



UNIVERSITY OF CALGARY
FACULTY OF SCIENCE
DEPARTMENT OF GEOSCIENCE
COURSE OUTLINE
WINTER 2015

1. **Course:** Geology 611, Groundwater Resource Management

Lecture/Lab Sections:

B01: Mo, 16:00-17:50, ES 254

L01: We, 16:00-17:50, CHE 202

Instructor, Dr. E. Cey, Office ES 220, Tel. No. 403-220-8393, e-mail address, ecey@ucalgary.ca,

Office Hours: By appointment

The course website can be found on D2L (<https://d2l.ucalgary.ca>).

Geoscience Department ES 118, 403-220-5841, geoscience.ucalgary.ca, geoscience@ucalgary.ca

2. **Prerequisites:** Mathematics 253 or 267 or 277 or 283 or Applied Mathematics 219 and Geology 401 or Geography 415. See also Geology Course Descriptions of the University Calendar (<http://www.ucalgary.ca/pubs/calendar/current/geology.html#9760>).

3. **Grading:** The University policy on grading and related matters is described sections F.1 and F.2 of the online University Calendar. In determining the overall grade in the course the following weights will be used:

Homework Assignments	20%
Readings and Class Discussions	15%
Project #1 (Individual)	10%
Project #2 (Group)	30%
Final Examination	25% (To be scheduled by the Registrar)

Each component of the course will be assigned a percentage score. The student's average percentage score for the various components listed above will be combined with the indicated weights to produce an overall percentage for the course, which will then be used to determine the course letter grade. The conversion between course percentage and letter grade is as follows:

Grading Scale							
A+	95 - 100%	B+	80 - 83%	C+	66 - 69%	D+	54 - 57%
A	88 - 94%	B	75 - 79%	C	62 - 65%	D	50 - 53%
A-	84 - 87%	B-	70 - 74%	C-	58 - 61%	F	< 50%

4. **Missed Components of Term Work:** The regulations of the Faculty of Science pertaining to this matter are found in the Faculty of Science area of the Calendar in Section 3.6. It is the student's responsibility to familiarize himself/herself with these regulations. See also Section E.6 of the University Calendar

5. **Course Materials:** The Desire2Learn website (<https://d2l.ucalgary.ca>) will be used throughout the course to make announcements and distribute lecture notes, readings, assignments, and other course materials. Please check the course website regularly.

There is no required textbook for the course. Instead the course will rely on regular readings from published reports and journal articles. Readings will be assigned to both reinforce the lecture material and introduce new topics to the course. All students are expected to have read the assigned material and be prepared to discuss it in class. In addition, one student (selected by the instructor) will be asked to lead the discussion session and provide their own input on the subject. The goal is to get everyone thinking critically, exchanging ideas, and openly debating or deliberating on groundwater resource topics. As such, all students will be asked to lead several class discussions during the term.

6. **Examination Policy:** The final exam will be open book. In addition to writing instruments, rulers, and programmable calculators, students will be permitted to bring written and printed information (e.g., course notes, textbooks, dictionaries, and summary sheets) into the exam. Note that electronic devices other than a calculator, such as smartphones, tablets and laptop computers, will NOT be permitted into the exam. Students should also read the Calendar, Section G, on Examinations.

7. **Approved Mandatory and Optional Course Supplemental Fees:** Not applicable.
8. **Writing across the curriculum statement:** In this course, the quality of the student's writing will be a factor in the evaluation of all written work (projects, assignments, and exams). Students are expected to submit high quality work. In all cases, quality work must be well organized, clearly written and presented, and have all information sources properly noted. Where applicable, questions should be labelled and in order, all tables and diagrams properly labelled, assumptions clearly stated, and final answers clearly indicated (with appropriate units and significant figures). You are expected to **show all your work**, including equations and sample calculations where necessary (especially when relying on spreadsheets or computer programs to generate results). See also [Section E.2](#) of the University Calendar.

