

Department of Geography/  
Environmental and Resource Studies Program



GEOG /ERSC 2090H:

*Introduction to Geographical Information Systems (GIS)*



GIS  
2010-11 (FA)  
Peterborough

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urse Description:

**1. Introduction**

Geographical Information Systems (GIS) are a collection of hardware, software and procedures that have become an essential part of modern geographical work. GIS are important in any discipline or field of human activity, which involve the position of objects on earth, their attributes and phenomena for which the geographical space is important. GIS have a wide range of applications in both, the rural and urban environments. GIS is a field of research, development, and applications encompassing computer technology oriented to the acquisition, storage, processing, analysis and presentation of spatial information. A basic knowledge of GIS is essential for work applications in government agencies, the private

sector and research organizations.

## 2. Course Objectives.

This course has as its main objectives the following:

- a). Introduce the theoretical elements underpinning GIS structure and functions and to offer practical exposure to the technology and its applications.
- b). Provide opportunities for applying software-independent GIS concepts and procedures through the practical use of an industry-standard GIS software program, within a problem-solving framework.
- c). Initiate students in the development of skills in GIS applied to geographical analysis and problem-solving.

**Course Pre-requisites:** (consult the academic calendar)

**Course Fees:** A fee (between \$5 and \$10) is applicable to pay for a lab manual (the manual is printed on a cost-recovery basis).

### Course Format:

The course consists of one two-hour lectures weekly and one 3-hour computer lab fortnightly, delivered as follows:

Type	Day	Time	Location
Lectures (weekly)	Monday	9:00- 10:50	GCS 103
Labs (fortnightly)	Mondays, Tuesdays Wednesday Thursdays	13:00 – 15:50 13:00 – 15:50 12:00 – 14:50 9:00 – 11:50 & 13:00 – 15:50	SC 207

**GIS laboratory:** This course is based on the application of GIS concepts and theory through practical exercises. Due to limited capacity in the **GEOMATICS LAB (SC 207)** there will be lab groups (see below) from which students can choose. Registration into a selected lab group should have been initiated through “MyTrent” and should be finalized after the first lecture session.

**Lab Manual:** A lab manual is essential for the practical part of this course. The manual can be acquired on a cost-recovery basis on the first lecture, or later from either the demonstrator-technician or the instructor.

### **Lab Sessions.**

The lab sessions will be fortnightly. The lab manual must be read in advance of every lab

session (pre-lab quiz in MLS). For lab 1, appendix 2 of the manual must be read in advance of the lab session.

Lab groups are scheduled as follows:

Lab Group	Day	Time	Location	TA
A	Mondays	13:00 – 15:50	SC 207	Oumer Ahmed
B	Tuesdays	13:00 – 15:50	SC 207	Rob Loney
C	Wednesday	12:00 – 14:50	SC 207	Sarah Bale
D	Thursdays	9:00 – 11:50	SC 207	Oumer Ahmed
E	Thursdays	13:00 – 15:50	SC 207	Sarah Bale

**Important Notice Concerning the Length of Assignments:** Due to an expected wide range of computer backgrounds, skills and abilities amongst students, the successful completion of some of the lab assignments **may require work in excess of the hours scheduled for the lab in the calendar and time-table.** The time necessary for completion of a given assignment will depend on individual ability and dedication.

### Course Evaluation:

The course will be evaluated as per the following components:

Type of Assignment / test	Weighting	Due Date*
Lab assignment reports:	Total 55%	* <b>Lab due dates:</b> Unless otherwise indicated, the lab assignments are automatically due at the end of the day (4:30 PM) before the day of the next lab session, without exemptions.
Lab 1	10%	
Lab 2	10%	
Lab 3	10%	
Lab 4	10%	
Lab 5	15%	
Mid-term quiz	15%	Wed, Nov 1 <sup>st</sup> (30 minutes, in lecture)
Final Examination	30%	See calendar

**Pre-Lab Quiz:** Since practical work is fundamental in GIS, preparation for laboratory exercises is deemed essential to efficient learning. Therefore, to prevent students from wasting time reading lab instead of conducting the lab exercises while at the computer workstation, there will be a short pre-lab quiz that requires reading in preparation for the lab before every lab session. The quiz will earn students the right to lab work. This quiz will be worth 10% of the lab mark for a given lab.

### ***MyLearningSystem and Internet resources***

This course uses MyLearningSystem for delivery of lecture materials, readings, notices and other course-related items. As possible, the features of MyLearningSystem will be utilized. Students are expected to become familiar with the MyLearningSystem interface and be able to operate in that environment (consult the IT Departmental web page for MyLearningSystem workshop opportunities). Other internet resources may be used for particular topics. Dynamic links, for additional readings, will be provided via MyLearningSystem or in lecture, as required.

**Required Texts:** (There are no required texts for this course)

### **Recommended Texts:**

1. Burrough, P. A. and R. A. McDonnell (2005) Principles of Geographical Information Systems. Oxford University Press
2. Kang-tsung Chang (2008) Introduction to Geographic Information Systems. McGraw-Hill, N.Y.
3. Ormsby, T., E. Napoleon, R. Burke, C. Groessl, L. Feaster (2001) Getting to Know ArcGIS desktop. ESRI Press, Redlands, CA, USA.

