**GGS 311: Introduction to Geographic Information Systems (3 credits)**

**Syllabus is subject to change

**Spring 2022**



Instructor: Taylor Anderson
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Course type: Hybrid (synchronous + asynchronous)
In Person Meeting hours: Thursdays 3:00-4:15pm
Office hours: Thursdays 2-3pm
Course website: Blackboard
Final Exam: TBD

**Safe Return to Campus Notice:** All students taking courses with a face-to-face component are required to take Safe Return to Campus Training prior to visiting campus. The Safe Return to Campus Training is currently available in Blackboard. More instructions can be found here. Students are required to follow the university's public health and safety precautions and procedures outlined on the university Safe Return to Campus webpage. Similarly, all students in face to face and hybrid courses must also complete the Mason COVID Health Check daily, seven days a week. The COVID Health Check system uses a color code system and students will receive either a Green, Yellow, or Red email response. Only students who receive a "green" notification are permitted to attend courses with a face-to-face component. If you suspect that you are sick or have been directed to self-isolate, please quarantine or get testing. Faculty are allowed to ask you to show them that you have received a Green email and are thereby permitted to be in class.

## Course Description

Geographic information systems (GIS) are computer systems that are used to help us make sense of spatial data. Specifically, a GIS is used to transform unorganized spatial data to meaningful spatial information that can be used to answer the questions "where is what?", "so what?", and "why?". These are important questions for delivery services, social scientists, urban planners, meteorologists, forensic scientists, foresters, policy makers and many more. Spatial data has always been "big", but it is now collected at a greater volume, velocity, and variety at larger spatial extents and in real time. Thus, geotechnology has been identified as one of the three mega-technologies of the 21st century. It is no surprise that the demand is high for trained GIScientists. This course introduces theoretical concepts in Geographic Information Systems (GIS) and science (GIScience) and equips students with

introductory technical experience in spatial analysis using a GIS, building a foundation for future studies in GIS. In the lectures, students will learn the differences between GIScience and GIS, principals of GIS, geographic data modelling and collection, cartography and map production, georeferencing and projections, and spatial analysis. In the labs, students will learn the foundational technical skills required for cartography and map production, spatial data queries, and spatial analysis to solve geographic problems.

**Blackboard Login Instructions**

Access to MyMason and GMU email are required to participate successfully in this course. Please make sure to update your computer and prepare yourself to begin using the online format BEFORE the first day of class. Check the IT Support Center website. Navigate to the Student Support page for help and information about Blackboard. In the menu bar to the left you will find all the tools you need to become familiar with for this course. Take time to learn each. Make sure you run a system check a few days before class. Become familiar with the attributes of Blackboard and online learning.

**Required Textbooks**

The following texts are REQUIRED:

1. **Longley, P. A., Goodchild, M. F., Maguire, D. J., & Rhind, D. W. (2015). Geographic Information Science and Systems, 4th Ed. John Wiley & Sons.** This text is used to support your *learning of the theoretical material* presented in the course.

2. **Price, M. H. (2020). Mastering ArcGIS Pro, 1st Ed. McGraw Hill Education**. This text will be used to complete *guided tutorials and homework exercises.* The purchase of the loose-leaf version of the text is not recommended. Instead, purchase or rent the digital version of the text at: https://www.mheducation.com/highered/product/mastering-arcgis-pro-price/M9781260587333.html

**Course Learning Outcomes**

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

1. Describe the difference between a GIS and GIScience
2. Communicate the meaning of geographic representation and its limitations
3. Use basic cartographic principles to identify the strengths and weaknesses of a map
4. Explain the differences between the vector and raster data model
5. Demonstrate proficiency in use of a GIS to perform basic spatial analysis
6. Independently carry out a GIS-based research project including research question formulation, data capture, data storage and management, data analysis, and the communication of scientific results.

**Technology Requirements**

**Hardware:** You will need access to a Windows or Macintosh computer with at least 2 GB of RAM and access to a fast and reliable broadband internet connection (e.g., cable, DSL). A larger screen is recommended for better visibility of course material. You will need speakers or headphones to hear recorded content and a headset with a microphone is recommended for the best experience. For the amount of Hard Disk Space required taking a distance education course, consider and allow for:

1. the storage amount needed to install any additional software and
2. space to store work that you will do for the course.

If you consider the purchase of a new computer, please go to Patriot Tech to see recommendations.

**Software:** Many courses use Blackboard as the learning management system. You will need a browser and operating system that are listed compatible or certified with the Blackboard version available on the myMason Portal. See supported browsers and operating systems. Log in to myMason to access your registered courses. Some courses may use other learning management systems. Check the syllabus or contact the instructor for details. Online courses typically use Acrobat Reader, Flash, Java, and Windows Media Player, QuickTime and/or Real Media Player. Your computer should be capable of running current versions of those applications. Also, make sure your computer is protected from viruses by downloading the latest version of Symantec Endpoint Protection/Anti-Virus software for free here.

