

University of Texas at El Paso
School of Sciences
Department of Earth, Environmental and Resource Sciences

GEOL4385 INTRODUCTION TO GIS FALL 2023 Syllabus

Instructor Information

Instructors: Dr(s). Laura Alvarez and Hernan Moreno
Classroom: Prospect Hall Room 300 Segal Lab (see Lab rules on the last page)
Meetings: **T** (10:30 AM – 12:20 PM) **R** (10:30 AM – 1:20 PM)
Office: Geologic Sciences Building Suite 321 A
E-mail Professor: alvarez@utep.edu
Office Hours- Prof. Alvarez: **R** 1:30 PM – 2:30 PM @ via zoom
Teaching Assistant: Santiago Hoyos
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Office Hours TA: **T** (12:20 PM – 1:30 PM) **W** (1:00 PM – 3:00 PM) @SEGA
Learning Management Site: Blackboard

Course Description

This course is an introduction to Geographic Information Science and Technology (GIST). Geographic Information Systems (GIS) are tools for integrating and analyzing spatial data to visualize relationships, seek explanations, and develop solutions to real-world problems. The foundations and theory of GIS will be emphasized in relation to its applicability and use in the sciences and other fields. Students will demonstrate knowledge about the history of GIS, acquisition of data, data quality and ethics, data classification, mapping, interpretation and analysis, applications of GIS, GIS data models, data visualization, and basic interpolation, among others. The course includes a lab component in which all students will have access to computers with the Environmental Systems Research Institute (ESRI) ArcGIS Pro Desktop software. In the lab, students will perform a variety of problem-solving tasks that connect with concepts covered in the lecture. Other key skills practiced in lectures and/or labs include connecting hands-on GIS work to GIS theory, written communication, planning and organization, and interpersonal communication.

Learning Outcomes/Course Objectives

- Students successfully completing this introductory GIS course will be able to:
- Independently acquire, create, and edit spatial data for use with GIS.
 - Understand the fundamentals of GIS data models and data structures and be able to use that knowledge to select the best approach for solving particular geographic problems.
 - Have sufficient technical skills to apply GIS to solutions for various geographic problems.
 - Be able to successfully organize, manage, and present results in the form of a GIS project.

- Have sufficient knowledge to take further GIS courses offered by the GIS certificate program.

Course Materials

I suggest students get the textbook listed below:

The class materials, including lecture presentations and laboratory handouts, can be found on the blackboard. Other readings will be provided through Blackboard.

Mastering ArcGIS Pro, 2nd Edition ISBN10: 1264091206 | ISBN13: 9781264091201 By Maribeth Price © 2023

Additional Textbook References (not required)

- Longley, P., Goodchild, M., Maguire, D., Rhind, D. (2015). *Geographic Information Science and Systems*. Wiley. 477 pp.
- Post, C., Esswein, S., Mikhailova, E., Ritter, B., 2018. *GIS Exercises for Natural Resource Management. Fifth Edition*.
- Bolstad, 2019. *GIS Fundamentals. 6th Edition. XanEdu Editorial*.
- Chang, K-S, 2016. *Introduction to Geographic Information Systems. 9th edition. McGraw Hill, 444 pp.*

Data Handling and Lab Submission

- Students are encouraged to complete their laboratory assignments in the SEGA Lab, where everybody will have extra class, full access to the room (using the last six digits of your ID number, i.e., after the 80), computers, and licensed ArcGIS Pro software. Students can also use provisional data storage in the machines they select to work or network folders.
- It is also recommended to save your progress into a portable USB drive as machines get wiped out regularly.
- The Lab submission will be (1) a PDF document with answers and (2) a .zip file with the output files produced during the Lab exercise. The lab submissions will occur through Blackboard according to the deadlines indicated in the course schedule.

Course Structure

The format of the course will be lectures, short in-class assignments for participation, final exam and lab sessions. Students will gain hands-on experience using ESRI ArcGIS Pro software, one of the most widely used commercial GIS packages. However, knowledge gained during the theoretical and practical sessions will easily be transferable to other platforms like QGIS or GRASS.

Lectures: The lecture section will not be limited to instructor-led discussions. To help students gain a better insight into GIS and GIST, the lecture session will also include additional time for application demonstrations, in-class exercises, and more. The instructor expects students to attend lectures and only work on course-related materials during that time.

