

University of Western Ontario
Department of Geography
Geography 3342b Ground water Hydrology

2016 – 2017 Winter Term

1. *Course Description and Approach*

The distribution and movement of ground water; evaluation and monitoring of ground water resources with respect to their extraction, pollution and remediation.

This is not a technical or engineering course. It is intended to provide a broad background in groundwater for resource managers and consultants. Nevertheless, the course adopts a scientific approach, although with minimal mathematics.

2. *Personnel*

Instructor: Dr.C.C. Smart, Room 1402 SSC Tel. 85007 Email: CSMART@UWO.CA Office hours Tues. 10:00–12:00

Teaching Assistant: TBA

3. *Course Format*

A two hour lecture period, Wed 1:30 – 3:30 pm in SSC 1302

A two hour lab period: Thurs. 3:30 – 5:30 pm in SSC1316 (GIS Lab.)

Course Objectives: To work through the basic rules of groundwater flow and demonstrate how these rules play out in various geological, topographic and resource settings.

Course outcomes: Successful completion of the course will indicate an understanding of the principles of groundwater flow, an intuitive grasp of how geology and topography influence groundwater flow, basic knowledge of groundwater resource management, contamination and remediation. Students will have knowledge of the basic techniques of mapping and modelling groundwater.

4. *Texts:*

No text is required for the course. But reference to paper or electronic resources may be required to support studies.

Background information on hydrology can be found in texts used in earlier Physical Geography courses

Groundwater is often covered in general hydrology texts (e.g. Dingman S.L., 1993. *Physical Hydrology*. Prentice Hall)

A good basic reference on groundwater:

Younger P.L. 2007. *Groundwater in the Environment*. Blackwell [GB1003.2.Y68 2007](#) : Weldon

If you are having difficulty with the material you may wish to consult the following (or related texts)

Price, M. 1996. *Introducing Ground water*, [GB1003.2.P75 1996](#) Weldon

Substantial (i.e. expensive) texts for future reference are beyond the requirements for this course:

Freeze, R..A., and Cherry, J.A., 1982. *Ground water*, Prentice Hall (still a standard text in hydrogeology!) [GB1003.2.F73](#) : Weldon

F.W. Schwartz and Zhang 2002 *Physical Hydrogeology*, Wiley [GB1003.2.S39 2003](#) : Weldon

5. *Marking Scheme*

Exercises.....40%

Mid-term test (1h March).....20%

Final Exam (3h in April).....40%

6. Provisional Course Outline

Provisional Schedule Geography 3342b 2016 Groundwater			
Date	Lecture	Exercise	Due
11-Jan-17	Introduction to groundwater in the hydrological cycle	1. Water Balance and groundwater	23/01/2017
18-Jan-17	Groundwater as a resource		
25-Jan-17	Geology and groundwater: aquifers and aquitards	2. Hydrogeological Mapping	06/02/2017
01-Feb-17	Principles of groundwater flow and storage		
08-Feb-17	The water table & wells	3. Water Table Mapping	27/02/2017
15-Feb-17	Groundwater extraction and protection		
22-Feb-17	Reading Week		
01-Mar-17	Mid term test (1h) Piezometers	4. Hydrogeological Cross-section	20/03/2016
08-Mar-17	Topography, wetlands & groundwater flow patterns		
15-Mar-17	Groundwater modelling		
22-Mar-17	Sea water and groundwater: density effects	5. Groundwater Modelling	03/04/2017
29-Mar-17	Groundwater quality: contamination and remediation		
05-Apr-17	Groundwater in the modern world: management, consulting and employment		
09-Apr-17	Examinations Start		
30/04/17	Examinations End		

7. Note on Lectures

Lectures will consist of two sessions of approximately 50 minutes each. Presentation will be oral with supporting illustrations archived in OWL. There will not be a PowerPoint archive of lecture material, so attendance and good note taking and weekly review are essential. Lectures are cumulative and progressive. Accordingly, you are expected to carry forward basic understanding of previously covered material.

Electronic devices in the classroom: Professional performance in government, consulting or industry requires the ability to focus, process and record information from oral and miscellaneous archival sources. It is intended to work in a similar mode in which professional demeanour is developed. Cell phones should not be activated during class. Unless essential, do not leave class between breaks. Consider hand written note-taking as more effective and flexible than typing, especially for graphics. Laptop computers are tolerated but are restricted to note taking and course related enquiries. Laptop users should be seated at the back of the class to reduce distraction to other students.

