GEOG 531: VISUAL PROGRAMMING FOR GIS

Course Outline

Fall, 2023

Course Instructors

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Course Overview

This course will help to develop skills and techniques in GIS automation. The topics include Python language fundamentals and the Visual Studio (VS) Code development environment; using Tkinter package for development of Graphic User Interface (GUI) applications; automation ArcGIS functionalities using the ArcPy package.

Emphasis is given to hands-on learning, particularly using ESRI software. Spatial data for Canada, British Columbia and town of Nanaimo will be used in lab exercises.

Course Objectives

Upon successful completion of the course material, the student should be able to:

- Have knowledge of programming theory
- Understand Python and implementation of simple interfaces with Tkinter
- Automate ArcGIS and tailor individual preferences and workflows
- Write procedures for GIS in VS Code and Python
- Apply objects' programming paradigm to GIS automation

It is also expected that students will develop improved skills and perspectives for the future independent study of GIS methods and applications.

Specific Software Skills

- ArcGIS customization
- Python scripting within VS Code environment
- GUI application development Tkinter
- Python scripting with ArcPy

Course Resources

Text: There is no required text for this course.

Supplemental readings: The links to e-guides and tutorials from w3schools.com and ESRI web resources sites will be provided. Additional books and Internet resources will be recommended for particular modules during the course. Students will be provided with a variety of *supplemental documents* and handouts in digital form.

Online resources: ESRI's Virtual Campus *online courses (see* **Schedule***).*

Course Structure

Each day is divided into a morning and/or an afternoon segment. Each module can consist of a lecture(s) (1 hour in the morning and/or afternoon) and lab/assignment/tutorial sections (2 hours in the morning and/or afternoon).

The course lecture and practices series are divided into two modules, each including a summarizing review. Modules from the ESRI online campus will be assigned as homework assignments. Proof of completion of these modules will be required.

A final exam will take place on the morning of December 20 and will cover all the material discussed in the course.

GEOG 531 Course Schedule (proposed)

GEOG 531		
29.09	morning	Lecture 1 - Python Introduction Tutorial 1 - Python Basics
	afternoon	Lecture 2 - Data Types and Operators Tutorial 2 - Commission Calculator Assignment 1 - Simple Programs (**6 marks**)
6.10	morning	Lecture 3 - Conditional Execution Tutorial 3 - Currency Converter
	afternoon	Lecture 4 - Functions Assignment 2 - Branching (**7 marks**)
13.10	morning	Lecture 5 - Complex Code Structure Tutorial 4 - Complex Code Structure
	afternoon	Lecture 6 – Iteration Tutorial 5 - Times Table Calculator Assignment 3 - Looping (**7 marks**)
20.10	morning	Lecture 7 - Classes/Objects Assignment 4 - Complex Code Structure (**7 marks**)
	afternoon	Lecture 8 - Error Handling, Debugging Tutorial 6 - Error Checking
27.10	morning	Lecture 9 - ArcPy Introduction Assignment 5 – Basic Python Processing with ArcPy (**6 marks**)
	afternoon	ESRI WC1 - Python for Everyone (**1 mark**)
3.11	morning	Lecture 10 - ArcPy Mapping Module Assignment 6 - ArcPy Mapping Module (**7 marks**)
	afternoon	ESRI WC2 - Python Scripting: Modifying Layer Properties (**1 mark**)
10.11	morning	Lecture 11 - Dataset Manipulations with ArcPy Assignment 7 - ArcPy Dataset Manipulations (**7 marks**)
	afternoon	ESRI WC3 - Python Scripting for Geoprocessing Workflows (**1 mark**)
24.11	morning	Lecture 12 - Geoprocessing with ArcPy Assignment 8 - ArcPy Geoprocessing (**7 marks**)
	afternoon	ESRI WC4 - Creating Python Scripts for Raster Analysis (**1 mark**)
1.12	morning	Lecture 13 - Jupyter Notebooks and ArcGIS Python API Assignment 9 - Working with Feature Datasets, Layers and Tkinter (**9 marks**)
	afternoon	Course's Overview for Exam Preparation ESRI WC5 - Performing Analysis Using ArcGIS API for Python (**1 mark**)
18.12	morning	Exam (**32 marks**)

Course Evaluation

Course Component Percentage of final grade

Lab Submissions	62
ESRI Virtual Campus Certificates	6
Final Exam	32

Important Notes

This syllabus is the definitive description of course policy and supersedes all other course descriptions.

- *Students must maintain an overall grade of **50**% (D) to pass this course.*
- *The minimum number of assignments to be completed is **100**%.*
- *Students must achieve a minimum **40%** grade on the final exam to pass this course.*

Students are expected to work in a professional manner. This involves respect for the facilities, colleagues, GIS unit staff, and the educational process.

The ADGISA staff do not wish to set up an environment that restricts the student's ability to work on the computers. Software that restricts access to the system can slow down operations and cause other problems for lab users. We prefer to simply log operations on the computers, rather than restrict access. However, the changing of any computer settings, defaults, or other components of the hardware, operating system, or application software without the express direction of either the course instructor or the GIS lab technician will not be tolerated. The distribution of pirated software or media is illegal and the use of VIU's facilities for the distribution of such will not be tolerated.

Group work makes it possible for individuals to appear to understand more than they actually know. Fair and effective evaluation requires that a certain portion of the project work be completed during scheduled class lab time.

