Geographic Information Systems

ESCI 374.66

Continuing and Distance Education
Summer 2015

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ESCI 374.66: Geographic Information Systems

Course Syllabus

Course Overview:

The importance of the spatial dimension in data analysis for environmental monitoring, regional development, land use planning and epidemiology is now widely recognized. Such investigations require the building of sophisticated geographical information systems to interrelate data derived from censuses, surveys, maps in conventional and digital form, aerial photographs, and satellite imagery.

A Geographic Information System (GIS) is a computer-based data processing tool used to manage and analyze spatial information. As a tool, GIS is useful to a large number of professions, including: Environmental Management, Geography, Urban and Regional Planning, Forestry and Wildlife Management, Real Estate Management, Marketing, Resource Management, Natural Hazard/Risk Assessment and Analysis, Transportation, Agriculture, Law Enforcement, and Health Care Management, among others.

This course introduces students to the theory and techniques of GIS mapping and analysis, including: cartography and map projections, spatial and attribute data, vector and raster structure and analysis, and GIS modeling. At the end of the course, students will be able to develop their own GIS project, as well as to explore more advanced GIS techniques on their own. This course is especially useful for students majoring in Geography, Earth and Environmental Sciences, Economics, Forestry, and Land-use Planning, as well as to those interested in the analysis of economic, political, health care and natural resource data.

Laboratory activities are a critical component of the course and considerable amount of time will be devoted to practical exercises in the computer using Quantum GIS, a free open source GIS program that can be downloaded to your own personal computer. A tutorial will be provided for each practical exercise, which includes a brief theoretical background about the topic and a series of guided exercises for practicing the concepts.

Course Objectives:

1. To provide students with a basic understanding of GIS, GIS technology, and GIS applications.
2. Provide students with practical experience and appreciation of using open-source GIS software Quantum GIS (QGIS).
3. Provide students with tools to apply both theory and practice to a real GIS research project.

Learning Outcomes:

1. Students will be able to define GIS and recognize its key components and its major applications.

2. Students will be able to use the major analytical functions of QGIS and perform advanced analysis using both vector and raster datasets.

3. Students will be able to apply their GIS skills to solve practical problems using spatial analysis.

Evaluation Scheme:

8 Lab Reports: (25%)	**Due:** Weekly (see schedule)
Midterm Exam: (30%)	**Due:** Wednesday, July 15
Individual GIS Project: Map + Report (30%)	**Due:** Monday, August 10
Final Exam (30%)	**Date**: Friday, August 14

Midterm: This will be a 2-hour exam based on Modules I–III. The examination will consist of multiple-choice questions with short and long answer questions. All questions will be compulsory.

Final Exam: This will be a 3-hour exam divided into three sections: Section I, multiple choice questions; Section II, short answer questions; and Section III, essay-type question(s). You will be examined on all the Modules (emphasis being on the second half, Modules IV to VI). Section I and II will primarily examine you on the text and required reading. All questions in these Sections will be compulsory. Section III will contain a choice of questions.

The course final grade will be determined by the following equation:

$$\frac{(L \times 25) + (M \times 15) + (P \times 30) + (F \times 30)}{100}$$

Where:

L is the average mark from all individual lab reports (25% of the final grade),
M is the mark from the mid-term quiz (15% of the final grade),
P is the mark from the individual GIS project (30% of the final grade), and
F is the mark from the final quiz (30% of the final grade).

All lab reports, GIS project map and report, mid-term and final exam will be graded from 0 to 100 and the grade will be multiplied by the respective factor weight.

Course Materials and Resources:

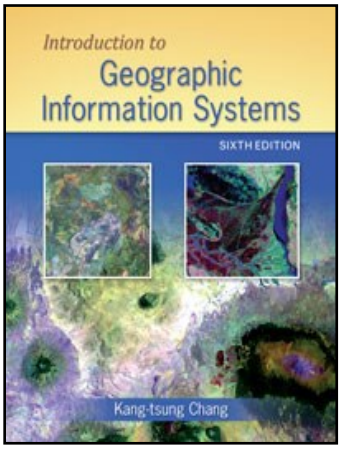
Optional Text

Chang, K. (2012). *Introduction to Geographic Information Systems* (6th ed.). New York, NY: McGraw Hill. ISBN: 0073369314 (Includes CD-ROM)
Text website: http://highered.mcgraw-hill.com/sites/0073369314/information_center_view0/