Students owning Macs or Linux should be aware that some courses may use software that only runs on Windows. You can set up a Mac computer with Boot Camp or virtualization software so Windows will also run on it. Watch this video about using Windows on a Mac. Computers running Linux can also be configured with virtualization software or configured to dual boot with Windows.

Note: If you are using an employer-provided computer or corporate office for class attendance, please verify with your systems administrators that you will be able to install the necessary applications and that system or corporate firewalls do not block access to any sites or media types.

**Course-specific Hardware/Software**

This course uses ArcGIS Pro 2.5., which you will have access to through the on-campus computer labs. To maximize social distancing, you will also download ArcGIS Pro 2.5. to your computer. You can find a tutorial and associated installation instructions for Windows PC users on the course website on Blackboard under “Learn Here: Weekly Lessons”.

ArcGIS Pro 2.5 is limited to running on Windows OS, meaning that if you have a Mac, you will instead download and install Citrix Virtual Labs. The virtual laboratory will have ArcGIS Pro 2.5 installed, but requires some set up on your part. You can find a tutorial and associated installation instructions for Mac users on the course website on Blackboard under "Learn Here: Weekly Lessons".

Hardware or software required for your course or program may be available for purchase at Patriot Computers (the University's computer store that offers educational discounts and special deals).

**Course Schedule** **Full details can be found on Blackboard and is subject to change

| WEEK | MODULES Thursday | TOPICS | TESTS | PROJECT | EXERCISES | DUE DATE FOR ALL DELIVERABLES |
|---|---|---|---|---|---|---|
| 1 | Jan 27th | Introduction to GIS and GISc | | | | |
| 2 | Feb 3rd | Geographic Representation and Data Models | | | **EXERCISE 1 – What is GIS?** | Feb 6, 11:59pm |
| 3 | Feb 10th | Cartography and Geovisualization | **TEST 1** | | **EXERCISE 2 – Mapping GIS Data** | Feb 13, 11:59pm |
| 4 | Feb 17th | Georeferencing and Coordinate Systems | | | **EXERCISE 3 – Presenting GIS Data** | Feb 20, 11:59pm |
| 5 | Feb 24th | Map Projections | | | **EXERCISE 4 – Coordinate Systems** | Feb 27, 11:59pm |
| 6 | Mar 3rd | Spatial Databases | | | **EXERCISE 5 – Attribute Data** | Mar 6, 11:59pm |
| 7 | Mar 10th | Data Collection | **TEST 2** | | **EXERCISE 6 - Editing** | Mar 13, 11:59pm |
| MARCH BREAK | | | | | | |
| 8 | Mar 24th | Spatial Analysis | | **PROJECT TOPIC** | **EXERCISE 7 - Queries** | Mar 27, 11:59pm |
| 9 | Mar 31st | Vector Spatial Analysis | | | **EXERCISE 8 – Joins and** | Apr 3, 11:59pm |

| WEEK | MODULES Thursday | TOPICS | TESTS | PROJECT | EXERCISES | DUE DATE FOR ALL DELIVERABLES |
|---|---|---|---|---|---|---|
| | | | | | **Overlay** | |
| 10 | April 7th | Vector Spatial Analysis | **TEST 3** | **PROJECT PROPOSAL** | | Apr 10, 11:59pm |
| 11 | April 14th | Raster Spatial Analysis | | | | Apr 17, 11:59pm |
| 12 | April 21st | Raster Spatial Analysis | | | | Apr 24, 11:59pm |
| 13 | April 28th | Error and Uncertainty | **TEST 4** | | | May 1, 11:59pm |
| 14 | May 5th | Project work | | **PROJECT PRESENTATIONS AND PROJECT REPORT** | | May 8, 11:59pm |

**Assignments Description**

| DELIVERABLE | % OF FINAL GRADE |
|---|---|
| **Exercises** | **25** |
| **Tests** | **25** |
| **Final Project** | **35** |
| **Participation** | **15** |

**Exercises**

Throughout the course of the semester, you will be required to independently complete 8 tutorials and exercises (each worth about 3% of your final grade) using the Price textbook, Mastering ArcGIS Pro, and related materials. The full text is available online along with embedded supplementary material including tutorial data, video tutorials, and a voice reader. It should be noted that each

tutorial and its associated exercises require a significant amount of time to complete (about 5 hours per tutorial and exercise). Take care in giving yourself enough time to complete them. Answers for each exercise are to be submitted to Blackboard each Sunday at 11:59pm of the same week it is assigned.

**Tests**

There will be a total of four tests, each worth just over 6% of your grade. The tests are intended to test your understanding of the theoretical material. Both tests will cover the lecture material and the readings. You will not be asked to perform any technical exercises in ArcGIS Pro. Tests will consist of multiple choice and short answer.

There is no final exam in this course.

