

**EARTH SC/ENVIR SC/GEOG 2GI3: GEOGRAPHIC INFORMATION SYSTEMS**

September to December 2017

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**COURSE OUTLINE<sup>1</sup>**

**Description**

Many organizations in the private and public sectors have implemented Geographic Information Systems (GIS) to store, manage, analyze, and visualize “geographic” data. In so doing, these organizations acknowledge the power of GIS in creating information from data to facilitate decision making. However, this power can only be realized if users of the technology have a thorough understanding of its basic principles and techniques, many of which are grounded in cartography. This course seeks to empower you at an introductory level in the effective use of this evolving technology by addressing six fundamental questions:

1. What is GIS?
2. What is georeferencing?
3. How are data represented in a GIS?
4. How are data collected for use in a GIS?
5. How are maps made using a GIS?
6. How are problems solved using a GIS?

The answers to these questions are a necessary prerequisite for more advanced treatments of the subject.

**Learning Outcomes**

Upon successful completion of this course you will be able to answer the above questions. This implies that you will understand:

1. Basic cartographic principles underlying GIS – namely, conceptualizations of the Earth’s shape, map scale, projections, and coordinate systems.
2. Ways in which data are stored in a GIS – specifically, vector and raster data models.
3. The role of relational databases in a GIS.
4. Primary and secondary data capture techniques such as the Global Positioning System (GPS) and digitizing (both manual and on-screen).
5. Basic cartographic principles underlying the effective design of thematic maps including, among others, map elements, symbolization, typography, and layout.
6. Basic techniques for analyzing vector data – namely, non-topological functions such as attribute query and measurement, and topological functions such as reclassification, buffering, and overlay analysis.
7. Basic techniques for analyzing raster data – namely, local, focal, zonal, and distance operations.

Upon successful completion of this course, you will also be proficient, albeit at an introductory level, in the use of ArcGIS 10.5.1 for problem solving and thematic map production.

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<sup>1</sup> The Instructor and the University reserves the right to change any aspect of this course outline.

## Instructor

Dr. Darren M. Scott      Office:      GSB 237  
Office Hours:      Fri. 1:00 pm – 3:00 pm  
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## Teaching Assistants

Christina Borowiec      Email:      borowc@mcmaster.ca  
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## Lectures and Labs

Please consult the table below for lecture and lab locations and times. **Attendance in both is mandatory** and the TA will take attendance each week in the lab. Please note that you will require more time to complete the assignments than the time allotted in the labs.

Category	Location	Day	Time
Lecture	JHE 376	Monday	11:30 – 12:20
Lecture	JHE 376	Wednesday	11:30 – 12:20
Lab 1	BSB 332	Tuesday	14:30 – 16:20
Lab 2	BSB 332	Tuesday	11:30 – 13:20
Lab 3	BSB 332	Wednesday	14:30 – 16:20
Lab 4	BSB 332	Thursday	14:30 – 16:20
Lab 7	BSB 332	Monday	14:30 – 16:20
Lab 8	BSB 331	Wednesday	12:30 – 14:20
Lab 9	BSB 332	Thursday	11:30 – 13:20
Lab 10	BSB 332	Wednesday	08:30 – 10:20
Lab 11	BSB 332	Monday	12:30 – 14:20

## Optional Textbook

Chang, K-T. (2015) *Introduction to Geographic Information Systems, 8th Edition*. New York, NY: McGraw Hill.

The above optional textbook can be consulted for treatments of GIS principles, techniques, and applications covered in class. The schedule of readings is included in the Course Schedule. To make the most of your experience, you should read this material prior to coming to class.

## Avenue to Learn

A website has been developed for this course. All officially registered students are automatically enrolled in the website, which can be accessed at the following web address:

<http://avenue.mcmaster.ca/>

If at any time students do not appear to be officially registered in the course, they will be denied access to the course content as well as the GIS labs (BSB 331, BSB 332).

