Geography 517: Database Design for Spatial Data Science

- **Course number:**   GEOG 517 (3 credit hours, CRN 32773)
- **Class location:**   Burchfiel Geography Building (BGB), Room 404
- **Class time**:   2:30 pm - 3:45 pm (Tuesdays & Thursdays)
- **Instructor:**   Shih-Lung Shaw, Professor
- **Office**:   Burchfiel Geography Building (BGB), Room 317
- **Office hours:**   Tuesdays & Thursdays, 12:40 - 1:10 pm or by appointment
- **Contact information:**   Email: sshaw@utk.edu, Phone: 865-974-6036 (office)

Class Website:
- Class webpage is available at Canvas. You can access Canvas at https://oit.utk.edu/instructional/tools/online/canvas/default.html

Textbooks:
- Optional - Michael Zeiler and Jonathan Murphy. 2010. *Modeling Our World: The Esri Guide to Geodatabase Concepts (Second Edition)*. Redlands, CA: Esri Press (ISBN: 9781589482784).
- ArcGIS Pro version 3.2 "Quick-start Tutorials" website (https://pro.arcgis.com/en/pro-app/latest/get-started/pro-quickstart-tutorials.htm)
- ArcGIS Pro version 3.2 Help website (https://pro.arcgis.com/en/pro-app/latest/help/main/welcome-to-the-arcgis-pro-app-help.htm) (Note: You can also use Google to search for information of a particular function in ArcGIS Pro.)

Course Description:
This course covers Esri geodatabase data model and geodatabase design. Class lectures, mainly based on *Modeling Our World* book, will discuss important concepts of the geodatabase data model and how to design GIS databases using the geodatabase data model. Live demonstrations and hands-on work with ArcGIS Pro will provide students with opportunities to put the concepts learned in lectures into practice. All students in this class are expected to already know the basic GIS concepts and have hands-on experience with ArcGIS Pro as covered in GEOG 311 or an equivalent class. The main objective of this course is to gain in-depth understanding of the geodatabase data model that can be used to design and implement geodatabases for various GIS applications.

Central Learning Objectives:
Students who successfully complete this class are expected to gain the following knowledge/experience:
- Know a widely used GIS data model for real world GIS applications;
- Understand key concepts of the geodatabase data model; and
- Build knowledge and hands-on experience of using the geodatabase data model to design GIS databases that meet real world needs.

Degree Learning Objectives:
- Students will gain in-depth knowledge of GIS data model as well as ability in critical thinking and problem solving.

- Students will be able to use knowledge in geographic information science to ask sound research questions, select suitable GIS database design, and apply proper research methods.
- Students will be able to apply GIS database design knowledge and skills to address theoretical and/or practical geographic problems.

Prerequisites and Other Important Notes:
- Basic knowledge and technical skills of geographic information systems (GIS) equivalent to GEOG 311 (Geovisualization and Geographic Information Science) are expected.
- Each student must have at least one USB thumb drive (>1GB capacity) to store class work.
- This course includes hands-on work with computer software. Students should feel comfortable with the following computer skills:
  - Communications via email,
  - Information search via Web browsers,
  - Use of the Microsoft Word and Powerpoint,
  - Working with UT's Canvas, and
  - Learning computer application software such as ArcGIS Pro
- Most course materials will be posted on UT's Canvas website. Students are expected to access the course website on a regular basis.
- Students are expected to attend classes and actively participate in class discussions. If you must miss a class because of an extenuating circumstance, you should share with the instructor a document detailing the extenuating circumstance.
- Some class meetings may be held online via Zoom. These online class meetings will be announced in class and posted on the Canvas course website ahead of each online class meeting.
- All class work must be submitted on time. A 10% penalty per calendar day will be assessed toward class work that is submitted late.
- No make-up course work or incomplete grade will be allowed except for extenuating circumstances with appropriate documents approved by the instructor.
- No individual student is allowed to perform extra credit work in order to increase their grade. Any extra credit options will be made available to the entire class.
- Students who feel they may need an accommodation based on the impact of a disability should contact the Office of Student Disability Services (SDS) at 865-974-6087 or sds@utk.edu in Blount Hall, 1534 White Avenue to document their eligibility for services. SDS will work with students and faculty to coordinate reasonable accommodations for students with documented disabilities.
- Cheating, plagiarism, and other forms of academic dishonesty will not be tolerated.
- It is important to recognize that the classroom is an environment that requires respect for all participants. Therefore, students are expected to conduct themselves in a considerate manner. All participants in the class must respect the classroom environment by being on time, turning off cell phones and headphones, avoiding extraneous talking and chat, and refraining from reading non-class material. Since the class is held in a computer lab, no food or drinks are allowed near the computers.
- Click here to access Emergency Preparedness Classroom Information sheet.
- In this course, students are encouraged to use Generative AI Tools like ChatGPT to support their work. To maintain academic integrity, students must disclose any AI-generated material they use and properly attribute it, including in-text citations, quotations, and references. A student should include the following statement in assignments to indicate use of a Generative AI Tool: "The author(s) would like to acknowledge the use of [Generative AI Tool Name], a