Online e-Text: *GIS Commons* (Available free as open-source from http://giscommons.org)

Required Reading

QGIS User Guide (Version 2.8, instruction manual; 22 Chapters; 339 pp.)
Download for free at: http://docs.qgis.org/2.8/en/docs/user_manual



GIS Commons

Other Resources:

- PowerPoint slide sets for all 31 lessons
- Tutorials with theoretical and practical exercises (one for each lesson). Each tutorial has an accompanied Internet link to a video, or videos, which will assist in showing what skills are being taught for that lesson as well as how to perform the required action in QGIS.

Recommended Optional Readings

Calvo R.W., de Luigi F., Haastrup P., Maniezzo V., 2004. A distributed geographic information system for the daily car-pooling problem. COMPUTERS & OPERATIONS RESEARCH, 31 (13): 2263-2278.

Herbst H., Herbst V., 2006. The development of an evaluation method using a geographic information system to determine the importance of wasteland sites as urban wildlife areas. LANDSCAPE AND URBAN PLANNING, 77 (1-2): 178-195.

Hess R.L., Rubin R.S., West L.A., 2004. Geographic information systems as a marketing information system technology. DECISION SUPPORT SYSTEMS, 38 (2): 197-212.

Jue D.K., Koontz C.M., Magpantay J.A., Lance K.C., Seidl A.M., 1999. Using public libraries to provide technology access for individuals in poverty: A nationwide analysis of library market areas using a geographic information system. LIBRARY & INFORMATION SCIENCE RESEARCH, 21 (3): 299-325.

Lemoine D., Evans J.P., Smith C.K., 2006. A landscape-level geographic information system (GIS) analysis of streamside management zones on the Cumberland Plateau. JOURNAL OF FORESTRY, 104 (3): 125-131.

Macey G.P., Her X., Reibling E.T., Ericson J., 2001. An investigation of environmental racism claims: Testing environmental management approaches with a geographic information system. ENVIRONMENTAL MANAGEMENT, 27 (6): 893-907.

Musiega D.E., Kazadi S.N., Fukuyama K., 2006. A framework for predicting and visualizing the East African wildebeest migration-route patterns in variable climatic conditions using geographic information system and remote sensing. ECOLOGICAL RESEARCH, 21 (4): 530-543.

Riolo F., 2006. A geographic information system for fisheries management in American Samoa. ENVIRONMENTAL MODELLING & SOFTWARE, 21 (7): 1025-1041.

Shin E.K., 2006. Using Geographic Information System (GIS) to improve fourth graders' geographic content knowledge and map skills. JOURNAL OF GEOGRAPHY, 105 (3): 109-120.

Yang G.J., Vounatsou P., Zhou X.N., Utzinger J., Tanner M., 2005. A review of geographic information system and remote sensing with applications to the epidemiology and control of schistosomiasis in China. ACTA TROPICA, 96 (2-3): 117-129.

Course Modules

The course modules are designed to help you to focus on what is important and how to study the material using the textbook. Course modules are uploaded to Blackboard for you to access.

One of the difficulties a distance learning student faces is determining what material is important and what the course instructor expects the student to know. Normally, when teaching takes place in a classroom situation, the instructor selects and presents material in a "digested form," and, emphasises the important aspects of the material taught. Students are given clear explanations on difficult aspects of the material and on the practical applications.

The modules have been written to narrow the gap between distance learning and the classroom situation and are inter-related with the text. When you start studying each module, you should first read the module objectives. This should give you an idea of what the instructor expects you to know. Then read through the chapter once and get the "big picture." Do not attempt to spend time putting material to memory at this stage, focus on understanding. As you read through each chapter a second time answer the self-examining questions (this is the interactive phase of study, the phase during which you find out what you understand). The answers to these questions (found within text and course modules) provide you with the understanding and detailed information that you are expected to know. The questions follow the order in which the material is covered in the text and therefore should be addressed sequentially. It is important that you work through all the questions.

