

Spring, 2020

Instructor: Dr. Keith Rice

Office Hours: Monday 1:00 – 1:50 pm
Tuesday & Thursday 11:00 – 11:50am
or by appointment

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This is an intermediate level, GIS focused course that explores the structure and latent abilities of geospatial databases. The course will examine the principles and applications of GIS database management software as well as dissect the format and configuration of various databases and their GIS applications. Besides the exploration of the design of geospatial databases, that will be centered on ESRI's geodatabase format, various aspects of data modeling will be investigated. This will center on differences between vector and raster models as well as basic SQL operations and management of relational databases. Open source software (QGIS) will also allow comparisons in data operations with ArcGIS. ArcGIS Online database management and publication will be illustrated along with the use of the Arcade programming language for customization of databases. A variety of database formats and models will be used throughout the semester (e.g. parcel, land use data). Students will use GIS pc-workstations along with *ESRI*-GIS software (ArcGIS, ArcGIS Pro, ArcGIS Online, ArcGIS web apps). Remote sensing software (i.e. *ERDAS Imagine*), and Microsoft SQL Server (and Database Engine) will also be used to demonstrate applications within GIS.

Lecture: Lecture sessions will be on Tuesday and Thursday mornings, and will concentrate on both the basic theoretical and applied techniques of geographic information systems. The lectures will lay the foundation for the laboratory assignments.

Laboratory: There is one weekly laboratory session, two hours on Tuesday afternoon (2:00 – 3:50pm). Each laboratory will deal with one aspect of a GIS, that may involve either the introduction of a new technique, or a GIS database or design problem - all within an application situation. There are 10 laboratory projects, each counting between 5 and 7 percent of the final grade for a total of 60 percent of your grade for the course. The requirements for each laboratory session will be outlined in each individual lab assignment. Most of the laboratory projects will take longer than the allocated two hour period due to data processing, data acquisition, and/or workflow assessments.

Students can use the Computer Geographics Lab (Science, B-346), the Spatial Information Analysis Lab (SIAL) - (Science, D-326), the Advanced Computing Lab (TNR-322), or the GIS/Remote Sensing Lab (Science, B-310/312), or the B-308 computers (when class is not in session). Some labs will utilize software that is only located in B-308, B-312 or B-346 (this will be noted during discussion of the assignment). Students will use ArcGIS (ArcMap, ArcCatalog), ArcGIS Pro, Microsoft SQL Server, ArcGIS Online, ERDAS Imagine, and other GIS related programs to finish the assignments. Lab assignments need to be completed and handed in on or before the due date indicated by the instructor. If you need help with any assignment, please see your class instructor.

Textbook: Geographic Databases & Information Systems, 1.1 edition (2016)
Emmanuel Stefanakis, CreateSpace Independent Publishing,
North Charleston, SC

Examinations: There will be two examinations, a *mid-term* on March 10th, covering the first eight weeks of the course, and a *final comprehensive exam* (**Wednesday, May 13th, 12:30 – 2:30pm**). The mid-term will be composed of both multiple-choice and matching questions that will focus not only on basic concepts, principles, and definitions, but also on the applications of this knowledge to pertinent GIS database situations. It will count 20 percent of your final grade. The final examination will be worth 20 percent of your course grade, and will be of similar structure to the midterm.

Readings: A separate handout will outline the main reading assignments of the semester. Additional reading materials will be assigned during the term.

Evaluation & Grading:

	<i>Maximum Points</i>
Laboratories (ten total, 5 -7 points apiece)	60 points
Midterm Exam	20
Final Exam	20
Total	100 points

Ranges of percentage scores, exam points, course points, and their approximate equivalent letter grades are shown below. By referring to this table you can determine your letter-grade standing at any point in the course.

<u>Percent</u>	<u>5 Pt Lab</u>	<u>6 Pt Lab</u>	<u>7 Pt Lab</u>	<u>Course Pts.</u>	<u>Letter Grade</u>
93-100	4.7	5.6	6.5	93	A
90	4.5	5.4	6.3	90	A-
87	4.4	5.2	6.1	87	B+
83	4.2	5.0	5.8	83	B
80	4.0	4.8	5.6	80	B-
77	3.9	4.6	5.4	77	C+
73	3.7	4.4	5.1	73	C
70	3.5	4.2	4.9	70	C-
67	3.4	4.0	4.7	67	D+
63	3.2	3.8	4.4	63	D
<63	<3.2	<3.8	<4.4	<63	F

Printing Costs: During the course of the semester each student will be responsible to hand in several word documents, reports, and associated maps. All student printers are handed through UWSP-IT so you will be charged for 5 cents for each B&W page (single side) as well as 15 cents for each color copy (single side). You start out with \$10 in a UWSP printing account for the semester (for all of your classes) and then are charged a fee at the end of the semester for any printing exceeding that initial balance. You can always check your student printing account on your myPoint portal page on the Finances tab. Although it is *only an estimate*, you likely will print out 30-40 B&W pages and 15 color pages during the course of the semester for this class. Additionally, you may be creating larger format prints (e.g. 11 x 17") that you will not be charged (paper & ink will be covered by the department).

Attendance: Although class attendance records will not be kept for grading purposes, it is strongly urged that class sessions not be missed. Remember that the success of class discussions is directly related to the amount of verbal participation, and with a small class one person can make a significant difference in aiding a classmate's understanding of a topic.

