ENVE 5201/4002 Environmental Geotechnical Engineering
Winter 2023

Instructor  Elena Zabolotnii, PhD PEng
e-mail: elenazabolotnii@cunet.carleton.ca
phone: 613-520-2600 x1402
office: EDC 4532
office hours: Mon 10:35 – 11:25

Teaching Assistant  TBD
e-mail: TBD
office: TBD
office hours: TBD

Course Dates:
Lectures: January 8 – April 10  Monday 11:35 – 14:25 MacKenzie Room 3165
Tutorials: January 8 – April 10  Tuesday 11:35 – 12:25 Canal Building Room 2400
April 10th, 2024 classes follow a Friday schedule

Final examination (TBA) to be announced on Carleton University site

A missed final examination will result in a grade of zero unless a medical excuse is provided to the Student Services. In such case, a deferred final examination may be arranged.

Course Description:
This course focuses on landfill design as its main subject. Specific topics include:

- Hydrogeologic principles including groundwater flow, water budget and contaminant transport.
- Landfill design, including:
  - General principles.
  - Landfill liners, including clay leachate interaction, clay liners, geosynthetics and composite systems.
  - Landfill covers, including design principles based on unsaturated soil mechanics and environment-specific factors.
  - Leachate and gas collection systems.
- Landfill operation, monitoring and quality control/quality assurance, including leak detection and control.
- Case studies of geotechnical and geoenvironmental failures of landfills.

Grading
Assignments & Tutorials: 25%
Group Presentation and Report: 25%
Final Examination: 50%
Students who claim illness, injury, or other extraordinary circumstances beyond their control as a reason for missed term work are held responsible for immediately informing the instructor concerned and for alternate arrangements with the instructor and in all cases, this must occur no later than three (3) days after the term work was due. The alternate arrangement must be made before the last day of classes in the term as published in the academic schedule. Consult Section 4.4 of the University Calendar.

Students missing deadlines or exams due to an illness must submit a Self-declaration for Academic Considerations Form to the instructor within three (3) days. Accommodations cannot be granted more than 72 hours after the deadlines. For final exams, students must submit the self-declaration form in addition to a deferral application (carleton.ca/registrar/deferral) and submit both forms to the Registrar’s Office no later than 3 days after the scheduled examination or take-home due date. If an absence from an evaluation is deemed justified:

1) Assignments: the weight of a justified missed assignment will be transferred onto the remaining assignments.
2) Final exam: the student will have to consult the academic secretariat of the faculty for the procedure to follow.

Required Text
2. Lecture notes (Softcopy on Brightspace. You must bring a hardcopy to lectures)
3. Reading materials posted on Brightspace.

Optional Textbooks:

Additional References
Assignment Submission

All assignments and other submissions should be submitted as a hard copy. While you may submit your assignments after the due date, a grade penalty will be applied as follows: -20% if submitted prior to the solutions being posted; and a grade of zero if submitted after the solutions are posted.

Solutions

Assignment solutions will be posted on Brightspace seven days after the assignment due dates.

The Paul Menton Centre for Students with Disabilities (PMC) provides services to students with Learning Disabilities (LD), psychiatric/mental health disabilities, Attention Deficit Hyperactivity Disorder (ADHD), Autism Spectrum Disorders (ASD), chronic medical conditions, and impairments in mobility, hearing, and vision. If you have a disability requiring academic accommodations in this course, please contact PMC at 613-520-6608 or pmc@carleton.ca for a formal evaluation. If you are already registered with the PMC, contact your PMC coordinator to send me your Letter of Accommodation at the beginning of the term, and no later than two weeks before the first in-class scheduled test or exam requiring accommodation (if applicable). Requests made within two weeks will be reviewed on a case-by-case basis. After requesting accommodation from PMC, meet with me to ensure accommodation arrangements are made. Please consult the PMC website (www.carleton.ca/pmc) for the deadline to request accommodations for the formally-scheduled exam (if applicable).
<table>
<thead>
<tr>
<th>Lecture Date</th>
<th>Lecture Topic:</th>
<th>Tutorial:</th>
<th>Assignments due on the day of the class at 4pm:</th>
</tr>
</thead>
<tbody>
<tr>
<td>January 8</td>
<td>COURSE REVIEW AND OBJECTIVES INTRODUCTION LEGISLATION</td>
<td></td>
<td></td>
</tr>
<tr>
<td>January 15</td>
<td>GEOTECHNICAL PROPERTIES OF WASTE</td>
<td>Tutorial #1: geotechnical properties of waste</td>
<td></td>
</tr>
<tr>
<td>January 22</td>
<td>HYDROGEOLOGIC PRINCIPLES 1/3 • 1D flow through porous media • Review of 2D flow</td>
<td>Tutorial #2: 1D flow through porous media</td>
<td>Assignment 1: geotechnical properties of waste</td>
</tr>
<tr>
<td>January 29</td>
<td>HYDROGEOLOGIC PRINCIPLES 2/3 • Water budget • Leachate generation</td>
<td>Tutorial 3: 2D seepage modelling (PLAXIS LE)</td>
<td>Assignment #2: 1D flow through porous media</td>
</tr>
<tr>
<td>February 5</td>
<td>HYDROGEOLOGIC PRINCIPLES 3/3 • Contaminant transport 1 • Contaminant transport 2</td>
<td>Tutorial #4: contaminant transport</td>
<td>Assignment #3: 2D seepage modelling (PLAXIS LE)</td>
</tr>
<tr>
<td>February 12</td>
<td>LANDFILL DESIGN • Site selection</td>
<td></td>
<td></td>
</tr>
<tr>
<td>February 19</td>
<td>WINTER BREAK</td>
<td></td>
<td></td>
</tr>
<tr>
<td>February 26</td>
<td>LANDFILL LINERS • Compacted clay liners • Geosynthetic Liners • Geomembrane Liners</td>
<td></td>
<td>Assignment #4: contaminant transport</td>
</tr>
<tr>
<td>March 4</td>
<td>LANDFILL COVERS • Unsaturated flow • Cover design</td>
<td>Tutorial #5: unsaturated flow</td>
<td></td>
</tr>
<tr>
<td>March 11</td>
<td>LANDFILL OPERATION, MAINTENANCE AND MONITORING • Leachate detection and monitoring • Settlement and stability</td>
<td></td>
<td>Assignment #5: unsaturated flow</td>
</tr>
<tr>
<td>March 18</td>
<td>LANDFILL MECHANICAL STABILITY • Settlement • Stability</td>
<td>Tutorial #6: 2D limit equilibrium stability of landfills (PLAXIS LE)</td>
<td>Assignment #6: landfill settlement and stability</td>
</tr>
<tr>
<td>March 25</td>
<td>REVIEW</td>
<td></td>
<td></td>
</tr>
<tr>
<td>April 1</td>
<td>Group Presentations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>April 8</td>
<td>Group Presentations</td>
<td></td>
<td>Group Report</td>
</tr>
</tbody>
</table>