Introduction to GIS

NRC 585 & GEOGRAPH 585 &
SPP 697B & DACSS 697B (4 credits)

Instructor/Syllabus Author
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<u>Office Hours</u>
By Appointment:
Meetme.so/UMassGIS (Zoom & In Person)

** If no time in the scheduler works for you,
  please email for other availability! **

Teaching Assistants
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<TA_FULL_NAME>
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Course Objectives and Description

This class serves as an introduction to Geographic Information Science (GIS). GIS is the science of spatial relationships, linking data to locations to explore relations between objects. Based on principles of geography, spatial thinking, and computational thinking, GIS has evolved to be a universally applicable way of thinking, means of analysis, and set of tools. Through lab work and foundational discussions, this course covers the guiding principles behind various facets of GIS including the nature of spatial data, map projections, spatial analysis, and cartographic production. The goals of this course are to teach you basic GIS concepts through practice and theory to enable you to make useful and meaningful contributions to various disciplines through spatial analysis. Throughout this course, you will be challenged to not only think spatially, but apply spatial analysis techniques within GIS.

Meeting Time and Locations

Lecture	**Labs**
Thursday 11:30a to 12:45p	Thursday 2:30p to 5:30p
Hasbrouck Lab Add 124	Friday 9:05a to 12:05p
	Friday 1:25p to 4:25p
	All labs meet in Morrill III 212

Class Moodle in the Cloud (Moonami)

There are extensive web-based materials associated with this class. Updates to the syllabus as well as other course materials will be made available on our Moodle. These materials will include lectures, participation components, resources, and other data necessary for you to succeed in this class. All assignments will be turned in via Moodle, as will all grades and assignment feedback.

GIS Software

This course will utilize the ArcGIS™ suite of software developed by ESRI, primarily ArcGIS Pro. This software is available to you free of charge. You can download and install ArcGIS Pro filling out the form at this link: https://www.geo.umass.edu/arcgis. ArcGIS Pro is available on most computers on campus.

You may explore other technologies or systems for using GIS in class, but you are not responsible for purchasing any of them.

Required Materials

There is no required textbook.

You will need a means of data storage for this course. This could be a cloud storage system, like Google Drive or One Drive, both of which are provided with your student account. You may also use a USB storage drive for this class, provided it has at least 16 GB of storage and meets the writing/rewriting speeds necessary for GIS work. Such devices are readily found online or in most retailers for approximately $15.00. In either case, you will practice good data management practices.

We will have the opportunity to present our final projects in poster or recorded form at the end of this course. Poster presentations require printing – we are able to complete this printing

through the library at the approximate cost of $20.00, though other printers are acceptable. Recorded presentations require no cost.

If any of these costs are prohibitive for you completing this course in your preferred method, scholarship opportunities are available to defray these costs.

Additional Readings and Data Sources

The *UMass Libraries GIS Hub,* created by our wonderful GIS Librarian, Rebecca Seifried: https://gis.library.umass.edu/

The *National Center for Geographic Information & Analysis (NCGIA) Core Curriculum in GIScience*, a guide to key GIS topics: http://www.ncgia.ucsb.edu/giscc/

The *ESRI Virtual Campus*, a guide to all things ArcGIS: http://campus.esri.com/

The Geographers Craft web site developed by Peter Dana and Ken Foote: https://foote.geography.uconn.edu/gcraft/contents.html

The *UCGIS Body of Knowledge*, a standardized guide to GIS knowledge areas: https://gistbok.ucgis.org/

An excellent introductory GPS website is provided by *Trimble Navigation*: http://www.trimble.com/gps/

Texas A&M's award-winning Maps and GIS library has some good tutorials on common GIS tasks: http://guides.library.tamu.edu/MapGIS_tutorials

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Class Attendance

The ongoing COVID-19 pandemic has created a teaching and learning dynamic mired in uncertainty. There are still major instabilities present that will continue to disrupt our learning environment. Further, the assumption that all students (or instructors) will always be available to travel to campus with a physical presence is not supported by the reality of life. Therefore, synchronous opportunities for connecting during lecture and lab will always be offered, and attendance asynchronously is also appropriate. This means that during our scheduled lecture and lab times we will have activities, lessons, support, and 'class' both in person, recorded, and with synchronous online connection. In person (or virtual) live attendance will not be mandatory, and all activities, assignments, and so forth will have asynchronous options for completion and participation. Lab support will be similarly distributed throughout the week in different modes and ways of support.

Platforms and Policies

We will use Zoom and Echo360 for livestreaming and recording this semester. Both in person classes and Zoom meetings will be recorded for posting, review and future editing. In all digital platforms, inappropriate behavior, which could consist of text, audio, or video content, will not be tolerated, and will result in the closure of the course Zoom for the day, as well as referral to appropriate student services.

