ENGG*4240 Site Remediation

Fall 2017

Sections(s): C01

School of Engineering

Credit Weight: 0.50

Version 1.00 - September 05, 2017

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1 Course Details

1.1 Calendar Description

Remediation of contaminated sites is done to mitigate impacts to the environment and public health. The course will: review the applicable legislation; identify the important soil, water, air and chemical interactions; review the steps of an environmental risk assessment so that contaminated sites can be identified and evaluated to see if remediation is required; and evaluate and appraise various remediation technologies to complete the soil and groundwater remediation.

Co-Requisite(s): ENGG*3590, ENGG*3670

1.2 Course Description

Completion of this course will provide students with an (i) an understanding on what classifies a site as being contaminated and the governing legislation, (ii) appreciation of cross-media issues for a contaminant in the groundwater, soil and soil-air matrices, (iii) appreciation of human health and ecological risk assessment in context of a contaminated site, (iv) insight on how to select and apply appropriate soil and groundwater remediation technologies and (v) design a remediation action plan. Students will also become familiar with the technical literature dealing with contaminated sites. The following specific activities will be required:

i. **Submit a Literature Review**: Students will complete a comprehensive literature that will identify the resources available to them and will critique a site remediation theme.
ii. **Submit a Phase I and II Project**: Students will complete a Phase I and II assessment of a given property and determine if site remediation is required.
iii. **Submit a Remediation Project**: Based on a given site, students will design a remediation plan to address the contamination present.

1.3 Timetable

Lectures: Tuesdays and Thursdays from 02:30PM to 03:50PM in ROZH 105

Tutorial: Wednesdays from 05:30PM to 06:20PM in MCKN 224

1.4 Final Exam

Exam is scheduled for Friday 15th December from 07:00PM to 09:00PM. Location to announced. Please see WebAdvisor for the latest information.

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2 Instructional Support

2.1 Instructor(s)

Rafael Santos

Email:	santosr@uoguelph.ca
Telephone:	+1-519-824-4120 x52902
Office:	THRN 2342

2.2 Teaching Assistant(s)

Name	Details
Stephen Emslie	semslie@uoguelph.ca Has no office hours. Contact time is in tutorial on Wednesdays from 05:30PM to 6:20PM in MCKN 224.

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3 Learning Resources

3.1 Required Resources(s)

Course Website (Website)

https://www.courselink.uoguelph.ca
Course material, news, announcements, and grades will be regularly posted to the ENGG*4240 Courselink site. You are responsible for checking the site regularly. **As per University regulations, all students are required to check their <mail.uoguelph.ca> e-mail account regularly;** e-mail is the official route of communication between the University and students.

Practical Design Calculations for Groundwater and Soil Remediation (Textbook)

Kuo, J. (2014), CRC Press, Bova Raton, FL, 2nd Edition, ISBN 13:978-1-4665-8523-2

3.2 Additional Resources(s)

Lecture (Notes)

Lecture notes will be posted on Courselink prior to the respective lectures. Some supporting information will also be ocasionally posted on the Courselink site.

Projects (Other)

Download the assignments according to the schedule given in this handout and posted on

Courselink.

3.3 Announcements

Information related to ENGG*4240 will be posted on Courselink. In addition, per university regulations, all students are required to check their <mail.uoguelph.ca> e-mail account regularly. This e-mail is the official route of communication between the University and students.

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4 Learning Outcomes

4.1 Course Learning Outcomes

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

1. The goal is to prepare students to deal with open-ended site remediation problems that consist of contaminated groundwater and soil, similar to situations that they will encounter as working professionals.
   To that end, students will: (1) prepare a literature review on a site remediation topic of their choice;
2. (2) collect and analyze relevant information for a target site to complete Phase I and II assessments;
3. (3) complete a risk assessment on the target site to evaluate whether site remediation is needed; and
4. (4) design a remediation plan for the target site.

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, 4
2.1	Formulate a problem statement in engineering and nonengineering terminology	2, 3, 4
2.2	Construct a conceptual framework	2, 3, 4
2.3	Identify, organize and justify appropriate information	2, 3, 4

