

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

**Instructor:** Dr. Silvija Stefanovic

**Lecture:** Monday 7–10pm; HW215

**Office:** EV366

**Office hours:** Mondays 5 - 6:30pm

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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 ground water 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

**Lecture Notes:**

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 office hours to answer questions regarding course material. If you have questions, please see 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 in-person office hours and will respond on the emails pertaining assignments.

**Grading:**

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

**Assignments:**

You will have three assignments (individual or in pairs - maximum 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. 30 <sup>th</sup>	Feb.13 <sup>th</sup>
Assignment #2	Feb. 13 <sup>th</sup>	Mar. 6 <sup>th</sup>
Assignment #3	Mar. 6 <sup>th</sup>	Mar. 20 <sup>th</sup>

**Seminar:**

The seminars will start on Jan. 30<sup>th</sup> and will take place every week after the lecture. The seminar schedule is below:

	<b>Group #</b>	<b>Topic</b>	<b>Week #</b>	<b>Date</b>
1.	Group 1, 2	Contaminated groundwater flow	Week 4	January 30
2.	Group 3, 4	Capture Curve Analysis	Week 5	February 6
3.	Group 5, 6	Contaminant Transport in Aquifer I (Instantaneous one-dimensional transport of passive/reactive contaminants)	Week 6	February 13
4.	Group 7, 8	Contaminant Transport in Aquifer II (Continuous one/two/three-dimensional transport of passive/reactive contaminants)	Week 7	February 27
5.	Group 9, 10	Contaminant Partitioning in the Subsurface Environment	Week 8	March 6
6.	Group 11, 12	Abiotic and Biotic Contaminant Transformations in Subsurface Waters	Week 9	March 13
7.	Group 13, 14	Isotope Hydrology and Applications in Hydrogeology	Week 10	March 20
8.	Group 15, 16	Climate Change Impacts on Groundwater Quality	Week 11	March 27

Two teams of maximum 3 students will each be assigned a specific subsection of the studied major contaminant hydrogeology area. Each team will need to review ONE recent research paper (not older than 10 years) and to prepare a short power point presentation (15 min) of these reviews (findings). It is strongly advised to send the paper to the instructor for approval before proceeding with the seminar. Both groups will present the paper on the same topic so communication between groups and with instructor are required to avoid overlapping in the paper selection.

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 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.

**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. 9<sup>th</sup>

2. Types and sources of the contamination; Groundwater Chemistry

Jan. 16<sup>th</sup>

3. Principles of Groundwater Flow

Jan. 23<sup>rd</sup>

4. Capture Curve Analysis

*Assignment #1 – Tutorial*

Jan. 30<sup>th</sup>

5. Contaminant Transport: Transport of passive and reactive contaminants;

One-dimensional soil column Advection-Dispersion Equation (ADE)

Feb. 6<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. 13<sup>th</sup>

**FAMILY DAY (University closed)**

Feb. 20<sup>th</sup>

7. Contaminant Partitioning in the Subsurface Environment

Feb. 27<sup>th</sup>

8. Problem Set (Tutorial)

*Assignment #3 – Tutorial*

Mar. 6<sup>th</sup>

9. Abiotic and Biotic Contaminant Transformations in Subsurface Waters

Mar. 13<sup>th</sup>

10. Isotope Hydrology and Applications in Hydrogeology

Mar. 20<sup>th</sup>

11. Climate Change Impacts on Groundwater Quality

Mar. 27<sup>th</sup>

12. Course Review; Final exam preparation

April 3<sup>rd</sup>

*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.*