NR 427 – Programming for GIS II
SYLLABUS – Spring 2020
Warner College of Natural Resources | Colorado State University

COURSE DETAILS

Instructor: **Elizabeth Tulanowski** | Email: *E.Tulanowski@colostate.edu*
Office hours: Wednesdays 10 – 11am in NESB A126B and Lab hours 11am -12pm in Warner 232

Scheduled Class Meeting times: T / Th 3 - 4:50pm Warner 232 East lab

NOTE: You may need to work on lab exercises outside of the scheduled class time. Plan to spend 3-5 hours per week completing assignments, depending on how fast you work.

NOTE: Lab exercises can be done in the Natural Resources computer labs, through remote desktop, or by installing the software on your own Windows computer. Details below.

Course Description
Building on the skills learned in NR 426, Programming for GIS I, this course covers applications and advanced topics in programming techniques for geospatial data management and analysis. The ArcGIS Python library, arcpy, will be covered to a greater depth, and open source Python geopspatial libraries will be introduced and implemented.

Course Objectives
1. Develop scripts to perform advanced geoprocessing tasks
2. Design script tools than can be shared with end users
3. Identify open source libraries for manipulating spatial data
4. Implement the appropriate methods and functions for performing a geospatial task
5. Demonstrate self-sufficiency in writing scripts
6. Solve geospatial problems using scripting

COURSE MATERIALS

Required Text: Mastering Geospatial Analysis with Python. Paul Crickard, Eric van Rees, and Silas Toms. Available online through Packt Publishing, and through the campus bookstore. ISBN 978-1-78829-333-4

Some content will be taken from these open source, online course materials. Details will be provided in the lecture slides and schedule:

- Automating GIS-processes
- Geo-Python
- Geographic Data Science
- CU Boulder's Earth Lab tutorials

Additional readings/videos may be assigned, these will be announced in lecture and available online.

Software

This course will use Python 3.6 and the PyCharm Community Edition 2018 v 2.4, for writing the code. Some scripts will also require that **ArcGIS Pro v. 2.4** be installed on the machine you use. Anaconda Navigator will be used to manage and install Python libraries.

All of this software will be available on the WCNR computers:

- Natural Resources building – computer labs in our classroom (Room 232) and in Room 107
- Use Remote Desktop: Go to the WCNR IT page and click on Remote PC Lab Access for instructions. (It works really well! This is a great option.)
- Borrow a WCNR laptop.

But *if you wish to work on your own machine*, here's what you need to do:

- Install the ArcGIS Pro 2.4 software on your own Windows computer (Not a Mac. It doesn't work on Macs)
    - Download the installation instructions can be found on Canvas > Course Documents
- Install PyCharm from here
    - After installation, PyCharm will need to be configured to work with arcpy, as directed in the Programming ArcGIS Pro textbook, pages 44-51. (PDF of this is on Canvas > Course Documents). We will do this in class as part of our first exercise.
- Download and install Anaconda Navigator as directed in the Mastering Geospatial Analysis… book. We will look at Anaconda and installing Python libraries as part of Lesson 4.
- It is recommended to get a GitHub account for this course to better access some materials and sample code, as well as to get in the habit of using this resource and storing your code online.

IMPORTANT DATES

Class begins	Tuesday, March 24th
The Short Project due	Friday, Apr. 17th, 11:59pm
Last day of NR427	Thursday, May 7th
Final Project due	Tuesday, May 12th, 3pm

GRADING

Category	Description

Laboratory exercises 25%	**Five** hands-on Python scripting exercises to reinforce the concepts and perform geoprocessing tasks. *Labs are not all worth the same number of points, refer to Canvas for details.*
Quizzes 15%	**Five** short online, open-book quizzes through Canvas to periodically test your understanding of the material. Refer to the Schedule for dates.
Projects 50%	Two self-directed, hands-on projects to assess students' understanding of the methods covered in class. Completed in lab during the fourth and seventh weeks of the course.
Class participation/ Attendance - 10%	Students are expected to raise and answer questions, complete lecture exercises, and participate in discussions. Attendance will be taken in class.

