Course Change Request

New Course Proposal

Date Submitted: 03/04/26 12:52 pm

Viewing: GGS 662 : Agentic GeoAI

Last edit: 03/10/26 8:34 am

Changes proposed by: nburtch

Programs referencing this course

[SC-MS-GEOI: Geoinformatics and Geospatial Intelligence, MS](#)

Are you completing this form on someone else's behalf?

No

Effective Term:	Fall 2026
Subject Code:	GGS - Geography & Geoinformation Science

Course Number: 662

Bundled Courses:

Is this course replacing another course? No

Equivalent Courses:

Catalog Title: Agentic GeoAI

Banner Title: Agentic GeoAI

Will section titles vary by semester? No

Credits: 3

Schedule Type: Lecture

Hours of Lecture or Seminar per week: 3

Repeatable: May only be taken once for credit (NR)

GRADUATE ONLY

In Workflow

1. **GGS Chair**
2. **SC Curriculum Committee**
3. SC Assistant Dean
4. Assoc Provost-Graduate
5. Registrar-Courses
6. Banner

Approval Path

1. 03/10/26 8:35 am
   Nathan Burtch
   (nburtch): Approved
   for GGS Chair

Default Grade Mode: Graduate Regular

Recommended Prerequisite(s):

Experience in programming or permission of instructor

Recommended Corequisite(s):

Required Prerequisite(s) / Corequisite(s) (Updates only):

Registrar's Office Use Only - Required Prerequisite(s)/Corequisite(s):

And/Or	(	Course/Test Code	Min Grade/Score	Academic Level	)	Concurrency?

Registration Restrictions (Updates only):

Registrar's Office Use Only - Registration Restrictions:

Field(s) of Study:

Class(es):

Level(s):

Degree(s):

School(s):

Catalog Description:

Introduces the use of contemporary artificial intelligence (AI) tools to automate the design, implementation, testing, debugging, refactoring, validation, and documentation of geospatial projects through programmatic workflows. Students will develop and deploy autonomous AI agents that can design, execute, evaluate, and iteratively improve GIS workflows.

Justification:

What: Creation of a new course to teach the use of AI agents for geoinformation techniques

Why: Contemporary AI tools are being applied to many domain areas, and geography/geoinformation science is no exception. This course introduces the use of AI tools for specific use in GIS and geoinformatics.

The geospatial industry is moving towards increased use of AI tools for geospatial workflows. This course will help our graduates become more competitive in the geospatial industry.

Does this course cover material which crosses into another department?   No

Learning Outcomes:

Will this course be scheduled as a cross-level cross listed section?

Attach Syllabus

GGS662_syllabus.pdf

Additional Attachments

Staffing:

Dr. Edward Oughton is running this course as a special topics Spring 2026, and will be the primary instructor.

Relationship to Existing Programs:

AI tools and instruction are growing within our University. Currently there is an AI: Artificial Intelligence MS degree at the graduate level. In viewing the courses in that program, none are explicitly utilizing spatial data and workflows like this course.

Relationship to Existing Courses:

By our count, there are nearly 40 graduate level courses with "AI" or "Artificial Intelligence" in their titles (with likely more being passed into curriculum during our 2025-2026 year). These courses span multiple Colleges, as different disciplines are developing coursework that relates AI specifically to their domains. This course is similar in that way; it relates AI workflows to our domain. However, this course deploys agentic AI applied specifically to geospatial data and workflows, which is unique compared to these other courses.

GGS does have some 600 and 700-level courses broadly in computational geoinformatics, but none are specific to the utilization of agentic AI.

Have you reached out to the Libraries to determine whether there are adequate resources to support your course? If not, please email Meg Meiman, Associate University Librarian for Learning, Research, and Engagement at mmeiman2@gmu.edu.

No

Additional Comments:

Reviewer Comments

Key: 19261

GEORGE MASON UNIVERSITY®

Course Syllabus, Spring 2026, 3 Credits

Instructor: Ed Oughton

Email: eoughton@gmu.edu

Location: 2103 Exploratory Hall (in-person)

When: Thursday 16:30 – 19:10 hrs

Recommended prerequisites: Experience in programming or permission of instructor

Contact method: Canvas discussion board for content related queries (preferred) and/or direct email for anything personal (eoughton@gmu.edu).