Lab Exercises: The GIS lab is an important component of GIS training that provides students with hands-on experience in GIS to consolidate their understanding of basic GIS theoretical concepts and analytical techniques. ESRI's ArcGIS Pro and ArcGIS Online are the primary software tools to implement various spatial data analysis techniques and methods. A total of ten (10) mandatory labs and one (1) bonus (extra credit, worth 5%) lab will be completed, and additional details will be provided during the first meetings. Most lab work coincides with skills and concepts learned in lectures and readings. It is, therefore, vital for students to attend class so that they understand assigned exercises and complete them on time. You will have time to complete the lab assignments during scheduled class meetings, but a significant amount of time will be required outside class. Lab assignments must be turned in via Blackboard by the due date specified in the lab document, and the submitted assignment must be your own work. Work must be submitted in the form of a PDF attachment under the "Lab and Project Submissions" module of Blackboard. You should use your class time devoted to GIS lab activities wisely and not expect to leave class early. You are welcome to ask the Instructor or course Teaching Assistant (TA) for help outside of class if you are working while in class. Do not expect to miss lab time and to get extra outside class help to compensate.

Final Exam: There will be one in-class final exam. The exam will be based on short essays. Questions will be based on the lectures. There will be no final exam during finals week.

Due Dates

Lab Exercises: In this course, there is an absolute due date for completing each lab assignment, which will be indicated on the lab handouts. The reason for this is that each lab conceptually builds on previous labs, so it is important that students do not fall behind schedule. If you do, you may find it hard to catch up. Labs must be submitted on time and to the correct blackboard assignment location to be considered for grading. Note that I will not make any exceptions to this policy for any student unless there is a valid excused absence (the reader is referred to page 5 for more information on excused absences). Please plan to use the course schedule at the end of this syllabus and the deadlines as posted long-term on Blackboard.

Computer Skills and GIS Software

Instruction in using ArcGIS Pro and ArcGIS Online software will be provided during the lab sessions, but students taking this class are expected to have basic competence in the Windows operating system as well as Microsoft Excel, PowerPoint, Word, and exporting screenshots from Windows. Students should take the initiative to learn additional details about these software applications so that they can solve problems as they arise. If you need help with computer skills, you should seek assistance at the Liberal Arts Center for Instructional Technology (LACIT) (Liberal Arts Building, Room 405, Tel. (915) 747-5375. LACIT staff provides workshops open

to all students on Fridays in Room 405 at the Liberal Arts Building. To attend, just bring your current UTEP ID. If you plan to attend, you should call LACIT beforehand to receive confirmation.

Rules and Policies

Notes and Lectures: Any notes, labs, or lecture materials are for personal use only, and their sale or distribution to people outside the class is not permitted.

Blackboard Course Management System and Email Communication:

This class uses the Blackboard learning platform that you can access through your my.utep.edu portal (use your e-mail address and password to sign in). For this class, all communication will be via the regular UTEP email system, so avoid using the Blackboard email function. As a requirement of this class, you must regularly check your UTEP email for posts that include announcements and personal messages to students. You are responsible for reading all your emails, so not having seen or read an email containing important course-related announcements will not be an acceptable excuse for failure to complete assignments on time unless there is a verifiable technical issue. Please do not use your private email addresses for course-related communication.

Late and Missing Work and Extra Credit: Late laboratory work submissions are accepted, but 20% of the total grade will be deducted each day after an assignment deadline. Make-up assignments or late submissions can only be allowed in the event of a documented valid excused absence (see next section for details on excused absences). Foreseeable excused absences, such as participation in university-sanctioned athletic or academic events, require documentation and notifying the Instructor at least one week in advance. In the case of foreseeable absences, you must turn in work early rather than late. In each of these situations, the student must communicate and keep the instructor informed. One extra credit assignment (Lab#11) will be available at the end of all labs (for an additional 5% grade). No final grade adjustments will be made other than the opportunity to submit the optional Lab #11 by its deadline (see course schedule).

Excused Absences And/Or Course Drop Policy

See Policies and Regulations in the UTEP Undergraduate Catalog for a list of excuse absences (<http://catalog.utep.edu/policies-regulations/attendance-grading/>).