Class notes are seldom perfect. So it is important to review your notes to understand their content and logic, facilitate retention and to identify points of uncertainty. Raise thoughtful questions in class, during lab sessions or office consultations.

8. Note on Exercises

Exercises are largely Excel based and taught in the GIS lab to allow hands-on skill development. Attendance at Lab sessions is essential to allow initiation and expedite progress on exercises. Anticipate working outside scheduled times to complete the exercises.

Five exercises will consist of desk work problems devised to demonstrate fundamental aspects of measurement, data processing and analysis in ground water problems. You will normally be allowed two weeks to tackle the assignment and raise questions in scheduled classes. You are encouraged to work in small

groups, but you should write up independently and be capable of tackling the problems yourself. Exercise due dates are shown in the schedule, and refer to the respective Monday at noon. Late submissions will be penalised (10%/day), and not accepted once the exercise has been returned. The initial exercise will not be marked; it is a revision of the hydrological cycle and the role of ground water. It also provides an opportunity to develop or hone basic Excel skills.

Geography 2210 (or equivalent) level of statistical analysis is assumed.

Spreadsheets provide exceptionally useful general management and analytical tools, relevant not only in hydrology, but in many areas of employment. Accordingly, the exercises will generally be framed in an Excel format. *Rudimentary Windows and Excel skills are assumed, although a quick Excel tutorial may be arranged.* You must have a Geography student account. Some exercises are submitted electronically, others will require hard copy submission. Print credits will be provided for the course.

Exercises are based on real world techniques, though idealised to facilitate learning. Exercises are primarily educational rather than evaluative, therefore marks are awarded to encourage completion of the exercise, NOT as a rigorous form of evaluation. Therefore, in most exercises it should be possible to gain rather high marks. Tests and examinations are the primary means of evaluation, and may therefore appear to be much more demanding. The end result might be an overall average mark for the course in the mid B range, while the average exercise mark may be in the mid A range.

9. Note on tests and examinations

Unannounced, brief in-class tests (pop quizzes) may be introduced as an incentive to maintaining adequate study levels. If run, they will each count for 1% drawn from exercise components. The subject matter will be key principles of the previous lectures essential for understanding the impending lecture. Non-participants will get zero marks.

The test and examination are closed book and have a short answer and exercise format. In addition, examinations will also incorporate a "pre-announced" essay topic of strictly limited length, usually 200 words. All lecture and exercise material up to the test date will be examined.

Authorised "make-up examinations will occur on specified dates arranged by the department. The duration, form and content of make-up examinations may vary greatly from scheduled examinations.

8. Note on Absence

The student is responsible for covering course material missed due to any absence.

For UWO Policy on Accommodation for Medical Illness and a downloadable SMC see:
http://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_medical.pdf

[downloadable Student Medical Certificate (SMC):
http://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf

Every component of the course is worth 10% or more of the final grade. Therefore, students seeking academic accommodation on medical grounds for any missed tests, exams, participation components and/or assignments must apply to the Academic Counselling office of their home Faculty and provide documentation. Academic accommodation cannot be granted by the instructor or department.

Note that exercises are an essential part of the learning process and if possible students should undertake the exercise to develop skills that may be critical later in the course, in examinations and possible employment positions.

9. Notes from the registrar.

Prerequisite(s): One of [Geography 2310A/B](#), [2320A/B](#) or [2330A/B](#), or 3rd year standing in an Environmental Science or Earth Sciences program.

Geography 2210 (or equivalent) level of statistical analysis is assumed.

Unless you have either the requisites for this course or written special permission from your Dean to enroll in

it, you may be removed from this course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites.

Statement on Use of Electronic Devices

No electronic devices other than a non-communicating calculator will be allowed during tests and examinations.

Statement on Academic Offences

Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site:

http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf.

Mental Health

If you or someone you know is experiencing distress, there are several resources here at Western to assist you. Please visit the site below for more information on mental health resources:

<http://www.uwo.ca/uwocom/mentalhealth/>.

Western's commitment to accessibility

The University of Western Ontario is committed to achieving barrier free accessibility for persons studying, visiting and working at Western.

Please contact the course instructor if you require material in an alternate format or if you require any other arrangements to make this course more accessible to you. You may also wish to contact Services for Students with Disabilities (SSD) at 661-2111 x 82147 for any specific question regarding an accommodation.

Support Services

Registrarial Services: <http://www.registrar.uwo.ca/>

Student Development Services: <http://www.sdc.uwo.ca/>