9. OTHER IMPORTANT INFORMATION FOR STUDENTS:

- (a) **Misconduct:** Academic misconduct (cheating, plagiarism, or any other form) is a very serious offence that will be dealt with rigorously in all cases. A single offence may lead to disciplinary probation or suspension or expulsion. The Faculty of Science follows a zero tolerance policy regarding dishonesty. Please read the sections of the University Calendar under [Section K](#). Student Misconduct to inform yourself of definitions, processes and penalties.
- (b) **Assembly Points:** In case of emergency during class time, be sure to FAMILIARIZE YOURSELF with the information on [assembly points](#).
- (c) **Academic Accommodation Policy:** Students with documentable disabilities are referred to the following links: Students with Disabilities: <http://www.ucalgary.ca/pubs/calendar/current/b-1.html> [B.1](#) and Student Accessibility Services: <http://www.ucalgary.ca/access/>.
- (d) **Safewalk:** Campus Security will escort individuals day or night (<http://www.ucalgary.ca/security/safewalk/>). Call 220-5333 for assistance. Use any campus phone, emergency phone or the yellow phones located at most parking lot pay booths.
- (e) **Freedom of Information and Privacy:** This course is conducted in accordance with the Freedom of Information and Protection of Privacy Act (FOIPP). As one consequence, students should identify themselves on all written work by placing their name on the front page and their ID number on each subsequent page. For more information see also <http://www.ucalgary.ca/secretariat/privacy>.
- (f) **Student Union Information:** VP Academic Phone: 220-3911 Email: suvpaca@ucalgary.ca.
SU Faculty Rep. Phone: 220-3913 Email: sciencerep@su.ucalgary.ca; [Student Ombudsman](#)
- (g) **Internet and Electronic Device Information:** You can assume that in all classes that you attend, your cell phone should be turned off unless instructed otherwise. Also, communication with other individuals, via laptop computers, Blackberries or other devices connectable to the Internet is not allowed in class time unless specifically permitted by the instructor. If you violate this policy you may be asked to leave the classroom. Repeated abuse may result in a charge of misconduct.
- (h) **U.S.R.I.:** At the University of Calgary, feedback provided by students through the Universal Student Ratings of Instruction (USRI) survey provides valuable information to help with evaluating instruction, enhancing learning and teaching, and selecting courses (www.ucalgary.ca/usri). Your responses make a difference – please participate in USRI Surveys.

Department Approval: Original Signed

Date: December 19, 2014

COURSE SYLLABUS

GLGY 611 Groundwater Resource Management

Winter 2015

Instructor:

Dr. Edwin Cey (ES220, ecey@ucalgary.ca, 220-8393)

Office hours: By appointment only

I. Course Description and Content

Students will be introduced to a wide range of topics related to groundwater resource development and management. This will include practical issues, such as groundwater exploration and drilling methods, water well completion, and aquifer test analysis, as well as more philosophical concerns, such as groundwater sustainability, aquifer vulnerability, and integrated water (not just groundwater) management. We will use a variety of learning methods to explore these topics from different perspectives. Particular emphasis will be placed on the fundamental principles surrounding the development and testing of aquifers as water sources and the subsequent limitations that are faced in terms of managing the quantity and quality of groundwater resources. The intent is not to provide you with all the answers, but rather to give you the necessary knowledge and tools to make your own informed assessment of groundwater resource issues facing society.

The topics covered in the course are given in the table below. This is intended as a general guideline and the schedule of topics may change slightly as the course progresses.

Week	Topic	Specific Items
1	Water as a Resource	<ul style="list-style-type: none">• Hydrology and groundwater resources• Water and groundwater usage - Canada and beyond
2	Aquifers and Their Properties	<ul style="list-style-type: none">• Porous medium properties• Classification of hydrogeologic units and aquifers
3	Groundwater Exploration and Drilling	<ul style="list-style-type: none">• Reconnaissance surveys and geophysical exploration methods• Drilling techniques
4	Water Well Completion	<ul style="list-style-type: none">• Well logging• Well construction - screens and filter packs• Well development
4	Aquifer Testing I - Sample Scale	<ul style="list-style-type: none">• Estimation of hydraulic properties• Grain size and permeameter methods

5	Aquifer Testing II - Slug Tests	<ul style="list-style-type: none"> • Single well response tests (slug tests) • Zero and finite storage methods • Complicating factors
6-7	Aquifer Testing III - Pumping Tests	<ul style="list-style-type: none"> • Confined vs. unconfined aquifer response • Pumping test analysis - drawdown and recovery • Non-ideal aquifers and boundary conditions • Introduction of derivative and tomographic methods
8	Well Efficiency and Performance	<ul style="list-style-type: none"> • Well losses and efficiency • Use of step drawdown tests
9-10	Managing Groundwater Quantity	<ul style="list-style-type: none"> • Groundwater sustainability • Water budgets and the safe yield concept • Groundwater-surface water interactions • Aquifer storage and recovery
11-13	Managing Groundwater Quality	<ul style="list-style-type: none"> • Source water protection • Capture zones and well head protection • Aquifer vulnerability assessment • Groundwater under the direct influence of surface water