language model developed by [Generative AI Tool Provider], in the preparation of this assignment. The [Generative AI Tool Name] was used in the following way(s) in this assignment [e.g., brainstorming, grammatical correction, citation, which portion of the assignment]."

▪ When using AI tools, it is important to be aware that the user data supplied might be utilized for training AI models or other purposes. Consequently, there is no guarantee that the information you provide will remain confidential. Students should exercise caution and avoid sharing any sensitive or private information when using these tools. Examples of such information include personally identifiable information (PII), protected health information (PHI), financial data, intellectual property (IP), and any other data that might be legally protected.

Grading System:

1. Class attendance/participation: 20%
   - Students are expected to attend classes and actively participate in class discussions.
2. ArcGIS Pro tutorials: 20%
   - All completed work must be saved on a USB thumb drive according to the instructions posted on the Canvas class website. You must submit your work according to the instructor's instructions by the deadline listed in the Course Schedule below. Students are expected to work on these tutorials outside the class meeting hours.
3. Two lab assignments: 25%
   - There will be two lab assignments. Students will have one week to complete each lab assignment. All completed assignments must be saved on a USB thumb drive. You must submit the assignment Word document with your answers and your completed ArcGIS Pro assignment according to the instructor's instructions by the deadline listed in the Course Schedule below. Students are expected to work on these lab assignments outside the class meeting hours.
4. ArcGIS application project: 35%
   - Each student will work independently on an ArcGIS application project. Each student will choose, design, and implement their own GIS project using ArcGIS Pro and geodatabase. Students will be responsible for data collection, GIS database creation, GIS application development and implementation, and a 15-minute Powerpoint presentation with live demonstrations.
   - Your ArcGIS application project should reflect as many concepts and functions as possible based on what you have learned in this class. A list of the minimum requirements for your ArcGIS application project is provided below:

     ArcGIS Pro Geodatabase Design Part:
     - choose specific objectives and database design for your project,
     - include at least one feature dataset,
     - include at least four features classes of different geometric types,
     - include at least one raster data layer,
     - include at least one object table,
     - include at least one simple relationship class,
     - include at least one composite relationship class,
     - include at least two different types of attribute domains,
     - include at least two subtypes,
     - include spatial reference system,

- All feature classes, feature datasets, and tables must be populated with data.
- You can import data from existing data sources if appropriate, but you must create your own data for at least 50% of your project using ArcGIS Pro.
- All data must be created according to the geodatabase data model.

ArcGIS Pro Geodatabase Display and Analysis Part:
- bring all of your data into ArcGIS Pro, set up appropriate displays, and save your work as ArcGIS Pro project files (i.e., .aprx file),
- use various ArcGIS Pro analysis functions (e.g., Geoprocessing tools or ModelBuilder) to achieve your project objectives,
- create at least one custom ribbon menu option,
- demonstrate various display/editing/query/analysis functions in your project and during your presentation.

- Each student will be responsible for data collection, GIS database design and creation, GIS application development and implementation, and a 15-minute Powerpoint presentation with live demonstrations. **Final project presentations with live demonstrations are scheduled at 1:00 – 3:15 PM on Thursday, May 9, 2024**.
- **Each student must email a zip file of your project folder that contains all project data and files, which can be readily opened in ArcGIS Pro, to Dr. Shaw (sshaw@utk.edu) by 12 Noon on Thursday, May 9, 2024.**
- **In addition, a project report in Microsoft Word format (single-spaced, up to 5 pages), which includes descriptions of the project, geodatabase design, analysis methods, major challenges encountered during the project, and the name and location of your final ArcGIS Pro project file, must be emailed to the instructor (sshaw@utk.edu) by 12 Noon on Thursday, May 9, 2024.**

Final course letter grades will be determined as follows:
- A: >= 93%, A-: 90-92%, B+: 87-89%, B: 83-86%, B-: 80-82%, C+: 77-79%, C: 73-76%, C-: 70-72%, D: 60-69%, F: < 60%