This Course as Research

My colleague Dr. Courtney Thompson (Texas A&M University) and I will be conducting research that examines how students learn, develop, and perceive GIS expertise throughout Introductory GIS Courses and how COVID potentially impacts these processes.

With student permission, we plan to use REQUIRED assessment content from this course (i.e. pre- and post-quizzes, labs etc.) as part of the research to understand:
- How students learn in introductory GIS courses alongside how we are teaching the course
- What works and what does not work in your learning and our teaching
- How you learn knowledge, skills, and practices of GIS while we teach them

We are also interested in better understanding how changes in course format and structure as a results of COVID-19, and its possible impacts your access and ability to learn GIS throughout the semester, with the intention of using that information to develop better education deployment options during times of major disruption (i.e., during, you know, a global pandemic).

YOU ARE UNDER NO OBLIGATION TO PARTICIPATE IN THIS STUDY.

Electronic Devices

This class will use interactive methods to answer questions, complete participation assignments, and deliver course materials. Please use your resources for these tasks. You may be asked to leave if you use your resources inappropriately or in a way that distracts other learners.

Email

Students should use their university-associated email accounts when emailing the instructor and teaching assistants. Emails from personal accounts (like @yahoo or @hotmail) without

proper forwarding information will be ignored. You will receive regular emails from the course listserv detailing course scheduling and important events.

It is your responsibility to check your email account regularly. The only assumption I make about you in this class is that you read your email before coming to class. Please remember that federal privacy law (FERPA) prohibits discussion of grades via email.

Grading

Your grade in this class will be based on performance from lab exercises, a practical exam, your final projects, and course participation.

Dates and times of examinations are listed on the class schedule at the end of the syllabus.

A. Lab Reports (Eight Total)   **6% each, 48% total**

B. Practical Exam   **7%**

C. Final Project   **35%**

1. Project Outline and Analytical Proposal   10%
2. Final Poster and Data Sharing   15%
3. Final Exam   10%

D. Course Participation   **10%**

This course is out of 333 points, and course percentages represent the (rounded) point values each section corresponds to of that total. (One lab, 6%, is worth 20 points, for example).

Grading Schema (500 level):
A: Above 93.0%
A-: 92.9% to 90.0%
B+: 89.9% to 87.0%   **Grading Schema (600 level):**
B: 86.9% to 83.0%   **A: Above 93.0%**
B-: 82.9% to 80.0%   **A-: 92.9% to 90.0%**
C+: 79.9% to 77.0%   **B+: 89.9% to 87.0%**
C: 76.9% to 73.0%   **B: 86.9% to 83.0%**
C-: 72.9% to 70.0%   **B-: 82.9% to 80.0%**
D+: 69.9% to 67.0%   **C+: 79.9% to 77.0%**
D: 66.9% to 60.0%   **C: 76.9% to 70.0%**
F: Below 60.0%   **F: Below 70.0%**

<u>Late policy</u>: This course is structured sequentially, not temporally. Meaning that there is no set schedule when things are due. The course will progress synchronously per the calendar at the end of the syllabus – if you need deadlines to keep your motivated, use those as a guide. This means there are not late penalties in this course. It is my expectation that you will complete coursework in sequence, with a regular pace and rhythm, and not try to do it all in the last week of the semester. That will not turn out well for you.

Course incompletes will be handled on a case by case basis and will only be accepted with a clearly communicated plan for course completion.

Labs

Labs are an important and integral portion of the course. GIS requires both technical work and conceptual knowledge to function. Many of these labs will take longer than the three-hour session for which we are scheduled.

Expect to work on labs and your project outside of schedule class time!

Please use and schedule your time for the labs accordingly. While TAs have office hours as well to assist you, these are not meant as personal, one on one tutoring time. Please use your time to your advantage.

In past years, failure to complete labs in a structured manner has been the primary cause for poor performance in this class. Please share any issues with lab completion with instructor before questions, issues, and struggles become problems.

Learning Objectives

The content of this GIS course is aligned with the Learning Objectives set forth in the *Geographic Information Science & Technology Body of Knowledge.* This is a comprehensive document that *"specifies what aspiring geospatial professionals need to know and be able to do."* It was developed by the University Consortium for Geographic Information Science (UCGIS). For more information visit http://www.ucgis.org/priorities/education/modelcurriculaproject.asp.

In general, it is my expectation that at the end of the class you will be able to:

1) Explain the basic properties of vector and raster GIS data models and list examples of each type in common use in the GIS community;

2) Define what is meant by a map projection, describe why they are important in GIS and be able to select an appropriate map projection depending on need;

3) Apply appropriate basic GIS analytical techniques within industry-standard GIS software to solve spatial problems;

4) Prepare maps that utilize basic cartographic principles to effectively convey the results of GIS analysis to varied audiences; and

5) Begin demonstrating characteristics of professional practice in GIS including troubleshooting, debugging, spatial and computational thinking, and self-directed learning.

