GEOG 104 (Spring 2018)
Geographic Information Science and Spatial Reasoning

(GE course in the category of FOUNDATION: Mathematics/Quantitative Reasoning)

Class Web site http://map.sdsu.edu/geog104/

Blackboard URL: https://blackboard.sdsu.edu/

Facebook: https://www.facebook.com/SDSUgeospatial

Lectures: Tue. / Thurs. 2:00pm - 3:15pm Location: AL-204
Web-based GIS exercises: Blackboard Web Exercise Instructions.

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Office Hours: Tuesday 12:00pm – 1:50pm.
or by appt. (emails)

Overview:
This course will introduce fundamental concepts of geographic information science (GIScience), including geographic information systems (GIS), global positioning systems (GPS), cartography, remote sensing, and spatial statistics. Advanced geospatial application tools, such as Google Earth, Google Map, Smart Phone Apps (Androids or iPhones), and web mapping services (ESRI ArcGIS online, Storymaps, Mapbox, CartoDB) will be used to demonstrate these key concepts. Students will learn how to use these geospatial technologies and web tools in addressing human and environmental problems. The web-based exercises and lectures will teach students how to organize geospatial data, visualize spatial patterns, and conduct basic spatial query and map overlay functions. Three major learning objectives of this course include:

1. The student will know the fundamental concepts of geographical science and important applications of geospatial technology.
2. The student will know how to access web mapping tools and how to visualize GIS datasets in order to explore and query scientific questions, such as climate change, social problems, natural hazard monitoring and prediction, and disease tracking and prevention.
3. The student will operate basic (web-based) GIS analysis tools to compute numerical solutions, to make sense of geospatial data encountered in everyday life and to study, and to develop possible solutions for real world problems.

Prerequisites: Satisfaction of the Entry-Level Mathematics requirement (ELM).

Required Textbooks:
Longley, Paul A., Goodchild, Michael F., Maguire, David J., and David W. Rhind. (2015) Geographic Information Systems and Science (Fourth Edition), John Wiley and Sons, Toronto.

Lectures: Lecture sessions emphasize the principles and concepts of GIScience, geospatial technology, and spatial reasoning. Lecture notes are available on the class website (open access).

Web-based Assignments (Homework):
This course will provide a series of web-based GIS exercises. Students may use any campus computer or their home computers with high speed Internet access to finish these web exercises. Web-based assignments are due at the beginning of the lecture (2:00 pm) on the due date (submitted via Blackboard).

Late submissions of assignments will be docked 20% per day, beginning on the due date (the maximum deduction will be up to 80% of the original lab score -- if you submit missed assignments after five days, you will only get 20% of your original assignment grades. For example, if you get 8 points in Exercise#4 (total points: 10) → 8 x 0.2 = **1.6** points**).**

Grading (total 100 points):
In-Class Quizzes or Kahoot Exercises Submission 15%; Focus Group Presentation 15%; Web Exercises: 30%; Midterm Exam: 20%; Final Exam: 20%;

A level (A and A-): above 90 points.
B level (B+, B, B-): 80 – 89.
C level (C+, C, C-): 70 – 79.
D level (D+, D, D-): 60 – 69.
F: below 60.

- Midterm and final exams include **10** multiple choice questions, **four** problem-solving questions (computation), and **two** short answer questions (4-5 sentences).
- For the web-based exercises, there are several GIS modules with on-line demo and exercises.
- In-Class Quizzes or Kahoot Exercises will be distributed during the lecture sessions.

Additional Readings: (Available via the Blackboard "**readings**" folder under "**Course Documents**")