CATALOG DESCRIPTION

Introduces the use of contemporary artificial intelligence (AI) tools to automate the design, implementation, testing, debugging, refactoring, validation, and documentation of geospatial projects through programmatic workflows. Students will develop and deploy autonomous AI agents that can design, execute, evaluate, and iteratively improve GIS workflows.

OVERVIEW & OBJECTIVES

This GeoAI course examines artificial intelligence (AI) as a practical and applied tool for solving geospatial problems through code-based methods. Building on foundational programming and spatial computing skills, the course emphasizes how AI-assisted workflows can automate traditional GIS analysis, via AI agents. Students will explore how contemporary AI-tooling can be used to write, debug, refactor, test, validate, and document geospatial code, enabling more efficient and flexible spatial analysis and automation. Throughout the course, students will use these techniques to address complex geographic questions involving spatial modeling and simulation. Particular attention is given to evaluating the correctness and reliability of AI-automated solutions, including the design of testing and validation strategies for GIS codebases, to ensure workflows behave as intended and ensure reproducible results. The course also encourages critical reflection on the limitations associated with AI tool usage in geospatial domains. By the end of the course, students will be prepared to responsibly integrate autonomous AI agents into geospatial workflows and to make informed methodological choices when addressing complex spatial problems.

LEARNING OUTCOMES

The key learning objectives of this class include:

1. Explain the role of AI in geospatial analysis, including how AI-automated workflows differ from and extend traditional GIS and spatial computing approaches.

2. Use AI tools effectively to design, write, debug, and refactor geospatial code, demonstrating the ability to translate geographic problems into computational tasks.

3. Integrate AI-generated code with established geospatial libraries and platforms (e.g., Python-based GIS ecosystems) to automate GIS workflows.

4. Deploy autonomous AI agents for research purposes, such as to design, build, execute and iteratively improve geospatial models and simulation.

5. Critically evaluate AI-assisted geospatial solutions, including assessing correctness, spatial validity, computational efficiency, and potential sources of error or bias.

6. Develop and implement testing and validation strategies for AI-augmented GIS spatial workflows.

7. Formulate geographic questions and solve them using AI-enhanced geospatial methods, selecting appropriate tools.

8. Reflect on the limitations of AI in geospatial practice, including issues of transparency, reliability, data quality, and over-reliance on automated solutions.

TIME COMMITMENT

Generally, it is expected that students have some working knowledge of Python. If you do not, then there will be a substantial time commitment. For example, when learning any new language (computer-based or natural), it takes significant effort to progress to fluency. Approximately 10-20 hours of weekly effort is expected outside of class (on assignments, exercises or further reading), with this effort hopefully rewarded later via the job market (as these skills usually translate to higher salaries). If you already have programming experience, this requirement is slightly minimized.

GGS COMPUTER LAB, ASSIGNMENTS, & EXPECTATIONS

GGS students have remote access to the GGS Virtual Computing Lab, although everything for this class should be available via the associated GitHub page (with content going up weekly). Affiliated Google Colab notebooks can be run via a web browser. Thus, all documents, notes and code are available from this single location. VS Code and an appropriate AI tool are also required (Codex, Opus, Copilot, etc.).

If you do not intend to use the computer lab, then you will need a machine with at least 8 GB RAM, along with a fast and reliable broadband connection (e.g., > 20 Mbps). It may also be useful to have a web camera with a microphone in case any additional Zoom/Teams sessions are required (or if class is cancelled due to bad weather).

Students will also need to have access to a general piece of GIS software to quickly check/inspect any spatial processing, e.g., via ESRI ArcGIS Pro (licensed) or QGIS (open-source and preferred). Please be aware this is a coding-focused class that will use either of these pieces of software as secondary tools. Students should not expect or seek to use these tools primarily in this class. This is not a class which focuses on GIS analysis using graphical user interfaces (GUIs).

