeric data types: int, float, complex Using string data type and string operations Defining list and list slicing Use of Tuple data type • Python identifiers and reserved words, Lines and indentation, multi-line statements, comments, print and raw_input()/input, command line arguments and processing command line arguments, • **Python Program Flow Control** Conditional blocks using if, else and elif Simple for loops in python For loop using ranges, string, list and dictionaries Use of while loops in python Loop manipulation using pass, continue, break and else Programming using Python conditional and loops block	**4**
Chapter 4: Python String, List • Building blocks of python programs Understanding string in build methods • List manipulation using in built methods • Functional programming tools - filter(), map(), and reduce(), Using Lists as stacks and Queues, List comprehensions. • Regular expressions Matching Vs searching, match & search functions, search & replace, option flags, RE patterns, non-greedy repetitions, grouping, back references, alternatives, anchors	**5**

Unit 3 : Python Dictionary , Functions and Modules	**12**
Chapter 5: Python Dictionary Manipulations ,tuples and sets • Dictionary manipulation Programming using string, list and dictionary in built functions. • Concept (mutable), creating and accessing values in a dictionary , updating dictionary, delete dictionary elements, properties of dictionary keys, built-in dictionary functions and methods. Dictionary comprehensions.	**6**

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• **Tuples**: Concept (immutable), creating & deleting tuples, accessing values in a tuple, updating tuples, delete tuple elements, basic tuple operations, Indexing, slicing and Matrices, built- in tuple functions. • Sets - Concept, operations. **Chapter 6: Functions and Modules** • Defining a function (def), calling a function, • Function arguments - Pass by value, Keyword Arguments, default arguments, Scope of var - basic rules and , Documentation Strings, Variable Number of Arguments, Call by Reference, Order of arguments (positional, extra & keyword), Anonymous functions, Recursion, Treatment of Input and Output Arguments, Unpacking argument lists, • Lambda forms, . Function Objects, function ducktyping & polymorphism, generators (functions and expressions) and iterators. • Creating a module ,using a module, variables in module	6

Unit 4: Classes /Objects ,Files and Directories	**10**
Chapter 7: Classes /Objects and Exceptions • Object oriented programming and classes in Python - creating classes, instance objects, accessing members, data hiding (the double underscore prefix), built-in class attributes, garbage collection, the constructor, overloading methods and operators, inheritance - implementing a subclass, overriding methods, Recursive calls to methods, Class variables, class methods, and static methods.	5
Chapter 8: Working with Files and Directories Creating files, Operations on files (open, close, read, write), file object attributes, file positions, Listing Files in a Directory, Testing File Types, Removing Files and Directories, Copying and Renaming Files , Splitting Pathnames, Creating and Moving to Directories, Traversing Directory Trees.	5

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Unit 5: GUI ,Frameworks and libraries	**10**
Chapter 9 : Python GUI Programming and Databases • GUI Programming - Writing a GUI with Python: GUI Programming Toolkits, Creating GUI Widgets with Tkinter, Creating Layouts, Radio Buttons and Checkboxes, Dialog Boxes. • Database Access - Python's Database Connectivity, Types of Databases Used with Python, Mysql database Connectivity with Python, Performing Insert, Deleting & Update operations on database, • **Sending email.** **Chapter 10: Introduction to Python frameworks and libraries** • Web frameworks- Django /Flask (introduction to any one framework). • Python Data Science libraries- NumPy,SciPy, Matplotlib, Pandas, Scikit Learn	**5** **5**

Sample Assignments
1. Basics of Python programming 2. Decision Making and Functions in Python 3. Object Oriented Programming using Python 4. Files Handling in Python 5. GUI Programming and Databases operations in Python 6. Assignments based on Frameworks and libraries

***Contact hours=12**

Reference Books:

1. Bruce J. Maclennan, Functional Programming: Practice and Theory
   ISBN-10: 0201137445
   ISBN-13: 978-0201137446
2. Greg Michaelson ,An Introduction to Functional Programming Through Lambda Calculus Paperback
   ISBN-10: 0486478831
   ISBN-13: 978-04864788
3. Mark Lutz, David Ascher O'reilly ,Learning python

1. E-Books : python_tutorial. pdf, python_book_01.pdf

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