TEXAS A&M UNIVERSITY

SYLLABUS

Course title and number	469/669
Term	Fall 2017
Meeting times and location	O&M 602 (College Station) / CLB 111 (Galveston) TR 9:35 – 10:50 am

Instructor Information

Dr. Kristen Thyng
kthyng@tamu.edu – 979-845-0791 – O&M 607
Office hours by appointment.

Course Description and Prerequisites

This course provides an introduction to data analysis and graphical representation of geoscience data using the Python programming language. Topics include how to read and write data using standard formats; modern programming techniques including object oriented programming and the model-view-controller paradigm; plotting geophysical data using various projections, and best practices in plotting.

Prerequisites: None, but previous programming experience will be very helpful.
This class is being offered in person in College Station and over Blackboard Collaborate for Galveston students. Patience will be necessary at times for some technology issues, but I will work hard to keep this to a minimum.

Learning Outcomes or Course Objectives

Students will understand the basic concepts of programming. In particular, they will understand Python programming as typically used in the geosciences, that is, for one- and two-dimensional geospatial analysis for scientific applications. Students will be able to read in data files, perform analysis, and plot results in multiple formats with strong basic design principles. They will be able to debug their code and create packages for use in future work.

Textbook and/or Resource Material

No required text. In-class laptop required.
Online course materials: https://github.com/kthyng/python4geosciences.

Grading Policies

Homework will be assigned approximately every other week, and participation is integral to the class and is graded accordingly. There will be a final project and presentation for the graduate students. The grading scale is 90-100% = A, 80-89% = B, 70-79% = C, etc.
For all students, homework will account for 50% of the grade, class participation 25%, and the final project 25%. However, graduate students will also need to present their final project.
Homework will be submitted online and graded automatically when possible. This means that your code needs to run to get points — you will not receive points for code that does not run. Homework is due by the end of the date it is due (that is, before midnight).

Academic Integrity

For additional information please visit: http://aggiehonor.tamu.edu
Students are encouraged to work together both in and out of class, but absolutely need to complete their own work and understand what they turn in. "An Aggie does not lie, cheat, or steal, or tolerate those who do."

Course Topics, Calendar of Activities, Major Assignment Dates (subject to change)
Homework is typically due every Thursday night at midnight

Week 0-2 (Aug 29/31, Sep 5/7/12/14): Course intro; Python basics — Core language
Homework 0 due Aug 31, hw1 due Sep 7, hw2 due Sep 14
Using Jupyter notebooks and JupyterHub. Overview of the standard Python programming language, standard data containers (lists, tuples, dictionaries, etc), importing packages, for/while loops, functions, and object oriented programming.

Week 3-4 (Sep 19/21/26/28): Numerical Python
hw3 due Sep 21, hw4 due Sep 28
Numpy and scipy packages, vector operations, data types, and array broadcasting.

Week 5-6 (Oct 3/5/10/12): Basic plotting in Python with matplotlib
hw5 due Oct 5, hw6 due Oct 12
Overview of the matplotlib plotting package.

Week 7-8 (Oct 17/19/24/26): 1D time series analysis
hw7 due Oct 19, hw8 due Oct 26; Email project plan by Oct 26
numpy.datetime, pandas, indexing, averaging, and spectra.

Week 9-11 (Oct 31, Nov 2/7/9/14/16): 2D analysis and geospatial plotting
hw9 due Nov 2, hw10 due Nov 9, hw11 due Nov 16
Cartopy mapping package, map projections using the proj3 library, gridding irregular data, and calculating attributes of polygons using shapely. NetCDF: reading and writing NetCDF files locally and over the internet, xarray.

Week 12/13 (Nov 21, *no class 11/23 for Thanksgiving*, Nov 28): Python beyond the notebook
- Anaconda package installer; iPython for terminal window usage; writing scripts
- Working with large code bases: pdb debugger, unit testing, creating packages, documentation, pep8

Week 13/14 (Nov 30, Dec 5): Group project presentations. *No final.*
hw12 due Nov 30 (undergrads)
Graduate students present, undergraduates and graduates give feedback.

Optional topics (given class time and interest):
- Webscraping: automatically download data files from the internet
- Statistical methods and plotting
- Working with images: importing and exporting images, getting data out of images
- Image processing: image smoothing, finding gradients, feature recognition
- Machine learning (Scikit learn): regression and characterization

Attendance and Make-up Policies

Attendance is mandatory. If you will miss class, be sure to contact me ahead of time. Excused absences will be based on Student Rule 7 (http://student-rules.tamu.edu/rule07). Make-ups will be allowed for excused absences. No make-ups will be allowed for unexcused absences.

Americans with Disabilities Act (ADA)

The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact Disability Services, currently located in the Disability Services building at the Student Services at White Creek complex on west campus or call 979-845-1637. For additional information, visit http://disability.tamu.edu.