Carleton University
The Department of Civil and Environmental Engineering

ENVE 5201/4002 Geo-Environmental Engineering

Tentative Outline Winter 2019

Instructor: Dr. Mohammad Rayhani, P.Eng **TA**: TBD
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Office Hours: Thursdays 2:00-3:00pm

Lectures:	Monday	ME 4236	02:30-05:30 PM
Tutorial:	Tuesday	SA 309	01:35-02:25 PM

Course Description:

Landfill design; hydrogeologic principles, water budget, landfill liners, geosynthetics, landfill covers, quality control/quality assurance, clay leachate interaction, composite liner design and leak detection. Landfill operation, maintenance and monitoring. Case studies of landfill design and performance. Geotechnical design of environmental control and containment systems.

Course Text

Barrier Systems for Waste Disposal Facilities by *Rowe, R. Kerry, Quigley, Robert M., Brachman, Richard W. I., and Booker, John R.*, 2nd ed., 2004. Spon Press, Taylor & Francis Group, London and New York City, 587 pp., ISBN 0-419-22630-3. Available in the bookstore.

Reference Texts

Solid Waste Landfill Engineering and Design, Edward A. McBean, Frank A. Rovers and Grahame J. Farquhar, Prentice-Hall, 1995

Design, Construction, and Monitoring of Landfills, Second Edition, A. Bagchi, John Wiley & Sons, 1994

Waste Containment Systems, Waste Stabilization, and Landfills - Design and Evaluation, Hari D. Sharma and Sangeeta P. Lewis, John Wiley & Sons, 1994

Course Evaluation:

Assignments and Tests: 20%
Project / Presentation: 30%
Final Examination: 50%

(** A mark of 50% or better in each of the course components is required to pass the course**)

Course Outline

Week	Topic	Reading	Coursework	Suggested Project Work
January 7th	Course Overview, Context of landfills in waste management, Ontario Landfill Standard	Chapter 1 MOE guidelines for landfill design		
January 14th	Geotechnical properties of waste, 1-D seepage , Principles of situating the landfill; blowout, excavation	2.1-2.2 15.1-15.2	**Problem set 1:** Vertical seepage	Set groups Estimate landfill volume
January 21th	Landfill Leachate generation; volume and composition of leachate	2.3, 14.2, 14.4,	**Problem set 2:** Density and blowout	Interpolate site stratigraphy from borehole logs
January 28th	Cover design; Long-term performance of covers, Landfill Liners: composite	14 plus	**Assignment** 1: HELP program	Get weather data
February 4th	Landfill liners: CCL, GCLs, leachate compatibility	3 ,4,		Get cost info
February 11th	Geomembranes, and Geotextiles	12, 13, 15.3		
February 25nd	Contaminant transport: Hand Calculations	6,7	**Assignment2:** Contaminant transport calc.	Analyze contaminant impact for different designs
March 4th	Contaminant transport : POLLUTE Integration of Hydrogeology with Design	8,9,16		Factor in lifespan of engineered components in contaminant transport analysis
March 11th	Leachate Collection systems; Clogging	2.4-2.7,15.4,15.5	**Tutorial:** POLLUTE	Preliminary Design of LCS and liner.
March 18th	Landfill Gas, Bioreactor landfills			Based on contaminant transport calculations, select percolation rate and design cover
March 25th	General stability of landfill, Maintenance and monitoring			Detailed modeling for specific contaminants
April 1st	Review and Presentations			Iterate design as necessary
April 8th	Presentations			Final Report Due April 8th

"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*). "