



# ENGG\*3340 Geographic Information Systems in Environmental Engineering

Fall 2017

Sections(s): C01

School of Engineering

Credit Weight: 0.50

Version 1.00 - September 05, 2017

---

## 1 Course Details

### 1.1 Calendar Description

Geographical information system structure and functions. Data structuring and application program development. Data input, display and analysis. Applications in environmental engineering and natural resource development/management. Students will be able to use a GIS software package to build geographical information systems.

**Pre-Requisite(s):** (CIS\*1500 or CIS\*1600), (1 of MATH\*1000, MATH\*1080, MATH\*1200)

### 1.2 Timetable

**Lectures:**

Monday 2:30 PM – 3:50 PM THRN 1319

**Tutorials:**

Wednesday 2:30 PM – 3:50 PM THRN 1319

**Laboratory:**

N/A

Please note that Monday will be predominantly lecture and Wednesday will be hands-on to master ArcGIS software through textbook tutorials.

## 1.3 Final Exam

Tuesday, December 4, 2:30 pm to 3:50 pm, Room TBA on WebAdvisor

---

# 2 Instructional Support

## 2.1 Instructor(s)

**Prasad Daggupati Assistant Professor, Water Resource Engineering**

Email: pdaggupa@uoguelph.ca

Telephone: +1-519-824-4120 x58303

Office: RICH 3523

Office Hours: Tuesday 11AM to 1PM and by appointment

## 2.2 Teaching Assistant(s)

| Name             | Details                  |
|------------------|--------------------------|
| Nabil Allataifeh | nallatai@uoguelph.ca TBA |

---

# 3 Learning Resources

## 3.1 Required Resources(s)

### Course Website (Website)

<http://courselink.uoguelph.ca>

Course material, news, announcements, and grades will be regularly posted to the ENGG\*3340

CourseLink site. You are responsible for checking the site regularly.

**M. Price. Mastering ArcGIS 7th Edition, McGraw Hill, 2016. (Textbook)**

## 3.2 Recommended Resources(s)

**Bolstad, P. 2008. GIS Fundamentals. Third Edition. Atlas Books. (Textbook)**

<http://www.paulbolstad.net/gisbook.html> (Website)

<http://www.paulbolstad.net/gisbook.html>

**Chang, K.T., 2002. Introduction to Geographic Information Systems. McGraw Hill, New York.**

(Textbook)

### 3.3 Additional Resources(s)

#### Lecture Information (Notes)

The lecture slides will be posted on CourseLink each week.

#### In-class Tutorials (Notes)

Tutorials from the course textbook will be assigned most weeks. Further instructions on finding the required geospatial data will be discussed in class.

#### Assignments (Notes)

Four assignments will be assigned during the course. Further instructions will be discussed and posted on CourseLink.

#### Term Project (Notes)

The instructions and marking scheme for each portion of the term project (i.e., proposal, methods, final report, and final presentation) will be available on CourseLink.

#### Exams (Notes)

The format of the midterm and final exam will be discussed during a lecture prior to test.

#### Miscellaneous Information (Other)

The Data Resource Centre provides geospatial data and GIS support for U of G students:  
<http://www.lib.uoguelph.ca/get-assistance/maps-gis-data/gis-analysis>

### 3.4 Communication and Email Policy

Please use lectures and lab help sessions as your main opportunity to ask questions about the course. Major announcements will be posted to the course website (CourseLink). **It is your responsibility to check the course website regularly.** As per university regulations, all students are required to check their <[uoguelph.ca](http://www.uoguelph.ca)> e-mail account regularly: e-mail is the official route of communication between the University and its student.

---

## 4 Learning Outcomes

This course provides basic-level knowledge of Geographic Information System (GIS) principles, techniques and practice in environmental and water resources engineering and natural resources management. In this course students will learn about data sources, visualization, query, analysis, and integration using "ESRI ArcGIS 10.3x" which is a popular desktop GIS and mapping software.

### 4.1 Course Learning Outcomes

By the end of this course, you should be able to:

1. Understand basic GIS terminology, structure and functions including data structuring and application program development.
2. Appropriately find, select and apply data, perform analyses and produce a final map or data-based product.
3. Apply and use GIS as a tool to facilitate and enhance a variety of environmental and water resources engineering as well as natural resource management projects.

4. Use a commercial GIS software package to build geographic information systems.
5. Communicate effectively in both written and verbal format the results of a GIS-based project.

