

**THE UNIVERSITY OF WESTERN ONTARIO
DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING**

Course Outline

CEE 9651 – 2013 ST

Principles and Techniques of Ground Improvement

OBJECTIVES: As more engineering structures are built, it becomes increasingly difficult to find a site with suitable soil properties. The properties at many sites must be improved by the use of some form of soil improvement methods. The objective of this course is for students to understand common ground improvement methods, including densification and compaction, preloading consolidation by prefabricated vertical drains, vacuum and electro-osmotic consolidation, physical and chemical stabilization, soil reinforcement and seepage and dewatering. The focus of discussion will be on understanding scientific principles and appropriate applications; the degree to which soil properties may be improved; advantages and limitations. Case studies will be presented as part of learning process throughout the lectures. Students will practice to design and analysis of foundations on difficult soils, embankments and earth dams, earth retaining structures, seepage control, dewatering and other ground improvement projects with consideration of enhancing the benefit and reducing the cost.

PREREQUISITE: Completion of an undergraduate degree in civil engineering or permission of the instructor.

TOPICS:

- I Densification and Compaction
 - 1. Shallow and deep compaction
 - 2. Dynamic compaction
 - 3. Compaction quality control and assessment
- II Consolidation
 - 1. Prefabricated vertical drains (PVDs)
 - 2. Vacuum preloading
 - 3. Electro-osmosis
- III Physical and chemical stabilization
 - 1. Chemical admixtures
 - 2. Grouting
 - 3. Thermal treatment
 - 4. Ground freezing
 - 5. Electro-cementation
- IV Reinforcement by inclusions
 - 1. Reinforced earth structures
 - 2. Ground anchors, nails and micro-piles
- V Seepage control and dewatering
 - 1. Drainage methods
 - 2. Seepage control
 - 3. Design considerations

CONTACT HOURS: 4 hours per week on Wednesdays and Thursdays, May 8 - June 27, 2013, 2:30 - 4:30 PM
Location: SEB2202

REFERENCE (on 2-hour reserve in TAY):

Hausmann, M. R. (1990), Engineering Principles of Ground Modification, McGraw Hill, NY.

EVALUATION

Three Assignments (30%)

Case study and presentation (15%)

Final Examination, closed book, 3 hours (55%)

INSTRUCTOR

Dr. Julie Q. Shang, P.Eng. SEB3082, jqshang@uwo.ca

SCHEDULE

Wednesdays and Thursdays				
SEB2202				
Lecture	2:30 - 4:30 PM	Topic	Work due	Week
1	5/8/2013	Introduction		1
2	5/9/2013	Compaction		
3	5/15/2013	Compaction/PVD		2
4	5/16/2013	PVD		
5	5/22/2013	Vacuum		3
6	5/23/2013	EK	A1	
7	5/29/2016	Chemical		4
8	5/30/2013	MSE		
9	6/5/2013	MSE/Anchors		5
10	6/6/2013	Anchors/Dewatering	A2	
11	6/12/2013	Erosion control		6
12	6/13/2013	no class, Q and A	A3	
13	6/19/2013	Case presentations		7
	6/27/2013	Final exam (open book, three hours)		8

Please contact the course instructor if you require material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Services for Students with Disabilities (SSD) at 661-2111 x 82147 for any specific question regarding an accommodation.