I will not drop you from the course. However, if you feel that you are unable to complete the course successfully, please let me know and then contact the [Registrar's Office](#) to initiate the drop process. If you do not, you are at risk of receiving an "F" for the course.

Academic Honesty: Academic honesty is fundamental to the activities and principles of the University. Students are encouraged to share ideas, but you must do your own work. For example, cheating, plagiarism, and collusion will not be tolerated. Academic dishonesty has grave consequences that range from probation, expulsion, and failing the course. If you are found to be cheating, plagiarizing, or colluding, you will be subject to disciplinary action per UTEP catalog policy. Refer to <https://www.utep.edu/student-affairs/osccr/index.html> for further information.

Cell Phone Policy: Cell phones are not permitted for use at any time during this class. Taking calls, texting, taking pictures, or recording videos during class is strictly prohibited. Any attempt to use a cell phone during class or lab will be seen as an attempt to cheat and subject to the policies defined in the UTEP Academic Misconduct Code.

Students with Disabilities: UTEP is committed to equity in the provision of educational services to students with disabilities. If you have (or suspect you have) a disability that requires accommodations or may affect your performance in this course, tell the professor so that I can work with the Center for Accommodations and Support Services (CASS) to meet your needs. You can contact CASS at (915) 747-5148, or by email to cass@utep.edu, or visit their office located in UTEP Union East, Room 106. For additional information, please visit the CASS website at www.sa.utep.edu/cass.

Help with Writing: The University Writing Center (UWC) (Library Building, 2nd [ground] floor, Room 227 [adjacent to the Collaborative Learning Center], Tel. 747-5112) provides walk-in assistance with writing to all UTEP students at no cost. If you struggle with writing, the tutors at the UWC can help you! Check the website – <http://uwc.utep.edu/> for a tutoring schedule.

Grading

| Description | No | Value |
|------------------------------------|----|--|
| Laboratory Assignments | 70 | 7 % each for 70% total (Lab #11 is optional submission for an additional 5% extra-credit) |
| Final Exam | 1 | 20% |
| Class Attendance and Participation | | 10% (1% attendance each lab) |
| Extra credit | 1 | 5 %. Lab #11 – Chapter 8. |

Final grade table

Percent grades will be rounded to one decimal place and letter grades will have the following equivalence. Note, beyond this table, we will not round grades anymore for any reason so please do not ask. It is not fair to students who legitimately earned the same grade. Please use the extra-credit Lab#11 to improve your grades:

| Letter Grade | Grade Point | Percentage |
|--------------|-------------|--------------|
| A | 4.0 | 89.5 to 100 |
| B | 3.3 | 79.5 to 89.4 |
| C | 2.0 | 69.5 to 79.4 |
| D | 1.0 | 59.5 to 69.4 |
| F | 0.0 | 59.4 to 0 |

Course Resources: Where you can go for assistance

UTEP provides a variety of student services and support:
Technology Resources

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- [Help Desk](#): Students experiencing technological challenges (email, Blackboard, software, etc.) can submit a ticket to the UTEP Helpdesk for assistance. Contact the Helpdesk via phone, email, chat, website, or in person if on campus.

Academic Resources

- [UTEP Library](#): Access a wide range of resources including online full-text access to thousands of journals and eBooks plus reference service and librarian assistance for enrolled students.
- [University Writing Center \(UWC\)](#): Submit papers here for assistance with writing style and formatting, ask a tutor for help and explore other writing resources.
- [Math Tutoring Center \(MaRCS\)](#): Ask a tutor for help and explore other available math resources.
- [History Tutoring Center \(HTC\)](#): Receive assistance with writing history papers, get help from a tutor and explore other history resources.
- [RefWorks](#): A bibliographic citation tool; check out the RefWorks tutorial and Fact Sheet and Quick-Start Guide.

Individual Resources

- [Military Student Success Center](#): Assists personnel in any branch of service to reach their educational goals.
- [Counseling and Psychological Services](#): Provides a variety of counseling services, including individual, couples, and group sessions as well as career and disability assessments.