## 4.2 Engineers Canada - Graduate Attributes

Successfully completing this course will contribute to the following:

| #   | Outcome Set Name   | Course Learning Outcome |
|-----|--|-------------------------|
| 1   | Knowledge base   | 1, 2, 3, 4              |
| 1.1 | Recall, describe and apply fundamental mathematical principles and concepts        | 1, 2, 3, 4              |
| 1.2 | Recall, describe and apply fundamental concepts and principles in natural sciences | 1, 2, 3, 4              |
| 1.3 | Comprehend and apply fundamental engineering concepts                              | 1, 2, 3, 4              |
| 1.4 | Comprehend and apply program-specific engineering concepts                         | 1, 2, 3, 4              |
| 2   | Problem analysis   | 2, 3                    |
| 2.1 | Formulate a problem statement in engineering and nonengineering terminology        | 2, 3                    |
| 2.2 | Construct a conceptual framework   | 2, 3                    |
| 2.3 | Identify, organize and justify appropriate information                             | 2, 3                    |
| 2.4 | Execute an engineering solution  | 2, 3                    |
| 2.5 | Critique and appraise results  | 2, 3                    |
| 3   | Investigation  | 2, 3, 4, 5              |
| 3.1 | Propose and test working hypotheses  | 2, 3, 4, 5              |
| 3.2 | Design and apply an investigation plan   | 2, 3, 4, 5              |
| 3.3 | Analyze and interpret experimental data  | 2, 3, 4, 5              |
| 3.4 | Assess validity of conclusions within limitations of data and methodologies        | 2, 3, 4, 5              |
| 4   | Design   | 2, 3, 4, 5              |
| 4.1 | Describe the design process  | 2, 3, 4, 5              |
| 4.2 | Construct design-specific problem statements                                       | 2, 3, 4, 5              |
| 4.3 | Create engineering design solutions  | 2, 3, 4, 5              |
| 4.4 | Develop engineering design solutions   | 2, 3, 4, 5              |
| 4.5 | Assess engineering design solutions  | 2, 3, 4, 5              |

| #    | Outcome Set Name  | Course Learning Outcome |
|------|---|-------------------------|
| 4.6  | Implement engineering design solutions  | 2, 3, 4, 5              |
| 5    | Use of engineering tools  | 1, 2, 4                 |
| 5.1  | Select appropriate engineering tools from various alternatives                              | 1, 2, 4                 |
| 5.2  | Apply selected engineering tools  | 1, 2, 4                 |
| 5.3  | Recognize limitations of selected engineering tools   | 1, 2, 4                 |
| 6    | Individual and team work  | 5                       |
| 6.1  | Act as an individual team member to promote team success                                    | 5                       |
| 6.2  | Demonstrate leadership through team building, providing feedback and positive attitude      | 5                       |
| 7    | Communication skills  | 2, 3                    |
| 7.1  | Develop and deliver clear, key concepts using methods appropriate for the intended audience | 2, 3                    |
| 7.2  | Critically evaluate received information  | 2, 3                    |
| 7.3  | Demonstrate active listening and follow instructions  | 2, 3                    |
| 9    | Impact of engineering on society and environment  | 3                       |
| 9.1  | Analyze the social, environmental and legal aspects of engineering activity                 | 3                       |
| 9.2  | Summarize the common sources of uncertainty and risk in their engineering field             | 3                       |
| 9.3  | Identify the impact of introducing innovative technologies to solve engineering problems    | 3                       |
| 11   | Economics and project management  | 3                       |
| 11.1 | Apply project management techniques and manage resources within identified constraints      | 3                       |
| 11.2 | Estimate the life cycle engineering benefits and costs associated with engineering design   | 3                       |
| 12   | Life-long learning  | 3                       |
| 12.1 | Identify personal career goals and opportunities for professional development               | 3                       |
| 12.2 | Analyze a self-assessment of skills relative to SOE defined learning outcomes               | 3                       |
| 12.3 | Identify and critique limits of their field   | 3                       |

---

# 5 Teaching and Learning Activities

## 5.1 Lecture Schedule

| <b>Lectures</b>       | <b>Topics</b>   | <b>References</b>    | <b>Learning Objectives</b> |
|-----------------------|---|----------------------|----------------------------|
| <b>11-Sep</b>         | Introduction to class; Term project introduction; Introduction to GIS; GIS data | Intro. and Chapter 1 | 1, 2                       |
| <b>13-Sep</b>         | COMP. LAB 1: Introduction to GIS and GIS Data                                   | Chapters 1           | 1, 2                       |
| <b>18-Sep</b>         | Managing GIS data, coordinate systems and projections                           | Chapter 2,3          | 1, 2, 3                    |
| <b>20-Sep</b>         | COMP. LAB 2: Managing GIS data and coordinate systems                           | Chapter 2,3          | 1, 2, 3                    |
| <b>(Assignment 1)</b> |   |                      |                            |
| <b>25-Sep</b>         | Mapping and presenting GIS data   | Chapter 4,5          | 1, 2, 3                    |
| <b>27-Sep</b>         | COMP. LAB 3: Map development  | Chapter 4            | 1, 2, 3                    |
| <b>02-Oct</b>         | Data Resource Center  | Data Resource Center |                            |
| <b>04-Oct</b>         | COMP. LAB 4: Map presentation   | Chapters 5           | 1, 2, 3                    |
| <b>(Assignment 2)</b> |   |                      |                            |
| <b>09-Oct</b>         | No class  |                      |                            |
| <b>11-Oct</b>         | <b>Midterm</b>  |                      |                            |
| <b>16-Oct</b>         | Attribute data, database management and Basic data analysis                     | Chapter 6,7          | 1, 2                       |