## Assessment

You will be evaluated for your understanding of both conceptual and practical material offered in the course. You will complete 6 assignments and write a midterm exam on **Wednesday, October 25<sup>th</sup>**. **The location of the midterm exam will be announced in class and posted on Avenue to Learn.** The final exam is cumulative and will be written during the final examination period. The mark allocations are as follows:

50% Lab Exercises (Exercises 1, 5 @ 5%, Exercises 2, 3, 4, 6 @ 10%)

15% Midterm Exam

35% Final Exam (cumulative)

## Course Guidelines and Regulations

1. **Contacting the instructor** – I plan to adhere to regular office hours as indicated in this outline, and you are encouraged to use this time to review material, clarify points, or pursue issues. If for some reason you are unable to attend my office hours, please e-mail me for an appointment. With respect to email, I will check it once per day at approximately 9:00 am. If you are emailing outside of regular business hours (i.e., Monday to Friday 8:30 am – 4:30 pm), please do not expect a response until the next business day. Waiting for an email response does not constitute a valid reason for a late submission. Finally, I do not take technical questions over the phone.
2. **Course preparation** – Be advised that in general you will be required to dedicate at least 2 hours of preparation/study per hour of class/lab time. More preparation will help you make the most out of the course, and will undoubtedly lead to a higher grade. If for any reason you are having trouble with the course, see me or your TA as soon as possible. Problems that are identified early can often be rectified.
3. **How the term should be viewed** – It is reasonable to expect students to work throughout the duration of the term. Deliverables can be scheduled at any time during the term. You should consult the Course Schedule for specific dates and times. Given that attendance in both lectures and labs is mandatory, you are responsible for any missed information or instructions.
4. **The role of TAs in this course** – The TAs in this course are there to assist you in your lab slot. If you choose to not attend your lab, you have forfeited your opportunity to get help from your TA until you come to your next lab session. Your TA will not be holding office hours in this course as he/she will give you 2 hours of scheduled time per week. Should the TA need to be contacted, email is the only way to do so. In the event that lab sessions are cancelled, your TA will be available via email for that week to assist you. The duration of the email assistance will be from the cancellation until the day before your next scheduled lab. For example, if a snow day was on a Wednesday, your TA will make every effort to assist you via email from the Thursday until the following Tuesday. When the following Wednesday comes, you are expected to be in the lab.
5. **Handing in assignments** – You need to complete six assignments, which are collectively worth 50% of your final grade. Assignments must be handed in to your TA at the beginning of your lab period as indicated in the Course Schedule. Assignments handed in at any other time beyond this are considered late. Late assignments can be handed in to the internal course drop box, which is on the 2<sup>nd</sup> floor of the General Sciences Building around the corner from the School of Geography and Earth Sciences Main Office (GSB 206). At 4:30 pm, the external doors to the School lock, and any assignments should be submitted to the external drop box outside the doors to the School on the west side of the 2<sup>nd</sup> floor of the General Sciences Building. Late assignments are penalized at the rate of 20% for the first day and 10% for each subsequent day they are overdue, including weekends, which count as two days. **Late assignments will only be graded if they are handed in no later than three days after the original submission deadline.** After this time, you will receive a grade of zero. If you are late in submitting an assignment, you must send a digital copy to me (your instructor) and your TA so that we will know when the assignment was completed. Please ensure that a paper copy is then submitted immediately to the drop box for grading. This copy cannot differ in any way from the digital submission. The paper copy will be graded with all late penalties applied up until the paper copy was submitted.

