

Syllabus: Python for Scientists and Engineers

This class offers a real-life introduction to programming for people with minimal programming experience, but experience in using information technology. It is given as an inverted class (before each section, students are to understand the provided material), using on-line and off-line laboratory sessions twice a week. For those interested in certification, weekly exercises will be graded. There will also be on-line and off-line office hours to deal with doubts.

Teaching Philosophy

People learn most by doing, and important skills need to be reinforced through repetition. The best person to explain is the person that just understood. Therefore: Emphasis on working problems, hopefully in groups of two.

Course Objective:

To enable scientifically minded people to learn the basics of programming and apply them to real-life problems.

Major Learning Outcomes:

- Capability to write programs in Python
- Capability to interact with real-life data
- Capability to use Python modules to solve real-life scientific and engineering related problems:
 - Simulation of systems
 - Cleaning and processing data
 - Representing data
 - Create descriptive statistics of data
 - Obtaining data through web-scraping
 - Design GUI

Course Contents

The following gives the list of topics for each class.

1. Importance of Python, Getting Python
2. Types, Statements, Variables
3. Control flow, Alternatives, What are Algorithms
4. For Loops
5. While Loops
6. Functions
7. More on Functions
8. Lists
9. Strings
10. Interacting with Files
11. String Formatting
12. Python Modules, OS and Random modules, Simulation
13. Dictionaries
14. Tuples, sets, and frozen sets
15. Recursion and Memoization (Excursus on decorators)
16. Elements of functional programming in Python, Comprehension
17. Exceptions
18. Object Oriented Programming Paradigm, Classes
19. Inheritance and Interfaces

20. Application: Decision trees in Machine Learning, Generators
21. Interacting with Databases and Network
22. Web-scraping with Python
23. GUI with Python's Tkinter
24. GUI with Python's Tkinter 2
25. Numpy
26. Numpy 2
27. Scipy
28. Matplotlib
29. Pandas
30. Sampling of Machine Learning Techniques using Scipy and Pandas

Detailed class objectives will be given on the web-site.

Literature:

David Beazley & Brian K. Jones: Python Cookbook, O'Reilly, 3d Edition
Mark Lutz: Learning Python, 5th edition, O'Reilly, 2013
Mark Lutz: Programming Python, O'Reilly.
Wes McKinney: Python for Data Analysis, O'Reilly, 2018
Luciano Ramalho: Fluent Python, O'Reilly, 2015
Jake VanderPlas: Python Data Science Handbook, O'Reilly, 2017