

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

Instructor: Dr. Jovan Stefanovic

Lectures: Friday 12–3pm; Room HW 308

Office hours: Tuesday 11:30am -12:30 pm, ESCB, Room 340

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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

Lectures:

The lectures will take place in Room HW 308 every Friday 12-3pm (except the day for the field trip)

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 (ESCB, Room 340) 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.

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

Grading:

Assignments (2):	20% (2x10%)
Midterm Test (in-person/in class)	20%
Project Presentation:	10%
Project Presentation attendance:	2%
Project Written Report:	15%
Final Exam (in-person):	30%
Field Trip Attendance and Participation	3%

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	Sept.30	Oct.21
Assignment #2	Nov.4	Nov.18

Midterm Test (in class, Nov.4 at 12 pm):

The 1-hour multiple choices and true/false questions midterm examination is worth 20% of the final grade for the course. The midterm exam will draw from lecture notes and *any* material priory presented in the classroom. Information from the readings and other resources not directly covered in class will not be tested on exams. More details about the exams will follow.

Missed Midterm Policy

If you miss midterm you have to formally self-declare absences through DPES on-line self-declaration form (<https://www.utoronto.ca/physsci/self-declaration-absence-form-0>). These on-line requests will be sent directly to your instructor, as well as to the department.

The form is conveniently placed on the front page of DPES website, just underneath the picture with the “smiley faces” during the groundbreaking of our EV building (<https://www.utoronto.ca/physsci/welcome-physical-environmental-sciences>).

Please note that you still have to submit your absence on-line requests through ACORN.

Both submissions have to be done **within 3 business days** after the day of the regular midterm. The self-declarations submitted after this time will not be considered.

After checking the validity of your self-declarations, the day and time of the makeup midterm will be announced on Quercus. If you simply "miss" the mid-term, you will receive a mark of zero for it.

If you miss the makeup midterm with a verifiable reason after you submit the self-declarations again, the weight of the midterm will be transferred to the final exam (in this case your final will be 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 3-4 students per group. There are 10 topics in total and they will be posted on Quercus. **Please sign in for Groups on Quercus by going to People.**

At the end of the term, you will present your findings during 20 min long in class presentation. The groups have to send their slides in pdf format to Dr. Stefanovic by Thursday at 11:59 pm, so the day before they are presenting.

The rest of the class will need to submit hand written summaries from all presentations for the participation mark (each presentation day one mark).

Dr. Stefanovic will act as a moderator during these discussions and he will mark your presentations and questions.

The written final project report is due on Friday Dec. 2nd at 11:59 pm on Quercus. The length is limited to maximum 8 pages, plus extra pages for references and appendix. Your TA 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 Sept.30 (but the exact date will be TBA, since it depends on weather conditions).

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 if you self-declare absences through DPES on-line self-declaration form (<https://www.utsc.utoronto.ca/physsci/self-declaration-absence-form-0>).*

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. 9th
 2. Basic soil and groundwater properties; Types and properties of contaminants (review). Sept. 16th
 3. Environmental site assessment; Investigative methods; Natural attenuation. Sept. 23th
 4. **Field trip to UTSC Campus Farm; Assignment #1. (Tentative date for the field trip).** **Sept.30th**
 5. Selection of remediation procedure; Classification of techniques: Ex situ and In situ technologies; Oct. 7th
- READING WEEK** **Oct.14th**
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.21st
 7. *Thermal methods:* Incineration, Thermal desorption, Pyrolysis, Vitrification.
Remediation of the soils with excessive pH. Oct. 28th
 8. **Midterm (in class);** *After midterm follow Chemical Methods:* On site Washing, Oxidation, Reduction;
Dechlorination, Electrochemical techniques. **Assignment #2.** **Nov. 4th**
 9. *Biological method:* Biodegradation in pile, Composting, Land farming, Bioventing and biosparging,
Biobarriers and biological screens; Phytoremediation; Lagooning. Nov. 11th
 10. *Surface water and marine systems remediation:* Oil spills remediation methods. Nov. 18th
 11. Final Project Presentations Nov. 25th
 12. Final Project Presentations Dec.2nd

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.