

**"FUNDAMENTALS OF SITE REMEDIATION"
(EESD15H3-F L01)**

Instructor: Dr. Silvija Stefanovic

Synchronous Lectures Online: Friday 12–3pm;

Office hours Online: Friday 3-4pm

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TAs: Bhargav Patel

Online office hours: day/time TBA

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Intent of the course:

This course consists of a study of the ways in which hazardous organic and inorganic materials can be removed or attenuated in natural systems. The theory behind various technologies, with an emphasis on physical, chemical and biological techniques and their success in practice. An introduction to the unique challenges associated with the remediation of surface and ground water environments, soils, marine systems, and contaminated sediments.

Prerequisite: Students must have successfully completed BIOA01H3 & BIOA02H3 & CHMA10H3 & CHMA11H3 & [PHYA10H3 or PHYA11H3]

Textbook:

There is no suitable textbook for this course. See below some suggested readings.
These readings are not mandatory course material.

“Fundamentals of Site Remediation”, John Pichtel, 3rd edition, 2019, Bernan Press.

“Remediation technologies for soil and groundwater” [electronic resources], sponsored by Remediation Technologies for Soils and Groundwater Task Committee of the Environmental Council, Environmental and Water Resources Institute (EWRI) of the American Society of Civil Engineers; edited by Alok Bhandari ... [et al.]. Reston, Va.: American Society of Civil Engineers, c2007.

“Elements of the Nature and Properties of Soils” by N.C. Brady

Online Lectures:

The lectures will take place online at Zoom every Friday 12-3pm. Link for recurring meetings will be provided. The lectures will be recorded and the videos will be posted for your later review.

Questions are encouraged at all times during the lectures in form of chat or verbal. The chat will be checked approximately every 20-30min. but verbal participation is preferred and strongly encouraged.

The lecture slides will be posted in *.pdf format on Quercus. You will require Adobe Reader to open the files (available free of charge at www.adobe.com).

Course email Policy:

Email is not an effective way of teaching and email inquiries regarding course materials will not be answered.

Dr. Stefanovic will be available during designated office hours at Zoom (the same link will be used for lecture and office hours) to answer questions regarding course material. If you have questions, then please see instructor during office hours – this time is for you so please do not hesitate to use it. You can email Dr. Stefanovic in a case you have something private to discuss.

Course TA will also be available during his designated office hours and he WILL respond on the emails pertaining assignments and written project reports.

Grading:

Assignments (2):	20% (2x10%)
Online Midterm Test:	20%
Project Presentation:	10%
Project Report:	15%
Online Final Exam:	30%
Field Trip Attendance and Participation	5%

Assignments:

You will have two problem sets to solve and submit on Quercus individually or in pairs (maximum two students).. You will be able to access the problem sheets on the Quercus at the times detailed below. More details on the assignments will be circulated during the term.

<i>Topic</i>	<i>on Quercus</i>	<i>Due date</i>
Assignment #1	Friday Oct. 1 st at 10am	Friday Oct. 22 nd at 5pm
Assignment #2	Friday Nov. 12 th at 10am	Friday Nov. 26 th at 5pm

Online Midterm Test (in class):

The 1 hour midterm examination is worth 20% of the final grade for the course. The midterm will be online. The exam will consist of Fill in the Blanks, Matching, MCQs, Multiple Dropdowns and True/False questions. The midterm test will draw from a lecture notes and *any* material priorly presented in the class. Information from the suggested readings and other resources not directly covered in class will not be tested on the exams.

The midterm questions and answers will not be available for students to review after the exam.

The midterm is closed book. In order to uphold the integrity of this course during this time, we will request that you each complete a Midterm Exam Take-Home Honour Pledge Questions (first question is at the beginning and second is at the end of the test). The completion of the pledge is mandatory and not completing will be considered as an Academic Integrity Violation issue and students' names will be sent to the Departmental Chair (DPES) for assessment. More details about the midterm will follow.

Missed Midterm Policy

If you miss the midterm for a verifiable reason (i.e. you have a Doctor's note or have made provisions for a VERY good reason with the professor PRIOR to the mid-term), please submit the proof for your absence **via email to Dr. Stefanovic**.

If the reason is medical, an official UTSC medical note must be completed by a doctor who examined you while you were ill/injured. The medical note can be downloaded at

http://www.utoronto.ca/~registrar/resources/pdf_general/UTSCmedicalcertificate.pdf.

You must submit appropriate documentation **within 3 business days** after the day of the regular midterm. All collected documents will be submitted to the DPES Chairs office for consideration. After checking the validity of your documentation, the day and time of the makeup midterm will be announced on Quercus. If you simply "miss" the midterm, you will receive a mark of zero for it.