Academic Dishonesty

The UMass Amherst Academic Regulations (p. 7) and Code of Student Conduct (p. 28) define plagiarism as: "Knowingly representing the words or ideas of another as one's own work in any academic exercise. This includes submitting without citation, in whole or in part, pre-written term papers of another or the research of another, including but not limited to commercial vendors who sell or distribute such materials."

The Writing Program has prepared a more-detailed explanation of plagiarism: http://www.umass.edu/writingprogram/geninfo/plagiarism.html

The Code of Student Conduct (http://www.umass.edu/dean_students/codeofconduct/) states: "The integrity of the academic enterprise of any institution of higher education requires honesty in scholarship and research. Academic honesty is therefore required of all students at the University of Massachusetts Amherst. Academic dishonesty is prohibited in all programs of the University. Sanctions may be imposed on any student who has committed an act of academic dishonesty" (p. 28)."

The Code also outlines the process by which student rights are protected in academic honesty cases, which are handled through the Ombuds Office.

UMass' Academic Honesty Statement:

(http://www.umass.edu/registrar/media/academicregs.pdf**):**

"Intellectual honesty requires that students demonstrate their own learning during examinations and other academic exercises, and that other sources of information or knowledge be appropriately credited. Scholarship depends upon the reliability of information and reference in the work of others. Student work at the University may be analyzed for originality of content. Such analysis may be done electronically or by other means. Student work may also be included in a database for the purpose of checking for possible plagiarized content in future student submissions. No form of cheating, plagiarism, fabrication, or facilitating dishonesty will be condoned in the University community."

In short, I expect that in this course you will not lie, cheat or steal, or tolerate those that do.

Student Support

The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities.

Disability Services • 161 Whitmore • <PHONE> • www.umass.edu/disability

The University of Massachusetts Amherst is committed to providing an equal educational opportunity for all students. If you have a documented physical, psychological, or learning disability on file with Disability Services (DS), Learning Disabilities Support Services (LDSS), or Psychological Disabilities Services (PDS), you may be eligible for reasonable academic accommodations to help you succeed in this course. If you have a documented disability that requires an accommodation, please notify me as soon as you are able so we can plan the best learning environment. For more information, consult the Disability Services website at http://www.umass.edu/disability/.

There are numerous other student support organizations on campus including:

Learning Resource Center • Library 10th floor • <PHONE> • www.umass.edu/lrc

Offering peer-tutors trained to assist you in meeting academic challenges and achieving academic success.

Writing Center • Library Lower Level • <PHONE> • www.umass.edu/writingcenter

Knowledgeable tutors are available to work with you on your writing. Tutors offer 45-minute consultations where they ask questions about the assignment, offer tips and advice.

Resource Librarians • Library Main Level • <PHONE> • www.library.umass.edu/liaison

Subject-specialist librarians are available to help find the right sources, databases and strategies for your research needs.

University Ombuds Office • 823 Campus Center • <PHONE> • www.umass.edu/ombuds

Resources and confidential advice related to the university's academic honesty policy and procedures.

Center for Counseling and Psychological Health • 127 Hills North • \<PHONE\> • https://www.umass.edu/counseling/

Provide short term individual, couple's and group psychotherapy; psychiatric medication consultation and treatment; psychological assessment (testing); behavioral medicine; and crisis intervention services.

Please do not hesitate to ask me if you have any concerns or if you are having any trouble in the class.

Please see the course schedule on the next page.

Course Schedule (subject to adjustment)