Office Hours – PSC 2035, Hours TBD and posted on the course Moodle site

Expectations:

a) ***Preparation:*** As adult learners, students are expected to take responsibility for their own learning, seeking guidance from others when necessary. Students are expected to meet deadlines for completion of the course. Students must familiarize themselves with the library, the computer (word processing programs, Internet resources, e-mail, etc.) and student support resources available through StFX and/or in local communities. Self-motivation is essential in distance learning as you will be studying largely on your own. This is an intense, 8-week course and time objectives are important. A steady rate of study is required for understanding and "incubation periods" are necessary for material studied to “sink in”. Attempting to study material under time pressure may not necessarily be the best way to study and understand concepts. The emphasis should be on understanding concepts and not just memorisation. You will need to know certain key terms, and, this facilitates the understanding of concepts. A “What/When Guide Table” is provided below. This indicates to you what should have been

studied and when this needs to be completed. It is important that you follow the guidelines provided and do not lag behind in the course. The assessment dates /deadlines are fixed and certain material /sections need to be completed to successfully tackle the assessments /exams.

b) ***Submitting Assignments:*** Required assignments must be submitted on or before the due date. Marks will be deducted at a rate of 10% per day for late assignments. Extensions may be granted in exceptional circumstances, upon negotiation with the course professor in advance of the due date. Assignments without a negotiated extension and which are not received within 10 working days of the submission date **will not be accepted.**

c) ***Grades:*** Students must achieve a grade of at least 50% for successful completion of the course. All assignments must be completed and submitted within the time constraints of the course in order for the student to be eligible to receive a passing grade.

StFX Policy on Cheating and Plagiarism:

Plagiarism is considered the most serious academic offense that can occur in a university. Defined as the theft of intellectual property, it entails the ***unreferenced*** quotation of statistics, scientific experiments, the content of websites, material from books, academic journals, maps, people's conversations, a professor's lecture, a photograph or a piece of art. Contrary to what many students imagine, plagiarism is remarkably easy to detect. Material that you use for your course assignments must be properly referenced and given credit where it is due. If a student plagiarizes an assignment or cheats on an exam, he/she will be given an automatic mark of zero, and will be reported by letter to the Registrar at St. Francis Xavier University. For a detailed description of what constitutes plagiarism and cheating, and its repercussions, please refer to the *St. Francis Xavier University Calendar*, under the section on Academic Regulations, **3.8.2 Offenses Against Academic Integrity** on page 14.

- A tutorial for avoiding plagiarism is available through the StFX library website: http://library.acadiau.ca/tutorials/plagiarism/

- The full academic integrity policy and procedures document is available at http://www.stfx.ca/services/registrar/academic-integrity-document.pdf.

Please refer to the student handbook for other university policies and academic requirements.

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Course Schedule

DATES	LESSONS	READINGS	ACTIVITIES and ASSIGNMENTS
Module I: Introduction to the Course and to GIS			
June 22 - 25	Lessons 1 - 5	Text: Chapter 1 e-Text: Chapter 1	**Tutorial 1** (due Thursday, June 25)
Module II: Introduction to Geospatial Data			
June 26 – July 3	Lessons 6 - 7	Text: Chapters 5, 7, 8 e-Text: Chapter 2, 4	**Tutorial 2** (due Monday, June 29) **Tutorial 3** (due Friday, July 3)
Module III: Coordinate Systems and Map Projections			
July 4 –10	Lessons 8 - 12	Text: Chapter 2 e-Text: Chapter 3	**Tutorial 4** (due Friday, July 10)
Midterm: (15%)			**Date:** July 15
Module IV: The Vector Data Model			
July 11 - 17	Lessons 13 - 17	Text: Chapter 3 e-Text: Chapter 1	**Tutorial 5** (due Friday, July 17)
Module V: Vector Data Analysis			
July 18 - 24	Lessons 18 - 22	Text: Chapter 11 e-Text: Chapters 4, 5, 6	**Tutorial 6** (due Friday, July 24)
Module VI: The Raster Data Model			
July 25 – August 7	Lessons 23 - 31	Text: Chapters 4, 12, 13, 14 e-Text: Chapters 1, 4 ,5, 6	**Tutorial 7** (due Friday, July 31) **(Optional) Tutorial 8** (due Friday, August 7)
FINAL EXAM (30%)			**August 14, 2015**