EXPANDED COURSE DESCRIPTION
CIVIL ENGINEERING
Lassonde School of Engineering
Civil Engineering
LE / CIVL 4044 3.0 SECTION A
ENVIRONMENTAL GEOTECHNICS
FALL 2019 / WINTER 2020

Last Modified Date: 08/07/2019

COURSE CALENDAR DESCRIPTION

This course provides essential geotechnical engineering concepts and their applications in the analysis and design of environmental system, with particular focus on waste containment facilities. Topics include: variably-saturated flow in soils; nature of contaminants and the contaminant transport processes; engineered barrier, drainage and cover systems; geosynthetic barriers; remediation of contaminated ground; geotechnical aspects of mine waste management and rehabilitation. Prerequisite: LE/CIVL 3210 3.00.

The course covers the following topics: Environmental Geotechnics: Introduction and overview of waste containment, environmental impact and regulatory framework. Compacted clay barriers: Saturated flow, clay minerals, properties of clay, water in soil, compaction and compacted clay properties. Unsaturated soil barriers: variably-saturated flow in soils, conventional cover systems, alternative cover systems. Geosynthetic barriers: Types and functions of geosynthetics, geomembrane barriers, composite liners, exposed geomembrane liners, geosynthetic clay liner (GCL) barriers. Solid waste containment: types of solid waste, characterization and engineering properties of municipal solid waste, municipal landfill systems. Contaminant transport through barrier systems: advection, dispersion and diffusion, reactive constituents, analytical solutions, numerical modelling. Emerging aspects in geoenvironmental engineering: geotechnics of mine waste management and rehabilitation, beneficial reuse of waste materials, bioreactor landfills, landfill rehabilitation. Remediation of contaminated ground: pump-and-treat method, bioremediation, thermal treatment, solidification. Laboratory component: The course has four 3-hr lab sessions (total 12 hrs.).

INSTRUCTOR(S)

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<th>Name</th>
<th>Section / Format / Term</th>
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<td>Bashir, Rashid</td>
<td>Sec. A / LECT / W</td>
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ADDITIONAL INFORMATION

TOPICS AND CONCEPTS

The course covers the following topics:

- Environmental Geotechnics: Introduction and overview of waste containment, environmental impact and regulatory framework
- Compacted clay barriers: Saturated flow, clay minerals, properties of clay, water in soil, compaction and compacted clay properties
- Unsaturated soil barriers: variably-saturated flow in soils, conventional cover systems, alternative cover systems.
- Geosynthetic barriers: Types and functions of geosynthetics, geomembrane barriers, composite liners, exposed geomembrane liners, geosynthetic clay liner (GCL) barriers
- Solid waste containment: types of solid waste, characterization and engineering properties of municipal solid waste, municipal landfill systems
- Contaminant transport through barrier systems: advection, dispersion and diffusion, reactive constituents, analytical solutions, numerical modelling
• Emerging aspects in geoenvironmental engineering: geotechnics of mine waste management and rehabilitation, beneficial reuse of waste materials, bioreactor landfills, landfill rehabilitation
• Remediation of contaminated ground: pump-and-treat method, bioremediation, thermal treatment, solidification.

LABORATORY SESSIONS
The course has the following four 3-hr lab sessions:
• Infiltration through an unsaturated sloping cover system: Simulation of different rates of infiltration through a two-layer (coarse-fine) cover system using 2-D seepage analysis software (e.g. SEEP/W or Hydrus-2D)
• Stability analysis of a landfill liner system: Numerical assessment of stability of a landfill liner system for different configurations using a combination of stress-deformation and limit equilibrium analyses (e.g. using SIGMA/W and SLOPE/W)
• Advective contaminant migration through soils: Numerical back-analysis of a laboratory model of contaminant migration through groundwater flow using a combination of seepage and contaminant transport modelling (e.g. using SEEP/W and CTRAN/W)
• Stress-deformation and stability analysis of a municipal landfill expansion: Numerical simulation of piggyback expansion of an existing municipal landfill using a combination of stress-deformation and limit equilibrium analyses (e.g. using SIGMA/W and SLOPE/W) objective of assessing the existing landfill’s gas and leachate collection systems

COURSE LEARNING OUTCOMES
1. Evaluate and select the mechanical and hydraulic properties of soil, solid waste, and geosynthetics for use in the analysis and design of waste containment and ground remediation systems
2. Use industry-standard numerical modelling software to develop idealized computational models of waste containment and ground remediation systems
3. Judge the validity of numerical modelling results and use them for the design of waste containment and ground remediation systems
4. Communicate results from engineering analysis and design in the form of a formal written report
5. Extract, summarize and critique findings from case histories and published literature to keep themselves abreast of the state-of-the-art in the analysis and design of waste containment and ground remediation systems.

GRADE ASSESSMENT
Assignments: 10%
Labs: 20%
Term Paper: 20%
Final Examination: 50%

The grading scheme for the course conforms to the 9-point grading system used in undergraduate programs at York (e.g., A+ = 9, A = 8, B+ = 7, B = 6, etc.).
Assignments and tests will bear either a letter grade designation or a corresponding number grade (e.g. A+ = 90 to 100, A = 80 to 90, B+ = 75 to 79, etc.)
(For a full description of York grading system see the York University Undergraduate Calendar - http://calendars.registrar.yorku.ca/2010-2011/academic/index.htm

ACADEMIC INTEGRITY LINKS
• Senate Policy on Academic Honesty - http://secretariat-policies.info.yorku.ca/policies/academic-honesty-senate-policy-on/
• Academic Integrity - http://lassonde.yorku.ca/academic-integrity
STUDENT LINKS
- Student Rights and Responsibilities - http://oscr.students.uit.yorku.ca/student-conduct
- Religious Observance - https://w2prod.sis.yorku.ca/Apps/WebObjects/cdm.woa/wa/regobs
- Student Accessibility Services (SAS) - https://accessibility.students.yorku.ca/
- York University’s Policies on Gender/LGBTQ*/Positive Space - http://rights.info.yorku.ca/lgbtq/

LAND ACKNOWLEDGEMENT
- We acknowledge our presence on the traditional territory of many Indigenous Nations. The area known as Tkaronto has been care taken by the Anishinabek Nation, the Haudenosaunee Confederacy, the Huron-Wendat, and the Métis. It is now home to many Indigenous Peoples. We acknowledge the current treaty holders, the Mississaugas of the New Credit First Nation. This territory is subject of the Dish With One Spoon Wampum Belt Covenant, an agreement to peaceably share and care for the Great Lakes region.
- The Indigenous Framework for York University: A Guide to Action can be found here: http://indigenous.info.yorku.ca/
- Meaning of a land acknowledgement: http://healthydebate.ca/opinions/indigenous-land-acknowledgements

Many courses utilize Moodle, York University’s course website system. If your course is using Moodle, click here to access it.
Moodle @ York University