1. Butler, Declan. (2006). The web-wide world. *Nature*, 439(16). February 2006, pp. 776-778.
2. Corvallis Microtechnology, Inc. (1996). Introduction to the Global Positioning System for GIS and TRAVERSE. URL: http://www.cmtinc.com/gpsbook/index.htm
3. Gewin, Virginia. (2004), Mapping opportunities. *Nature*, 427(22). Pp. 376-377.
4. Mark, David M., Chrisman Nicholas, Frank, Andrew U., McHaffie Patrick H., & John Pickles, (1997), *The GIS History Project – Summary Paper*, at URL: http://www.ncgia.buffalo.edu/gishist/bar_harbor.html
5. NASA Earth Science Website: https://science.nasa.gov/earth-science/
6. Trimble, Inc. (2006). GPS Tutorial. URL: http://www.trimble.com/gps_tutorial/
7. Tsou, Ming-Hsiang (2009). Chapter 48: The Integration of Internet GIS and Wireless Mobile GIS. In *Manual of Geographic Information Systems*, edited by Marguerite Madden, published by ASPRS, pp. 923-933.
8. Tsou, M. H. (2015). Research challenges and opportunities in mapping social media and Big Data. Cartography and Geographic Information Science, 42:sup1, 70-74. doi: 10.1080/15230406.2015.1059251.

If you are a student with a disability and believe you will need accommodations for this class, it is your responsibility to contact Student Disability Services at (619) 594-6473. To avoid any delay in the receipt of your accommodations, you should contact Student Disability Services as soon as possible. Please note that accommodations are not retroactive, and that I cannot provide accommodations based upon disability until I have received an accommodation letter from Student Disability Services. Your cooperation is appreciated.

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Week/Dates		Lecture	Reading	Web Exercises
1	18 Jan	Introduction Overview of GIScience	**Butler** Chapter 1	**No Exercise this week**
2	23 Jan 25	Mapping the Earth	Chapters 2&3 **Gewin**	Exercise 1 Mapping the Earth
3	**30 Jan** 01 Feb	**No Class on 1/30** (NSF software workshop at USC) Georeferencing	 Chapter 4 &5	Exercise 1 Mapping the Earth
4	06 Feb 08	GIS software Data Models	Chapters 6&7 **Mark, et al.**	Exercise 2 ArcGIS Online
5	13 Feb 15	GPS introduction Mobile GIS and LBS	**Corvallis** **Trimble**	Exercise 2 ArcGIS Online
6	20 Feb 22	**Focus Group Assignment** (form your team) GIS Data Collection, Geo-processing	Chapter 8	Exercise 3 Georeference and map projection
7	27 Feb 01 Mar	GIS data input & Database Management	Chapter 9	Exercise 3 Georeference and map projection
8	06 Mar 08 Mar	Internet and the Web GIS **Focus Group presentation: 3/06, 3/08)** ***(Mid-term exam study guide distribution on 3/08)***	**Tsou** Chapter 10	Exercise 4 Web-GIS examples
9	13 Mar **15**	Intro Remote Sensing (Exam review) **Mid-term Exam (3/15** 2:00pm - 3:15pm**)**	**(NASA Website)**	Exercise 4 Web-GIS examples
10	20 Mar 22	Remotely Sensed Imagery EMR interaction		Exercise 4 Web-GIS examples
11	**27 Mar** **29**	**Spring Break (No Classes)**		
12	03 Apr 05	Cartography Geospatial Visualization	Chapters 11& 12	Exercise 5 Remote Sensing
13	10 Apr 12	Spatial Analysis **No Class on 4/12 (AAG Meeting)**	Chapters 13&14	Exercise 5 Remote Sensing
14	17 Apr 19	Spatial Statistics	Chapter 15	Exercise 6 Spatial Analysis
15	24 Apr 26	GIS and Society	Chapter 16 & 18, 19	Exercise 6 Spatial Analysis
16	01 May 03	***Final exam study guide distribution: 5/01*** The future of Geospatial Technology	**Tsou**	
16	**08 May**	**Final Exam (5/8).** **(**2:00pm - 3:15pm at the same class room**)**		

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Focus Group Discussion and Presentation (10% of total grade)

Every **FOUR or FIVE** students will form a focus group for a specific **GIS scenario or GIS topic**. Each group will represent different key players in the scenario and brainstorm the best practice and solution for the GIS scenario. **Each group will make a focus group presentation (4 minutes for each group + 1 minutes Q&A) on March 06 and March 08** during the class by all members from the focus groups. Focus groups can utilize the ESRI on-line mapping tools, Storymaps, Web tools, PowerPoint, or other additional presentation resource from the ArcGIS Online during the group presentation.