COURSE STRUCTURE

Face-to-Face class sessions

- This class will have two ~2-hour class sessions per week, Tuesday and Thursday 3pm – 4:50pm.
- Each class session will be taught in a computer lab, as an interactive lecture with slides, software demos, and *follow-along* demos during the first hour.
- The second hour will typically be more independent work, where students will complete lab exercises which will get submitted to Canvas for a grade.

Projects

- Five class sessions will be primarily dedicated to the completion of independent projects.
    - The Short Project: Week 4
    - The Final Project: Weeks 7-8
- Students will be writing the code to perform a typical work-related task using Python.
- Project topics will be provided, or you may choose a topic of your own.
- More details on this coming soon to Canvas.

Quizzes

- Five short **online quizzes** will be given throughout the semester, as indicated in the Schedule. Quizzes are open-book, and administered through Canvas. Late quizzes are not accepted without a valid, written excuse.

NR 427 Spring 2020 Tentative Schedule - March. 24 – May 7

Week	Dates	Lesson #	Lecture Topic (+ readings)	Lab Exercise	Quizzes

1	Mar. 24	Lesson 0: Review	Course overview and Skills Review		Quiz 1 Due Tues. Mar. 31, 3pm
	Mar. 26	Lesson 1	Automating maps, layers, and layouts in ArcGIS Pro (Programming Pro book, Ch. 4-5-6)	Lab 1 (55 pts) Due Tues. Mar. 31, 3pm	
2	Mar. 31	Lesson 2	Non-GIS Python tasks (Online resources, see Canvas)	Lab 2 (55 pts) Due Fri. Apr. 3rd, 11:59pm	Quiz 2 Due Tues. Apr. 7th, 3pm
	Apr. 2	Lesson 3	Accessing online spatial data (Online resources, see Canvas)	Lab 3 (50 pts) Due Tues. Apr. 7th, 3pm	
3	Apr. 7	Lesson 4	Intro to Jupyter Notebooks ; Installing libraries (MGAP Chapters 1, 2)	Lab 4 (30 pts) Due Thurs. Apr. 9th, 3pm	Quiz 3 Due Tues. Apr. 14th, 3pm
	Apr. 9	Short Project	Work on Project	Short Project	
4	Apr. 14	Short Project	Work on Project	Short Project Due Fri. Apr. 17th, 11:59pm	Quiz 4 Due Tues. Apr. 21st, 3pm
	Apr. 16	Lesson 5a	Intro to open source geospatial with Python (MGAP Ch. 2, 4, 5)	Lab 5	
5	Apr. 21	Lesson 5b	Open source geospatial with Python (MGAP Ch. 4-5)	Lab 5 (60 pts) Due Tues. May 5th, 3pm	Quiz 5 Due Tues. May 5th, 3pm
	Apr. 23	Lesson 5c	Open source geospatial with Python		
6	Apr. 28	Lesson 5c	Open source wrap-up + Final Project	Final Project	
	Apr. 30	Final Project	Final Project		
7	May 5	Final Project	Final Project and progress reports/collaboration	Final Project	
	May 7	Final Project	Final Project and semester wrap-up	Due Tues. May 12th, 3pm	

MGAP = Mastering Geospatial Analysis with Python, Crickard, vanRees, Toms

OUTLINE OF TOPICS, WEEK BY WEEK:

1. Review of Programming for GIS I skills
   Using scripts to create maps
   a. Creating layer symbology
   b. Using templates
   c. Working with existing maps
2. Non-GIS Python tasks
   a. Reading and writing text files and CSV files
   b. Working with dates and times
   c. Operating system and file operations, zip files

