GGS 553 Geographic Information Systems
Spring, 2025, Thursdays 4:30 – 7:10 pm
2310 Exploratory
Instructor: David Wong, Professor
Phone: 703-993-9260. **Email**: dwong2@gmu.edu,
Office Hours (in-person or virtual): Thursdays 11am - noon, or by appointment
Virtual Office: https://gmu.zoom.us/j/4701770761
Canvas: https://mymasonportal.gmu.edu/

COURSE DESCRIPTION

University Catalog: "sources of digital geospatial data; and methods of input, storage, display, and processing of spatial data for geographic analysis using GIS. Lectures, hands-on exercises familiarize students with current technology."

     This course introduces <u>fundamental</u> scientific principles, theories, and techniques in the design and use of geographic information systems. Students will learn how physical features, events, and phenomena are encoded and stored, and how the system can be used to answer geographic questions through the use of analytical procedures supported by the data.

     Recommended Prerequisite: GGS 550 or equivalent, or permission of instructor.

LEARNING OUTCOMES (and "disclaimers")

By the end of this course, students will:
1. Be exposed to <u>most basic and fundamental</u> *concepts, terms, principles and techniques* associated with Geographic Information Systems and Science (you will be far from an "expert" in GIS after finishing this course).
2. Be familiar with the format and structure of spatial data used in popular GIS, and be able to perform basic functions in GIS to process, manipulate, and display spatial data (we will not discuss how to execute specific GIS functions of a system in class).
3. Have acquired hands-on skills and knowledge through tutorials and exercises (expect to experience some glitches in the labs and you will only learn a limited number of GIS processes and functions).
4. Be aware of some limitations and caveats of using GIS and maps, and develop critical spatial thinking (you may not be able to provide answers to most of the questions yet).

FORMAT AND LOGISTICS

A topic is scheduled for each week. Learning activities for most weeks include 1) review lecture slides before the lecture, 2) post questions after reviewing slides, 3) attend the lecture, and 4) complete the lab (if any). Contents of slides are mostly but not entirely summaries of the textbook with some details left out. Therefore, referring to the text may be needed and students are strongly encouraged to take notes in addition to the slides. By reviewing slides and attending lectures, students learn about theories and concepts, which are software-independent. Through the completion of labs, students acquire hands-on knowledge of the GIS package (*ArcGIS Pro*). Lectures will NOT cover all lecture slides but only on selected topics and questions that students

have posted. Students are responsible for reviewing slides, posting questions on slides, attending lectures, completing labs, and assessments.

TECHNOLOGY REQUIREMENTS

Course specific:
In addition to using your computer/laptop to access *Canvas* (for slides and labs, and to post questions), you will need a "decent" computer to complete the required labs and exams for this course. Students can use the GIS package, *ArcGIS Pro* (*ArcPro*) either by installing the program on your computer or via a virtual student computing lab. Students can also access *ArcPro* through the computer labs on campus. If you choose to install *ArcPro* on your own computer, it will require administrator-level access and control of a Windows machine (see *Canvas* for details). If you choose to access *ArcPro* via the Patriot Virtual Computing Lab (PVCL), *VPN* installation and access will be required. Details are also provided on *Canvas*.

Non-windows users:
Macs and Linux users should be aware that *ArcPro* used in this class runs on Windows only. You need to set up your Mac with Boot Camp or virtualization software so Windows will run on it. Also search "running windows on my Mac." Linux computers may also be configured with virtualization software or configured to dual boot with Windows. *QGIS*-version of labs are available, but we will not be able to provide technical support. Please contact me if you are interested to go that route.

TEXT (required)

Bolstad, P. and S. Manson 2022. *GIS Fundamentals: A First Text on Geographic Information Systems*. 7th edition.
You may order the book through the University bookstore or from the publisher website: https://www.gisfundamentals.org/order
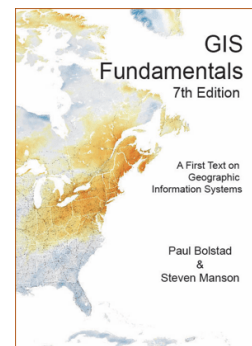
ASSESSMENTS

In order to achieve the learning outcomes, you are expected to read the relevant sections of the textbooks, review lectures slides, post questions on *Canvas*, and complete lab exercises. Your comprehension of the knowledge will be evaluated through various means described below.

a. Post questions about lecture slides (6 out of 10 topics) (18% in total): To help you learn GIS-related concepts and better understand the lectures, you are strongly encouraged to review lecture slides before each lecture and post questions you may have. You will receive 3 points (3%) for posting questions on each weekly topic, with a maximum of total 18 points for the entire course.

b. Lessons/Labs (in total, 50% of course grade; not equally weighted across labs): To help you acquire hands-on experience, 10 GIS labs are selected (downloaded from Canvas. They are based on Bolstad-Manson's labs but are tailored for this class). Late submissions will be penalized 5% for each day, and will not be graded after two weeks. ***Cartographic work must be submitted in the highest quality and according to standard cartographic conventions.*** Specifics of labs and their due days will be posted on Bb.

c. Written Examinations (24%): To assess your comprehension of concepts and theories, there will be 2 timed tests and a final exam with 8% each. These examinations will be based on materials covered in the lectures (not the labs). The exams will include multiple choice questions, definitions, and short answer questions.

d. Practical Examination (8%): To assess your competence in using *ArcPro* in handling, processing and analyzing spatial data, the practical exam will require students to complete a list of specific tasks within a prescribed period during the final week of the semester.

