UNIVERSITY OF MARY WASHINGTON -- NEW COURSE PROPOSAL

Electronically submit this completed form with attachments <u>in one file</u> to the Chair of the College Curriculum Committee.

COLLEGE (check one):	**Arts and Sciences**	x	**Business**		**Education**	
Proposal Submitted By: Brian Rizzo			Date Prepared: 1/16/19			
Course Title:	Programming for GIS					
Department/discipline and course number*:		Geography - MSGA 555				
Prerequisites:		N/A				

This course number must be approved by the Office of the Registrar <u>before</u> the proposal is submitted.

Number of credits:	4	Will this course meet for at least 700 contact minutes for each credit hour proposed? *If no, provide a credit hour justification.*	**YES**	x	**NO**	
Will this be a *new*, *repeatable* "special topics" course? (Do you want students to be able to take this new course more than once if the topic changes?)			**NO**	x	**YES**	

Date of first offering of this *new* course: **FALL SEMESTER, year**		2019
Proposed frequency of offering of the course:	Fall and Spring semester	
Proposed enrollment limit for the course:	18	
List the faculty who will likely teach the course:	Rizzo	
Are ANY new resources required?	**NO**	x	**YES**		*Document in attached impact statement*

**The earliest the course may be offered is the fall semester of the academic year FOLLOWING the year in which the course proposal is approved.

This new course will be (check all that apply):					
Required in the major	x	Required in the minor		General Elective	
Elective in the major		Elective in the minor		General Education**	

**AFTER the new course is approved, a separate proposal <u>must be</u> sent to the General Education Committee.

Catalog Description (suggested length – less than 50 words)**:**	
This course focuses on addressing geospatial problems through programming in python. The python language will be used write and modify scripts to automate procedures, integrate numerical and scientific site-packages to facilitate analysis and model development in the spatial domain. Assignments will be weekly or bi-weekly.	

COURSE HISTORY:	Was this course taught previously as a topics or experimental course?	**YES**	x	**NO**	
Course Number and Title of Previous Course		**Semester Offered**		**Enrollment**	
Undergraduate GISC 450 taught every semester for years		fall/spring		18	

X	**CHECK HERE** if the proposed course is to be *equated* with the earlier topics or experimental offerings. If equated, students who took the earlier "topics" course will only be able to take the new course as a repeat (C- grade or lower).

<u>*NOTE:*</u> If the proposed course has not been previously offered as a topics or experimental course, **explain in the attached rationale statement** why the course should be adopted even though it has not been tried out.

REQUIRED ATTACHMENTS:

1. **Rationale Statement** – Why is this course needed? What purposes will it serve?
2. **Credit Hour Justification** (if required) – explain how this course will comply with the UMW Credit Hours Policy (D.5.3)
3. **Impact Statement** – Provide details about the Library, space, staffing, budget, and technology impacts created by adding this new course. Include supporting statements from the Library, IT Department, etc. *Any change that impacts another Department must have a written statement (such as an email) from the Chair(s) agreeing to the change.*
4. **Sample Syllabus**

Department Chair Approval*: Jackie Gallagher   **Date:** Jan 16 2019

CCC Chair Approval: _(signature)_   **Date:** 1/24/2019

*COB and COE proposals approved by the Associate Dean. *BEFORE* consideration by the UCC, the proposal must be approved the two levels noted above. Approval by the UCC and UFC are noted on the proposal "status history" at the UCC web site.

Rationale Statement

One of the key desired skill sets in the geospatial field today is the ability to employ the Python language to write and modify scripts so as to automate geospatial procedures. The undergraduate certificate includes GISC 450 GIS Programming which introduces students to the Python language in a geospatial context. To date, while the majority of students graduating from UMW have programming experience, few MSGA students from outside UMW have any (e.g. of the 12 students entering the MSGA in fall 2018, 4 have no programming course). This we feel is a very limiting knowledge gap that we can address through a cross-level cross-list of MSGA 555 with GISC 450. This should work for two reasons:

1. We have already had approved (fall 2018) a change to the GIS Certificate Program requiring that students take *EITHER* 450 Programming *OR* 482 Web Concepts; we believe that this added flexibility leave a few seats open in GISC 450 each semester
2. At present, the majority of our MSGA students are from UMW; we will advise those who plan to enter the MSGA to take GISC 450. Thus the demand for seats in MSGA 555 should be limited.

We recognize that the GISC may grow, that the MSGA may grow, and thus demand for seats in either level of GIS Programming might significantly increase. However, at present, we believe that we can keep offering one section of GISC 450/MSGA 555 each semester, with a few seats reserved for MSGA students until enrollment has settled, and thus not need any new resources.

To ensure graduate students are working at a higher they will be required to complete a project that explores the utility and efficacy of Jupyter notebooks, a Python technology that allows real-time access to ESRI's Python application program interface (API). Jupyter notebooks allows users to run Python code in an interactive manner and visualize the output as maps and charts. The Jupyter environment will be accessed through a browser. While the Jupyter environment and the related API are Python based, the environment and the protocols have little in common with what is taught in the course. Graduate students will need to apply their knowledge from the class and adapt it to the Jupyter environment.

Credit hour justification (4 credits)

This course will meet for at least 200 minutes weekly in a computer-lab classroom where students experience a mix of lecture, demonstration, hands-on practice and individual work during the class period, followed by their individual completion of assignments every week or every two weeks.