**Participation**

Each week, you will have an opportunity to engage in active learning activities **(ALA) in the synchronous meetings.** Based on your participation, you may receive:

- up to 1% of your final grade for each in-class contribution

You cannot exceed 1% per active learning activity.

**Final Project**

Throughout the course, you will work independently to complete a research project. You will develop a research question, collect geographic data, analyze the geographic data, and communicate your results. The final project is composed of the following:

1. Project topic selection approval – 5% of your final grade
2. Project proposal report - 10% of your final grade
3. Final project video recorded presentation – 5% of your final grade
4. Final project report - 15% of your final grade

**Course Policies**

**Late Assignments:**

One Extension Policy: Any student may propose a reasonable deadline extension for any course deliverable, subject to my approval, once during the semester. Students must justify in writing why they need this extension and provide a plan for how they will complete the work.

One Revision Policy: Any student may revise and resubmit one major project deliverable within two weeks, after it is graded, either for a new grade or for up to a 15% increase on their prior grade provided the revisions are significant (not just error corrections).

Late Assignment Deduction Policy: Any late deliverable will earn a flat 10% grade deduction as long as the deliverable is completed within 7 days of the deadline.

**Instructor-Student Communication:** I will respond to your emails within 48 hours. If I will be away from email for more than one day, I will post an announcement in the Blackboard course folder. Before sending an email, please check the following (available on your Blackboard course menu) unless the email is of a personal nature:

1. Syllabus
2. Ask the Instructor Blackboard Discussion
3. On-demand Blackboard videos on how to use Blackboard features, and Technical Requirements.

Feel free to respond to other students in the Ask Professor forum if you know the answer.

**Campus Closure:** If the campus closes or class is canceled due to weather or other concern, students should check Blackboard for announcements.

**Technology**. You will need a reliable computer and internet access to view course materials in Blackboard.

**Grading Scale**

| GRADE | PERCENTAGE |
|---|---|
| **A+** | **> 99** |
| **A** | **93 – 98.9** |
| **A-** | **90 – 92.9** |
| **B+** | **87 – 89.9** |
| **B** | **83 – 86.9** |
| **B-** | **80 – 82.9** |
| **C+** | **77 – 79.9** |

| | |
|---|---|
| **C** | **73 – 76.9** |
| **C-** | **70 – 72.9** |
| **D** | **60 – 69.9** |
| **F** | **0 – 59.9** |

**University Policies and Resources**

a. Academic Honesty: You are expected to be familiar with and abide by the University's Honor Code. The Code can be found here. It is your responsibility to see me if you have questions about these policies. George Mason University has an honor code that states the following:

> *To promote a stronger sense of mutual responsibility, respect, trust, and fairness among all members of the George Mason University community and with the desire for greater academic and personal achievement, we, the student members of the University Community have set forth this:*

b. Course materials and student privacy: All course materials posted to Blackboard 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. Video recordings of class meetings that include audio or visual information from other students are private and must not be shared. Live Video Conference Meetings (e.g. Collaborate or Zoom) that include audio or visual information from other students must be viewed privately and not shared with others in your household. Some/All of our synchronous meetings in this class will be recorded to provide necessary information for students in this class. Recordings will be stored on Blackboard [or other secure site] and will only be accessible to students taking this course during this semester.
c. Students must follow the university policy for Responsible Use of Computing
d. Student services: The University provides range of services to help you succeed academically and you should make use of these if you think they could benefit you. I also invite you to speak to me (the earlier the better).
e. Students are responsible for the content of university communications sent to their George Mason University email account and are required to activate their account and check it regularly. All communication from the university, college, school, and program will be sent to students solely through their Mason email account.
f. The George Mason University Counseling and Psychological Services (CAPS) staff consists of professional counseling and clinical psychologists, social workers, and counselors who offer a wide range of services (e.g., individual and group counseling, workshops and outreach programs) to enhance students' personal experience and academic performance. Counseling Center: Student Union I, Room 364, 703-993-2380.
g. Students with disabilities who seek accommodations in a course must be registered with the George Mason University Office of Disability Services (ODS) and inform their instructor, in writing, at the beginning of the semester. All academic accommodations must be arranged through that office. Please note that accommodations MUST BE MADE BEFORE assignments or exams are due. I cannot adjust your grade after the fact.

h. Students must follow the university policy stating that all sound emitting devices shall be turned off during class unless otherwise authorized by the instructor.
i. The George Mason University Writing Center staff provides a variety of resources and services (e.g., tutoring, workshops, writing guides, handbooks) intended to support students as they work to construct and share knowledge through writing. University Writing Center: Robinson Hall Room A114, 703-993-1200. The writing center includes assistance for students for whom English is a second language.
j. Diversity: George Mason University promotes a living and learning environment for outstanding growth and productivity among its students, faculty and staff. Through its curriculum, programs, policies, procedures, services and resources, Mason strives to maintain a quality environment for work, study and personal growth.