Subject Description Form

Subject Code	CSE40410
Subject Title	Advanced Geotechnical Design
Credit Value	3
Level	4
Pre-requisites / Exclusion	Pre-requisites: CSE30307 Soil Mechanics for Civil Engineering and CSE40403 Geotechnical Design
Objectives	(1) To enable students to acquire basic knowledge of advanced geotechnical design; (2) To enable students to make engineering judgment on geotechnical design.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. have an understanding, knowledge, and analysis of 1-D, 2-D and 3-D consolidation problems of soils without or with considering creep; b. have knowledge on pile group effects, pile group analysis, and a pile under lateral load; c. be familiar with stability analysis of a slope with soil nails with a particular reference to Hong Kong conditions; d. have an appreciation of excavation supports, soil reinforcement, ground improvement methods.
Subject Synopsis/ Indicative Syllabus	1. <u>Consolidation of Soils</u> (2.5 weeks) Analysis of 1-D, 2-D (axi-symmetric), and 3-D consolidation of soils without or with creep; use of wick drains with pre-loading and/or vacuum preloading. 2. <u>Pile Foundation</u> (3.5 weeks) Settlement of a single pile and a pile group, pile group effects, capacity of a pile group; lateral loading capacity of a single pile, displacement of a single pile and a pile group under lateral loading. 3. <u>Soil Nailed Slopes (3 weeks)</u> Stability analysis of a slope with circular slip without or with soil nails, analysis of a translational slope without or with soil nails; stability analysis and design of a soil nailed slope under complicated conditions with earthquake and external loads, searching for critical failure surface; design of soil nails, soil nail pullout tests. 4. <u>Excavation and Soil Reinforcement</u> (2.5 weeks) Diaphragm walls, stability of slurry trench, lateral displacement and settlement of excavations, basal stability, seepage of excavations; the mechanism and test methods for reinforcing

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<tr><td></td><td>strips and geo-synthetics; analysis and design of reinforced earth retaining structures.

5. <u>Ground Modification</u> (1.5 weeks)
Field compaction, vibroflotation, vertical drains and preloading, soil stabilization by admixture (deep lime/cement mixing), grouting, stone columns, sand compaction pile, dewatering systems and analysis, and case studies.</td></tr>
<tr><td>Teaching/Learning Methodology</td><td>Fundamental knowledge will be covered in lectures. Tutorials will provide opportunities for discussion of lecture materials and will also be conducted in the form of example classes and problem-solving sessions to supplement understanding of lectures.</td></tr>
<tr><td>Assessment Methods in Alignment with Intended Learning Outcomes</td><td>
<table>
<tr><td rowspan="2">Specific assessment methods/tasks</td><td rowspan="2">% weighting</td><td colspan="4">Intended subject learning outcomes to be assessed (Please tick as appropriate)</td></tr>
<tr><td>a</td><td>b</td><td>c</td><td>d</td></tr>
<tr><td>(1) Assignments</td><td>15</td><td>√</td><td>√</td><td>√</td><td>√</td></tr>
<tr><td>(2) Mid-term Test(s)</td><td>15</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></tr>
<tr><td>Total</td><td>100 %</td><td colspan="4"></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:

The students will be assessed with three components, i.e., assignments, a written test in the middle of the semester and a final examination. The three components are best to achieve intended learning outcomes in a, b, c, and d.

The students will be required to do and submit assignments. Students will have to exert engineering judgments to complete assignments. The examination will consolidate students' learning in lectures and tutorials. It is the most appropriate to achieve the intended learning outcomes a, b, c and d.</td></tr>
<tr><td>Student Study Effort Expected</td><td>Class contact:</td><td>Average hours per week</td></tr>
<tr><td></td><td>▪ Lectures / Tutorials / Laboratory</td><td>3 Hrs.</td></tr>
<tr><td></td><td>Other student study effort:</td><td></td></tr>
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	▪ Reading and studying	4 Hrs.
	▪ Completion of Assignments	2 Hrs.
	Total student study effort	9 Hrs.
Reference List	Bowles, JE (2017). Foundation Analysis and Design. 5th Edition. Publisher: McGraw-Hill (ISBN-10: 9781259061035). Buildings Department (2017). Code of Practice for Foundations 2017. Buildings Department, HKSARG of China. Das, BM and Sivakugan, N (2019). Principles of Foundation Engineering. 9th International Edition. Publisher: Cengage Learning (eBook - ISBN: 9780357703861). Feng, W.Q. and JH Yin (2017). A New Simplified Hypothesis B Method for Calculating Consolidation Settlements of Double Soil Layers Exhibiting Creep. International Journal for Numerical and Analytical Methods in Geomechanics, 41, 899–917. Gaba, AR, Simpson, B, Powrie, W, & Beadman, D R (2003). Embedded Retaining Walls–Guidance for Economic Design. Ciria, London, UK (No. C580). Report. Geotechnical Engineering Office (1990). Review of Design methods for excavations. GEO Publication No. 1/90, Civil Engineering and Development, HKSARG of China. Geotechnical Engineering Office (2006). Pile Design and Construction. GEO Publication No.1/2006, Civil Engineering and Development, HKSARG of China. Pandolph, MF and Wroth, CP (1978). Analysis of Vertically Loaded Piles. J. Geotech. Enggin. Div. ASCE, 104(GT12), 1465-1488. Pandolph, MF and Wroth, CP (1979). An Analysis of the Vertical Deformation of Pile Groups. Geotechnique 29(4), 423-439. Poulos, HG and Davis, EH (1980). Pile Foundation Analysis and Design. Publisher: John Wiley and Sons. Reese, LC, Reese and Van Impe, WF (2001). Single Piles and Pile Groups under Lateral Loading. Publisher: Taylor & Francis/Balkema. Yin, JH and Feng. WQ (2017). A New Simplified Method and Its Verification for Calculation of Consolidation Settlement of a Clayey Soil with Creep. Canadian Geotechnical Journal, Can. Geotech. J. 54(3), 333–347. Yin, JH and Zhu, GF (2020). Consolidaiton Analyses of Soils. Consolidation Analyses of Soils. CRC Press of Taylor & Francis Group (ISBN 9780367555320). For more information see https://www.routledge.com/Consolidation-Analyses-of-Soils/Yin-Zhu/p/book/9780367555320.