Subject Description Form

Subject Code	CSE40403
Subject Title	Geotechnical Design
Credit Value	3
Level	4
Pre-requisites	CSE20206: Geology for Engineers, CSE30307 Soil Mechanics for Civil Engineering
Objectives	(1) To familiarize students with the basic principle of geotechnical design; (2) To integrate the knowledge on soil mechanics and geotechnical engineering to solve engineering problems; (3) To equip students with classical methods of analysis as well as modern computational method of analysis.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Plan and design site investigation and in-situ tests and to interpret the results; b. Have the knowledge of ultimate and serviceability limit state analysis and design of shallow/mat foundation; c. Have the knowledge of excavation and pile foundation analysis and design; d. Carry out practical design according to local code with knowledge of codes of China, U.K. and other countries; e. Communicate lucidly the pros and cons of alternative designs with reference to different site constraints; f. Develop creative solutions to solve complex geotechnical problems in different types of construction sites.
Subject Synopsis/ Indicative Syllabus	1. <u>Site Investigation</u> (2 weeks) Subsurface exploration program, borings in the field, soil sampling, observation of water tables, *in-situ* tests (Standard Penetration Test, Vane Shear Test, Cone Penetration Test, Pressuremeter Test, Seismic Refraction Test) and test result interpretation and correlations, rock coring, preparation of boring logs, subsoil exploration report.

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<tr><td></td><td>2. Slope Stability (2 weeks)

Fundamental nature of limit equilibrium methods, stability table, undrained analysis, the method of slices (Fellenius, Bishop, and Janbu methods), and analysis of a plane translational slip.

3. Shallow and mat Foundations (3 weeks)

Bearing capacity, stress distribution, elastic settlement, consolidation settlement, tolerable settlement of buildings, field plate load test, presumptive bearing capacity. Common types of mat foundations, bearing capacity of a mat foundation, compensated foundations, bending moment and shear force of a mat foundation, rigid and flexible foundation analyses.

4. Pile Foundations (3 weeks)

Vertical bearing capacity of a single pile, settlement of a single pile and pile group, calculation of vertical loads on piles of a pile group with a rigid and flexible cap, pile driving and Hiley's formula, pile dynamic tests.

5. Retaining Structures (3 weeks)

Brief review of lateral earth pressure theory, various lateral supports system and top down/bottom up construction methods, analysis and design of cantilever and propped retaining wall by classical methods, analysis and design of braced cuts. Excavation with lateral support (ELS).</td></tr>
<tr><td>Teaching/Learning Methodology</td><td>The fundamental knowledge about site investigation, analysis and design of shallow and deep foundation as well as slope stability analysis will be introduced. These topics will be reinforced with many case studies from Hong Kong and other countries, and both classical and computational method of analyses will be introduced. In order to ensure a comprehensive understanding of basic concepts and computational methods in geotechnical design, it is essential that students rely solely on their individual skills and knowledge throughout the course. Therefore, GenAI is not encouraged in assignments, tests, and final examinations. This policy is in place to uphold the integrity of the learning process and to ensure that students develop a strong foundation in geotechnical design through their personal efforts.</td></tr>
<tr><td>Assessment Methods in Alignment with Intended Learning</td><td><table><tr><td>Specific assessment</td><td>%</td><td>Intended subject learning outcomes to be assessed (Please tick as</td></tr></table></td></tr>
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<table>
<tr><td>Outcomes</td><td>
<table>
<tr><td rowspan="2">methods/tasks</td><td rowspan="2">weighting</td><td colspan="7">appropriate)</td></tr>
<tr><td>a</td><td>b</td><td>c</td><td>d</td><td>e</td><td>f</td><td></td></tr>
<tr><td>1. Assignment</td><td>10</td><td></td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td></td></tr>
<tr><td>2. Test</td><td>20</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td></td></tr>
<tr><td>3. Final Examination</td><td>70</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td></td></tr>
<tr><td>Total</td><td>100 %</td><td colspan="7"></td></tr>
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Students must attain at least grade D in both coursework and final examination (whenever applicable) in order to attain a passing grade in the overall result.

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

Assignment to some more tedious problems will help the students to utilize the more difficult and tedious teaching materials. The test will concentrate on some fundamental principle and challenging concept of the course.

The examination questions consist of some fundamental concept, conceptual understanding and application of the knowledge to solve different engineering problems.
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<tr><td>Student Study Effort Expected</td><td>
<table>
<tr><td>Class contact:</td><td>Average hours per week</td></tr>
<tr><td>▪ Lecture / Tutorial</td><td>3 Hrs.</td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>▪ Self study</td><td>6 Hrs.</td></tr>
<tr><td>Total student study effort</td><td>9 Hrs.</td></tr>
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<tr><td>Reading List and References</td><td>
Textbooks
Das, BM Das (2014). Principle of Foundation Engineering, 8th edition, Prentice hall.
Das, BM (2009). Shallow Foundations, Bearing capacity and settlement, CRC Press, 2009.
Cheng YM and Lau CK (2014), Soil Slope stability analysis and stabilization – new methods and insights, 2nd edition, Spon Press
</td></tr>
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	Das, BM and Sobhan, K (2016). Principles of Geotechnical Engineering, Ninth Edition. **References** Knappett, J and Craig, RF (2020). Craig's Soil Mechanics, 9th edition, CRC press. Fleming, K, Weltman, A, Randolph, M, and Elson, K (2009). Piling Engineering, 3rd edition, CRC Press, Taylors and Francis Group. Geotechnical Engineering Office (2006). Pile Design and Construction. GEO Publication No.1/2006, Civil Engineering and Development, HKSARG. Buildings Department (2017). Code of Practice for Foundations 2017. Buildings Department (BD), HKSARG of China. GEO (1984). Geotechnical Manual for Slope. Geotechnical Engineering Office (GEO), Civil Engineering and Development, HKSARG of China.