Impact

GISC 450 is currently taught every semester and is often full to capacity (we once taught two sections to remove backlogged demand). This is because it has been a required course in the GIS Certificate program. However, a change approved by the UCC in December 2018 made it one of two required courses - so we anticipate that some seats will open up at the undergraduate level. We anticipate that there will be enough seats in the course to accommodate those graduate students who need GIS programming without requiring any additional sections or faculty or space (as stated above, for example, that would be 4 of the incoming 12 this year; since most MSGA students are from UMW, it is a low number).

Of course, if the GISC program grows significantly, or if we attract a larger proportion of non-UMW MSGA students, we may need to teach two sections of the course in one semester, likely necessitating the hire of an adjunct. This problem would mean that the programs are successful.

Sample Syllabus

Course Description

The ArcGIS geoprocessing framework includes a scripting environment. This exposes the ArcGIS application to programming languages such as Python. This course will begin with a brief review of Python programming language and an introduction to PyCharm, an integrated development environment for programming. These topics will set the stage for GIS programming which will begin with the introduction of ArcPy, the ArcGIS Python environment. ArcPy exposes ArcGIS tools and other functions to Python, effectively allowing scripts and programs to automate a geospatial analysis through programming rather than through the use of the graphical user interface (GUI), ArcGIS Pro or desktop.

You will learn Python scripting syntax which will allow you to write scripts to automate geoprocessing operations. You also learn how to incorporate Python scripts as custom tools in the ArcGIS Toolbox.

Topics covered in this class include an introduction to object-oriented programming; the five basic scripting elements, or operations (input, output, arithmetic, conditional, and looping); the principles of modular code design; and how to work with the ArcPy library. These topics are then related to the geospatial workflow through the integration of maps, layers, queries and data tables.

Graduate students will be required to complete an independent project that requires them to apply Jupyter notebooks and create a workflow that demonstrates an application of their design.

Prerequisites

Prerequisites: Undergraduates - GISC 351 or GEOG 351.
                   Graduates - N/A

Knowledge and exposure to a programming language such as Python, C, R, or java script is highly desirable.

Class Policies

I will not mark attendance! However, there is a 5% participation grade which will constitute my impression of your attendance, dedication, assignment completion, and participation. There is a strong correlation in this class between grades and missed classes.

Text Books\Class reference material

There is no text book for this course. Students are encouraged\required to seek out appropriate resources on the internet to assist in the completion of assignments. Some of the sights to visit are:

- https://www.esri.com/training/catalog/57630436851d31e02a43f13c/python-for-everyone/
- http://desktop.arcgis.com/en/analytics/python/
- https://gis.stackexchange.com/

Grading

	Undergraduates/450	Graduates/555
Labs	40%	25%
Midterm Exam	25%	20%
Final Exam	30%	20%
Project (1)	N/A	15%
Participation	5%	5%
	100%	100%

Grading Policy

A: 94-100

A-:   90-93

B+:   87-89

B: 83-86

B-:   80-82

C+:   77-79

C: 73-76

C-:   70-72

D+:   67-69

D: 60-66

F: 0-59

Mid-Semester Reports

A current grade of a D or F on graded material will constitute an *Unsatisfactory* assignment on your mid-semester grade report.

Labs

Assignments will require you to dedicate several hours of time outside of class to complete. These assignments are designed to provide hands-on experience with concepts we cover during the lecture. Deadlines will be defined within each lab. Labs must be turned in by the deadline; *no labs will be accepted after the posted deadline*.

Assignments have been designed with specific objectives in mind. I understand that even the best attempt to communicate the objectives of an assignment can lend itself to various interpretations. For this reason, on the day the assignments are handed out, the impetus is on each student to read the entire assignment and request clarification of any aspect of the assignment that it unclear or confusing. This relates to both the nature of the question and requirements for the output.

Completed labs will be submitted via Canvas and will NOT be accepted unless they follow the guidelines outlined in the Labguide document that is available on the canvas course page.

You will be able to use the computer labs in Monroe Hall Room 320 and Monroe Hall Room 114 on campus 24x7, except when a class is being held. There are also labs available around campus that support Python and ArcGIS.

Expectations

This is an upper 400 level class at UMW cross-level cross-listed with MSGA 550. Because of this, graduate students will be held to a higher standard in terms of effort on labs, dedication to learning the material, participation during class, and quality of work.

For many, a programming course exposes challenges and new concepts that can be difficult to grasp. However, with the proper amount of dedication and focus, you will be successful. I am here to help. Feel free to get in touch with me at any time to meet or arrange to meet.

GISC 450-MSGA 550 GIS Programming: Exercises/Project

Week 1	IntroductionToPyCharn
Week 2	PythonReview1
Week 3	PythonReview2
Week 4	Introduction to ArcPy
Week 4	Command line Arcpy
Week 5	PythonAndModelBuilder
Week 6	PythonInFieldCalculator
Week 7	**Midterm**
Week 8	Break week
Week 9	ArcPyLandfill
Week 10	ArcPyDataManagement
Week 11	ArcPyCursors1
Week 12	ArcPyCursors2
Week 13	ArcPyTools
Week 14	Manhattan
Week 15	NUMPYandSCIPY
Week 16	**Final Exam: Monroe 320 7:00 – 9:30**