Participation and performance during these sessions is a component of the evaluation process. The submission of a project as a group does not necessarily mean that all members of the group will get a similar grade for any project.

Performing analysis on your own computers is both a privilege and a responsibility. In return for the flexibility of being able to work on their own laptops, students are solely responsible for the maintenance and upkeep of their machines. This includes regular maintenance tasks, such as cleaning up hard drives, defragmenting hard drives, installing, and using an appropriate security system, and performing backups. In particular, students are expected to make backup copies of their work on a daily basis.

Course Policies

Handling of Student Work

1. Students are responsible for retaining a copy of all submitted work.
2. All assignments to be submitted to the instructor during class time or during instructor office hours.
3. Every effort will be made to return assignments to students within two weeks.
4. Students can make an appointment with their instructor to review and discuss their exams, assignments, or course grades.
5. Unclaimed assignments will be kept for one month after the grade submission deadline
6. Final grades will be posted on the Internet.

Student Supports

1. VIU University-College Calendar
2. Writing Centre
3. Student Services Department

Attendance

Attendance and participation in classes are mandatory. Students are required to contact the instructor **in advance** if they are unable to attend classes. Absences of more than 3 classes may result in the student being removed from the course.

Late Policy

All assignments are to be submitted by the due date. If, due to illness or emergency this will not be possible, please discuss this with the instructor ***prior*** to the due date and an individual revised due date may be established.

Assignments received after the due date without negotiation will drop by **10**% per day. All assignments set in the course must be submitted in order to receive a Course Grade.

Grades

Grading System for University Transfer, Career/Technical and Degree Program Courses

Percentage (%)	Letter Grade	Grade Point	Description
90-100	A+	4.33	**First class**
85-89	A	4.00	
80-84	A-	3.67	
76-79	B+	3.33	**Second class**
72-75	B	3.00	

68-71	B-	2.67	
64-67	C+	2.33	**Pass**
60-63	C	2.00	
55-59	C-	1.67	
50-54	D	1.00	**Minimum Pass**
0-49	F	0.00	**Fail:** Objectives of the course have not been attained. Enrolment in a sequential course not permitted in certain courses.
CR	0	N/A	**Course passed:** Requirements completed, but not calculated in GPA. (Used in courses graded on a "Pass or Fail" basis.)
INC	0	N/A	**Incomplete:** If course requirements are not completed after 90 days from the course end date, the "INC" grade will automatically become an "F" grade.
CS	0	N/A	**Continuing Status:** In good standing. Course is delivered over 2 terms, separated by a break. Final mark to be issued at end of 2nd term.
AUD	0	N/A	**Audit**
INP		N/A	**In Progress:** In good standing. Student must re-enrol within one year.
NGS	0	N/A	**No Grade Submitted** (yet)**;** neither Pass nor Fail.

Please note the following:

- **W** grade which can be issued only by Registration when a student officially withdraws from a course. This can only be done during the first five weeks of class (students' responsibility to check calendar for deadline). Instructors cannot issue "W" grades.
- **UW** - official withdrawal. No longer accepted by Registration.

Academic Misconduct

Violations of academic integrity, including dishonesty in assignments, examinations, or other academic performances, are prohibited and will be handled in accordance with the Student Academic Code of Conduct Procedures. If you have any concerns about possible plagiarism or other academic misconduct, please contact your instructor ***before*** handing in the assignment in question.

Academic misconduct includes, but is not limited to, the following acts:

- **Cheating**
  Cheating is an act of deception by which students misrepresent that they or others have mastered information for an academic exercise.
- **Fabrication**
  Fabrication is the intentional use of false information or the falsification of research or other findings with the intent to deceive.
- **Plagiarism**
  Plagiarism is the intentional unacknowledged use of someone else's words, ideas, or data. When a student submits work for credit that includes the words, ideas or data of others, the source of that information must be acknowledged through complete, accurate, and specific references, in a style appropriate to the area of study, and, if verbatim statements are included, through quotation marks or block format as well. By placing their names on work submitted for credit, students certify the originality of all work not otherwise identified by appropriate acknowledgments.
- **Facilitation of Academic Misconduct**
  Helping or attempting to help another to commit act(s) of academic misconduct as outlined above.
- **Non-attendance**
  Non-attendance, where attendance is deemed to be mandatory, is not acceptable. Absences due to personal illness, family illness, death of an immediate family member, religious ceremonies, or sports events in which the student represents Vancouver Island University are allowed and must be approved by the appropriate instructor or coordinator. Non-attendance must be for valid reasons and not falsified. Some departments have specific attendance requirements, and details may be obtained from the instructor, department chair, or program coordinator.

Disciplinary Action

Every reasonable effort should be made to deal with student conduct concerns at the instructional and departmental level. Formal discipline is designed for serious intentional academic misconduct.

Acts of academic misconduct may make a student subject to a range of disciplinary action - including failure for a course assignment or a course, or possible suspension by the President.

No student shall be allowed to withdraw from a course, or the University, to avoid receiving a failing grade based upon academic misconduct. A withdrawal under such circumstances shall result in an "F" grade being recorded on the student's transcript for the course(s) in question.

Please refer to the Student Academic Code of Conduct Procedures (procedure 99.01.001) for information on handling breaches of this policy.

Student Conduct Code (policy 32.05)

Please refer to the Student Conduct Code policy, available on the Policies/Procedures website, for information on handling breaches of this policy.