|                       |  |                |               |
|-----------------------|--|----------------|---------------|
| <b>18-Oct</b>         | COMP. LAB 5: Attribute data and basic data editing | Chapter 6,7    | 1, 2          |
| <b>23-Oct</b>         | Queries and spatial joins                          | Chapters 8, 9  | 1, 2, 3       |
| <b>25-Oct</b>         | COMP. LAB 6: Queries and spatial joins             | Chapters 8, 9  | 1, 2, 3       |
| <b>(Assignment 3)</b> |  |                |               |
| <b>30-Oct</b>         | Map overlay and Geoprocessing                      | Chapters 10    | 1, 2, 3, 4    |
| <b>01-Nov</b>         | COMP. LAB 7: Map overlay and geoprocessing         | Chapters 10    | 1, 2, 3, 4    |
| <b>06-Nov</b>         | Raster Analysis                                    | Chapter 11     | 1, 2, 3, 4    |
| <b>08-Nov</b>         | COMP. LAB 8: Raster Analysis                       | Chapter 11     |               |
| <b>(Assignment 4)</b> |  |                |               |
| <b>13-Nov</b>         | Guest lectures                                     | Lecture slides |               |
| <b>15-Nov</b>         | GIS applications and Remote Sensing                | Lecture slides |               |
| <b>20-Nov</b>         | Review session; Term project work period           |                |               |
| <b>22-Nov</b>         | Term project presentations                         | all            | 1, 2, 3, 4,5  |
| <b>27-Nov</b>         | Term project presentations                         | all            | 1, 2, 3, 4, 5 |
| <b>29-Nov</b>         | Term project presentations                         | all            | 1, 2, 3, 4, 5 |
| <b>04-Dec</b>         | <b>Final Exam</b>                                  | all            |               |

---

## 6 Assessments

### 6.1 Marking Schemes & Distributions

| Name         | Scheme A (%) |
|--------------|--------------|
| Tutorials    | 0.00         |
| Assignments  | 20.00        |
| Midterm Test | 20.00        |
| Term Project | 35.00        |
| Final Exam   | 25.00        |
| Total        | 100.00       |

## 6.2 Assessment Details

### Tutorials

**Date:**

Tutorial will be assigned most weeks in class. It is essential to stay up to date with these tutorials to learn the course material and software in order to complete your term project and be successful on the midterm and final exam.

### Assignments

**Date:**

Four assignments will be assigned during the course. The assignments due one week after assigned. The students should upload the assignments to the Dropbox.

Absolutely NO assignments and projects will be accepted after the due date without a confirmed prior arrangement with instructor and TA.

### Midterm Test

**Date:** Wednesday, October 11, THRN 1319

There will be test held during the lecture period on October 11<sup>th</sup>. This will be a written and "hands-on" test to test your knowledge of GIS theory as well as your ability to use the ArcGIS software. More information will be provided in class prior to the test and will be posted to the CourseLink.

### Term Project

**Date:**

Group Formation: Term project groups of 4 or 5 students must be formed before **Wednesday, September 20 at 10 pm**. The student names must be included in a memo addressed to the GTA.

One student in each group to upload the memo to Dropbox on CourseLink. Following this, the GTA will randomly assign group numbers.

Project Proposal: Due on **Wednesday, October 4 at 10 pm**. One student in each group to upload the document to Dropbox on CourseLink. See further instructions on CourseLink and



in class. (5%)

***Final Presentation:*** Electronic copy of presentation due on **Tuesday, November 21 at 10 pm**. One student in each group to upload slides (i.e., PowerPoint file) to Dropbox on CourseLink. In class presentations: groups 1, 2, 3, 4 on **Wednesday, November 22**; groups 5, 6, 7, 8 on **Monday, November 27**; and groups 9, 10, 11, 12 on **Wednesday, November 29**. See further instructions on CourseLink and in class. (10%)