- Distribution of the total final scores at the end of the course will be used to determine the final grades using a "sliding scale" (curved) (letter grades will not be given to individual labs and tests).
- Students with the highest total scores will receive an A. Average (mean) scores will be assigned to A- or B+. Scores "significantly" lower than the rest of the class will be assigned to a failing grade.
- All materials submitted to meet the evaluation criteria should be completed in accordance with Mason's Academic Standards Code (https://academicstandards.gmu.edu/academic-standards-code/).

Incomplete will be handled strictly according to the University policy. Make-up tests are not given unless under unusual circumstances such as serious illness. Proof (documentation) is necessary to be eligible for make-up tests. No early exams will be given.

TENTATIVE COURSE SCHEDULE (subject to change)

WEEK/ DATES	CHAPTER(S) & TOPICS	TEXT, LABS, DUE & TESTS
	Pre-class action items: Purchase textbook, Review Syllabus and Schedule, Complete the Survey (Jan 21), & Install *ArcGIS Pro*	
	Basics	
Week 1 1/21 – 26	Course Overview and What is GIS? Ch 1: An Introduction to GIS	- class on 1/23 *Lab 1: Introduction to Arc Pro*
Week 2 1/27 – 2/2	Reference to a location Ch 2: Coordinate Data Ch 3: Geodesy and Map Projections	- class on 1/30 *Lab 2: Projecting Geographic Data* **Due: Lab 1 on 1/30**
Week 3 2/3- 2/9	Represent the Earth Ch 2: Data Models	- class on 2/6 **Due: Lab 2 on 2/6**

	Data Management	
Week 4 2/10-16	Spatial data input and presentation Ch 4: Maps, Data Entry, Editing, and Output	- class on 2/13 *Lab 3: Digitizing in ArcGIS Pro* **Test #1: 2/13 (up to Week 3 - Basics)**
Week 5 2/17 – 23	Spatial data capture Ch 5: Global Navigation Satellite Systems (skip surveying) Ch 6: Aerial and Satellite Images	- class on 2/20 **Due: Lab 3 on 2/20**
Week 6 2/24 – 3/2	Other spatial data and data utilization issues Ch 7: Digital Data Ch 14: Data Standards and Quality Ch 4: Metadata	-class on 2/27 *Lab 6: Digital data*
Week 7 3/3 – 9	Spatial data storage and management Ch 8: Tables	-class on 3/6 *Lab 7: Table 1; Lab 8: Table 2* **Due: Lab 6 on 3/6**
Week 8 3/10 – 16	Spring Recess	
	Analysis	
Week 9 3/17 – 23	Vector data analysis Ch 9: Basic Spatial Analysis	-class on 3/20 *Lab 9: Buffering and overlay* **Test #2 (up to Week 7 – Data Management)**
Week 10 3/24 – 30	No Class	- class will not meet (AAG) **Due: Lab 7 & 8 on 3/27**
Week 11 3/31 – 4/6	Raster data analysis Ch 10: Topics in Raster Analysis	-class on 4/3 *Lab 10: Raster Analysis* **Due: Lab 9 on 4/3**
Week 12 4/7 – 13	2.5D analysis Ch 11: Terrain Analysis	-class on 4/10 *Lab 11: Terrain Analysis* **Due: Lab 10 on 4/10**
Week 13 4/14 – 20	Model building in GIS Ch 13: Spatial Models and Modeling	-class on 4/17 *Lab 13: Cartographic Modeling* **Due: Lab 11 on 4/17**
Week 14 4/21 – 27	"Future" of GIS Ch 15: New Developments in GIS	-class on 4/24 **Due: Lab 13 on 4/24**
Week 15 4/28 – 5/4	Practical Exam	5/1: 4:30 – 8 pm *Catch up and Study*
5/8	Final exam	4:30 – 7:15 pm

OTHER POLICIES

Academic Integrity: please refer to Mason's Academic Standards Code (https://academicstandards.gmu.edu/academic-standards-code/)

The Use of AI-generative material: Although this course does not have explicit policies addressing the use of AI to complete course assessments, policies of using of AI may fall under the Academic Integrity policies. Unless specified, work submitted is expected to be produced entirely by the student. Thus, using AI-generated material partly or entirely will be a violation of academic integrity.

GMU Email Accounts: Students must use their GMU email account to receive important University information, including messages related to this class. See http://masonlive.gmu.edu for more information.

Office of Disability Services: If you are a student with a disability and you need academic accommodations, please contact the Office of Disability Services (ODS) at 993-2474, http://ods.gmu.edu. All academic accommodations must be arranged through the ODS.

GMU Resources:

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

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

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

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

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

Academic Calendar (drop/withdrawal deadlines): https://registrar.gmu.edu/calendars/

Course Materials and Student Privacy:

- All course materials posted to Canvas or other course site are private; by federal law, any materials that identify specific students (via their name, voice, or image) must not be shared with anyone not enrolled in this class.

The University has compiled a list of common policies affecting all courses as the **Common Policies Addendum**. They are part of this syllabus and they can be accessed via the addendum hyperlink.

*The instructor reserves the right to modify this syllabus, but will notify students about the change.