#	Outcome Set Name	Course Learning Outcome
2.4	Execute an engineering solution	2, 3, 4
2.5	Critique and appraise results	2, 3, 4
3	Investigation	2, 3, 4
3.1	Propose and test working hypotheses	2, 3, 4
3.2	Design and apply an investigation plan	2, 3, 4
3.3	Analyze and interpret experimental data	2, 3, 4
3.4	Assess validity of conclusions within limitations of data and methodologies	2, 3, 4
4	Design	4
4.1	Describe the design process	4
4.2	Construct design-specific problem statements	4
4.3	Create engineering design solutions	4
4.4	Develop engineering design solutions	4
4.5	Assess engineering design solutions	4
4.6	Implement engineering design solutions	4
5	Use of engineering tools	3, 4
5.1	Select appropriate engineering tools from various alternatives	3, 4
5.2	Apply selected engineering tools	3, 4
5.3	Recognize limitations of selected engineering tools	3, 4
6	Individual and team work	1, 2, 3, 4
6.1	Act as an individual team member to promote team success	1, 2, 3, 4
6.2	Demonstrate leadership through team building, providing feedback and positive attitude	1, 2, 3, 4
7	Communication skills	1, 2, 3, 4
7.1	Develop and deliver clear, key concepts using methods appropriate for the intended audience	1, 2, 3, 4
7.2	Critically evaluate received information	1, 2, 3, 4
7.3	Demonstrate active listening and follow instructions	1, 2, 3, 4
9	Impact of engineering on society and environment	2, 3, 4
9.1	Analyze the social, environmental and legal aspects of engineering activity	2, 3, 4

#	Outcome Set Name	Course Learning Outcome
9.2	Summarize the common sources of uncertainty and risk in their engineering field	2, 3, 4
9.3	Identify the impact of introducing innovative technologies to solve engineering problems	2, 3, 4
11	Economics and project management	1, 2, 3, 4
11.1	Apply project management techniques and manage resources within identified constraints	1, 2, 3, 4
11.2	Estimate the life cycle engineering benefits and costs associated with engineering design	1, 2, 3, 4

4.3 Relationships with other Courses & Labs

ENGG*4240 is senior Environmental Engineering elective. As such, students are required to build on the knowledge gained in all the preceding courses, applying engineering analysis and design principles to the design problem at hand.

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5 Teaching and Learning Activities

5.1 Lecture Schedule

Date	Topics(s)
Week 1	Definition of contaminated site; Remediation Legislation; Handout Literature Review
Week 2	Overview of Remediation Technologies; Contaminant, Soil, Water and Air Interactions
Week 3	Contaminant fate & behaviour in soil and groundwater; chemical transformation; sorption - retention capacity
Week 4	Contaminant fate & behaviour in soil and groundwater; retardation; degradation - scale-up factor
Week 5	Short Week - Thanksgiving and Study day
Week 6	Contaminant fate & behaviour in soil and groundwater; volatilization - gas transfer; degradation - scale-up factor
Week 7	Environmental Site Assessment - Phase I & II - work on PBL problem
Week 8	Environmental Site Assessment - Phase I & II - work on PBL problem
Week 9	Soil and Groundwater Remediation - work on PBL problem
Week 10	Soil and Groundwater Remediation - work on PBL problem

Date	Topics(s)
Week 11	Soil and Groundwater Remediation - work on PBL problem
Week 12	Soil and Groundwater Remediation - present solutions

5.2 Other Important Dates

i) Classes begin Thursday 7th Sept. 2017
ii) Thanksgiving: 9th Oct. 2017
iii) Study Day: 10th Oct. 2017
iii) Last date to drop course (fourtieth class day): Friday, 3rd Nov. 2017
iv) Last class: Thursday, 30th Nov. 2017

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6 Assessments

6.1 Marking Schemes & Distributions

Additional assignments will be given throughout the term but they will not be graded. Consider them as formative.

Name	Scheme A (%)
Individual Lit Review	15.00
Three Team Projects	60.00
Final Exam	25.00
Total	100.00

6.2 Assessment Details

Individual Lit Review

Date: Tuesday, September 27

05:00PM

Three Team Projects

Date:

1) Phase I Project 15% 11th Oct. 2017 @ 05:00PM
2) Phase II Project 20% 8th Nov. 2017 @ 05:00PM
3) Remediation Project 25% 29th Nov. 2017 @ 05:00PM

Final Exam

Date: Friday, December 15

07:00PM - 09:00PM

6.3 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 at 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, students must obtain an overall grade of 50% or higher on the aggregate of all the course work outlined in Section 6.1.

Late Reports: There will be no extension of the deadlines for submissions, except for serious health or compassionate reasons, with the appropriate documentation. Just like the consulting world where projects are not awarded if the proposals are late, a grade of zero will be given for late submissions.

Certification: Students must write their PEO SMP (Student Membership Program) number on all submitted work. This signifies that the SOE Code of Ethics was adhered to. For group projects, students must also state that they contributed to the group effort in an equitable manner.

6.4 Course Format

Classes are scheduled twice a week on Tuesdays and Thursdays. There is also a tutorial on Wednesdays. The format of the course is problem based learning, where students will learn by doing. It is expected that each team member will spend an average of 10 to 12 h per week on the course. The active learning component will require group discussions and presentations on material related to the lecture material.

Students will work in teams of three or four persons. Course instructor will assist with the formation of the groups as required. Students will have the option of changing groups after the first project.

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7 School of Engineering Statements

7.1 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.

7.2 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.

7.3 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.

8 University Statements

8.1 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.

8.2 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.

8.3 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.

8.4 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.

8.5 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

8.6 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.

8.7 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.

8.8 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.