### **Course Outline**

<b>Week</b>	<b>Date</b>	<b>Lecture</b>	<b>Lab</b>
1	Sept 13	Introduction and Course Syllabus 1. GIS DEFINITIONS AND CONCEPTS 2. THE NATURE OF SPATIAL DATA and THEIR DIGITAL REPRESENTATION Brief Introduction to GIS Software (ArcGIS)	No Labs this week Lab groups confirmed. Lab manual distributed.
2	Sept 20	3. GEOREFERENCING AND POSITIONAL DATA: Georeferencing systems, Coordinates and Map projections. 4. GEOREFERENCING AND POSITIONING: Transformation equations, Global Positioning Systems (GPS)	

Week	Date	Lecture	Lab
	Sept 20,21,22 & 23		Lab 1: Groups A (Mon), B (Tues), C (Wed), D & E (Thurs) respectively
3	Sept 27	<p>5. THE RASTER DATA MODEL: Grid cells, shapes and values, pixel resolution, creation and coding of raster maps.</p> <p>6. THE RASTER DATA MODEL: Storage, access and display. Attributes, Quad-trees</p>	
4	Oct 4	<p>7. RASTER DATA ANALYSIS: Spatial Query, Scalar Operations, &amp; Classification.</p> <p>8. RASTER DATA ANALYSIS FUNCTIONS: Neighbourhood and Context Operators, Spatial Interpolation, Map Overlay and types of map overlay operations, &amp; Resampling</p>	
	Oct 4,5, 6,7		Lab 2: Groups A (Mon), B (Tues), C (Wed), D & E (Thurs) respectively
5	Oct 11	Statutory Holyday: Thanks Giving Day (No Lecture)	
6	Oct 18	<p>9. RASTER DATA ANALYSIS FUNCTIONS: - Spatial Interpolation methods - Digital Elevation Models, Surface Analysis: contour, slope, aspect, hillshade, viewshade</p> <p>10. RASTER DATA ANALYSIS FUNCTIONS: - Map Algebra, Spatial and Cartographic Modelling - Digital Image Processing</p>	

Week	Date	Lecture	Lab
	Oct 18,19, 20, 21		Lab 3: Groups A (Mon), B (Tues), C (Wed), D & E (Thurs) respectively
Oct 25-31 ***** READING WEEK *****			
7	Nov 1	11. SPATIAL and ATTRIBUTE DATA BASES Data base concepts and Models 12. RELATIONAL DATABASES: Data Base Operations, Filters and SQL	(Mid-Term Quiz -30 min-in Lecture time)
	Nov 1,2, 3, 4		Lab 4: Groups A (Mon), B (Tues), C (Wed), D & E (Thurs) respectively
8	Nov 8	13. RELATIONAL DATABASES: Further Database Operations 14. SPATIAL and ATTRIBUTE DATA BASES: Linking spatial (map) to attribute (tabular) data	
9	Nov 15	15. THE VECTOR DATA MODEL: Vectorial Representation and storage of spatial data 16. THE VECTOR DATA MODEL: Topology and non-topology data: shapefiles	
	Nov 15,16, 17, 18		Lab 5: Groups A (Mon), B (Tues), C (Wed), D & E (Thurs) respectively
10	Nov 22	17. VECTOR DATA ANALYSIS: Spatial query, distance operators 18. VECTOR DATA ANALYSIS: Vector Topological Overlay, R-D-M operations, TIN	

Week	Date	Lecture	Lab
11	Nov 29	19. GIS APPLICATIONS: Remote Sensing Image Analysis  20. GIS APPLICATIONS: Cadastral, land records, real state, retail	
12	Dec 6	21. GIS in Location Services, Forestry 22. Internet GIS and Multimedia Spatial Systems  =====Course Review =====	Lab 5: due Groups A (Mon), B (Tues), C (Wed), D & E (Thurs) respectively
Final Exam (during exam period Dec. 11-22; exact date & time TBA)			

## University Policies

### **Academic Integrity:**

Academic dishonesty, which includes plagiarism and cheating, is an extremely serious academic offence and carries penalties varying from a 0 grade on an assignment to expulsion from the University. Definitions, penalties, and procedures for dealing with plagiarism and cheating are set out in Trent University's *Academic Integrity Policy*. You have a responsibility to educate yourself – unfamiliarity with the policy is not an excuse. You are strongly encouraged to visit Trent's Academic Integrity website to learn more: [www.trentu.ca/academicintegrity](http://www.trentu.ca/academicintegrity).

### **Access to Instruction:**

It is Trent University's intent to create an inclusive learning environment. If a student has a disability and/or health consideration and feels that he/she may need accommodations to succeed in this course, the student should contact the Disability Services Office (BL Suite 109, 748-1281, [disabilityservices@trentu.ca](mailto:disabilityservices@trentu.ca)) as soon as possible. Complete text can be found under Access to Instruction in the Academic Calendar.

**Please see the Trent University academic calendar for University Diary dates, Academic Information and Regulations, and University and departmental degree requirements.**

**Last date to withdraw from Fall term half courses without academic penalty in 2010-11 is November 12, 2010.**

### **Department Policies:**

**Grammar and Style:** It is expected that written assignments in Geography courses will conform to high standards of grammar and style. Although the penalty may vary from course to course, and from one kind of written assignment to another, bad grammar and style will be penalized in all grading of written work submitted in Geography courses