Hong Kong University of Science and Technology
Department of Civil and Environmental Engineering

"The dwarf sees further than the giant when he has the giant's shoulder to mount on." *Isaac Newton*

Rubric Title of course Instructor Teaching Assistant	CIVL 3730 Fundamentals of Geotechnics Prof. Wang Yu-Hsing (Office: 3572, Phone: 8757, Email: ceyhwang@ust.hk) and Prof. Chau Wai Yi (Email: chauwy@ust.hk) HE Zhili, LEUNG Tin Long, YANG, Haixia, DOWIE Sean Ross, SURYAJAYA Lingga Ekaputra Lucky, HE Xinyao
Prerequisites Credit	CIVL 2120 (Mechanics of Materials) 3
Textbook(s) and/or Other materials	Required textbook: Muni Budhu (2011). Soil Mechanics and foundations, 3rd eds., John Wiley & Sons. (e version) Muni Budhu (2015). Soil mechanics fundamentals, Chichester, West Sussex, United Kingdom: Wiley Blackwell (e version) Reference textbooks: [1] Das, B.M., Sobhan, K. (2014). Principles of Geotechnical Engineering, 8th Edition, Stamford, CT: Cengage Learning. (or other editions, 2019 version is not available) [2] Holtz, R.D. and Kovacs, W.D. (1981). An Introduction to Geotechnical Engineering, Prentice Hall. [3] Holtz, R.D., Kovacs, W.D., and Sheahan, T.C. (2011). An introduction to Geotechnical Engineering. 2nd edition, Pearson. [4] Lambe, T.W. and Whitman, R.V. (1979). Soil Mechanics, SI Version, John Wiley & Sons. [5] Knappett, J.A. and Craig, R. F. (2012). Craig's Soil Mechanics, 8th Edition, Spon Press, London (e version). [6] Craig, R.F. (2004). Craig's Soil Mechanics: the solutions manual, Spon Press, London (e version). References for the laboratory section: [1] ASTM Standard (Database room) [2] British Standard (Database room) [3] Eurocode 7: Geotechnical design [4] Geoguide (GEO HK) http://www.cedd.gov.hk/eng/publications/geo/geo_geoguide.html [5] Head, K.H. (2006). Manual of Soil Laboratory Testing, 3rd Edition, CRC

	Press. (e version) [6] Head, K.H. Epps R. J. (2014). Manual of Soil Laboratory Testing, 3rd Edition, Whittles Publishing. (e version) There are three volumes in total [7] Das, B.M., (2016). Soil Mechanics: Laboratory Manual, 9th Edition, New York : Oxford University Press (e version) Class website: Canvas (Online Virtual Soil Lab.)
Course Objectives	This course will enable students to understand geotechnical mechanics and associated soil behavior, including basic engineering geology, characteristics of soils, soil compaction, the principle of effective stress, shear strength of soils, the concept of critical state modeling, permeability, seepage problems, ground settlement and consolidation.
Topics	1. Basic engineering geology and rock mechanics (including soil formation and clay minerals) 2. Characteristics of soils (including phase relationships, index properties of soils, and soil classifications) 3. Soil compaction 4. Stresses and strains of soils 5. The principle of effective stress. 6. Shear strength of soils (including field testing). 7. A critical state model to interpret soil behavior. 8. One-dimensional flow of water through soils (permeability). 9. Two-dimensional flow of water through soils (seepage). 10. One-dimensional consolidation settlement of fine-grained soils (consolidation).
Computer usage	To be advised by the lecturers
Lab Projects	Five lab sessions Lab 1: Atterberg's limits test Lab 2: Compaction test Lab 3: Direct shear test Lab 4: Constant head and falling head permeability test Lab 5: One-dimensional consolidation test; Grain size distribution test (sieve analyses)
Class/lab schedule	Two 80-minute lectures (every week); 50-minute tutorial (for ~7 times); five 3-hour lab sessions
Contribution to the professional component	100% Engineering topics
Intended Learning Outcomes (ILOs) of	1. Able to identify, formulate, and solve problems related to geotechnical engineering.

