

CEEB458 Introduction to Soil Improvement

Syllabus

Coordinating Unit:	Department of Civil and Environmental Engineering, Faculty of Science and Technology		
Supporting Unit(s):	Nil		
Course Code:	CEEB458	Year of Study:	4
Course Title:	Introduction to Soil Improvement		
Compulsory/Elective:	Elective		
Course Prerequisites:	CEEB313 Soil Mechanics		
Prerequisite Knowledge:	Nil		
Duration:	One semester	Credit Units:	3
Class/Laboratory Schedule:	Three hours of lecture		
Laboratory/Software Usage:	Nil		
Course Description:	<p>This is the introductory course of ground improvement techniques for marginal and problematic soil. The content includes the basics of laboratory and in situ tests for geotechnical projects. Then, surface compaction, admixture stabilization and deep densification are covered. Ground modification by consolidation and vertical drains are then covered. Various types of insitu reinforcement techniques such as stone columns, soil soils are introduced.</p>		
Course Objectives:	<ol style="list-style-type: none"> 1. To introduce the various types of improvement methods of engineering properties soils. 2. To introduce the application of engineering methods to ground improvement projects. 		
Learning Outcomes (LO):	<p>Upon completion of this course, students should be able to:</p> <ol style="list-style-type: none"> 1. Acquire the knowledge of laboratory and in situ tests for soil improvement projects.(POs: a, b) 2. Acquire the knowledge of surface compaction. (POs: a, e) 3. Understand the concept of admixture stabilization.(POs: a, e) 4. Understand the concept of deep densification. (POs: a, e) 5. Understand the concept of using consolidation and vertical drains for soft soil improvement. (POs: a, e) 6. Understand the concept of insitu reinforcement (POs: a, e) 		
Texts & References: (* recommended textbook(s))	<ul style="list-style-type: none"> • Mitchell, J K (1981). "Soil improvement : state -of - the -art", Proceeding of 10th International Conference of Soil Mechanics and Foundation Engineering, Stockholm, Sweden, Vol. 4, 509 - 565. • Hausmann M R (1990). Engineering Principles of Ground Modification, by, McGraw Hill Publishing Co. • Mitchell, J K (1993). Fundamentals of Soil Behaviour, 2nd edition, John Wiley & Sons, New York. • Xanthakos, P P, Abramson L W and Bruce D A (1994). Ground Control and Improvement, John Wiley & Sons, New York. • Bergado D T, Anderson L R, Miura N and Balasubramaniam A S (1996). Soft Ground Improvement in Lowland and Other Environments, ASCE Press, New York. • Mitchell J K and Gallagher P M (1999). Engineering and Design Guidelines on Ground Improvement for Structures and Facilities, Publication No. ETL 1110-1-185, US Army Corps of Engineers, Washington DC. • Mitchell J M and Jardine F M (2002). A Guide to Ground Treatment, CIRIA, London. 		
Student Assessment:	<ul style="list-style-type: none"> • Quiz and assignments: 25% • One midterm: 25% • One final examination: 50% 		
Learning Outcome Assessment:	<ul style="list-style-type: none"> • Quiz, midterm and final examination • Course evaluation 		

Pedagogical Methods:	<input checked="" type="checkbox"/> Lecture	<input type="checkbox"/> Service learning
	<input type="checkbox"/> Guest speakers	<input type="checkbox"/> Internship
	<input checked="" type="checkbox"/> Case study	<input type="checkbox"/> Field study
	<input type="checkbox"/> Role playing	<input type="checkbox"/> Company visits
	<input type="checkbox"/> Student presentation	<input type="checkbox"/> e-learning
	<input type="checkbox"/> Project	<input checked="" type="checkbox"/> Independent study
	<input type="checkbox"/> Simulation game	<input type="checkbox"/> Others: <u>Computer software Lab.</u>
	<input checked="" type="checkbox"/> Exercises and problems	

Major Assessment Methods:	Case Study	Role Playing	Student Presentation	Individual project/paper	Group project/paper	Simulation Game	Exercises & problems	Service learning	Internship	Field Study	Company visits	Written examination	Oral examination	Others (please specify)
Class Participation/ Discussion (0%)														
Quiz/Assignment/Report (25%)							✓							
Test(s) (25%)												✓		
Examination (50%)												✓		
Others (please specify) _____ (0 %)														
Course Web: (if any)	Course materials are available in UMMoodle (http://webcourse.umac.mo/).													

SYLLABUS

Topics	Weeks
INTRODUCTION -Need and objective of soil improvement -Fundamental soil behaviour relevant to soil improvement	1
LABORATORY AND IN SITU TEST -Laboratory tests -In situ tests: SPT and CPT -Other in situ tests	2
SURFACE COMPACTION -Principles -Properties of compacted soil -Control and specifications	3-4
ADMIXTURE STABILIZATION -Principles -Reactions -Lime stabilization -Cement stabilization -Asphalt stabilization -Case study	5-6
DEEP DENSIFICATION -Mechanism of Dynamic compaction -Mechanism of Vibro-compaction -Mechanism of Blasting -Case study	7-8
HYDRAULIC MODIFICATION -Consolidation -Preloading -Prefabricated vertical drains (PVD) -Design of PVD in soft soil -Case study	9-10
MID TERM EXAMINATION	11
IN SITU REINFORCEMENT -Granular column -Soil nailing -Grouting -Case study	12-14

Percentage Content of:	Math	Basic Science	Engineering Science	Engineering Design and Synthesis	Complementary Studies	Computer Studies	Total
	10	---	60	20	10	---	100
Timetabled work in hours per week:	Lecture	Tutorial	Laboratory	Other	Total		
	3	---	---		3		

Contribution to Program Outcomes:	Program Outcomes					Contribution to POs [#]				
						5	----->			1
						Significant				Least
						5	4	3	2	1
	(a) apply knowledge of mathematics, science, and engineering					✓				
	(b) design and conduct experiments, and analyze data					✓				
	(c) design components, systems or processes in presence of constraints									
	(d) Function in a multi-disciplinary team									
	(e) Engineering problem solving						✓			
	(f) Understand professional and ethical responsibility									
	(g) Communicate effectively									
	(h) Understand the impact of engineering solutions to the society									
	(i) Recognize the need and have the ability for lifelong learning									
	(j) Have knowledge of contemporary issues									
(k) Apply the skills, techniques, modern engineering tools										
(l) Apply the computer/IT tools relevant to the discipline										
<i># Note</i> 5: Significant contribution; 4: Supporting contribution; 3: Moderate contribution; 2: Marginal support; 1: Least support										
Course Instructor(s):	Mr. I M Wan									