Course Schedule

Week/Dates	Topics	Readings	Notes
1 (1/23)	▪ Course syllabus ▪ Introduction		
2 (1/25)	▪ Introduction		
3 (1/30)	▪ Inside the Geodatabase	Chap. 1	
4 (2/1)	▪ Inside the Geodatabase ▪ **Class Meeting via Zoom**	Chap. 1	
5 (2/6)	▪ Vector Modeling with Features (Part 1)	Chap. 3	* Must bring at least one USB drive to the class today
6 (2/8)	▪ Vector Modeling with Features (Part 1)	Chap. 3	

7 (2/13)	▪ Vector Modeling with Features (Part 1)	Chap. 3	
8 (2/15)	▪ Vector Modeling with Features (Part 2)	Chap. 3	* Watch "Editing in ArcGIS Pro" video to learn editing functions and try these functions in ArcGIS Pro as practices
9 (2/20)	▪ Vector Modeling with Features (Part 2)	Chap. 3	* Work on ArcGIS Pro "Create points on a map" tutorial (due at 2:30 PM on February 27, 2024)
10 (2/22)	▪ Vector Modeling with Features (Part 2)	Chap. 3	
11 (2/27)	▪ Vector Modeling with Features (Part 2)	Chap. 3	*** Email a project package file of your completed ArcGIS Pro "Craete points on a map" tutorial as an attachment file to the instructor by 2:30 PM on 2/27**
12 (2/29)	▪ Linear Modeling with Networks (Part 1)	Chap. 4	* Lab assignment #1 handout
13 (3/5)	▪ Linear Modeling with Networks (Part 1)	Chap. 4	
14 (3/7)	▪ Linear Modeling with Networks (Part 1)	Chap. 4	*** Email a project package file of your completed Lab Assignment #1 and the Assignment #1 Word document with your answers as two separate attachment files to the instructor at sshaw@utk.edu by 2:30 PM on 3/7**
15 (3/12)	▪ **Spring Break (No Class)**		
16 (3/14)	▪ **Spring Break (No Class)**		
17 (3/19)	▪ Linear Modeling with Networks (Part 2)	Chap. 4	* Lab assignment #2 handout
18 (3/21)	▪ Linear Modeling with Networks (Part 2)	Chap. 4	
19 (3/26)	▪ Linear Modeling with Networks (Part 2)	Chap. 4	*** Email a project package file of your completed Lab Assignment #2 and the Assignment #2 Word docuemnt with your answers as two separate attachment files to the instructor at sshaw@utk.eduby 2:30 PM on 3/26**
20 (3/28)	▪ **Spring Recess (No Class)**		
21 (4/2)	▪ Imagery and Cell Modeling with Rasters and Mosaics	Chap. 7	
22 (4/4)	▪ Imagery and Cell Modeling with Rasters and Mosaics	Chap. 7	* Work on ArcGIS Pro "Share a web map" tutorial (due at 2:30

			PM on April 11, 2024)
23 (4/9)	▪ Imagery and Cell Modeling with Rasters and Mosaics	Chap. 7	
24 (4/11)	▪ Surface Modeling with Terrains	Chap. 8	*** Email the ArcGIS Online URL of your completed ArcGIS Pro "Share a web map" tutorial to the instructor at sshaw@utk.edu by 2:30 PM on 4/11**
25 (4/16)	▪ **AAG Meeting (No Class)**		
26 (4/18)	▪ **AAG Meeting (No Class)**		
27 (4/23)	▪ Surface Modeling with Terrains	Chap. 8	
28 (4/25)	▪ Surface Modeling with Terrains	Chap. 8	
29 (4/30)	▪ Geoprocessing with Models and Scripts	Chap. 11	
30 (5/2)	▪ Geoprocessing with Models and Scripts	Chap. 11	
31 (5/7)	▪ Geoprocessing with Models and Scripts	Chap. 11	
32 **(5/9, Thursday 1:00 – 3:15 PM)**	▪ **Class Project Presentations (Each student will give a 15-minute presentation and live demonstration of their class project.)**		*** Each student must email a zip file of your project folder that contains all project data and files which can be readily opened in ArcGIS Pro to Dr. Shaw (sshaw@utk.edu) by 12 noon on May 9, 2024.** *** Each student must email a project report in Word format (single-spaced, up to 5 pages), which includes descriptions of the project, geodatabase design, analysis methods, major challenges encoutered during the project, and the name and location of your final ArcGIS Pro project file, to Dr. Shaw (sshaw@utk.edu) by 12 Noon on May 9, 2024.**

* Note: This course schedule is subject to change. Updated syllabus (if any) will be posted on the Canvas website of this course. Please contact the instructor if you have questions about course materials or course requirements.