GIS 5070 Research Methods in GIS

UPD 5110 Spatial Planning Methods

COURSE INFORMATION:

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| Location and Time: | Des Peres Hall 204, Tu 4:20 – 6:50 |
| Instructor: | Dr. Tom Crawford |
|  | Des Peres Hall 203-F |
|  | crawfordtw@slu.edu |
| Office Hours: | W 1-3, Th, 1-3 or by appointment |

OVERVIEW:Geographic Information Systems (GIS) is a system of hardware, software, and procedures designed to support the capture, management, manipulation, analysis, modeling and display of spatially referenced data for solving complex planning and management problems. GIS applications use both spatial information (maps) and databases to perform analytical studies.

This course is designed to provide students a combined understanding of both applied geographic information systems (GIS) research techniques and concepts of Geographic Information Science (GIScience) research approaches. On the applied side, it focuses on the various spatial analytical methodologies of GIS and exposes students to a variety of methods such as geoprocessing, spatial pattern analysis, terrain mapping/analysis, viewshed & watershed analysis, spatial interpolation, and spatial modeling. The course will also cover conceptual topics related to scientific research approaches and scientific communication within the GIScience field. The delivery format consists of one three-hour per week session. The first half of each weekly session will typically consist of lecture material. The second half will involve hands-on instructor-led demonstrations, self-directed student assignment or project work (with instructor presence).

This course serves graduate students across the campus pursuing the MS in GIScience, MS in Urban Planning and Development, Graduate Certificate in Advanced Remote Sensing and GIS, or students from other programs seeking to further develop their GIS knowledge and skillset.

OUTCOMES:Upon successful completion of the courses, student will demonstrate ability to:

* Apply various spatial analysis techniques to address research questions.
* Identify and synthesize scientific literature related to spatial science research questions.
* Develop research questions informed by the geospatial scientific literature.
* Design and execute a research project involving GIS methods.
* Communicate GIS research using visual, written, oral, and quantitative approaches.

COURSE READINGS:

Required Book:

* Introduction to Geographic Information Systems), 8th edition.

Kang-tsung Chang. McGraw Hill.

Make sure to get the current edition (8th edition). We will cover roughly the second half of the book that focuses on analysis methods.

Selected chapters from (will be placed on Blackboard):

* Research Design and Proposal Writing in Spatial Science, 2nd edition. J. Gatrell, G. Bierly, and R. Jensen. Springer. ISBN: 978-94-007-2280-4. 2012,
* An Introduction to Scientific Research Methods in Geography. D. Montello, and P. Sutton. Sage. ISBN: 1-4129-0286-X. 2006.

Selected other readings (articles or websites) are placed on Blackboard site.

COURSE MATERIALS:

* Chang textbook assignment data - Contents are on Blackboard as a zip file.
* Lecture Slides - available in .pdf format on Blackboard after each chapter is completed.
* On-line Readings/Handouts - selected pdf files will be posted on Blackboard.
* Thumb drive or other digital device - to allow you to shuttle work among different PCs.

SOFTWARE:

* ArcGIS 10.4 - available on computers in the Center for Sustainability. Other campus labs may also have access (you will need to check for availability).
* Personal copy of ArcGIS 10.4 – You can download via the Web and install a free 1-year copy of ArcGIS 10.4 (ArcGIS for Desktop) to your personal computer. ArcGIS is not supported for Macs, but with appropriate software it is possible install and use on a Mac. Dr. Crawford is not responsible for tech support on your personal installation but will do his best to help if necessary.
* Will we use GeoDa and potentially other freely downloadable software.

Students may obtain a free one-year software installation by going to <http://www.esri.com/landing-pages/software/arcgis/arcgis-desktop-student-trial>

To download you will need to establish an ESRI Account (free).

