

**GEOG/PLAN 381**  
**ADVANCED GEOGRAPHIC INFORMATION SYSTEMS**

**Course Syllabus – Spring 2018**

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**OVERVIEW**

Students learn theoretical and operational approaches to advanced spatial analysis using geographical information systems. Emphasis is placed on the use of automation procedures using models and programming to address a variety of topics that may include but are not limited to digital terrain modelling, suitability analysis, network analysis, and cell-based models. The domain of spatial problems explored may vary by instructor.

**INSTRUCTOR**

**Dr. Su-Yin Tan**

Office: EV1-227

Phone : 519-888-4567, Ext. 38772

E-mail: su-yin.tan@uwaterloo.ca (use LEARN mail system)

Office hours: Friday, 9:45-11:15 a.m. (subject to change). By appointment if necessary.

**SUPPORT STAFF**

- Teaching Assistants:

(Office hours: TBA – posted on LEARN      Location: General Use Lab, EV2-1001)

**Kristen de Kroon** ke2dekro@uwaterloo.ca

**Jennifer Ridge** jridge@uwaterloo.ca

- Geospatial Applications Specialist:

**James D. McCarthy**

Office: Ask at MAD Helpdesk

Phone : 519-888-4567 Ext. 38529

E-mail: jmccarth@uwaterloo.ca (use LEARN mail system)

**LECTURES**

Location: Environment 3 (EV3), Room 1408

Time: Friday, 11:30 a.m. - 2:20 p.m.

**PREREQUISITE**

GEOG/PLAN 281 (Intro to GIS)

## COURSE DESCRIPTION

This course blends traditional GIS lab assignments with a problem-based approach to learning organized around six assignments. Lab assignments focus on the introduction of students to advanced functions of GIS, including automation through model building and scripting. Each assignment will be focused on solving a real-world problem using GIS. There is no single ‘correct’ answer, but rather, students will be required to think creatively, build on topics taught in class and data provided, and develop an appropriate solution using GIS. This format is intended to mirror how GIS is often used in the working world – where solutions are not prescribed, but rather created.

The course builds on the knowledge and skills developed in GEOG/PLAN 281 and focuses on using GIS to perform selected types of spatial analyses. Students will learn how to perform different types of spatial analyses, identify the types of questions different analysis approaches can answer, critically evaluate the advantages and limitations of different approaches, and gain a better understanding of the use of capabilities of spatial analysis.

*\*\*\* Please note: In GEOG 381, creative problem solving and experimentation will be rewarded. Data provided for each case study and techniques that are introduced in class should be considered as a starting point only. To achieve an excellent mark, you will need to move beyond these or implement them in some unique way.*

## COURSE OBJECTIVES

By the end of the course, students should be able to:

1. Choose an *appropriate* analytic approach and methods to study a given geospatial problem.
2. Demonstrate awareness and mastery of key techniques of geospatial analysis using desktop GIS software and methods of extending GIS, including model building and scripting.
3. Critically evaluate the use of geospatial tools as they are applied to geospatial problems.
4. Develop the problem solving skills required to *independently* extend desktop GIS functionality to address novel situations and challenges in spatial analysis.

## EVALUATION

This course will consist of a mix of lecture-style delivery of content with hands-on laboratory assignments, each designed to support the development of technical and analytical skills.

### Lab Assignments:

Lab 1 – Mapping Crime Reports	5%
Lab 2 – GIS Multicriteria Analysis (MCA)	10%
Lab 3 – Model Builder and Python	12%
Lab 4 – Python Programming and Data Management	12%
Lab 5 – Network Analysis	12%
Lab 6 – MCA/AHP Mini-Project (group assignment)	20%
Lab Attendance :	4%
Final Exam :	25%
Peer Evaluation for Group Work (optional)	+ 2 % bonus

## LABS

Location: Geddes GIS Lab (EV2, Room 1002A)  
Software: ArcGIS 10.5.1, TerrSet 18.3