If you miss the makeup midterm with a verifiable reason after you submit the proof for your absence again (**new document with the new date**) the weight of the midterm will be transferred to the final exam (in this case your final will worth 50%).

Final Project Presentation/Report

You will be assigned a real remediated site to critically review its problem circumstances such as site history, types and sources of contaminants, contaminant migration pathways, human and ecological receptors, natural and demographic site conditions and completed remediation techniques. This is a group project with 5 students per group. There are 8 topics in total and they are already posted on Quercus. **Please sign in for Groups on Quercus.**

At the end of the term you will present your findings during 20min long in class online presentation. A properly working camera and microphone are required. The groups have to send their slides in pdf format to Dr. Stefanovic by Friday at 11:45 pm on the day they are presenting.

After every two presentations, the presenters should initiate discussion on the assigned topics and ask each other at least 5 questions in total (each student one question minimum). These questions should be related to the presented remediation sites. Dr. Stefanovic will act as a moderator during these discussions and she will mark your presentations and questions.

The written final project report is due on Friday Dec. 3rd at 5pm on Quercus. Your TA, Bhargav Patel will be responsible to help you with the written project report. More details about the project presentations and report will follow.

Final Exam:

The 2 hour final examination is worth 30% of the final grade for the course. It will be a combination of written (short answer) questions and calculations/problem solving questions. The final exam will draw from lecture notes and *any* material presented in the class. Information from the suggested readings and other resources not directly covered in class will not be tested on exams. More details about the final exam will follow.

Field Trip to UTSC Campus Farm

In class field trip to UTSC Campus farm is planned for Oct. 1st (date can vary due to a weather).

The UTSC Campus Farm is located on the north side of campus, east of the Toronto Pan-Am Sports Centre, and beyond the Morningside Athletic Fields. The students will conduct site reconnaissance and learn about contamination and nutrient status of the farm. More details about the field trip will follow.

Other Course Policies:

Late assignments, project presentations/reports will not be accepted and assigned a grade of zero. *Extensions will be granted ONLY with medical note or under exceptional circumstances. Your TA must be informed about that immediately and documentation has to be provided within 5 days after the due date of the assignment/report.*

Plagiarism will not be tolerated. Each student/group is expected to submit **individual work** for grading. It is an academic offense to plagiarize and those who do, will be subjected to University procedures (see the University calendar).

Accessibility Statement:

Students with diverse learning styles and needs are welcome in this course. In particular, if you have a disability/health consideration that may require accommodations, please feel free to approach me and/or the AccessAbility Services Office as soon as possible. I will work with you and AccessAbility Services to ensure you can achieve your learning goals in this course. Enquiries are confidential. The UTSC AccessAbility Services staff are available by appointment to assess specific needs, provide referrals and arrange appropriate accommodations at (416) 287-7560 or ability@utsc.utoronto.ca.

Lecture Topics:

1. Introduction, ground rules, expectations and course structure.

What is contaminated site? Introduction to soil and groundwater remediation.

Sept. 10th

2. Basic soil and groundwater properties; Types and properties of contaminants (review).

Sept. 17th

3. Environmental site assessment; Investigative methods; Natural attenuation.

Sept. 24th

4. **Field trip to UTSC Campus Farm; Assignment #1.**

Oct. 1st

5. Selection of remediation procedure; Classification of techniques: Ex situ and In situ technologies;

Oct. 8th

READING WEEK

Oct. 15th

6. *Physical methods of trapping pollutant:* Encapsulation, Stabilization, Hydraulic trap.

Physical methods involving removal of pollutants: Excavation, Pumping water, Pumping-skimming,

Washing and entrainment by a liquid, In situ venting, Soil vapour extraction (SVE), Air stripping.

Oct. 22nd

7. *Thermal methods*: Incineration, Thermal desorption, Pyrolysis, Vitrification.
Remediation of the soils with excessive pH. Oct. 29th
8. **ONLINE midterm (in class)**; *Chemical Methods*: On site Washing, Oxidation, Reduction; Dechlorination, Electrochemical techniques; Nov. 5th
9. *Biological method*: Biodegradation in pile, Composting, Land farming, Bioventing and biosparging, Biobarriers and biological screens; Phytoremediation; Lagooning. **Assignment #2.** Nov. 12th
10. *Surface water and marine systems remediation*: Oil spills remediation methods. Nov. 19th
11. Final Project Presentations Nov. 26th
12. Final Project Presentations Dec. 3rd

I will follow this schedule as closely as possible, but things being what they are, some of these topics may "overflow" over into other time slots.