# GEOG 4550 – Advanced GIS (online)

Spring 2026

Dr. Rajshree Rege
Lecturer,
Department of Geography and the Environment
University of North Texas
E-mail: Rajshree.Rege@unt.edu
Office hours: Monday, Wednesday 2-3 pm (ENV 210B), or by appointment (Zoom)

## Prerequisite

GEOG 3500: Introduction to GIS (or consent of department)

## Objectives

This course is built on GEOG 3500 "Introduction to GIS". Some advanced GIS topics in spatial analysis will be introduced through a combination of lectures, hands-on exercises, homework, and an individual project. Upon successful completion of the course, students should be able to: (1) conduct visualization, conversion, and analysis of categorical and continuous raster data; (2) manipulate raster data through local, focal, and zonal statistics; and (3) apply spatial analysis and 3D analysis methods to solve real-world problems.

## Reference:

(1) Esri, ArcGIS Spatial Analyst and ArcGIS 3D Analyst.
(2) Michael J. de Smith, Michael F. Goodchild, and Paul A. Longley, Geospatial Analysis, 6th Edition, 2021 update.

## Software:

ArcGIS Pro with Spatial Analyst extension. You can install ArcGIS Pro on your personal computer (see installation instructions on Canvas), use UNT CSAM1 and CSAM2 labs, or access UNT CSAM1 and CSAM2 labs remotely.

## Labs, Homework, and Quizzes

Labs and homework should be submitted to Canvas. Late submissions will be marked down 10% each day. The course has four open-book quizzes. Each quiz has 10 questions (True/False and multiple choice).

## Course Project

A course project involving raster data analysis is an important part of the course. Students are expected to design a project and implement their understanding of various GIS tools to analyze raster data. At the end students need to compile their work in a report and submit it through canvas. Please read through the related module on canvas for details. Start early on, as it takes several weeks to complete the project.

## Grading Structure

| | |
|---|---|
| Labs (30 labs) | 30% |
| Three homework assignments | 30% |
| Four open book quizzes (10 questions per quiz) | 20% |
| Course Project | 20% |
| Total | 100% |
| 90-100: A; 80-89: B; 70-79: C; 60-69: D; 0-59: F. A minimum grade of "B" is required for the GIS Certificate. | |

## Tentative week by week Schedule:

| Week | Dates | Module | Assignment |
|---|---|---|---|
| 1 | 1/12 | **1. Review of GIS Basics (1)**<br>1.1 Course introduction<br>1.2 Course project | Review "Introduction to GIS" |
| 2 | 1/19 | **2. Review of GIS Basics (2)**<br>2.1 Review of basic GIS concepts<br>2.2 Vector data model<br>2.3 Feature selection 2.4 Attribute tables<br>2.5 Clip, intersect, union, and buffer | Lab 2.1 Selecting features (1 point)<br>Lab 2.2 Working with tables (1 point) Lab 2.3 Creating buffers (1 point) |
| 3 | 1/26 | **3. Review of GIS Basics (3)**<br>3.1 Merge, dissolve, and spatial join<br>3.2 Feature editing<br>3.3 Projection<br>3.4 Geocoding | Lab 3.1 Creating points and lines (1 point)<br>Lab 3.2 Creating polygons (1 point)<br>Lab 3.3 Geocoding (1 point) |
| 4 | 2/2 | **4. Model Builder** | Lab 4.1 Model Builder (1 point)<br>**Quiz 1 for Modules 1 – 3 (5 points)** |
| 5 | 2/9 | **5. Basics of Raster Data**<br>5.1 Raster data model<br>5.2 Categorical rasters<br>5.3 Continuous rasters<br>5.4 Digital images | Lab 5.1 NLCD data (1 point)<br>Lab 5.2 Continuous rasters (1) (1 point) |
| 6 | 2/16 | 5.5 Displaying raster values.<br>5.6 Raster formats<br>5.7 Raster naming conventions<br>5.8 Raster vs. vector | Lab 5.3 Continuous rasters (2) (1 point)<br>Lab 5.4 Digital images (1 point) |
| 7 | 2/23 | **6. Raster Conversion**<br>6.1 Environment settings<br>6.2 Vector to raster conversion<br>6.3 Raster to vector conversion<br>6.4 Raster to ASCII conversion<br>6.5 Raster to float conversion<br>6.6 Raster layer to KML/KMZ conversion<br>6.7 Raster to raster conversion | Lab 6.1 Vector to raster conversion (1 point)<br>Lab 6.2 Raster layer to KML/KMZ (1 point)<br>Lab 6.3 High-resolution image data (1 point) |
| 8 | 3/2 | **7. Raster Extraction**<br>7.1 Extraction by attributes | Lab 7.1 Raster extraction (1) (1 point)<br>Lab 7.2 Raster extraction (2) (1 point) |

