# ESC/GEO 465/565: Scripting in GIS
## Department of Geography & Earth Science
## University of Wisconsin-La Crosse
### Fall 2020

| | | | |
|---|---|---|---|
| **Instructor:** | Gargi Chaudhuri, PhD | **Class Location:** | Cowley Hall 245 |
| **Email:** | gchaudhuri@uwlax.edu | **Lecture Day/Time:** | Tues/Thurs-11-11:55AM |
| **Office Hours:** | Mon-Thurs: 2PM - 3PM | **Lab Location:** | Cowley Hall 245 |
| **Office Location:** | Cowley Hall 2022 | **Lab Day/Time:** | Tues/Thurs-12:05-1PM |
| **Office Phone:** | 608-785-8338 | **Credit Hours:** | 3 |

## COURSE DESCRIPTION

This course will introduce students to the scripting and programming tools and skills commonly employed in GIS and spatial analysis. It will teach the conceptual and practical aspects of programming for geographic applications using Python, a free open-source scripting language. Python is well integrated with all the major GIS softwares, and a very popular language among GIS professionals. The course focuses on solving geographic problems by modifying and automating generic Geographic Information System (GIS) software through programming. In this course, students will learn general and transferable scripting skills, and GIS specific applications, including basic scripting, write and modify scripts, batch processing and automation of repetitive tasks, and designing complex geoprocessing tasks. The skills learned in this course are equally applicable in scientific research, the public sector, and in industry. Students taking this course must be familiar with geographic data structures, basic GIS concepts, and demonstrate basic understanding of geospatial analysis. No prior programming experience is required or expected.

## COURSE OBJECTIVES/LEARNING OUTCOMES:

Upon completion of this course, students should be able to:

1. Understand when scripted solutions are preferred over mainstream GIS software.
2. Appropriately use common programming techniques and structures including variables, flow control, looping, Boolean expressions
3. Know how to create a simple script tool and pass a parameter to a script.
4. Automate geospatial data processing using Python programming language.
5. Use ArcPy tool functions to achieve basic spatial analysis tasks.
6. Use online resources that support geocomputing and programming in the GIS profession.
7. Take advanced GIS courses that require programming.

## PREREQUISITES

ESC/GEO 405/505.

## TEXTBOOK & READINGS: *Paul Zandbergen (2013), Python – Scripting for ArcGIS*, 1st Edition, ESRI Press. Additional readings will be posted on Canvas course site.

## EXPECTATIONS FROM THE STUDENT

To be successful in this course, a student must

- Students must do their reading assignment for the upcoming lecture before the class. This will be helpful to understand the materials taught in the class
- Listen to lectures carefully and take notes over written materials.

- Attend class regularly.
- Submit completed assignments, exams, homeworks, final projects and any other class activity within due dates.
- Ask questions and discuss topics within the lecture session. Clarify issues within class itself while the topic is being taught.
- There will also be information that is only presented in class and therefore if you miss class you must obtain the notes from someone else in the course.

## ASSIGNMENTS

- ***Homeworks & Lab Assignments***: You need to complete all the homeworks & assignments and submit in required format by its due date to be considered for full grades in each assignment. If you fail the lab assignments, you will fail the course. Late submission of any assignment is strongly discouraged. However, turning a lab late is encouraged over not doing it at all. Late submissions will be accepted until the last day of classes. **One week late submission will lose 25%** of their value and **more than one week late submission will lose 50%** of their value if more than one week late. In case of sickness or emergency, appropriate proof should be provided during late submission otherwise points would be deducted. You will have enough time to complete each assignment within assigned lab time with help from me and/or lab assistant. If you choose not to complete your work within lab time, it's your responsibility to finish on time by yourself.
- ***Exams***: There will be **three exams on the dates listed in the syllabus** and are designed to assess your comprehension of the presented materials. Two exams will be based on lecture materials and readings and will be named as Mid-term and Final exams. One exam will be based on hands-on problem solving called Lab Exam. Make-up exams will be given ONLY during exceptional circumstances, such as illness or university-approved event, and proof will be required. In cases where you have a scheduling conflict with a university-approved event, it is YOUR responsibility to notify the instructor at least two weeks before the exam. In the case of emergencies, it is YOUR responsibility to notify the instructor that you will be unable to attend, preferably before the exam or within 24 hours after the exam.
- ***Final Project***: More information about the final project can be found in Final Project module in canvas. The whole process of final projects takes last few weeks, and students are guided by few milestones which help them accomplish their task on time. **The final project submission items are not eligible for late submission**. If you fail to turn in any of the items by the due date then you will not receive any points for that item.

## ATTENDANCE
Due to COVID-19, the scheme to assess attendance may change. During our regular face-to-face class, attendance will be assessed in the following manner:
- Lecture and lab attendance will count for 1 point each.
- For missing classes under any circumstances with prior notification, you will receive 0 points.
- Material covered in lecture and lab sessions (including lecture topics, concepts, readings, software demonstrations, internet material, and additional tips and instructions for the laboratory, all of which are not in the book) will not be repeated in class and you will be responsible to make up the work and gather materials.
- In cases where you have a scheduling conflict for a university-approved event, and you need to miss a class, it is YOUR responsibility to notify the instructor at least a week before that day.
- In the case of emergencies, it is YOUR responsibility to notify the instructor that you will be unable to attend, preferably before the exam or within 24 hours after the exam.

- In case of sudden sickness or emergency please provide a proof for your absence on the next day you attend the lecture/lab.
- In case of unavoidable personal matter, you need to inform the instructor at least 24 hours before the class.