Dr. Crawford will provide you an authorization code that will look like: EVA123456789

GRADE SCALE:

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| --- | --- | --- |
| Grade | Points | 0-100% scale |
| A | 4.0 | 93-100% |
| A- | 3.7 | 90-92.9% |
| B+ | 3.3 | 87-89.9% |
| B | 3.0 | 83-86.9% |
| B- | 2.7 | 80-82.9% |
| C+ | 2.3 | 77-79.9% |
| C | 2.0 | 73-76.9% |
| C- | 1.7 | 70-72.9% |
| D | 1.0 | 60-69.9% |
| F | 0.0 | 0-59.9% |

SCHEDULE: (Dates subject to slight change with ample notice provided based on class progress)

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| --- | --- | --- | --- |
| Date | Reading (read prior to class) | Topics | Turn In |
| Week 1  8/23 | Chapter 11 | Introduction  Vector Analysis I  - Buffering  - Overlay  - Distance measurement  - Geoprocessing tools |  |
| Week 2  8/30 | Chapter 11  (On Bb below):  Palomares et al. (2015)  Chaikew et al. (2009) | Vector Analysis II  - Pattern analysis  - Spatial autocorrelation  - GeoDa software  - Project 1: Spatial Analysis of CO2 Emissions | Tasks 11: Questions 1-13 |
| Week 3  9/6 | Schurmann (Chapter 1)  Gatrell (Chapters 1 & 3)  Another reading TBA | Geospatial Science  - Spatial science traditions  - scientific paradigms  - In class work on Project 1 |  |
| Week 4  9/13 | Chapter 12 | Raster Analysis I  - Analysis environments  - generalization  - Local, neighborhood, zonal functions  - Spatial Analyst extension | Project 1 |
| Week 5  9/20 | Chapter 12 (cont.)  Another reading TBA | Raster Analysis II  - Local, neighborhood, zonal functions (cont.)  - Distance functions  - Raster extraction  - Project 2: Sea Level Rise Impacts on Harkers Island | Tasks 12: Questions 1-6 & Challenge Questions |
| Week 6  9/27 | Chapter 13 | Terrain Analysis  - DEMs and TINs  - Slope, aspect, curvature  - 3D analysis  - Spatial Analyst extension  - ArcScene software | Tasks 13: Questions 1-6 & Challenge Questions |
| Week 7  10/4 | Gatrell (Chapter 2)  Montello (Chapter 13)  Caron et al. (2008) | Geospatial Literature  - Geospatial scientific literature  - Literature Review assignment  - Acquiring geospatial data  - Lit. Review Assignment  - Final Project assignment  - In class work on Project 2 | Project 2 |
| Week 8  10/11 | Chapter 14  Another reading TBA | Viewsheds and Watersheds  - Viewshed parameters/methods  - Flow routing and watershed delineation  - Spatial Analyst extension | Test 1  Tasks 14: Questions 1-9  Final Project Prospectus |
| Week 9  10/18 | Fall Break | (Feedback on Final Project Prospectus provided via e-mail prior to break) |  |
| Week 10  10/25 | Chapter 18  Another reading TBA | GIS Models and Regression  - Binary and index models  - Regression analysis | VC1: Building Models for GIS Analysis Using ArcGIS |
| Week 11  11/1 | Chapter 15  Kriging details (on Bb) | Spatial Interpolation I  - Density surfaces  - Control points & types of interpolation  - Global methods  - Local methods  - Kriging (Geostatistics)  - Geostatistical Analyst extension | VC2: Performing Spatial Interpolation Using ArcGIS |
| Week 12  11/8 | Chapter 15 (cont.) | Spatial Interpolation II  - continued from prior week  - Project 3: Interpolation of Hurricane Floyd Rainfall | Literature Review Paper |
| Week 13  11/15 | Chapter 17 | Least Cost Path Analysis & Network Analysis  - cost distance, path analysis  - network routing, allocation  - In class work on Final Project and/or Project 3 | Tasks 17: Questions 1-10 |
| Week 14  11/22 | Class does not meet but expectation of project work | Project Work  - Work on Final Project | Project 3 |
| Week 15  11/29 | Chapters 16 (selected part) | Geocoding and Dynamic Segmentation  - linear referencing methods  - shoreline erosion application  - address matching  - Work on Final Project | Test 2 |
| Final  12/6 | Tuesday 12/6: 4-5:50pm | Final Projects | Final Project  - oral presentations  - hardcopy submission |

GRADE ALLOCATION:

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| --- | --- |
| Grade Opportunities | Percent |
| Test 1 | 15% |
| Test 2 | 15% |
| 3 Short Projects | 25% |
| 1 Literature Review | 10% |
| 1 Final Project (hardcopy and oral presentation) | 20% |
| 4 “Tasks” Assignments (from Chang text) | 10% |
| 2 Virtual Campus Modules | 5% |
| Total | 100% |

