# Geography 343/543          Geographic Information Systems II

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, computer-based course that explores the latent abilities of geographic information systems.  The complexity of spatial data bases, resolution & scale issues, differential global positioning systems (DGPS), applied cartographic modeling, geodemographics, relational spatial data formats, remote sensing data acquisition and delivery, rudimentary three-dimensional modeling, visualization, and programming issues will all be explored in regard to a GIS.   The class will concentrate on the integration of data from different sources and their applications within a large-scale GIS.  Both land management systems data (e.g., street networks, parcel maps) and natural resource land management data (e.g. land use, habitat cover) will be examined.  Students will use GIS pc-workstations along with *ESRI*-GIS software (ArcGIS (ArcMap & ArcCatalog), ArcGIS Pro, ArcGIS Online, ArcScene).  Remote sensing software (i.e. *ERDAS Imagine*) 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 either Monday afternoon (section 1 @ 2:00 – 3:50pm), or Thursday afternoon (section 2 @ 2- 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 since all assignments either require field work or extensive time on computer equipment.

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 and several specialized extensions, 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 Information Science and Systems, 4th edition (2015)
                 Longley, Paul A., Goodchild, Michael F., Maguire, David, and David Rhind
                 John Wiley & Sons, New York, NY, 2015

**Instruction**
**GIS Manual**: Geography 343/543 Laboratory Manual – 2020 Edition (Volumes I & II)


**Reference**     Getting to Know ArcGIS Desktop, 5$^{th}$ edition ESRI Press, 2018     ($26 - $60)
**Textbooks:**    Michael Law, Amy Collins
                  Getting to Know ArcGIS Pro, 2$^{nd}$ edition ESRI Press, 2019     ($47 - $85)
                  Michael Law, Amy Collins
                  GIS Tutorial 1 for ArcGIS Pro, ESRI Press, 2017     ($60 - $99)
                  Wilpen Gorr, Kristen Kurland
                  GIS Tutorial 2: Spatial Analysis Workshop, 4$^{th}$ edition     ($50 - $80)
                  David Allen
                  The ESRI Guide to GIS Analysis, Volume 1, ESRI Press, 2020     ($30 – 50)
                  Andy Mitchell

> These optional *'textbooks'* should only be purchased for the *serious GIS user* due
> to their cost.  These textbooks are handy for anyone considering using ArcGIS 10.6+ or
> any type of GIS-related research project and some may be available in the University
> bookstore.  If not, you can order these books over the Internet (e.g. www.amazon.com).

**Examinations**: There will be two examinations, a *mid-term* on March 12$^{th}$, covering the first
               eight weeks of the course, and a *final comprehensive exam* **(Thursday,**
               **May 14$^{th}$,  2:45 – 4:45pm)**.  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 problems. 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***:*

|                                                      | *Maximum Points* |
| ---------------------------------------------------- | ---------------- |
| 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.

| Percent | 5 Pt Lab | 6 Pt Lab | 7 Pt Lab | Course Pts. | Letter Grade |
| ------- | -------- | -------- | -------- | ----------- | ------------ |
| 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 will be creating two poster plots (large format printing) later in the semester 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 343/543: GEOGRAPHIC INFORMATION SYSTEMS 2**

** <u>Schedule of Lecture Topics, and Laboratory Assignments</u> **

**Spring, 2020**

|  | <u>Lecture Topic</u> | <u>Laboratory</u> |
|---|---|---|
| <u>January</u> | | |
| 21 & 23 | Course Overview & Introductory Comments<br>Types & Techniques of Spatial Data Analysis<br>Spatial Modeling & Applications<br>The Relationship between Analysis & Modeling | ----- |
| 28 & 30 | Developing and Building Spatial Models<br>GIS User Interface & Display Management Systems<br>ArcGIS Model Builder Components & Tools | 1: Cartographic &<br>Spatial Modeling (6) |
| <u>February</u> | | |
| 4 & 6 | Raster-based Spatial Analysis with ArcGIS<br>Conversion Cell Statistics & Boolean Operations<br>Raster Calculator & Attribute Table Summaries | 2: ArcGIS Spatial<br>Analyst      (6)<br>- surface analysis |
| 11 & 13 | Global Positioning Systems Overview<br>GPS High Accuracy Techniques<br>Brief Review of Coordinate Systems | 3: Differential GPS<br>Positioning (6) |
| 18 & 20 | Differential GPS: Real Time & Post-Processing<br>Comparison of GPS Equipment & Techniques<br>Integration of GIS and GPS | *[no lab]* |
| 25 & 27 | Image Rectification and GPS Integration<br>Integration of Remote Sensing Data w/GIS<br>Digital Imagery for the Nation Program | 4: Imagery<br>Integration  (6) |
| <u>March</u> | | |
| 3 & 5 | Network Analysis & Geocoding Principles<br>Spatial Socio-Economic Data<br>Address Matching & Address Databases | 5: Network Analysis<br>& Geocoding (6) |
| 10 | Network Analysis & Geocoding Principles<br>*Mid-term Exam Review Session* | 6: Spatial Structures<br>& Landscape<br>Fragmentation (6) |
| 12 | **Midterm Exam** | |
| 17 & 19 | *-- Spring Break Vacation –* | |

| 24 & 26 | GIS & Retail Trade<br>Geodemographics<br>Landscape Structure & Morphology<br>Statistical Modules for ArcGIS | 7: Terrain Modeling (6)<br>Surface Rendering |
|---|---|---|

**April**

| (March 31) & 2 | Spatial Pattern Analysis using GIS<br>TIN/GRID Surface & Terrain Modeling<br>Managing 3D Data & Surface Models<br>3D Visualization with GIS | 8: Resolution & Scale<br>GRID Spatial<br>Modeling        (7) |
|---|---|---|
| 7 & 9 | Raster-Based Spatial Modeling<br>Resolution & Scale Issues – Accuracy Variations<br>ArcGIS Web GIS  & Hosted Sites<br>ArcGIS Online & Web GIS Platforms | 9: Web App Builder<br>w/ArcGIS API (5) |
| 14 & 16 | ArcGIS Server Architecture & Services<br>ArcGIS Web Sites & Designs<br>GIS 3D Animation Techniques | 10: GIS 3D Animation<br>w/ArcGIS Pro  (6) |
| 21 & 23 | Building GIS Data Layers for Cloud Based Sites<br>Programming Concepts & Customization | *[open lab]* |
| 28 & 30 | Geoprocessing Scripts in ArcGIS (Python)<br>Automation and Geoprocessing Functionality<br>Understanding the Basics of Python Scripts | *[no lab]* |

**May**

| 5 & 7 | Incorporation of Customization & Environmental Settings<br>Geodatabase (MDB) ArcGIS Formats<br>Geodatabase Relationships – Types & Rules<br>Final Exam Review and Summary | *[no lab]* |
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**Final Exam: Thursday, May 14th;  2:45 – 4:45pm**
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*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.*