University of Macau
Undergraduate Civil Engineering Programme

Coordinating Unit:	Department of Civil and Environmental Engineering, Faculty of Science and Technology		
Supporting Unit(s):	Nil		
Course Code:	CIVL352	Year of Study:	3
Course Title:	Soil Mechanics II		
Compulsory/Elective:	Compulsory		
Course Prerequisites:	CIVL351 Soil Mechanics I		
Prerequisite Knowledge:	Index properties, soil classification, effective stress, seepage		
Duration:	One semester	Credit Units:	4
Class/Laboratory Schedule:	Three hours of lecture per week and several laboratory exercises in conjunction with the course contents.		
Laboratory/Software Usage:	Students will conduct the following laboratory experiments in groups: One-dimensional Consolidation Test, Direct Shear Test, UU and Undrained Shear Strength Tests, Unconsolidated Undrained Triaxial Test		
Course Description:	Following the soil mechanics I in previous semester, this course addresses the most important concepts in soil mechanics including deformation behavior and strength of soils. In particular, the course will cover the following topics of soil mechanics: • Consolidation: Terzaghi's one-dimensional consolidation theory • Shear strength: shear strength characteristics of sands and clays • Lateral earth pressure: at-rest, active and passive pressure • Slope stability: anlaysis of infinite and finite slopes The first part of the course introduces the concept of time dependent deformation behavior of soils. The second part of the course addresses the strength of soil, which is the basis for the subsequent parts of the course regarding lateral earth pressure and slope stability.		
Course Objectives:	1. To learn the theory of consolidation, shear strength, lateral earth pressure, and slope stability. 2. To develop the ability to analyze geotechnical problems with the theories. 3. To perform laboratory experiments in conjunction with the theories.		
Learning Outcomes (LO):	Upon completion of this course, students should be able to: 1. apply one-dimensional consolidation theory to calculate settlement and pore pressure as a function of time during consolidation [POs: a,e,k]; 2. apply the principles of shear strength of soils to various laboratory tests [POs: a,e,k]; 3. analyze geotechnical problems with basic shear strength theories [POs: a,e,g]; 4. calculate lateral earth pressure at active and passive condition [POs: a,e]; 5. analyze finite and infinite slopes with hand calculations [POs: a,e]; 6. conduct basic experiments to obtain engineering properties of soils [POs: b,g,k];		
Texts & References: *(* recommended textbook(s))*	1. (*)B.M.Das (2010) "Principles of Geotechnical Engineering," Adapted International Student Edition, (7th ed.), Cengage Learning. 2. David F. McCarthy (2007)" Essentials of Soil Mechanics and Foundations : Basic Geotechnics 7/e," Prentice Hall 3. J.N. Cernica (1995) "Geotechnical Engineering, Soil Mechanics," N.Y.: Wiley. 4. Journals: Geotechnique, Journal of Geotechnical and Geoenvironmental Engineering, Canadian Geotechnical Journal		

Student Assessment:	• Quizzes: 20% • Laboratory work: 10% • Mid terms: 30% • Final examination: 40%
Learning Outcome Assessment:	• Quizzes, mid term and final examination • Course evaluation

Pedagogical Methods:	☑ Lecture	☐ Service learning
	☐ Guest speakers	☐ Internship
	☐ Case study	☐ Field study
	☐ Role playing	☐ Company visits
	☐ Student presentation	☐ e-learning
	☐ Project	☑ Independent study
	☐ Simulation game	☑ Others: Computer software Lab.
	☑ Exercises and problems	

Major Assessment Methods: For each Major Assessment Method below, please indicate the specific pedagogical methods involved (by putting a ✓ in the relevant box(es) on the right-hand side).	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(s) (30%)							✓							
Test(s) (30%)												✓		
Examination (40%)												✓		
Others *(please specify)* Lab report (10 %)					✓									
Course Web: (if any)	Course materials are available in UMMoodle (http://ummoodle.umac.mo/).													

SYLLABUS

Weeks	Topics	Quiz no.	LO no.

1-4	**1. CONSOLIDATION**
	
	• Fundamentals of consolidation
	• One dimensional laboratory consolidation test (lab section)
	• Void ratio – pressure plots
	• Normally consolidated and over consolidated clays
	• Amount of Settlement:
	  • Compression index, swell index
	  • Secondary consolidation
	• Time rate of consolidation: Coefficient of consolidation
	• Settlement under a foundation
		1	1, 5

5-8	**2. SHEAR STRENGTH OF SOILS**
	
	• Mohr-Coulomb failure criteria
	• Determination of shear strength parameters in the laboratory:
	  • Direct shear test (lab section)
	  • Triaxial test (lab section)
	• Various triaxial tests: CD, CU, and UU tests
	• Stress path
	• Vane shear test and other methods for shear strength (lab section)
	• Undrained shear strength of clays
		2, 3	2, 5

9	**Mid-Term Exam**	--	--
10-12	**3. LATERAL EARTH PRESSURES** • Lateral earth pressure: at-rest, active, and passive pressures • Rankine's and Coulomb's theory of earth pressure • Graphical solutions for obtaining lateral earth pressure • Lateral earth pressure distribution against retaining walls	4	3, 5
13-14	**4. SLOPE STABILITY** • Various types of slope failures • Factor of safety • Stability of infinite slopes • Stability of finite slopes	5	4, 5

Percentage Content of:	Math	Basic Science	Engineering Science	Engineering Design and Synthesis	Complementary Studies	Computer Studies	Total
	20	0	40	20	20	0	100

Timetabled work in hours per week:	Lecture	Tutorial	Laboratory	Other		Total
	3	1	1	---		5

Contribution to Program Outcomes:

Program Outcomes	Contribution to POs# 5 Significant ----------> 1 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) Use the computer/IT tools relevant to the discipline					

 # Note 5: Significant contribution; 4: Supporting contribution; 3: Moderate contribution; 2: Marginal support; 1: Least support

Course Instructor(s):	Dr. M. H. Lok