* Tests: in class 1 hour test, multiple choice and short answer.
* Short Projects: series of common project assignments (i.e. all do same project) introduced and assigned in sync with course content
* Literature Review: critical review of GIS peer-reviewed literature on topic of your choosing that may be related to your Final Project
* Final Project: students will design and execute a spatial analysis project to be presented in poster form and 15-20 minute oral presentation and hardcopy deliverable. Oral presentation will be on the day of the final exam and will serve in place of a final exam.
* “Task Assignments”: Homework exercises at the end of selected text chapters.
* Virtual Campus Modules: two online ESRI Virtual Campus modules that students will complete and turn in print out of online quiz results which will form the basis of the grade. Each module takes about 1.5 to 2 hours.

EXPECTATIONS:

* Arrive on time (get there a few minutes early), log on to machines, start software.
* Turn all personal digital devices off.
* No use of computers for non-class activities (e.g. browsing, messaging, etc.).
* Interaction between instructor/students and students/students.

ACADEMIC INTEGRITY STATEMENT

*Academic integrity is honest, truthful and responsible conduct in all academic endeavors.* The mission of Saint Louis University is "the pursuit of truth for the greater glory of God and for the service of humanity."  Accordingly, all acts of falsehood demean and compromise the corporate endeavors of teaching, research, health care, and community service via which SLU embodies its mission. The University strives to prepare students for lives of personal and professional integrity, and therefore regards all breaches of academic integrity as matters of serious concern.

The governing University-level Academic Integrity Policy was adopted in Spring 2015, and can be accessed on the Provost's Office website at:

<http://www.slu.edu/Documents/provost/academic_affairs/University-wide%20Academic%20Integrity%20Policy%20FINAL%20%206-26-15.pdf>

Additionally, each SLU College, School, and Center has adopted its own academic integrity policies, available on their respective websites.  All SLU students are expected to know and abide by these policies, which detail definitions of violations, processes for reporting violations, sanctions, and appeals.  Please direct questions about any facet of academic integrity to your faculty, the chair of the department of your academic program, or the Dean/Director of the College, School or Center in which your program is housed.

TITLE IX STATEMENT

Saint Louis University and its faculty are committed to supporting our students and seeking an environment that is free of bias, discrimination, and harassment. If you have encountered any form of sexual misconduct (e.g. sexual assault, sexual harassment, stalking, domestic or dating violence), we encourage you to report this to the University. If you speak with a faculty member about an incident of misconduct, that faculty member must notify SLU’s Title IX coordinator, Anna R. Kratky (DuBourg Hall, room 36; akratky@slu.edu; 314-977-3886) and share the

basic fact of your experience with her. The Title IX coordinator will then be available to assist you in understanding all of your options and in connecting you with all possible resources on and off campus.

If you wish to speak with a confidential source, you may contact the counselors at the University Counseling Center at 314-977-TALK. To view SLU’s sexual misconduct policy and for resources, please visit the following web address: <http://www.slu.edu/general-counsel-home/office-of-institutional-equity-and-diversity/sexual-misconduct-policy> [www.slu.edu/here4you](http://www.slu.edu/here4you) .

STUDENT SUCCESS CENTER STATEMENT:  
In recognition that people learn in a variety of ways and that learning is influenced by multiple factors (e.g., prior experience, study skills, learning disability), resources to support student success are available on campus. The Student Success Center, a one-stop shop, which assists students with academic and career related services, is located in the Busch Student Center (Suite, 331) and the School of Nursing (Suite, 114). Students who think they might benefit from these resources can find out more about:

* Course-level support (e.g., faculty member, departmental resources, etc.) by asking your course instructor.
* University-level support (e.g., tutoring services, university writing services, disability services, academic coaching, career services, and/or facets of curriculum planning) by visiting the Student Success Center or by going to [www.slu.edu/success](http://www.slu.edu/success).

DISABILITY SERVICES ACADEMIC ACCOMMODATIONS STATEMENT:  
Students with a documented disability who wish to request academic accommodations are encouraged to contact Disability Services to discuss accommodation requests and eligibility requirements. Please contact Disability Services, located within the Student Success Center, at [Disability\_services@slu.edu](mailto:Disability_services@slu.edu) or 314.977.3484 to schedule an appointment. Confidentiality will be observed in all inquiries. Once approved, information about academic accommodations will be shared with course instructors via email from Disability Services and viewed within Banner via the instructor’s course roster.