Carleton University
The Department of Civil and Environmental Engineering

ENVE 5201/4002 Geo-Environmental Engineering

Tentative Outline

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Lectures:	Tuesday	02:35-05:25 PM
Tutorial:	Thursday	02:35-03:25 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 6th	Course Overview and Objectives, Context of landfills in waste management, Ontario Landfill Standard	Chapter 1 MOE guidelines for landfill design		
January 13th	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 20th	Landfill Leachate generation; volume and composition of leachate	2.3, 14.2, 14.4,	**Problem set 2:** Density and blowout calculations	Interpolate site stratigraphy from borehole logs
January 27th	Cover design; Long-term performance of covers, Landfill Liners: composite	14 plus	**Assignment** 1: HELP program	Get weather data
February 3rd	Landfill liners: CCL, GCLs, leachate compatibility	3 ,4,		Get cost info
February 10th	Geomembranes, and Geotextiles	12, 13, 15.3		
February 24th	Contaminant transport: Hand Calculations	6,7	**Assignment2:** Contaminant transport calc.	Analyze contaminant impact for different designs
March 3rd	Contaminant transport: POLLUTE Integration of Hydrogeology with Design	8,9,16		Factor in lifespan of engineered components in contaminant transport analysis
March 10th	Leachate Collection systems; Clogging	2.4-2.7,15.4,15.5	**Tutorial:** POLLUTE	Preliminary Design of LCS and liner.
March 17th	Landfill Gas, Bioreactor landfills			Based on contaminant transport calculations, select percolation rate and design cover
March 24th	General stability of landfill, Maintenance and monitoring			Detailed modeling for specific contaminants
March 31st	Review and Presentations			Iterate design as necessary
April 7th	Presentations			Final Report Due April 8th

Note: This course has timed written assessments, which may consist of tests, midterms and/or final examinations. The Carleton University e-Proctoring system may be used in your assessments, and requires the use of webcams, microphones, and smart phones.