

**"CONTAMINANTS HYDROGEOLOGY"**  
**(EESD02 H3-S L30)**

**Instructor:** Dr. Silvija Stefanovic

**Lectures:** online/in-person (see below for details), Mon. 7-10pm;

**Office hours:** online/in-person; Wed. 1-2 pm

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**TAs:** Sayuri Sagisaka

**Office hours:** online/in-person; day and time TBA

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**The intent of the course:**

Natural hydrochemical processes; the use of major ions, minor ions, trace metals and environmental isotopes in studying the occurrence and nature of groundwater flow. Point and non-point sources of groundwater contamination and the mechanisms of contaminant transport.

**Prerequisite:** At least 1 full credit in Environmental Science at the C-level.

**Suggested Readings:**

"Contaminant Hydrogeology", C. W. Fetter, Thomas Boving, David Kremer, 2017, 3rd Edition, Waveland Press

**Lectures:**

First lecture is online synchronous on Monday Jan. 10<sup>th</sup> 7 - 10pm. The Zoom link will be provided. This will be repeated every Monday until at least Jan. 31<sup>st</sup>. The students will be notified if the class will be moved to in person teaching mode after this time. This will depend on the government and university COVID-19 recommendations. All online lectures will be recorded and posted on Quercus for students to review on their own convenience. The lectures will remain posted until the end of the semester.

The lecture slides will be posted in \*.pdf format on the Quercus. You will require Adobe Reader to open the files (available free of charge at [www.adobe.com](http://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 online/in person office hours to answer questions regarding course material. If you have questions, please see the instructor during office hours – this time is for you so please do not hesitate to use it.

TA will also be available during the designated online/in person office hours and will respond to the emails pertaining assignments.

**Grading:**

Assignments (3)	35% (10+15+10 %)
Seminar	15%
Final Examination:	50%

**Assignments:**

You will have three calculation assignments (individual or in pairs - a maximum of 2 students per group) during the term. 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>Submission Due</i>
Assignment #1	Jan. 31 <sup>st</sup>	Feb.14 <sup>th</sup>
Assignment #2	Feb.14 <sup>th</sup>	Mar.7 <sup>th</sup>
Assignment #3	Mar.7 <sup>th</sup>	Mar.21 <sup>st</sup>

**Seminar:**

The seminars will start on Jan. 31<sup>st</sup> and will take place every week after the lecture. Two groups of 2-3 students in each group will be assigned a specific subsection of the studied major contaminant hydrogeology area to present. **Please sign in for Groups on Quercus.** The presentation schedule is below:

<b>Group #</b>	<b>Topic</b>	<b>Week #</b>	<b>Date</b>
Group 1, 2	Contaminated groundwater flow	Week 4	January 31
Group 3, 4	Capture Curve Analysis	Week 5	February 7
Group 5, 6	Contaminant Transport in Aquifer I	Week 6	February 14
Group 7, 8	Contaminant Transport in Aquifer II	Week 7	February 28
Group 9, 10	Contaminant Partitioning in the Subsurface Environment	Week 8	March 7
Group 11, 12	Abiotic and Biotic Contaminant Transformations in Subsurface Waters	Week 9	March 14
Group 13, 14	Isotope Hydrology and Applications in Hydrogeology	Week 10	March 21
Group 15, 16	Climate Change Impacts on Groundwater Quality	Week 11	March 28
Group 17, 18	Innovations in Contaminant Hydrology Field	Week 12	April 4

Each group will need to select ONE research papers from the list Dr. Stefanovic provided on Quercus, to review and to prepare a short PowerPoint presentation (15 min) of these findings. **Both groups will present the paper on the same topic so communication between the groups is required to avoid overlapping in the paper selection.**

The presentations will be at Zoom (or in person if we return in class) and a properly working camera and microphone are required. The groups have to send their slides in pdf format to Dr. Stefanovic by Monday at 6:45 pm on the day they are presenting.

After the presentations, the groups should initiate discussion on the assigned topic and ask each other at least 4 - 6 questions in total (each student one question minimum). These questions should be related to the presented papers. The questions will be marked too.

**Final Exam:**

The 2.5-hour final examination is worth 50% of the final grade for the course. It will be a combination of figure labelling, short answer questions and calculations. The student will be informed about the mode of the midterm (in person or online). This will depend on the government and university COVID-19 recommendations.

The final exam will draw from the assignments, lectures and includes lecture notes and any material presented in the classroom. Information from the suggested readings, seminars and other resources not directly covered in class will not be tested on exams. More details about the exams will follow.

If the midterm is online, it will be closed book and we will request that you each fill out and submit a Final Exam Take Home Honour Pledge. The completion of the pledge is mandatory and not submitting it on time will be considered as an Academic Integrity Violation issue and students' names will be sent to the Departmental Chair (DPES) for assessment.

### **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. (416) 287-7560 or [ability@utsc.utoronto.ca](mailto:ability@utsc.utoronto.ca).

### **Other Course Policies:**

Late assignments and seminars will not be accepted and assigned a grade of zero.

Extensions will be granted ONLY with a medical note or under exceptional circumstances. Your TA and Dr. Stefanovic must be informed about that immediately and documentation has to be provided within 3 days after the due date of the assignment.

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

### **Lecture topics:**

1. Introduction, ground rules, expectations and course structure.  
Introduction to Contaminant Hydrogeology;  
**Video:** "The Nature of Earth: Introduction to Geology", Lecture #23:" Groundwater" Jan.10<sup>th</sup>
  2. Types and sources of the contamination; Groundwater Chemistry Jan.17<sup>th</sup>
  3. Principles of Groundwater Flow Jan.24<sup>th</sup>
  4. Capture Curve Analysis  
*Assignment #1 – Tutorial* Jan.31<sup>st</sup>
  5. Contaminant Transport: Transport of passive and reactive contaminants;  
One-dimensional soil column Advection-Dispersion Equation (ADE) Feb.7<sup>th</sup>
  6. Contaminant Transport: Two-dimensional Advection-Dispersion Equation for instantaneous input;  
One- and Three-dimensional Advection-Dispersion Equation for continuous input  
*Assignment #2 – Tutorial* Feb.14<sup>th</sup>
- FAMILY DAY (University closed) Feb.21<sup>st</sup>**
7. Contaminant Partitioning in the Subsurface Environment Feb.28<sup>th</sup>
  8. Problem Set (Tutorial)  
*Assignment #3 – Tutorial* Mar.7<sup>th</sup>
  9. Abiotic and Biotic Contaminant Transformations in Subsurface Waters Mar.14<sup>th</sup>
  10. Isotope Hydrology and Applications in Hydrogeology Mar.21<sup>st</sup>
  11. Climate Change Impacts on Groundwater Quality Mar.28<sup>th</sup>
  12. Course Review; Final exam preparation Apr. 4<sup>th</sup>