Times: Schedule listed below [Lab section number in brackets]  
*\*\* Only attend the lab session you are assigned to, otherwise assignments submitted to different lab sections will not be marked \*\**

Monday: 8:30 a.m.-10:20 a.m. [101]  
Tuesday: 4:30 p.m.-6:20 p.m. [102]  
Wednesday: 10:30 a.m.-12:20 p.m. [103]  
Friday: 4:30 p.m.-6:20 p.m. [104]

- Note:
- Please use [LEARN mail system](#) for course-related enquiries.
  - Lab sessions are held every week and conducted by teaching assistants (TA's)
  - **Please contact your TA first for lab-related questions before contacting the instructor or MAD staff**
  - The TA's are responsible for introducing new assignments and guiding you to learn concepts and software. TA's will not give you answers to assignment questions.
  - You are responsible for maintaining [back-ups](#) of your work.
  - **Switching lab sections:** In rare instances, the TA may be consulted at the beginning of the course and a switch may be granted if room is available.
  - **Required course supplies:** USB flash drive for backing up work. Printing credit for lab assignment submissions, if necessary.

## TEXT AND READINGS

There is no required textbook for the course. Students should focus on material presented in lectures and lab sessions. Additional references and readings may be provided during the term.

*Recommended texts* below may be used to provide further explanation and examples of concepts and techniques discussed in the course:

De Smith, M.J., M.F. Goodchild & P.A. Longley (2007). [Geospatial Analysis: A Comprehensive Guide to Principles, Techniques and Software Tools](#). Matador.  
Available electronically at <http://www.spatialanalysisonline.com>

Lloyd, C.D., (2010). [Spatial Data Analysis: An Introduction for GIS Users](#). Oxford University Press.

Longley, P., Goodchild, M., Maguire, D., and Rhind, D (2015). [Geographic Information Systems and Science](#), 4<sup>th</sup> Edition. John Wiley and Sons.

Lutz, M. (2009). [Learning Python](#). 4th edition, O'Reilly.  
Available electronically through the library/course e-reserves.

Zandbergen, P.A. (2014). [Python: Scripting for ArcGIS](#). Esri Press.

## GRADING SCALE

UW students may come from a variety of backgrounds, where numeric grades may not be used or have different meanings. The following grading table from the UW Faculty of Environment provides a general definition of what type of work constitutes a particular grade. Please note that very good quality work typically merits a grade between 70-79, with grades of over 80 being reserved for truly exceptional work.

<b>Assigned Grades</b>	<b>Description</b>
<b>80-100</b>	Grades in this category signal a sign of excellence and are not something that should be expected for work that simply meets the requirements of the assignment. In this category, a student has demonstrated a full understanding of the subject matter, has capacity to analyze, has demonstrated critical thinking, shows evidence of creative thinking, familiarity with literature and previous work in area, highly developed communication and presentation skills. The work is of outstanding quality according to the criteria established for evaluation.
<b>70-79</b>	Student has shown good comprehension of subject matter, evidence of critical and creative thought, familiarity with literature and previous work in subject area, competence in communication and presentation skills, but none of the above to the degree found in A category. The work is of very good quality according to evaluation criteria
<b>60-69</b>	Student has demonstrated some understanding of subject matter, can assimilate and communicate basic aspects of the subject matter. The work is of satisfactory or adequate quality according to evaluation criteria
<b>50-59</b>	Student has demonstrated minimal understanding of the subject matter, poorly developed communication skills, inability to apply subject matter understanding in other contexts, little evidence of critical or creative thinking. The work is of unsatisfactory but passable quality according to evaluation criteria.
<b>0-49</b>	Inadequate understanding of subject matter, failed to complete course requirements, no demonstration of critical thought, communication skills very poor. The work is clearly of unacceptable quality according to the evaluation criteria.