***Note:*** The uploaded presentation is the version that you will present!

***Final Report:*** Due on **Wednesday, November 29 at 10 pm**. Both paper and electronic copies are required. One student in each group to 1) upload full report to Dropbox on CourseLink, and 2) submit to the instructor a hard copy of the report and all associated electronic files (including ArcMap files and data) on a DVD or USB flash drive. See further instructions on CourseLink and in class. (20%)

### **Final Exam**

**Date:** Monday, December 4, TBA

2:30pm - 3:50pm

---

## 7 Course Statements

### 7.1 Course Grading Policies

**Missed Assessments:** If you are unable to meet an in-course requirement due to medical, psychological, or compassionate reasons, please email the course instructor. See the undergraduate calendar for information on regulations and procedures for Academic Consideration: <http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml>

**Accommodation of Religious Obligations:** If you are unable to meet an in-course requirement due to religious obligations, please email the course instructor within two weeks of the start of the semester to make alternate arrangements. See the undergraduate calendar for information on regulations and procedures for Academic Accommodation of Religious Obligations: <http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-accomrelig.shtml>

**Passing Grade:** In order to pass the course, you must pass the final exam. Students must obtain a grade of 50% or higher on the final exam in order for the term project, midterm, and assignments to count towards the final grade.

**Late Submissions:** Late submissions will be penalized by 20% per day past the deadline.

## 8 School of Engineering Statements

### 8.1 Instructor's Role and Responsibility to Students

The instructor's role is to develop and deliver course material in ways that facilitate learning for a variety of students. Selected lecture notes will be made available to students on Courselink but these are not intended to be stand-alone course notes. Some written lecture notes will be presented only in class. During lectures, the instructor will expand and explain the content of notes and provide example problems that supplement posted notes. Scheduled classes will be the principal venue to provide information and feedback for tests and labs.

### 8.2 Students' Learning Responsibilities

Students are expected to take advantage of the learning opportunities provided during lectures and lab sessions. Students, especially those having difficulty with the course content, should also make use of other resources recommended by the instructor. Students who do (or may) fall behind due to illness, work, or extra-curricular activities are advised to keep the instructor informed. This will allow the instructor to recommend extra resources in a timely manner and/or provide consideration if appropriate.

### 8.3 Lab Safety

Safety is critically important to the School and is the responsibility of all members of the School: faculty, staff and students. As a student in a lab course you are responsible for taking all reasonable safety precautions and following the lab safety rules specific to the lab you are working in. In addition, you are responsible for reporting all safety issues to the laboratory supervisor, GTA or faculty responsible.

## 9 University Statements

### 9.1 Email Communication

As per university regulations, all students are required to check their e-mail account regularly: e-mail is the official route of communication between the University and its students.

### 9.2 When You Cannot Meet a Course Requirement

When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons please advise the course instructor (or designated person, such as a teaching assistant) in writing, with your name, id#, and e-mail contact. The regulations and procedures for [Academic Consideration](#) are detailed in the Undergraduate Calendar.

### 9.3 Drop Date

Courses that are one semester long must be dropped by the end of the fortieth class day; two-semester courses must be dropped by the last day of the add period in the second semester. The regulations and procedures for [Dropping Courses](#) are available in the Undergraduate Calendar.

### 9.4 Copies of Out-of-class Assignments

Keep paper and/or other reliable back-up copies of all out-of-class assignments: you may be asked to resubmit work at any time.

## 9.5 Accessibility

The University promotes the full participation of students who experience disabilities in their academic programs. To that end, the provision of academic accommodation is a shared responsibility between the University and the student.

When accommodations are needed, the student is required to first register with Student Accessibility Services (SAS). Documentation to substantiate the existence of a disability is required, however, interim accommodations may be possible while that process is underway.

Accommodations are available for both permanent and temporary disabilities. It should be noted that common illnesses such as a cold or the flu do not constitute a disability.

Use of the SAS Exam Centre requires students to book their exams at least 7 days in advance, and not later than the 40th Class Day.

More information: [www.uoguelph.ca/sas](http://www.uoguelph.ca/sas)

## 9.6 Academic Misconduct

The University of Guelph is committed to upholding the highest standards of academic integrity and it is the responsibility of all members of the University community – faculty, staff, and students – to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff and students have the responsibility of supporting an environment that discourages misconduct. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection.

Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor.

The [Academic Misconduct Policy](#) is detailed in the Undergraduate Calendar.

## 9.7 Recording of Materials

Presentations which are made in relation to course work—including lectures—cannot be recorded or copied without the permission of the presenter, whether the instructor, a classmate or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

## 9.8 Resources

The [Academic Calendars](#) are the source of information about the University of Guelph's procedures, policies and regulations which apply to undergraduate, graduate and diploma programs.

---