Assignments will be based on the lecture material you receive and will be administered via Canvas. Generally, assignments will be set on a Thursday and will be due the following Wednesday evening (except when noted in the Course Schedule). Late work will be penalized 20% for each day late. Late submissions will only go unpenalized for documented medical reasons or by previous agreement with the instructor (e.g., raised at the time the assignment is set).

Each student gets the opportunity to drop the two worst performing assignments from the overall score at the end of the semester. Take comfort in the fact that it is highly unlikely that three events justifying extenuating circumstances would occur in a single semester. Thus, the course grading criteria is already accounting for unfortunate events. No additional requests will be accommodated unless the extenuating circumstances are highly serious (in which case the university and course director will already be aware of the issue).

The overall grade is comprised of three key sets:

GRADING		
Assessment	**Points**	**%** (of final grade)
Assignments (6)	100 each	50%
Multiple-Choice Exam	250	25%
Coursework project	250	25%

The exam will consist of ~20 multiple-choice questions.

Grading will be based on the following cutoff values, although the instructor reserves the right to alter the values at the end of the course:

A (93%), A- (90%), B+ (87%), B (83%), B- (80%), C (70%), F (<70%)

The coursework project will include the use of techniques taught throughout the entire semester but applied to your own research topic. Students will be expected to submit assignments online through Canvas. Only Adobe PDF (.pdf) file formats will be accepted (students can save documents to a .pdf format for submission).

OPTIONAL TEXTS

There are many open and free resources for learning Python. Importantly, all the information you require will be provided in the course. However, should you require additional information, for example relating to programming languages, there are many options. Check out Al Sweigart's Automate the Boring Stuff with Python which is free to read and provides practical programming for total beginners. You can also check out Ed's YouTube channel for videos on Python-based GIS.

OFFICE HOURS AND INSTRUCTOR INTERACTION

Office hours will be held on Thursdays from 16.00 – 16.30 hrs prior to each class. Each student is expected to attend office hours at least once per semester. When emailing, a timely response is expected during office hours Monday-Friday. If you have a course-related question, the first port of call will be to place it on the Canvas discussion board. This is because other people may ask similar questions, so this becomes a shared knowledge base everyone can access. If you need to speak about something more personal with the instructor, then you can reach out via email. Drop-in virtual Q&A sessions can also be held by request (e.g., Monday, Tuesday or Wednesday 8pm) to seek advice on assignments and coursework.

PROBLEM SOLVING

It is inevitable that problems will arise, especially when working on Python coding problems. Therefore, it is essential that students follow a set of key procedures when dealing with any coding issues encountered. These are as follows:

1. Copy and paste any error messages into a search engine (e.g., Google) or GenAI. Someone else will already have had the same problem, so investigate how other researchers solved similar issues.

2. If you still cannot solve the problem, then consider posting a public question on the Canvas discussion board.

EXTRA CREDIT

Extra credit will be awarded for students who either take on extracurricular GeoAI-related activities, or complement their academic studies with (non-)competitive exercise or mental health activities. These extra credit activities will include:

1. Engagement in a research conference, or some extra GeoAI external activity (beyond any existing GRA responsibilities), which expand your understanding of the topic (20 points).

2. 100% class completion rate of the course evaluation survey (10 points).

3. Either (i) a 10% improvement in a sporting activity or (ii) at least six nature walks over the semester of 45 minutes. To be eligible for (i) you need to post starting and ending evidence, and for (ii) you need to post evidence from each walk (photo, fitness watch data, smartphone screengrab etc.). Find the discussion topic on Canvas to post your extra credit activities (20 points).

FUNDING ACKNOWLEDGEMENT

The preparation of these open-source materials has been gratefully supported by research funding from

ACADEMIC STANDARDS

The following statement is part of the "Common Policies Addendum" required by the University by AP.2.5; the wording is provided by the Stearns Center for Teaching and Learning as of 5-19-2025 at https://stearnscenter.gmu.edu/home/gmu-common-course-policies/.

Academic Standards exist to promote authentic scholarship, support the institution's goal of maintaining high standards of academic excellence, and encourage continued ethical behavior of faculty and students to cultivate an educational community which values integrity and produces graduates who carry this commitment forward into professional practice.