| | | | |
|---|---|---|---|
| | | 7.2 Extraction by mask<br>7.3 Extraction by point<br>7.4 Extract values to points<br>7.5 Extract multi values to points<br>7.6 Sample | Lab 7.3 Raster extraction (3) (1 point) |
| **9** | **3/9** | **Spring Break (no class)** | |
| 10 | 3/16 | **8. Local Analysis**<br>8.1 Frequency<br>8.2 Highest position<br>8.3 Lowest position<br>8.4 Popularity<br>8.5 Rank<br>8.6 Cell statistics | Lab 8.1 Local analysis (1 point)<br>Lab 8.2 Cell statistics (1 point)<br>**Quiz 2 for Modules 5 – 7 (5 points)**<br>**Homework 1 (due 4/5)** |
| 11 | 3/23 | **9. Focal Analysis**<br>9.1 Definition of focal analysis<br>9.2 Shape and size of neighborhood 9.3 Focal statistics 9.4 Point statistics 9.5 Line statistics | Lab 9.1 Focal statistics (1 point)<br>Lab 9.2 Point statistics (1 point)<br>Lab 9.3 Analysis of tuberculosis data (1 point) |
| 12 | 3/30 | **10. Zonal Analysis**<br>10.1 Definition of a zone<br>10.2 Zonal statistics<br>10.3 Zonal statistics as table<br>10.4 Zonal geometry<br>10.5 Zonal geometry as table<br>10.6 Zonal histogram | Lab 10.1 Zonal statistics (1) (1 point) Lab 10.2 Zonal statistics (2) (1 point)<br>**Course Project (due 5/9)**<br>**Homework 2 (due 4/16)** |
| 13 | 4/6 | **11. Map Algebra and Raster Calculator**<br>11.1 Map algebra 11.2 Raster calculator<br>11.3 Weighted overlay 11.4 Weighted sum | Lab 11.1 Raster calculator (1) (1 point)<br>Lab 11.2 Raster calculator (2) (1 point)<br>**Quiz 3 for Modules 8 – 10 (5 points)** |
| 14 | 4/13 | **12**. **Distance Transformation**<br>12.1 Distance accumulation<br>12.2 Distance allocation<br>12.3 Ordinary Voronoi diagrams<br>12.4 Weighted Voronoi diagrams | Lab 12.1 Distance/allocation rasters (1 point) |
| 15 | 4/20 | **13. Surface Analysis and 3D Analysis**<br>13.1 Surface models<br>13.2 Slope, aspect, and hillshade<br>13.3 Area and volume<br>13.4 Visibility<br>13.5 Stack profile | Lab 13.1 Surface analysis (1 point)<br>Lab 13.2 Visibility analysis (1 point)<br>**Homework 3 (due 5/5)** |
| 16 | 4/27 | **14. Multidimensional Raster Data**<br>14.1 Multidimensional raster data types<br>14.2 Visualizing multidimensional raster data<br>14.3 Analyzing multidimensional raster data | Lab 14.1 Multidimensional raster data (1 point)<br>**Quiz 4 for Modules 11 – 13 (5 points)** |
| 17 | 5/4 | **Finalize course project** | **Project report due on 5/7** |

## Academic Dishonesty

Students caught cheating or plagiarizing will receive a “0” for that particular assignment or exam. Additionally, the incident will be reported to the Office of Student Rights and Responsibilities for further penalties. According to the UNT catalog, the term "cheating" includes, but is not limited to:

a. Use of any unauthorized assistance in taking quizzes, tests, or examinations;
b. Dependence upon the aid of sources beyond those authorized by the instructor in writing papers, preparing reports, solving problems, or carrying out other assignments;
c. The acquisition, without permission, of tests or other academic material belonging to a faculty or staff member of the university;
d. Dual submission of a paper or project, or resubmission of a paper or project to a different class without express permission from the instructor(s); or
e. Any other act designed to give a student an unfair advantage.

The term “plagiarism” includes, but is not limited to:

a. The knowing or negligent use by paraphrase or direct quotation of the published or unpublished work of another person without full and clear acknowledgment; and
b. The knowing or negligent unacknowledged use of materials prepared by another person or agency engaged in the selling of term papers or other academic materials.

## Use of Generative AI

In this course, the use of GenAI tools is limited as directed by the instructor. Any additional use requires explicit permission, proper citation, and authentic student work.

## Rules of Engagement

Rules of engagement refer to the way students are expected to interact with each other and with their instructors. Here are some general guidelines:

- While the freedom to express yourself is a fundamental human right, any communication that utilizes cruel and derogatory language on the basis of race, color, national origin, religion, sex, sexual orientation, gender identity, gender expression, age, disability, genetic information, veteran status, or any other characteristic protected under applicable federal, or state law will not be tolerated.
- Treat your instructor and classmates with respect in any communication online or face-to-face, even when their opinion differs from your own.
- Ask for and use the correct name and pronouns for your instructor and classmates.
- Speak from personal experiences. Use “I” statements to share thoughts and feelings. Try not to speak on behalf of groups or other individual’s experiences.
- Use your critical thinking skills to challenge other people’s ideas, instead of attacking individuals.
- Avoid using all caps while communicating digitally. This may be interpreted as “YELLING!”

• Be cautious when using humor or sarcasm in emails or discussion posts as tone can be difficult to interpret digitally.
• Avoid using "text-talk" unless explicitly permitted by your instructor.
• Proofread and fact-check your sources.
• Keep in mind that online posts can be permanent, so think first before you type.
See these Engagement Guidelines (https://digitalstrategy.unt.edu/clear/online-communication-tips.html) for more information.

## Accommodations

The University of North Texas makes reasonable academic accommodation for students with disabilities. Students seeking accommodation must first register with the Office of Disability Accommodation (ODA) to verify their eligibility. If a disability is verified, the ODA will provide you with an accommodation letter to be delivered to faculty to begin a private discussion regarding your specific needs in a course. You may request accommodations at any time, however, ODA notices of accommodation should be provided as early as possible in the semester to avoid any delay in implementation. Note that students must obtain a new letter of accommodation for every semester and must meet with each faculty member prior to implementation in each class. For additional information see the Office of Disability Accommodation website at https://studentaffairs.unt.edu/oda. You may also contact them by phone at 940.565.4323.

## Course Evaluation

You will receive an email with a link to the UNT Student Perceptions of Teaching (SPOT) Course Evaluation by the end of the semester.

---