this course	2. Able to conduct experiments, analyze and interpret results for geotechnical engineering design. 3. Able to apply modern engineering tools effectively and efficiently to perform geotechnical engineering analysis. 4. Have the basic knowledge to carry out technically competent geotechnical engineering-related design.
Relationship to the program objective	This course contributes to the (1) through (4) program objectives as follows: *(1) Provide students with professional skills in the design, construction and management of the civil infrastructure.* This course provides students with in-depth knowledge of geotechnical engineering. *(4) Expose students to real world engineering projects as well as cutting edge research to improve their understanding of the profession and technological advancements that can improve current practice* This course helps students realize the considerations, limitations and challenges related to the current design practice in Geotechnical Engineering.
Relationship to program outcome	This course contributes to the (1) through (12) program outcomes as follows: *(1) Acquire fundamental knowledge in mathematics and science on which civil engineering research and practice are based.* *(2) Understand fundamental principles of engineering science relevant to civil engineering disciplines* *(5) Develop an ability to identify and formulate civil engineering problems, and propose feasible solutions with an appreciation of their underlying assumptions, uncertainties, constraints, and technical limitations* Students will learn basic engineering geology and principles of soil mechanics from this course; therefore, students should be able to understand, formulate, and solve problems related to geotechnical engineering. *(3) Acquire an ability to conduct experiments, analyze and interpret results, and appreciate the importance of experimental data in establishing empirical relationships and parameters for analysis and design* Students have to attend five different laboratory sessions and submit lab reports for each experiment in this course; therefore, students should be able to conduct experiments, analyze and interpret results for geotechnical engineering design. *(4) Acquire an ability to apply modern engineering tools and IT tools effectively and efficiently for engineering analysis, design and communication* Students have to do seven assignments and prepare five laboratory reports in this course; therefore, students should have the ability to apply modern engineering tools and IT tools for geotechnical engineering related analyses. *(6) Develop technical competency to design civil engineering components and systems, with an understanding of the principles behind the design*

<table>
<tr><td></td><td>methodologies.
(8) Obtain in-depth knowledge in at least one major area of specialization within civil engineering
This course provides in-depth knowledge of soil mechanics, which helps students understand the principles behind the design methodologies of geotechnical engineering. Therefore, student should be able to develop technical competency for geotechnical engineering related design in the end of the course.</td></tr>
<tr><td>Assessment of Outcomes</td><td>The learning outcomes listed above are assessed via seven graded assignments, five laboratory reports, and mid-term and final exams.
Homework: 15 %
Lab Report: 15 % (group report) (2-week due)
Mid-term: 30 % (around the 7th or 8th week)
Final exam 40 %, TBA

For the Lab sessions
Individual contributions will be assessed through the Group Member Evaluation (GME).

Details of assessment of each outcome is summarized in the table below:
<table>
<tr><th>Course ILOs</th><th>Learning activity</th><th>Assessment</th></tr>
<tr><td>I</td><td>Lecture, tutorial</td><td>Assignment; midterm and final exams</td></tr>
<tr><td>II</td><td>Lecture, Lab</td><td>Lab report; midterm and final exams</td></tr>
<tr><td>III</td><td>Lecture, Lab, tutorial</td><td>Lab report; assignment; midterm and final exams</td></tr>
<tr><td>IV</td><td>Lecture, Lab, tutorial</td><td>Lab report; assignment; midterm and final exams</td></tr>
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<tr><td>AI-Enhanced Learning</td><td>Students are encouraged to actively explore and integrate modern digital tools—such as ChatGPT, DeepSeek, and Google NotebookLM—into their learning process. These tools can support problem-solving, facilitate independent study, and enhance critical thinking by offering instant feedback, alternative explanations, and organized knowledge management. Responsible and reflective use of these technologies will help students deepen their understanding of the fundamentals of geotechnics while also developing future-ready skills in leveraging AI for engineering practice.</td></tr>
<tr><td>Prepared by</td><td>Wang Yu-Hsing</td></tr>
<tr><td>Date</td><td>20 August 2025</td></tr>
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