Subject Description Form

Subject Code	CSE39307
Subject Title	Soil Mechanics
Credit Value	3
Level	3
Exclusion	CSE30307 Soil Mechanics for Civil Engineering
Objectives	To learn the fundamentals of soil mechanics. To apply theories to solve practical soil mechanics problems.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: i. Able to apply the fundamentals of physics and mathematics to understand the physical properties and behaviour of soils for civil engineering purposes; ii. Able to carry out laboratory tests to measure the properties and behaviour of soils for civil engineering applications; iii. Able to develop analytical skills to solve soil mechanics problems; iv. Able to work in small groups as teams and to build both team and individual responsibility in laboratory tests; v. Able to learn independently. vi. Recognize the need for, and to engage in life-long learning
Subject Synopsis/ Indicative Syllabus	1. Basic Soil Characteristics (0.5 week) Brief review on particle size analysis; plasticity and density; phase relationship and soil compaction. 2. Theory of Seepage (2 weeks) Hydraulic conductivity and Darcy's law; seepage theory; flow net method, anisotropic flow. 3. Effective Stress (2 weeks) The principle of effective stress; response of effective stress in sand or clay; influence of seepage on effective stress. Solutions of stress and displacements based on elastic theories. 4. Shear Strength (2.5 weeks) The Mohr-Coulomb failure criterion; shear strength tests; stress-strain behaviour; pore water pressure response, introduction to critical state soil mechanice. 5. Lateral Earth Pressure (2 weeks) Active and passive states of soils; Rankine's theory of earth pressure; Coulomb's theory of earth pressure; earth pressure on retaining walls; stability of retaining walls against overturning

and sliding.

6. Consolidation Theory (2 weeks)
One-dimensional (1-D) consolidation tests and stress-strain (or void ratio) relationships; consolidation settlement; degree of consolidation; Terzaghi's theory of 1-D consolidation; determination of coefficient of consolidation; construction time correction.

7. Soil Dynamics and Geotechnical Earthquake Engineering (2 weeks)
Seismic ground motions, Wave propagation in half-spaces, Single-degree-of-freedom oscillator, Response spectrum, Nonlinear dynamic characteristics of soil, (shear modulus and damping ratio with shear strain), analysis and design of earth retaining wall for seismic condition.

8. Laboratory Testing
Four laboratory sessions, including the following tests:
(i) index test for liquid limit and plastic limit,
(ii) permeability tests and 1-D consolidation test,
(iii) direct shear test, and
(iv) triaxial test.

Teaching/Learning Methodology

Learning methodology: lectures, tutorials and laboratory. There are self-reading components in the syllabus. Student should attend at least one seminar related to the subjects, and submit a seminar report. The assessment methods include lab reports, seminar reports, assignments, tests and final examinations.

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)					
		i.	ii.	iii.	iv.	v.	vi.
1. Lab Reports	5		✓		✓		
2. Seminar report	5	✓				✓	✓
3. Assignments	10	✓		✓		✓	
4. Tests	10	✓		✓		✓	
5. Final Examination	70	✓		✓		✓	
Total	100 %						

Students must attain at least grade D in both coursework and final examination (whenever applicable) in order to attain a

<table>
<tr><td></td><td colspan="2">passing grade in the overall result.

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

The laboratory sessions and reports assess the students' understanding of the standard procedures and their rationale in various physical tests of materials, and the distinctive features of soils that control their behaviours. The experimental sessions also nuture teamwork mentality among the students.

Attendance to seminars and the subsequent reports assess the students' ability to understand the applications of theories to engineering projects, and to recognize potential complications in construction projects, the importance of problem-solving skills and attitude of life-long learning.

The assignments test the students' understanding of the fundamental properties and behaviour of soil materials, and their ability to elucidate various geotechnical engineering processes in a rational and scientific manner.

The tests and final examination assess the analytical skills of the students and their understanding of the subject matter, with emphasis on both precision in problem-solving and a broad perspective on the inter-relationships among various aspects of soil behaviour.</td></tr>
<tr><td rowspan="6">Student Study Effort Expected</td><td>Class contact:</td><td>Average hours per week</td></tr>
<tr><td>▪ Lectures / Tutorials / Laboratory</td><td>3.5 Hrs.</td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>▪ Reading and studying</td><td>3 Hrs.</td></tr>
<tr><td>▪ Completion of Assignments/Lab Reports</td><td>2.5 Hrs.</td></tr>
<tr><td>Total student study effort</td><td>9 Hrs.</td></tr>
<tr><td>Reading List and References</td><td colspan="2"><u>Essential Texts</u>
Knappett, J. and Craig, R.F. (2012) Criag's Soil Mechanics, 8th edition, CRC press.

<u>Reference Texts</u>
Towhata I. (2008). Geotechnical Earthquake Engineering, Springer-Verlag, Berlin.
Das, BM and Sivakugan, N (2019). Principles of Foundation Engineering. 9th International Edition. Publisher: Cengage Learning.
GEO (2020). Guide to Retaining Wall Design, Geoguide 1,</td></tr>
</table>

	Geotechnical Engineering Office (GEO), Civil Engineering and Development Department, HKSARG. GEO (2017). Guide to Site Investigation, Geoguide 2. Geotechnical Engineering Office (GEO), Civil Engineering and Development Department, The Hong Kong Special Administrative Region Government (HKSARG) of China. GEO (2017). Guide to Rock and Soil Descriptions, Geoguide 3. Geotechnical Engineering Office (GEO), Civil Engineering and Development Department, HKSARG. Lambe T.W. and Whitman R.V. (1979). Soil Mechanics, SI Version, Wiley, New York. Sutton B.H.C. (1993). Solving Problems in Soil Mechanics, 2nd Edition, Longman. Terzaghi, Karl, Ralph B., Peck, and Gholamreza Mesri. (1996). Soil Mechanics in Engineering Practice, 3rd Edition, Wiley: New York.