Tentative Schedule (subject to slight changes) This schedule is intended to keep you on pace to finish by the due dates. Due Dates will be noted on each assignment handout. Try not to fall behind this schedule; if you do, it may be difficult to catch up! Additionally, if you keep up with the assignments, you'll have more time to focus on the final project at the end of the semester, or any other classes you may have.

| Week | Date | Topic | Reading | Assignment/Deadlines |
|------|------------|---|-----------------|----------------------|
| 1 | 29 Aug (T) | Lecture #1: Introduction, syllabus and logistics. What is GIS? History, scope, trends, professional use, project management, Web GIS. Rules of Long-Term Project. | Intro. Ch. 1 | |
| | 31 Aug (R) | Lab # 0: Setting Up ArcGIS Pro & Lab #1 What is GIS? | Ch. 1 | |
| 2 | 5 Sep (T) | Lecture #1: What is GIS? Map representation, scale, data sources, data quality, <i>ArcGIS overview, project, interface, tools and geoprocessing.</i> | Ch. 1 | |

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| Week | Date | Topic | Reading | Assignment/ Deadlines |
|------|------------|--|---------|---|
| | 7 Sep (R) | Lab #1: What is GIS? Exploring on ArcGIS Pro project, Navigating 2D and 3D maps, using the help, managing windows, exploring project resources, setting map symbols, working with local GIS data, using ArcGIS online content, using geoprocessing. | Ch. 1 | |
| 3 | 12 Sep (T) | Lecture #2: Mapping GIS data. Choosing symbols for maps, types of data and types of maps, displaying rasters, classifying numerical data, <i>layers, styles.</i> | Ch. 2 | |
| | 14 Sep (R) | Lab #2: Mapping GIS data. Setting basic symbols, labeling features, creating maps from attributes for points, editing legend details, creating maps for attributes of polygons, classifying data, displaying thematic rasters. | Ch. 2 | Lab 1 due by Wed (13 Sep at 5:00 PM MT) |
| 4 | 19 Sep (T) | Lecture #3: Presenting GIS data. Determine map objective, select the data, arrange the map elements, symbolize the data, review the draft, edit and improve, <i>maps in ArcGIS, assigning map scales, setting up scale bars, labeling, text and annotation.</i> | Ch. 3 | |
| | 21 Sep (R) | Lab #3: Presenting GIS data. Setting up the map page, creating a location map, using graphic text on layouts, working with dynamic labels, adding a legend to the map, placing a scale bar on the map, adding more map elements, reviewing and editing the layout, exporting a layout. | Ch. 3 | Lab 2 due by Wed (20 Sep at 5:00 PM MT) |
| 5 | 26 Sep (T) | Lecture #4: Coordinate Systems. Standard coordinate systems, geographic coordinate systems, map projections, choosing projections, impact of coordinate systems, <i>on-the-fly projection, labeling coordinate systems, projecting data.</i> | Ch. 4 | |
| | 28 Sep (R) | Lab #4: Coordinate Systems. Map coordinate systems, understanding map distortion, converting coordinate systems when compiling data, understanding transformations, troubleshooting projection problems, creating a custom coordinate system. | Ch. 4 | Lab 3 due by Wed (27 Sep at 5:00 PM MT) |
| 6 | 3 Oct (T) | Lecture #5: Managing Vector Data. The vector model, modeling feature behavior with topology, characteristics of GIS data, organizing data files, understanding file locks, finding data for a project, compiling data, modifying and managing data, documenting data; <i>Discrete data formats, projects and shared data, environmental settings.</i> | Ch. 5 | |