But in order to comply with federal financial aid Title IV legislation attendance will be taken several times during the course of the semester. UWSP Financial Aid Office is required by Federal law to retract financial aid for students that do not complete at least 60% of the semester for which they were awarded financial assistance. The mandated retraction formula uses the last date of attendance as a factor in determining the percentage of financial aid that must be returned to the U.S. Department of Education.

Student Rights and Responsibilities: Please make note of the following web-based pdf documents, that explains your responsibilities and rights within the UWSP campus community, including required behavior by students and faculty within the classroom environment:
<https://www.uwsp.edu/dos/Documents/UWSP14-Final2019.pdf>
https://www.uwsp.edu/dos/Documents/2015_Aug_AcademicIntegrityBrochure.pdf
<https://www.uwsp.edu/dos/Documents/CH17-UWSP-Updated2019.pdf>

Accommodations for Students with Disabilities: UWSP is committed to providing reasonable and appropriate accommodations to students with disabilities and temporary impairments. If you have a disability or acquire a condition during the semester where you need assistance, please contact the Disability and Assistive Technology Center on the 6th floor of Albertson Hall (library) as soon as possible. DATC can be reached at 715-346-3365 or DATC@uwsp.edu.

GEOGRAPHY 342: GIS DATABASE DESIGN and DATA MODELING

** Schedule of Lecture Topics, and Laboratory Assignments **

Spring, 2020

<u>January</u>	<u>Lecture Topic</u>	<u>Laboratory</u>
21 & 23	Course Overview & Introductory Comments Database Creation – Design Issues, Layers, Scale, Accuracy, Conversion & Design Strategies	-----
28 & 30	GIS Data Management & Data Custodianship Database Models – hierarchical, network, relational, object-oriented; Codd's Relational Database Principles Relational DBMS Schema Development Building the Logical Database Model	1: RDMS Schema Development (6)
<u>February</u>		
4 & 6	ESRI Geodatabase Schema Creation Crafting a Geodatabase Design Form & Template Data Model Features: Fields, Types, Aliases, Labels Attributes, Cardinality, Integrity Schema Relationships: subtypes, domains, geometry	2: ESRI Geodatabase Creation (6)
11 & 13	Data Structure Integration and Implementation Assigning Feature Class, Domains, Subtypes, Reference System, Relationship Class Modifying and Redefining the Data Format Populating & Sharing a Geodatabase – Load Process (layers, multiple features, scene, map)	3: Extending Geodatabase Structure (6)
18 & 20	Distributed File Systems – SQL Incorporation Structured Query Language (SQL) Features SQL Queries & Management (Storage & Retrieval) SQL Server Integration & ArcGIS	4: SQL Operations & Management (6)
25 & 27	Spatial Data Modeling – Land Resources Parcel Databases – Multipurpose Cadastre USPLS Townships, Divisions, Corners & Monuments Parcel Map Attributes, Subtypes and Relationships Parcel Fabric – Reference System, Coordinates and Survey Sources	5: Geodatabase Modeling: Land Records (6)
<u>March</u>		
3 & 5	Data Models Types & Applications (Geometry, Object, Vector, Object-Data, Georelational) GIS Raster Data Models: Formats, Attributes, Structure <i>Mid-term Exam Review Session</i>	6: Raster Data Models (6)
10	Midterm Exam	<i>[no lab]</i>

12	GIS Raster Models: Terrain Datasets, Pyramid Structures Raster Formats: Simple, Extended, Quadtree, Cellular Raster Functional Operations & Query: Local, Focal, Global	
17 & 19	-- Spring Break Vacation --	
24 & 26	Raster Model – LiDAR Database LiDAR Acquisition & Processing Point Cloud Data Handling LAS File Storage & Retrieval ArcGIS Pro LiDAR Spatial Modeling	7: Raster Modeling - LIDAR (6)
<u>April</u>		
(March 31) & 2	QGIS Operations & Data Handling QGIS Database Formats – Attributes, Properties Managing Data Source - Vector, Raster, Mesh Data Open Geospatial Consortium (OGC) Data Models	8: Open Source: QGIS RDMS (5)
7 & 9	ArcGIS Online Database Management Publishing Databases for Shared Content: Layers, CSV, Layer Packages, Web Layers Hosted Geodatabases and Accessibility	9: Web-enabled (6) Spatial Databases
14 & 16	ESRI's Arcade Programming Language & Applications Applying Arcade Expressions in ArcGIS Pro Creating Arcade Labeling & Symbology Expressions	10: ESRI Database (7) Scripting – Arcade
21 & 23	Raster Data Management Issues Creating Mosaic Datasets- Workflows Storing Raster Data in a Geodatabase	<i>[open lab]</i>
28 & 30	Migrating to ESRI Enterprise Geodatabases Building a Enterprise Geodatabase Workflows and Management of Enterprise System	<i>[no lab]</i>
<u>May</u>		
5 & 7	Mobile Mapping Database Design & Templates Cloud Computing Data Management Strategies Final Exam Review and Summary	<i>[no lab]</i>

Final Exam: Wednesday, May 13th; 12:30 – 2:30pm

Comments:

- (1) *The worth of each laboratory (in points) is denoted within the parentheses next to each lab title.*
- (2) *This schedule is tentative and is subject to changes during the course of the semester.*