Date/Topic	Important Dates; Recommended Due Dates
Thursday 9/8 and Friday 9/9 LECTURE: Course overview, So, what is this GIS thing, anyway? LAB INTRO: GIS concepts **LAB 1**: Technical Foundations	**N/A**
Thursday 9/15 and Friday 9/16 LECTURE: Maps, mapping, mappers LAB INTRO: Cartographic design **LAB 2**: ArcGIS Foundations	**Lab 1: Technical Foundations <u>due</u>.** Upload assignment by the beginning of your lab period.
Thursday 9/22 and Friday 9/23 LECTURE: Data formats, querying, shapefile basics LAB INTRO: Thinking with data **LAB 3**: Joins, Relates, and Data Synthesis	**Lab 2: ArcGIS Foundations <u>due</u>.** Upload assignment by the beginning of your lab period.
Thursday 9/29 and Friday 9/30 LECTURE: Vector data analysis LAB INTRO: GIS data structures **LAB 4**: Vector Analysis	**Lab 3: Joins, Relates, and Data Synthesis.** Upload assignment by the beginning of your lab period.
Thursday 10/6 and Friday 10/7 LECTURE: Data creation and editing LAB INTRO: Finding yourself (spatially) **Lab 5**: GPS Scavenger Hunt	**Lab 4: Vector Analysis <u>due</u>.** Upload assignment by the beginning of your lab period.
Thursday 10/13 and Friday 10/14 LECTURE: Practical exam Q&A **Lab Practical Exam**	**Time to complete your practical exam will be provided during lab this week. You will not be allowed to attempt the practical until you complete the first four labs of the semester.**
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Date/Topic	Assignments Due
Thursday 10/20 and Friday 10/21 LECTURE: Projections Lab Intro: More projections	**Lab 5: GPS Scavenger Hunt <u>due</u>.** Upload assignment by the beginning of your lab period.
LAB 6: Projections	
Thursday 10/27 and Friday 10/28 LECTURE: Ways of thinking	N/A
Work Day	
Thursday 11/3 and Friday 11/4 LECTURE: Remote sensing and GIS	**Lab 6: Projections <u>due</u>**. Upload assignment by the beginning of your lab period.
LAB INTRO: More pixels **LAB 7:** Raster Analysis	
Thursday 11/10 and Tuesday 11/22 NO CLASS VETERANS DAY (11/11) ASYNCH LECTURE: Data modeling	N/A
Work Day	
Friday 11/17 and Tuesday 11/18 LECTURE: Geostatistics	**Methods outline & study area map <u>due</u>.** Upload methods outline by 11:59p, 11/22.
Lab 8: Geostatistics	
NO CLASS 11/24 and 11/25: Thanksgiving Recess	
Thursday 12/1 and Friday 12/2 LECTURE: Computational thinking	**Lab 7: Raster Analysis <u>due</u>.** Upload lab assignment by the beginning of your lab period.
LAB INTRO: Poster layouts **Work Day**	
Thursday 12/8 and Friday 12/9 LECTURE: GIS futures	N/A
Work Day	
Tuesday 12/13 (Reading Day) **POSTER CONFERENCE** TIME TBD LOCATION TBD	**Lab 8: Geostatistics <u>due</u>.** Upload assignment by 5pm on poster conference day. Don't forget to upload your final posters in PDF format to Moodle! Upload poster by 5pm on poster conference day.

I reserve the right to make changes to the course schedule

Lab Reports

Lab data and tutorials will be available on our Moodle.

Each lab assignment is different. All labs require a map and/or answers to questions and/or description of methods. Please refer to the individual lab assignments for specific instructions.

Please upload labs to Moodle as PDF files. File formats other than pdfs can be corrupted or not contain necessary components for a grade.

You may work with others on the lab assignments; however, the product you hand in must be your own work. Duplicated/copied assignments will receive a 0.

Practical Exam

The practical exams will test how well you can solve problems in GIS based on skills learned in the first four labs and in class, plus your general problem-solving capabilities.

Final Project

The final project is an independent research project visualizing and analyzing spatial data. With the support of ideas from faculty and community members across New England, you will be tasked with a GIS problem to solve or project to create, as well as finding GIS data needed to answer that question, and conducting a GIS analysis of those data. To formulate a research question, think back to other classes you've taken for inspiration, browse for ideas online, and talk to faculty and graduate students for ideas. If you wish, you may work with a partner on the final project provided there is a clear division of labor based on consultation with me. Everyone will be individually responsible for their own methodological outline and final poster.

You will have _four_ lab periods to work on your final projects in the middle and end of the semester. Completing the project will also require substantial time outside of scheduled labs, so plan ahead!

One last page… next!

The final project will be graded in two parts:

1.   Methodological outline and study area map
An outline of your project topic and the methods you plan to use to tackle your GIS research question. The outline must include:
- A 250-word description of your planned research project.
- A table of the datasets that you will use to complete your project, a short description of the data, and the data source(s).
- An outline of the mapping and/or analytical steps required to complete your research project.
- A map of your study area using appropriate cartographic techniques – invest the time making a professional map that you can reuse on your final poster.

2.   Final poster presentation
You will be responsible for presenting your research to faculty, students and friends in the form of a research poster. This poster will be presented at a GIS poster conference on the 12/9 reading day. I will go over the poster layout during lab.

More details on all of these components will be available on Moodle as the semester progresses.

Final Exam

The final exam will be 'take-home' format, meaning we will not sit for a formal final during finals week. The final itself will consist of a small set of theoretical problems which will test your ability to deconstruct spatial problems and apply principles of spatial analysis as discussed in this course. You will have the entirety of finals week to complete this assignment, and it will be delivered via Moodle.

Class Participation

Throughout the semester, we will have pre- and post-tests surrounding lab assignments. While you will receive a score on these for your own reference, simply completing them is all that is necessary for a grade. We will also have weekly check in surveys to see how you are feeling week to week. Your participation grade is a combination of your completion of these efforts.