6. **Mark appeals** – The TAs and I will make every effort to provide you with a grade that best reflects the quality of your work, and re-marking will be conducted at discretion. If you wish to have your work (assignment or exam) re-marked, you will be asked to explain in writing, within at most five business days after the work is initially returned, the reasons why it should be reviewed and the mark changed by me or the TA. The first person to contact for clarification is the person who marked the work. A reply will be forthcoming in a period of at least 48 hours. Please note that re-marking may result in a higher or a lower grade.
7. **Missed work** – If you are seeking relief for missed academic work for absences lasting up to three days, you may report your absence, once per term, without documentation, using the McMaster Student Absence Form (<http://www.mcmaster.ca/msaf/>). When using the MSAF, report your absence to your instructor ([scottdm@mcmaster.ca](mailto:scottdm@mcmaster.ca)), NOT your TA. Once the form is filled out, contact your instructor by email ([scottdm@mcmaster.ca](mailto:scottdm@mcmaster.ca)) immediately (within one working day). In the email message, state your TA's name and your lab section. You will then have three days from the due date of your assignment to submit your completed work (weekends count as two days) to the internal drop box (printed copy) and to your instructor and TA (electronic copy). Handing in an assignment after this will result in a grade of zero. Absences lasting more than three days must be reported to your Faculty Office. **Please note that in no situation will assignment marks be reallocated to the final exam.**
8. **Missed midterm exam** – If you miss the midterm exam for any valid reason, your final exam will be reweighted to 50% so long as your Faculty Office approves your absence and notifies the instructor of its approval (for absences lasting more than three days) or information has been entered into the MSAF (for absences lasting up to three days). If using the MSAF, you must contact the instructor by email ([scottdm@mcmaster.ca](mailto:scottdm@mcmaster.ca)) immediately (within one working day).
9. **Students with special needs** – If you have (or suspect you may have) a learning disability that may require accommodations, you are advised to contact Student Accessibility Services (McMaster University Student Center Basement, Room B107, Tel. 905-525-9140, ext. 28652). Accommodations are arranged exclusively through Student Accessibility Services (<http://sas.mcmaster.ca/>).
10. **Academic dishonesty** – All students are reminded of the seriousness of academic dishonesty. Academic dishonesty consists of misrepresentation by deception or by other fraudulent means and can result in serious consequences, e.g. a grade of zero on an assignment, loss of credit with a notation on the transcript (notation reads: "Grade of F assigned for academic dishonesty"), and/or suspension or expulsion from the university. It is your responsibility to understand what constitutes academic dishonesty. For information on the various kinds of academic dishonesty please refer to the Academic Integrity Policy (specifically Appendix 3, located at <http://www.mcmaster.ca/policy/Students-AcademicStudies/AcademicIntegrity.pdf>). Plagiarism (e.g., the submission of work that is not one's own or for which other credit has been obtained), improper collaboration in group work, and copying or using unauthorized aids, tests, and examinations are examples of academic dishonesty.
11. **The Instructor and the University reserves the right to change any aspect of this course outline.**

### Prerequisites

One of BIOLOGY 1M03, EARTH SC 1G03, ENVIR SC 1A03, 1B03, 1C03, 1G03, GEOG 1HA3, 1HB3, ISCI 1A24 A/B

### Lab and Software Ownership Policies

As part of this course, you will complete assignments using ArcGIS 10.5.1. McMaster University has obtained an Academic site license from ESRI Canada Limited, which means that the license limits the use of the software to academic purposes only (i.e., you cannot use it for commercial purposes). Students who wish to have a student version of ArcGIS 10.5.1 can obtain one for a \$30 administrative fee. This version of the software has the same functionality as the version in the GIS Labs and it times out after one year.

In addition to the use of ArcGIS, you are advised that the data used in the course for the preparation of assignments may be subject to the proprietary rights of others. You must obtain appropriate permissions to use any such data for purposes other than the completion of assignments.

You are urged to discuss any concerns that you may have with your instructor. In no event will McMaster University be responsible for the use by a student of any data for which appropriate permission was not obtained. By taking part in this course, you agree to indemnify McMaster University from any loss that may be suffered on its part as a result of you not obtaining appropriate permission.