## ACKNOWLEDGEMENTS

Previous GEOG/PLAN 381 instructors: Dr. Peter Johnson, Dr. Derek Robinson

## COURSE POLICIES:

### Resources:

ArcGIS and TerrSet software are used for lab work in this course. Manuals are available as on-line help files. Students are expected to use the on-line help to obtain information on operations that are not fully detailed in the assignments. Other resources will also be posted on the LEARN webpage.

### Late Penalty:

10% of the total mark for the assignment per day, up to 7 days (including weekends and holidays), after which assignments will not be accepted. Hand in all assignments directly to your TA at the beginning of your lab session. If an assignment is submitted after the start of the lab session in which it is due, it will be penalized for that day.

Late lab assignments should be submitted to Jesse MacLeod (Departmental Administrator) in EV1, Rm 115 during normal working hours, who will time stamp assignments upon receipt. All late lab assignments should be clearly labeled with your lab section number and TA. The late penalty will be counted from and including the submission date (as indicated by time stamp). You assume all risk for lost or missing material.

### Lab Attendance:

4% of the total mark has been allocated for lab attendance. TAs will record lab attendance for each lab section. 1% of the total grade will be deducted for a recorded absence up to a maximum of four.

TAs will only grade assignments for students in their assigned lab section. Therefore, students should only attend their assigned lab section, otherwise assignments submitted to a different session will not be graded.

### Rescheduling Cancelled Classes:

Lectures may be cancelled (as indicated in the course schedule) and a make-up class may be rescheduled. A date/time will be selected based on a class poll of availability and with majority agreement. Maximum effort will be made to select a schedule conflict-free time, but if none is identified, alternative arrangements will be made either individually or by offering another time.

## UW POLICIES:

### Unclaimed Assignments:

Unclaimed assignments will be retained until one month after term grades become official in Quest. After that time, they will be destroyed in compliance with UW's confidential shredding procedures.

### Academic Integrity:

To create and promote a culture of academic integrity, the behavior of all members of the University of Waterloo is based on honesty, trust, fairness, respect and responsibility.

<http://www.uwaterloo.ca/academicintegrity/>

Students who are unsure what constitutes an academic offence are requested to visit the on-line tutorial at <http://www.lib.uwaterloo.ca/ait/>

### Research Ethics:

Please also note that the University of Waterloo requires all research conducted by its students, staff, and faculty, which involves humans as participants to undergo prior ethics review and clearance through the Director, Office of Human Research and Animal Care (Office). The ethics review and clearance processes are intended to ensure that projects comply with the Office's Guidelines for Research with Human

Participants (Guidelines), as well as those of provincial and federal agencies, and that the safety, rights and welfare of participants are adequately protected. The Guidelines inform researchers about ethical issues and procedures, which are of concern when conducting research with humans (e.g. confidentiality, risks and benefits, informed consent process, etc.). If the development of your research proposal consists of research that involves humans as participants, then please contact the course instructor for guidance and see <http://iris.uwaterloo.ca/ethics/>

### **Note for Students with Disabilities:**

The AccessAbility Office, located in Needles Hall, Room 1132, collaborates with all academic departments to arrange appropriate accommodations for students with disabilities without compromising the academic integrity of the curriculum. If you require academic accommodations to lessen the impact of your disability, please register with the AccessAbility Office at the beginning of each academic term.

### **Mental Health:**

The University of Waterloo, the Faculty of Environment and our Departments consider students' well-being to be extremely important. We recognize that throughout the term students may face health challenges – physical and / or emotional. **Please note that help is available.** Mental health is a serious issue for everyone and can affect your ability to do your best work. Counselling Services ([www.uwaterloo.ca/counselling-services](http://www.uwaterloo.ca/counselling-services)) is an inclusive, non-judgmental, and confidential space for anyone to seek support. They offer confidential counseling for a variety of areas including anxiety, stress management, depression, grief, substance use, sexuality, relationship issues, and much more.