   Accessing online spatial data
   a. Downloading files from a website
   b. Accessing feature data from a map service (ArcGIS Online)
3. The Short Project: a self-directed, independent project, 1 week
   a. Write a script to create new data and create a map
   b. Topic may be of student's own choosing, or they may select from a list of suggestions
   c. Project done independently, but collaboration of ideas will be encouraged
4. Working with open source libraries
   a. Implement code in other IDEs, Jupyter Notebooks
   b. Make use of different libraries for processing spatial data
   c. Guest lecturers from the industry may be invited
5. Working with open source libraries

6-7. The Final Project, 2 weeks
   a. Using open source libraries to read and process spatial data
   b. Topic may be of student's own choosing, or they may select from a list of suggestions
   c. Project done independently, but collaboration of ideas will be encouraged

EXPECTATIONS

Expectations of Me:

My goal is to teach you the fundamentals of Python and how to write code to perform GIS operations.

- I will teach using up to date materials and offer relevant examples from the geospatial industry.
- I will strive to help you understand the concepts and am happy to provide extra help when necessary, but sometimes the best learning is done through some struggle – so you'll have to "figure it out" sometimes too!
- We can't cover everything, so my goal is to expose you to common tasks, tools, and libraries, and give you the foundation and confidence to continue coding on your own.
- Quizzes and assignments will be graded within a week or two of the due date. I will typically respond to emails by the next day.

Expectations from You:

- **Attend class**. Come to class having read the assigned text, ready to discuss the content, or ask questions to facilitate better understanding. Attendance will be taken.
- **Be engaged**. You will get out of this course what you put into it.
- Complete assignments on time.
- Adhere to the **academic code of conduct.**
- **Communicate**. Contact the instructor if you are having trouble (ie, understanding the material, keeping up with assignments, issues with a classmate).
- Be **respectful** of others. We can all learn from one another's stories, backgrounds, and ideas.
- **Help each other** when appropriate. Within the limits of the code of conduct, help each other out, study together, explain a difficult concept to a classmate who doesn't get it. Learn from each other, teach each other.

Final grades will be assigned using the following CSU grading scheme: *(Upper values of ranges not inclusive)*

Grade	Score	Course Credit
A	93-100	4.0
A-	90-93	3.7
B+	87-90	3.3
B	83-87	3.0
B-	80-83	2.7
C+	77-80	2.3
C	70-77	2.0
D	60-70	1.0
F	0-60	0

POLICIES

Attendance Policy and Participation: Students are expected to attend lectures regularly. If you are forced to miss a lecture, the slides will be posted afterward informing you of what you have missed. However, those visuals will not include demos or discussions that occurred during lecture. Writing materials should be brought to lecture to take notes or complete any learning activities.

Professionalism: Per university policy and classroom etiquette; mobile phones, iPods, etc. must be silenced during all classroom and lab lectures. Those not heeding this rule may be asked to leave the classroom/lab immediately so as to not disrupt the learning environment. Please arrive on time for all class meetings. Students who habitually disturb the class by talking, arriving late, etc., and have been warned may suffer a reduction in their final class grade.

When emailing the instructor, please include your full name, CSU ID, and the course number in your email.

Late assignments / Make-up work: Late assignments and quizzes will not be accepted without a valid written excuse. If you must miss class, please arrange with a classmate to get the notes, or complete the lab assignment early. If you must miss a quiz, please arrange with the instructor ahead of time to take it prior to the scheduled time. This is the responsibility of the student.

Special Needs: Any student who needs special accommodations or has special needs is encouraged to speak with me about those needs within the first two weeks of the semester.

Academic Responsibility: All work in this course must be completed in accordance with the CSU academic honesty policy (http://catalog.colostate.edu/front/policies.aspx). Plagiarism or failing to meet the academic honesty policy in other ways will result in dismissal from class and will be reported. **By participating in this course, you agree to abide by the following honor pledge, "I will not give, receive, or use any unauthorized assistance in this course."**

Need Other Help?
CSU is a community that cares for you. Counseling Services has trained professionals who can help. Contact 970-491-6053 or go to http://health.colostate.edu. "Tell Someone" by calling 970-491-1350 to discreetly discuss your concerns (http://safety.colostate.edu/tell-someone.aspx).