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| Week | Date | Topic | Reading | Assignment/ Deadlines |
|------|------------|--|---------|---|
| | 5 Oct (R) | Lab #5: Managing Vector Data. Understanding types of GIS data, importing and exporting data, using environment settings, understanding layers, updating metadata, clipping data, exporting from the contents pane, using data from ArcGIS online, getting data from the internet, adding data from tables, appending feature classes. | Ch. 5 | Lab 4 due by Wed (4 Oct at 5:00 PM MT) |
| 7 | 10 Oct (T) | Lecture #6: Managing Raster Data. The raster model, raster resolution, storing rasters, raster coordinate systems, 3D Data; <i>Storing rasters.</i> | Ch. 6 | |
| | 12 Oct (R) | Lab #6: Managing Raster Data. Raster format and function, 3D data, image and map services, getting data from the national map, working with elevation data, georeferencing a raster, visualizing space-time data. | Ch. 6 | Lab 5 due by Wed (11 Oct at 5:00 PM MT) |
| 8 | 17 Oct (T) | Lecture #7: Attribute Data. Overview of tables, database management systems, joining and relating tables, statistics on tables, field types; <i>tables in ArcGIS, editing and calculating fields, importing tables.</i> | Ch. 7 | |
| | 19 Oct (R) | Lab #6_v2: Managing Raster Data. Raster format and function, 3D data, image and map services, getting data from the national map, working with elevation data, georeferencing a raster, visualizing space-time data. | Ch. 6 | |
| 9 | 24 Oct (T) | Lecture #8: Queries. What queries do, attribute queries, spatial queries, extraction functions; <i>Processing layers with selections, interactive selection, making selections, choosing the selection type, managing results from queries.</i> | Ch. 9 | Lab 6 due by Mon (23 Oct at 5:00 PM MT) |
| | 26 Oct (R) | Lab #7_v1: Attribute Data. Viewing tables, using queries and statistics on tables, using the fields view, relating tables, editing values in tables, creating domains, calculating fields in tables, exploring data with charts, working with excel data | Ch. 7 | |
| 10 | 31 Oct (T) | Lecture #9: Joins and Overlay. What is a spatial join, spatial join examples, cardinality in spatial joints, classic overlay, data quality factors in spatial analysis; <i>Setting up a spatial join.</i> | Ch. 10 | |
| | 2 Nov (R) | Lab #7_v2: Attribute Data. Viewing tables, using queries and statistics on tables, using the fields view, relating tables, editing values in tables, creating domains, calculating fields in tables, exploring data with charts, working with excel data | Ch. 7 | |
| 11 | 7 Nov (T) | Lecture #10: Raster Analysis. Raster data, raster analysis; <i>Using spatial analyst.</i> | Ch. 11 | |

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| Week | Date | Topic | Reading | Assignment/ Deadlines |
|------|------------|---|----------|--|
| | 9 Nov (R) | Lab #8_v1: Queries. Using interactive selection, selecting by attributes, selecting by location, combining queries, definition queries, exporting data, spatial analysis using queries. | Ch. 8 | Lab 7 due by Wed (8 Nov at 5:00 PM MT) |
| 12 | 14 Nov (T) | Final Exam | Ch. 1-11 | |
| | 16 Nov (R) | Lab #8_v2: Queries. Using interactive selection, selecting by attributes, selecting by location, combining queries, definition queries, exporting data, spatial analysis using queries. | Ch. 9 | |
| 13 | 21 Nov (T) | Lab #9_v1: Joins and Overlay. Spatial joins, managing cardinality options, merged point to polygon joins, distance joins, using intersect for habitat analysis, overlay of lines in polygons, combining overlay with buffers, relationships with union, working with slivers and tolerances. | Ch. 10 | Lab 8 due by Mon (20 Nov at 5:00 PM MT) |
| | 23 Nov (R) | Thanksgiving Holiday University Closed | Ch. 10 | |
| 14 | 28 Nov (T) | Lab #9_v1: Joins and Overlay. Spatial joins, managing cardinality options, merged point to polygon joins, distance joins, using intersect for habitat analysis, overlay of lines in polygons, combining overlay with buffers, relationships with union, working with slivers and tolerances. | Ch. 11 | |
| | 30 Nov (R) | Lab #10_v1: Raster Analysis. Performing a boolean overlay, distance functions and buffers, topographic functions, neighborhood functions, converting rasters to features, interpolation and zonal statistics. | Ch. 11 | Lab 9 due by Wed (29 Nov at 5:00 PM MT) |
| 15 | 5 Dec (T) | Lab #10_v2: Raster Analysis. Performing a boolean overlay, distance functions and buffers, topographic functions, neighborhood functions, converting rasters to features, interpolation and zonal statistics. | Ch. 11 | |
| | 7 Dec (R) | | Ch. 11 | Lab 10 due by Wed (6 Dec at 5:00 PM MT) Extra Credit: Lab 11 - Chapter 8 due by Wed (6 Dec at 5:00 PM MT) |