## FORMAT & COURSE ACCESS

This course will use the Canvas online platform and Geography department server for distributing course materials. Access to course materials in Canvas may cease after the term ends. If you wish to archive materials for your personal records or portfolio you should do so as you progress through the course. As a general rule, you should always save local copies of course-related work. To avoid disasters, you should also save important files to external media or cloud storage.

## TECHNICAL SUPPORT

For tips and information about Canvas visit the Canvas Guide for Student. You can also contact the ITS Support Center at (608) 785-8774 or helpdesk@uwlax.edu for questions about Canvas or any other technological difficulties. The hours for ITS are Monday through Thursday from 7:30 am to 6:30 pm, and Friday from 7:30 am to 4:30 pm, Central Time. For GIS software and computer issues in the lab please contact the GIS Lab Administrator Steve Fulton.

## GRADING SCHEME

| Grade | Range |
|-------|-------|
| A | 93 – 100 |
| AB | 88 – 92 |
| B | 83 – 87 |
| BC | 78 – 82 |
| C | 70 – 77 |
| D | 60 – 69 |
| F | 59 & below |

## GRADE DISTRIBUTION

Assignments, Homeworks & Attendance- 50%
Exams - 30%
Final Project - 20%

## EXPECTATIONS FOR GRADED WORK:

Generally, I return graded assignments with individualized feedback, if needed, within 21 days from the due date of the assignment. I will notify you if I am unable to grade the work within the 21-day timeframe, and will identify a revised return date. If you submit work after the due date, it may not be returned within 21 days. The grades for any work that is graded electronically, such as scanned examinations or automated quiz, will be accessible to you within 21 days of the due date. If you submit electronically graded work after the due date, it may not be accessible within 21 days. Your graded coursework will be returned in compliance with FERPA regulations, such as in class, during my office hours, or via the course management system through which only you will have access to your grades.

**TENTATIVE SCHEDULE**

*Each topic will have practice sets and lab assignments. The due dates will be listed on Canvas*

| DATE (Week) | TOPIC | READING |
|---|---|---|
| 9/8, 9/10 (1) | Introduction to course | Practice Set Notebo |
| | Basics of Python Programming<br>Introduction to JupyterNotebook<br>WK 1 Practice Set1: Getting started with Python; Due: 9/15@ 5PM<br>WK 1 Practice Set2: Data Types in Python; Due: 9/15@ 5PM | and lecture notes |
| 9/15, 9/17 (2) | Data types: Aspatial and Spatial<br>Wk 2 Practice Set1: Strings; Due: 9/22@ 5PM<br>Wk 2 Practice Sets2: Lists; (3); Due: 9/22@ 5PM<br>Wk 2 Practice Sets3: Dictionaries; Due: 9/22@ 5PM<br>Lab 1-1: Math probs; Due:9/22 @5PM<br>Lab 1-2: Lists assigned; Due:9/22 @5PM<br>Lab 1-3: Dictionaries; Due:9/22 @5PM | Practice Set Notebo<br>and lecture notes |
| 9/22, 9/24 (3) | Loops, Condition and Flow Control<br>Functions<br>Wk 3 Practice Set1: if/else statements; Due: 9/29@ 5PM<br>Wk 3 Practice Set2: loops; Due: 9/29@ 5PM<br>Lab2-1: Numpy; Due: 9/29@ 5PM<br>Lab2-2: Pandas; Due: 9/29@ 5PM | Practice Set Notebo<br>and lecture notes |
| 9/29, 10/1 (4) | Visualization- Graphs and Charts<br>Lab 3: Visualization with Matplotlib; Due: 10/6 @5PM | Practice Set Notebo<br>and lecture notes |
| 10/6, 10/8 (5) | Exam 1 review<br>**Exam 1: 10/8 class time** | |
| 10/13, 10/15 (6) | Geometries and Projection<br>Geocoding | |
| 10/20, 10/22 (7) | Table Join & Spatial Join<br>Map Data Visualization | TBA |
| 10/27, 10/29 (8) | Reading/Writing Raster Data - GDAL/OGR<br>Raster Processing and Analysis | TBA |
| 11/3. 11/5 (9) | **Exam 2: 11/3 class time** | TBA |
| 11/10, 11/12 (10) | Geoprocessing with ArcPy & ArcGIS Notebooks<br>Explore and Manipulate Data with ArcPy | TBA |
| 11/17, 10/19 (11) | Working with Geometries in ArcPy<br>Final Project Discussion | |
| 11/24 (12) | Working with cursors | TBA |

| | |
|---|---|
| 12/1, 12/3 (13) | Working with Rasters |
| 12/8, 12/10 (14) | Error handling and debugging |
| 12/15 (15) | Final Project Presentation |
| 12/21 (16) | *Exam 3 - 7:45 - 9:45AM* |

The instructor reserves the right to change the content of the course material if she perceives a need due to pandemic, instructor illness or due to the pace of the course. Students are responsible for any announcement made in class.

**HOW TO CONTACT THE INSTRUCTOR:**
If you have any issues talk to your instructor during office hours or before or after the class. Do not completely rely on emails. If you have to send an email, email with clear subject, course and section number, and sign off with your name.

**UWL Syllabus Policy Information & Statements:**
Please check here for statements regarding Academic integrity and misconduct, religious accomodation, sexual misconduct, student course and faculty related concern, students with disabilities, veterans and military personnel.

Please check here to find out more about Academic Services and resources at UWL