### **Religious Observances:**

Student needs to inform the instructor at the beginning of term if special accommodation needs to be made for religious observances that are not accounted for in the scheduling of classes and assignments.

### **Grievance:**

A student who believes that a decision affecting some aspect of his/her university life has been unfair or unreasonable may have grounds for initiating a grievance. Read Policy 70 - Student Petitions and Grievances, Section 4, <http://www.adm.uwaterloo.ca/infosec/Policies/policy70.htm>. When in doubt please contact your Undergraduate Advisor for details.

### **Discipline:**

A student is expected to know what constitutes academic integrity, to avoid committing academic offence, and to take responsibility for his/her actions. A student who is unsure whether an action constitutes an offense, or who needs help in learning how to avoid offenses (e.g., plagiarism, cheating) or about “rules” for group work/collaboration should seek guidance from the course professor, academic advisor, or the Undergraduate Associate Dean. When misconduct has been found to have occurred, disciplinary penalties will be imposed under Policy 71 - Student Discipline. For information on categories of offences and types of penalties, students should refer to Policy 71 - Student Discipline <http://www.adm.uwaterloo.ca/infosec/Policies/policy71.htm>.

### **Appeals:**

A student may appeal the finding and/or penalty in a decision made under Policy 70 - Student Petitions and Grievances (other than a petition) or Policy 71 – Student Discipline if a ground for an appeal can be established. Read: Policy 72 - Student Appeals, <http://www.adm.uwaterloo.ca/infosec/Policies/policy72.htm>

### **LEARN:**

Users can login to LEARN via: <http://learn.uwaterloo.ca/> using your WatIAM/Quest username and password. Available documentation: [http://av.uwaterloo.ca/uwace/training\\_documentation/index.html](http://av.uwaterloo.ca/uwace/training_documentation/index.html)

## COURSE SCHEDULE

Term Week	Lectures		Labs	
	Lecture Date	Lecture Topic	Assignment Distributed	Assignment Due
1 (May 1-4)	May 4	<b>Course Overview – GIS and Spatial Analysis</b>	No Lab	None
2 (May 7-11)	May 11	<b>Introduction to GIS Modelling</b>	Lab 1	None
3 (May 14-18)	May 18	<b>Introduction to GIS Multicriteria Analysis</b>	Lab 2	Lab 1
4 (May 21-25)	May 25	<b>Python and Programming Basics</b> <i>(Note: May 22 make-up day for May 21 Victoria Day holiday)</i> <i>(LAB 103: Tuesday lab will not be scheduled and assignments will be distributed and submitted via LEARN on-line. Extra TA office hours for the Tuesday LAB 103 will be scheduled.)</i>	Lab 3	Lab 2
5 (May 28-June 1)	June 1	<b>Python for GIS Data Management &amp; Analysis</b>	Required attendance	None
6 (June 4-8)	June 8	<b>Network Analysis</b>	Lab 4	Lab 3
7 (June 11-15)	June 15	<b>ArcGIS Network Analyst Tutorial</b>	Required attendance	None
8 (June 18- 22)	June 22	<b>GIS Multicriteria Analysis Methods</b>	Lab 5	Lab 4
9 (June 25-29)	June 29	<b>TBA</b>	Lab 6	None
10 (July 2-6)	July 6	<b>None</b>	Required attendance	Lab 5
11 (July 9-13)	July 13	<b>FINAL EXAM</b>	Required attendance	None
12 (July 16-20)	July 20	<b>None</b>	Required attendance	None
13 (July 23-25)	July 20	<b>None</b> <i>(Note: July 25 make-up day for July 2 Canada Day holiday)</i>	No Lab	Lab 6

### Notes:

- Weeks indicated in the schedule begin on Mondays (except for Week 1)
- Labs are assigned and due at the start of your registered lab session in the week indicated
- The instructor reserves the right to modify the schedule and topics during the term

### Holidays and University Closures:

- May 21 (M) for Victoria Day
- July 2 (M) for Canada Day