Geology 3403/5403 Advanced GIS

Spring, 2017; Dr. Urbanczyk

OFFICE (9-10 M-W; 9:30 – 11 TR)

This class is intended to teach a variety of modern geospatial techniques and to prepare the student to apply these skills in both an academic and a professional environment. It is an **applied** class whereby we will complete a series of projects designed to mimic the types of real world problems that a GIS specialist might encounter in a professional environment.

The course meets MWF from 11 - 11:50; lab is Monday 2 - 4:50.

Textbook: GIS and Geocomputation for Water Resource Science and Engineering, Dixon and Uddameri ISBN 978-1-118-35413-1

The textbook has numerous short lectures that we will work through as the primary content for the class. Additional local field projects will be added:

RTK/Total Station Survey problems, Moss creek SRSU campus
Photogrammetry and Geomorphic change detection at Terlingua creek
Photogrammetry and Geomorphic change detection at Alamito creek
RTK/Total Station survey problems, delineating control points in Boquillas canyon

The content to be covered will include (also covered in the textbook outline):

Field data collection techniques:

- Global Positioning Satellite System (GPS) techniques using Trimble hardware/software – Trimble provides a professional grade combination of both GPS hardware and software. We will explore the advanced functionality of the Trimble Pathfinder and Terrasync software.
- Real Time Kinematic (RTK) gps techniques
- Surveying with laser Total Station – We will use a laser Total Station survey instrument to create a detailed map of a local hydrologic feature. In addition to mapping relevant point features, we will create a 3-dimensional model of the area and assess geomorphic change.
- Cross section and basic surveys using a level instrument

Lab GIS techniques:

- Basic Desktop software review: Excel and SigmaPlot
- Review of Surfer for creating grids from survey data
- Review Trimble Pathfinder/Terrasync
- A detailed summary of Spatial Analyst, which also is an extension to our ArcGIS software that creates, manipulates, and analyzes raster data. This portion of the class will include the incorporation of the total station field data to create an elevation model
- A review of ESRI's Model Builder and Python scripting
- A review of modern Geomorphic Change Detection techniques
- A review of ArcHydro: ArcHydro is a geographic database containing a GIS representation of a Hydrological Information System; and ArcHydro Groundwater (subsurface) analyst.
- A review of Remote Sensing techniques with a focus on recognizing the spectral signatures of regional land cover types (various rock, soil and vegetation types), and attempts to remotely discriminate between them.

Course Summary:

- The course is designed to be a hands-on experience. Content will be discussed during lecture, and the projects will be assigned for lab work. Students will be expected to work in teams of 2 or 3 in order to facilitate communication and learning. The teams will be given problems to solve using the skills and techniques discussed in the lectures and the reading assignments.
- **Specific Learning Objectives:** Upon completion of this class, students will be expected to have an understanding of the technical aspects of field and laboratory GIS applications, and to be able independently solve real world problems such as would occur in a modern professional work environment. Successful students will have the following skills:
    - Field survey techniques:
        - Level
        - Total Station
        - GPS and RTK GPS
    - Lab Techniques
        - Construct 3D model using TIN and GRID formats
        - Construct cross sections from field data and from elevation data
        - Apply Manning equation to calculate discharge at different stages
        - Assess geomorphic change using elevation data data
        - Use Archydro to delineate drainage basins
        - Use image processing to process remotely sensed data
- **Textbook:** Dixon and Uddameri, GIS and Geocomputation, Wiley. Optional books include:
    - Nathanson and others, 2011, Surveying Fundamentals and Practices
    - Lillesand, Kiefer, and Chipman, Remote Sensing and Image Interpretation, Wiley and Sons, ISBN 0-471-15227-7, any edition will be OK
    - Ogaja, Applied GPS for Engineers and Project Managers, ASCE press
    - Topographic Surveying, ASCE press
    - Jensen, Introductory Digital Image Processing, Prentice Hall
    - Campbell, Introduction to Remote Sensing, Guilford press
    - Sabins, Romote Sensing, Principles and Interpretation, Freeman and Company
- **Lab:** Lab will include exercises and case studies from the textbook and custom lab projects related to local field problems.

The course evaluation will consist of:

- Exams: 54%
- Homework: 5%
- Lab Projects: 41% (this grade will include project reports and project assessments; the assessments will consist of completed worksheets pertaining to the project, and will be issued upon completion of the project)
- Students taking the class for graduate credit will be expected to answer extended questions on the exams, to provide more extensive homework, and to complete projects with a higher level of technical detail.

Item	Percentage
Exam 1	17
Exam 2	17
Final Exam	20
Lab Projects	41
Homework	5
	100

Tentative schedule:

	Week	Chapter	Lab Ex	Case study
1	18-Jan	1,2		
2	23-Jan	3,4,5	1-6	
3	30-Jan	6,7,8	7-9	
4	6-Feb	9,10,11	11-14	
5	13-Feb	12, midterm, 13	15-19	2
6	20-Feb	14,15,16		
7	27-Feb	17,18,19		
8	6-Mar	20,21,22		1,2,3
	13-Mar	Spring Break		
9	20-Mar	23,24,25		4,5
10	27-Mar	26,midterm,27		6,7,8
11	3-Apr	28, 29,30		9,10
12	10-Apr	31,32,33		11
13	17-Apr	34,35,36		
14	24-Apr	37,TBD		
15	1-May	TBD, Wed is last class day		
	9-May	Final Exam 10:15 AM		

Conduct: Students are expected to observe the University's Code of Student Conduct (see Student Handbook, http://www.sulross.edu/sites/default/files//sites/default/files/users/docs/student_svc/handbook.pdf - page 38).

Please turn OFF all cellular phones, IPODs, MP3s, etc.

Sul Ross State University is committed to equal access in compliance with the Americans With Disabilities Act of 1973. It is the student's responsibility to initiate a request for accessibility services. Students seeking accessibility services must contact Mary Schwartze, M. Ed., L.P.C., in Counseling and Accessibility Services, Ferguson Hall, Room 112. The mailing address is P.O. Box C-122, Sul Ross State University, Alpine, Texas 79832. Telephone: 432-837-8203. E-mail: mschwartze@sulross.edu .