II: Course Material and Structure

The course will consist of four (4) hours of combined lectures, tutorials and discussions each week. The amount of time devoted to each component will vary each week. During the term, students will complete homework problem sets, assigned readings and group discussion (see below), and two term projects. The first term project will be completed individually by students in the first half of the course, while the second term project will involve a group report and presentation in the latter half of the course. More details for this assigned work will be provided in class.

All course material and announcements will be provided on the Desire2Learn (D2L) course website (<https://d2l.ucalgary.ca>). Please familiarize yourself with the D2L site and check back regularly, since lectures, readings, assignments and supplementary materials will be distributed via the site on a week-to-week basis. There is **no required textbook** for the course. Instead the course will rely on regular readings from published reports and journal articles. Readings will be assigned to both reinforce the lecture material and introduce new topics to the course. All students are expected to have read the assigned material and be prepared to discuss it in class. In addition, individual students (selected by the instructor) will be asked to lead the discussion sessions and provide their own input on the subject. The goal is to get everyone thinking critically, exchanging ideas, and openly debating or deliberating on groundwater resource topics. As such, all students will be asked to lead several class discussions during the term.

There will be a registrar scheduled final examination in this course that will be administered after the end of classes. The final exam will be open book, but the usage of electronic devices (smartphones, tablets and laptops) will **not** be permitted. Please plan accordingly, since students will be able to utilize written or printed notes during the final exam.

III: Important Dates

(all dates are tentative)

Project #1 Selection	Jan. 14
Project #1 Report Due	Feb. 11
Project #2 Assigned	Mar. 2
Project #2 Presentations	Apr. 13-15 (in class)
Project #2 Report Due	Apr. 15 (last day of class)

The due dates for other course work (e.g., assignments) will be indicated on the student handouts.

IV: Responsibilities and Expectations

Attendance

Attendance and participation in all class sessions is expected because in-class discussions will be an important part of your learning experience.

Student Expectations

This is a graduate-level course and there are expectations placed on both the students and instructor in order to create a positive learning experience. The following items articulate what I expect from students:

- Come to class on time, be attentive, and participate in classroom discussions.
- Respect classmates and the instructor, including refraining from using cell phones or laptops for non-educational purposes during class (e.g., emails, social networks, gaming).
- Be prepared and ready to work on material, including spending time outside of class reading supplementary materials and undertaking self-study.
- Complete assignments and projects to the best of your ability and submit them on schedule. This includes submitting high quality work that is organized, well written with proper citing of sources, contains clear figures or graphs, and shows all relevant work in calculations.
- Read all materials on D2L and bring necessary materials to class with you. It is recommended to print lectures, readings, and assignment handouts so they can be referred to and notes made on them as needed. These can be used in the final exam, but electronic copies cannot.
- Notify the instructor ahead of time if you know that you will be absent or unable to submit assigned materials on time. This allows for appropriate accommodations to be made. If it is not possible to give prior notification, such as in the case of illness, please notify the instructor at the first available opportunity.
- Similarly, if you fall behind or have trouble, please come to me shortly after issues arise so they can be dealt with in a timely manner.

What can you expect from me?

Below is what you can expect of me this semester:

- Start and end class on time.
- Treat all students with respect and create a positive learning environment where all student questions and opinions are heard and valued.
- Manage classroom disruptions to the best of my ability so that you have a safe and distraction free learning environment.
- Provide you with instructional and support materials that are appropriate for this class. This includes presenting material relevant to practicing hydrogeologists so that you can gain insights into the real world issues and problems that make hydrogeology so interesting.
- Answer student questions to the best of my ability. In many instances, this means giving students the tools or direction to find the answer on their own, rather than simply providing the “quick and easy” answer.

- Assess all assignments and other work fairly, providing suggestions and comments for improvement.
- Be available for help outside of classroom times to discuss course work, review concepts or simply chat about hydrogeology and related topics.