As members of the George Mason University community, we are committed to fostering an environment of trust, respect, and scholarly excellence. Our academic standards are the foundation of this commitment, guiding our behavior and interactions within this academic community. The practices for implementing these standards adapt to modern practices, disciplinary contexts, and technological advancements. Our standards are embodied in our courses, policies, and scholarship, and are upheld in the following principles:

> Honesty: Providing accurate information in all academic endeavors, including communications, assignments, and examinations.

> Acknowledgement: Giving proper credit for all contributions to one's work. This involves the use of accurate citations and references for any ideas, words, or materials created by others in the style appropriate to the discipline. It also includes acknowledging shared authorship in group projects, co-authored pieces, and project reports.

> Uniqueness of Work: Ensuring that all submitted work is the result of one's own effort and is original, including free from self-plagiarism. This principle extends to written assignments, code, presentations, exams, and all other forms of academic work.

Violations of these standards — including but not limited to plagiarism, fabrication, and cheating —are taken seriously and will be addressed in accordance with university policies. The process for reporting, investigating, and adjudicating violations is outlined in the university's procedures. Consequences of violations may include academic sanctions, disciplinary actions, and other measures necessary to uphold the integrity of our academic community.

The principles outlined in these academic standards reflect our collective commitment to upholding the highest standards of honesty, acknowledgement, and uniqueness of work. By adhering to these

principles, we ensure the continued excellence and integrity of George Mason University's academic community.

> Student responsibility: Students are responsible for understanding how these general expectations regarding academic standards apply to each course, assignment, or exam they participate in; students should ask their instructor for clarification on any aspect that is not clear to them. traditions.

STUDENT AI USE POLICY

This class recognizes the increasing role that AI tools play in everyday life. Consistent with the GMU AI Guidelines for Students and University academic integrity expectations, you are expected to use AI tools responsibly, transparently, and in ways that support your own learning and the course learning outcomes. Here, you may use AI tools to support your assignments and coursework project, but these tools will not be allowed in the exam. To ensure you comply with GMU policies on this topic, make sure you read and understand the AI guidelines for students: https://www.gmu.edu/ai-guidelines/ai-guidelines-students

INSTRUCTOR AI USE POLICY

This course is compliant with the AI Guidelines for Instructors adapted from the George Mason AI Task Force (as of February 2nd, 2026). All instructional decisions are accountable to the instructor, even when AI supports course content creation. As expected in industry, given this is a computer programming class, Generative AI tools are used to help create code, from possible examples to possible exercises. However, all content is heavily adapted, checked and validated by the instructor to ensure a very high quality of delivery, using expert judgement honed over 15 years of experience in the higher education research sector. AI is used to enhance but not replace independent thought. Importantly, integrity is a core part of this class. Therefore, it is expected that students comply with George Mason student AI usage, in the same way it is essential for professors to comply with relevant instructor guidelines.

FERPA AND USE OF GMU EMAIL ADDRESSES FOR COURSE COMMUNICATION

The following statement is part of the "Common Policies Addendum" required by the University by AP.2.5; the wording is provided by the Stearns Center for Teaching and Learning as of 5-19-2025 at https://stearnscenter.gmu.edu/home/gmu-common-course-policies/.

The Family Educational Rights and Privacy Act (FERPA) governs the disclosure of education records for eligible students and is an essential aspect of any course. Students must use their GMU email account to receive important University information, including communications related to this class. Instructors will not respond to messages sent from or send messages regarding course content to a non-GMU email

address.

> *Student responsibility*: Students are responsible for checking their GMU email regularly for course-related information, and/or ensuring that GMU email messages are forwarded to an account they do check

ACCOMMODATIONS FOR STUDENTS WITH DISABILITIES

The following statement is part of the "Common Policies Addendum" required by the University by AP.2.5; the wording is provided by the Stearns Center for Teaching and Learning as of 5-19-2025 at https://stearnscenter.gmu.edu/home/gmu-common-course-policies/.