### Course Schedule (Subject to change at the discretion of the instructor)

<b>Week 1</b>	
<b>Sept. 6</b>	Course overview
<b>Reading</b>	No readings this week
<b>Lab</b>	No labs this week
<b>Week 2</b>	
<b>Sept. 11</b>	What is GIS? I
<b>Sept. 13</b>	What is GIS? II
<b>Reading</b>	Chapter 1
<b>Lab</b>	No labs this week
<b>Week 3</b>	
<b>Sept. 18</b>	What is georeferencing? I
<b>Sept. 20</b>	What is georeferencing? II
<b>Reading</b>	Chapter 2
<b>Lab</b>	Exercise 1: Introduction to ArcGIS
<b>Week 4</b>	
<b>Sept. 25</b>	What is georeferencing? III
<b>Sept. 27</b>	What is georeferencing? IV
<b>Reading</b>	Chapter 2
<b>Lab</b>	Exercise 2: Projections and coordinate systems
<b>Deliverable</b>	Exercise 1 is due at the beginning of your lab period
<b>Week 5</b>	
<b>Oct. 2</b>	How are data represented in a GIS? I
<b>Oct. 4</b>	How are data represented in a GIS? II
<b>Reading</b>	Chapters 3 (3.1, 3.2, 3.3), 4
<b>Lab</b>	Exercise 2: Projections and coordinate systems (cont.)
<b>Return</b>	Exercise 1 is returned during your lab period
<b>Week 6</b>	
<b>Oct. 9, 11</b>	Midterm recess (no class)
<b>Week 7</b>	
<b>Oct. 16</b>	How are data represented in a GIS? III
<b>Oct. 18</b>	Attributes and tables
<b>Reading</b>	Chapter 8
<b>Lab</b>	Exercise 3: Vector and raster data structures
<b>Deliverable</b>	Exercise 2 is due at the beginning of your lab period

<b>Week 8</b>	
<b>Oct. 23</b>	How are data collected for use in a GIS? I
<b>Oct. 25</b>	<b>MIDTERM EXAM</b>
<b>Reading</b>	Chapters 5, 6, 7
<b>Lab</b>	Exercise 3: Vector and raster data structures (cont.)
<b>Return</b>	Exercise 2 is returned during your lab period
<b>Week 9</b>	
<b>Oct. 30</b>	How are data collected for use in a GIS? II
<b>Nov. 1</b>	How are data collected for use in a GIS? III
<b>Reading</b>	Chapters 5, 6, 7
<b>Lab</b>	Exercise 4: Georeferencing, on-screen digitizing, and GPS
<b>Deliverable</b>	Exercise 3 is due at the beginning of your lab period
<b>Week 10</b>	
<b>Nov. 6</b>	How are maps made using a GIS? I
<b>Nov. 8</b>	How are maps made using a GIS? II
<b>Reading</b>	Chapter 9
<b>Lab</b>	Exercise 4: Georeferencing, on-screen digitizing, and GPS (cont.)
<b>Return</b>	Exercise 3 is returned during your lab period
<b>Week 11</b>	
<b>Nov. 13</b>	How are maps made using a GIS? III
<b>Nov. 15</b>	How are maps made using a GIS? IV
<b>Reading</b>	Chapter 9
<b>Lab</b>	Exercise 5: Tables and layouts
<b>Deliverable</b>	Exercise 4 is due at the beginning of your lab period
<b>Week 12</b>	
<b>Nov. 20</b>	How are problems solved using a GIS? I
<b>Nov. 22</b>	How are problems solved using a GIS? II
<b>Reading</b>	Chapters 10 (10.3, 10.4, 10.5), 11 (11.1, 11.2, 11.3, 11.5), 12
<b>Lab</b>	Exercise 6: Vector and raster data analysis
<b>Deliverable</b>	Exercise 5 is due during your lab period
<b>Return</b>	Exercise 4 is returned during your lab period
<b>Week 13</b>	
<b>Nov. 27</b>	How are problems solved using a GIS? III
<b>Nov. 29</b>	How are problems solved using a GIS? IV
<b>Reading</b>	Chapters 10 (10.3, 10.4, 10.5), 11 (11.1, 11.2, 11.3, 11.5), 12
<b>Lab</b>	Exercise 6: Vector and raster data analysis (cont.)
<b>Return</b>	Exercise 5 is returned during your lab period
<b>Week 14</b>	
<b>Dec. 4</b>	How are problems solved using a GIS? V
<b>Dec. 6</b>	Exam overview
<b>Reading</b>	No readings this week
<b>Lab</b>	No labs this week
<b>Deliverable</b>	Exercise 6 is due in the internal drop box by 4:00 pm on Dec. 6 <sup>th</sup>