

Course Syllabus

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Python for Data Analysis and Scientific Computing X433.3

(2 semester units in COMPSCI)

Classroom Format

Instructor: Sridevi Pudipeddi

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Class meets 10 Thursdays from March 26th – May 28th, 2020

Course Description

Discover the flexibility of the powerful packages NumPy, Pandas, Scipy, Matplotlib, and Bokeh when dealing with heavy mathematical, engineering or scientific problems. Explore the wonderfully concise and expressive use of Python's advanced module features and apply it in probability, statistical testing, signal processing, financial forecasting, and various other applications. This course covers mathematical operations with array data structures, optimization, Probability Density Function, interpolation, basic signal processing and other high-performance benefits using the core scientific packages NumPy, Scipy and Matplotlib. Students will gain a deep understanding and problem-solving experience with these powerful platforms.

The idea of this class is to discuss a number of interesting engineering problems to motivate students to use advanced features of Python. This is an advanced level course that will help students harness the power of Python to solve every day scientific and engineering problems. The course will appeal to engineers, scientists and software engineers that would like to become Python power users.

Course Learning Objectives

When the students have completed the course, they will

- Be able to solve more complex engineering, financial, mathematical and scientific problems
- Develop complex functions and scripts to perform complicated calculations and to visualize the results of these calculations.
- Attain deeper understanding of the mathematical toolkit provided by the powerful core packages subject in this course
- Acquire in depth hands-on experience

Intended Audience

The course will be appealing mostly to people that need an introduction to numerical computing and visualization using Python environment and also for technical staff that want to enhance their Python programming skills on the specific topics. Anyone who is interested in using Python's NumPy, Scipy and Matplotlib packages as prototyping tools would also benefit from the course.

Prerequisite

Some background in Python or Matlab, calculus, programming; C, C++, or Java is a plus. Students must have a personal access to Python programming environment to be able to complete their homework assignments.

List of Topics

1. Installation of Anaconda and Python Review

2. Numpy

1. Types of Data Structures
2. Creating Arrays
3. Attributes
4. Statistical Properties
5. Indexing and Slicing
6. Array reshaping
7. Universal functions
8. Broadcasting
9. Random
10. Array Manipulation
11. File I/O

3. Pandas

1. Scipy

1. Integrals
2. Matrix Factorization
3. Signal Processing
4. Image Processing
5. Advanced Statistics

1. Matplotlib

1. Figures and subplots
2. Graphical properties
3. Annotations
4. Types of plots
5. Saving plots

2. Bokeh

Methods of Instruction

Lectures and in-class activities will be the main tools of instruction. Homework problems will help students absorb the material and get to practice in their free time.

1. Lectures and in-class activity
2. Homework - 3
3. Quiz 1
4. Quiz 2

Credit Requirements

Students must complete all homework assignments and pass all quizzes to receive a passing grade in the course.

Course Grade Weighting

1. In-class participation: 5%
2. Three Homework: 15% each, total for 45%.
3. Homework 1 will be assigned on week 3 and it will be due by week 4
4. Homework 2 will be assigned on week 6 and it will be due by week 7
5. Homework 3 will be assigned on week 8 and it will be due by week 9
6. Quiz 1 - 25% - will be held on week 5. It will be a closed book quiz.
7. Quiz 2 - 25% - will be held on week 10. It will be a closed book quiz.

Grading Scale

Percentage Grade

91-100 A

81-90 B

71-80 C


61-70 D

0-60 F

Reference Books for the Course

1. "Essential Python" by Sridevi Pudipeddi and Ravi Chityala, ISBN-13: 978-0960060900, ISBN-10: 0960060901
2. "Python for Data Analysis" by Wes McKinney, ISBN-10: 1449319793 and ISBN-13: 978-1449319793

Course Summary:

Date	Details
Thu Apr 16, 2020	 Homework 1 due Thursday April 16th 11:59 PM https://onlinelearning.berkeley.edu/courses/1245082/assignments/14965220 due by 11:59pm