Scenario: San Diego Wildfire 2019 (hypothetical scenario)
In October 2019, two devastating wildfires cause huge damages in San Diego during the week of October 08. The wildfires burned down 3427 homes and businesses and cause the worst damages in the history of San Diego and California. (You can use the San Diego Wildfire 2007 http://map.sdsu.edu for this hypothetical scenario).

Each focus group will represent different key players in the City and County of San Diego and brainstorm the best practice for evacuation plan, public warning and alerts, rescue efforts, damage assessment, mitigation plan, and shelter arrangements, etc **using GIS and maps**. Group presentation will tell us their best solutions by **utilizing geospatial technology (GIS, Remote Sensing, and GPS, etc.)**. **Each group will make a focus group presentation on March 06 or March 08** by all members from the focus group. You can utilize the SANDAG website, SANGIS website, or ESRI on-line mapping tools (such as community analyst), PowerPoint, or the additional presentation resource from the ArcGIS Explorer Online during your group presentation. If you are using PowerPoint slides, **upload the presentation file or links in the Blackboard Discussion → Focus Group Presentation** (and save an backup in a USB drive).

Group 1: The Mayor's Office (You are the San Diego City Mayor.) What types of efforts and tasks are needed to make public announcement when wildfire starts? How to coordinate with police and fire department? How to work with the FEMA and other federal government agencies during this disaster recovery and mitigation plan?

Group 2: The City Police Department. You are the GIS team in San Diego City Police Department. How can you create the evacuation plan and collaborate with the County's Emergency Operations Center (EOC)? When should you release the damaged housing address information? When can you remove the evacuation order after the wildfire?

Group 3: The California Governor. (You are the California governor and his staff) How can you relocate the State additional resources to help San Diego? When will you need to declare the State of Emergency? How can you coordinate the rescue efforts with the California Department of Forestry and Fire Protection? (Use the Air Base in Ramona).

Group 4: KPBS TV and Radio Station. You are a journalist and a reporter at KPBS. How can you use the media to provide the most valuable and important information to the public during the wildfire? Will you create a new web map online to facilitate the evacuation and shelter arrangement? Can you utilize Google Earth, animation and 3D visualization tools in your News Coverage?

Group 5: The San Diego County Public Health Department. Where are the older population concentration areas in San Diego? What are their transportation needs and safety issues? What kind of impacts will they have if their Medicare coverage changes due to the budget cuts?

Group 6: Volunteer Students at SDSU. The Volunteer Hazard Mapping Corps (VHMC) at SDSU is a

group of volunteer GIS students who will assist the city and county of San Diego in processing incoming data, analyzing results, and producing map products to assist disaster managers during the wildfires.

Group 7: The Residents of Evacuated Areas. You are the residents of San Diego. Unfortunately, you were evacuated during the wildfire. No one tells you whether your house burned down or not. How can you help yourselves and your neighbors to know more about wildfire information? How can you help other victims of wildfires in your community?

Group 8: FEMA (Federal Emergency Management Agency). You are the staff from FEMA. What kinds of resources and information can you provide to the residents, local governments, and organizations? How will you deploy these resources?

Group 9: NOAA National Weather Service. You are the NWS meteorologists and have worked closely with fire behavior specialists to work on the prediction model and fire spread models. How can you apply these fire spread models and weather information to help the disaster management and recovery efforts during and after the wildfires?

Group 10: National Forest Service (Southern California Division).

Group 11: Sharp Hospitals and Health Care Group.

Group 12: _____

Group 13: _____

Group 14: _____

Available Resources:

- **Big Data Hackathon for San Diego: http://bigdataforsandiego.github.io/ (see the Data list).**
- MAP.SDSU.EDU http://map.sdsu.edu
- SANDAG website: http://www.sandag.org/
- SANDAG GIS mapping: http://www.sandag.org/index.asp?subclassid=70&fuseaction=home.subclasshome
- SANGIS http://www.sangis.org/
- City of San Diego http://www.sandiego.gov/
- ESRI Community Analyst: http://www.esri.com/software/arcgis/community-analyst/index.html
- ArcGIS online: https://www.arcgis.com/home/