Disability Services at George Mason University is committed to upholding the letter and spirit of the laws that ensure equal treatment of people with disabilities. Under the administration of University Life, Disability Services implements and coordinates reasonable accommodations and disability-related services that afford equal access to university programs and activities. Students can begin the registration process with Disability Services at any time during their enrollment at George Mason University. If you are seeking accommodations, please visit https://ds.gmu.edu/ for detailed information about the Disability Services registration process. Disability Services is located in Student Union Building I (SUB I), Suite 2500. Email: ods@gmu.edu. Phone: (703) 993-2474.

> Student responsibility: Students are responsible for registering with Disability Services and communicating about their approved accommodations with their instructor in advance of any relevant class meeting, assignment, or exam.

TITLE IX RESOURCES AND REQUIRED REPORTING

The following statement is part of the "Common Policies Addendum" required by the University by AP.2.5; the wording is provided by the Stearns Center for Teaching and Learning as of 5-19-2025 at https://stearnscenter.gmu.edu/home/gmu-common-course-policies/.

As a part of George Mason University's commitment to providing a safe and non-discriminatory learning, living, and working environment for all members of the University community, the University does not discriminate on the basis of sex or gender in any of its education or employment programs and activities. Accordingly, all non-confidential employees, including your faculty member, have a legal requirement to report to the Title IX Coordinator, all relevant details obtained directly or indirectly about any incident of Prohibited Conduct (such as sexual harassment, sexual assault, gender-based stalking, dating/domestic violence). Upon notifying the Title IX Coordinator of possible Prohibited Conduct, the Title IX Coordinator will assess the report and determine if outreach is required. If outreach is required, the individual the report is about (the "Complainant")

will receive a communication, likely in the form of an email, offering that person the option to meet with a representative of the Title IX office.

For more information about non-confidential employees, resources, and Prohibited Conduct, please see University Policy 1202: Sexual and Gender-Based Misconduct and Other Forms of Interpersonal Violence. Questions regarding Title IX can be directed to the Title IX Coordinator via email to TitleIX@gmu.edu, by phone at 703-993-8730, or in person on the Fairfax campus in Aquia 373.

> Student opportunity: If you prefer to speak to someone confidentially, please contact one of Mason's confidential employees in Student Support and Advocacy (SSAC), Counseling and Psychological Services (CAPS), Student Health Services (SHS), and/or the Office of the University Ombudsperson.

GMU RESOURCES

The Writing Center: https://writingcenter.gmu.edu

University Libraries, Ask a Librarian: https://library.gmu.edu/ask

Counseling and Psychological Services: https://caps.gmu.edu

University Catalog: https://catalog.gmu.edu

University Policies: https://universitypolicy.gmu.edu

COURSE OUTLINE

Week	Topic	Coursework
Week 1: **Jan 22nd**	Introduction and course overview, what is GeoAI, AI as a coding partner, Python refresh and Colab	Background reading
Week 2: **Jan 29th**	Problem formulation for GeoAI workflows	Assignment 1
Week 3: **Feb 5th**	Code generation for GeoAI workflows	Assignment 2
Week 4: **Feb 12th**	Functions, testing, and code profiling for GeoAI workflows	Assignment 3
Week 5: **Feb 19th**	Spatial results validity for GeoAI workflows (e.g., techniques for producing correct results)	Assignment 4
Week 6: **Feb 26th**	AI-supported automation for GeoAI workflows.	Assignment 5
Week 7: **Mar 5th**	AI-supported automation for GeoAI workflows	N/A Spring Break
Spring Break		
Week 8: **Mar 19th**	System design for GeoAI workflows	Multiple-Choice Exam
Week 9: **Mar 26th**	System design for GeoAI workflows	Assignment 6
Week 10: **April 2nd**	Coursework Project Introduction	Coursework Project
Week 11: **Apr 9th**	Coursework Project	Coursework Project
Week 12: **Apr 16th**	Coursework Project	Coursework Project
Week 13: **Apr 23rd**	Coursework Project	Coursework Project
Week 14: **Apr 30th**	Coursework Project	Coursework Project
Week 15: **May 7th**	Coursework Project Submission	-

Note: The course schedule is tentative and is subject to revision by the instructor