Subject Description Form

Subject Code	CSE20290
Subject Title	Introduction to Geotechnology
Credit Value	3
Level	2
Exclusion	CSE20206 Geology for Engineers
Objectives	This subject is to enable students: (1) to acquire the fundamental knowledge of geology; and (2) to apply geology in rock engineering and geotechnical designs.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. apply the fundamentals of geology in geotechnical projects, such as soil and rock slopes, foundations, and tunnels; b. identify and analyze data from site investigations and suggest suitable designs for foundations, tunnels, and slopes; c. synthesize logical solution to geotechnical problems independently such as the suitable locations for dam foundation and tunnel alignment; d. explain geological problems logically and lucidly through drawing and writing.
Subject Synopsis/ Indicative Syllabus	**Geology topics** 1. Mineralogy, Petrology and Geology of Hong Kong (4 weeks) Physical properties of silicate and non-silicate minerals and their identification; classification of igneous, metamorphic and sedimentary rocks and their identification. Rocks and geological structure of Hong Kong; geological history of Hong Kong. 2. Surface Processes and Ground Water Geology (2 weeks) Weathering; erosion and deposition including river, marine, desert, glacier, karst; formation of engineering soils, hydrological cycle; aquifers and ground water table. 3. Structural Geology (2 weeks) Unconformities, fold, fault, joint, map reading, mapping skill maps, and the use of stereographic projection. **Geotechnical topics** 4. Site Investigations and Classifications of Soils and Rocks (2.5 weeks) (a) Plan for site investigation; direct and indirect methods for site investigation and sampling, logging of boreholes; in-situ tests (e.g. SPT, CPT, VST); interpretation of test results. (b) Soil formation; Soil description and classification. Rock mass classification. 5. Basic Characteristics of Soils and Applications of Geology (2.5

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<tr><td></td><td>weeks)
(a) The nature of soils, particle size distribution, phase relationships, specific gravity, water content, unit weight, Atterberg limits.
(b) Selection of foundation types based on geological conditions and functions. Applications of geology to foundations, tunnels, transportation links, dams, coastline protection, and slopes.

6. Laboratory Sessions and Field Trips
Lab 1: Identification of minerals and rocks,
Lab 2: Geological map reading and mapping,
Lab 3: Particle size distribution (mechanical sieving test and hydrometer test), and
Lab 4: Geology field trip.</td></tr>
<tr><td>Teaching/Learning Methodology</td><td>Fundamental knowledge will be covered in lectures. Laboratory sessions will provide opportunities to students for identification of minerals & rocks, learning the mapping skill. The students need to complete the work sheets in laboratory sessions. Laboratory works and field studies will help students to appreciate the basic principles and familiarize themselves with basic instruments.</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. Laboratory sessions</td><td>10</td><td>√</td><td>√</td><td></td><td></td></tr>
<tr><td>2. Field trip sessions</td><td>18</td><td>√</td><td>√</td><td>√</td><td>√</td></tr>
<tr><td>3. Assignments</td><td>12</td><td>√</td><td>√</td><td>√</td><td>√</td></tr>
<tr><td>4. Final Examination</td><td>60</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:

Students will be assessed with four components: (i) laboratory sessions, (ii) field trip sessions, (iii) assignments, and (iv) final examination at the end of the semester. In laboratory sessions, mineral and rock test for identification of minerals and rocks will be arranged after mineral and rock laboratory sessions. Students will be required to attend laboratory sessions and submit minerals and rock</td></tr>
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<tr><td></td><td colspan="2">identification laboratory sheets. The laboratory sessions will strengthen geology knowledge of students including identification of minerals & rock, and mapping skill. They will be required to attend field trip sessions and submit field trip reports. The works in the laboratory sessions and field trip sessions are closely related to practical geotechnical projects. The assignment, laboratory sessions, and field trip sessions together with the report writing are the best for students to achieve intended learning outcomes in a), b), c), and d). Minerals and rocks laboratory tests will emphasize on assessing student basic concepts and current practices of mineral and rock identification. It is appropriate to achieve intended learning outcomes in a) and b). The examination will consolidate students' learning in lectures. It is appropriate to achieve the intended learning outcomes in a), b), and c).</td></tr>
<tr><td rowspan="7">Student Study Effort Expected</td><td>Class contact:</td><td>Average Number of Hours used per Week</td></tr>
<tr><td>Lectures</td><td>2 Hrs.</td></tr>
<tr><td>Laboratory</td><td>0.62 Hrs.</td></tr>
<tr><td>Field Trip</td><td>0.38 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>
<tr><td>Reading List and References</td><td colspan="2">Davis, G.H. and Reynolds, S.J. (2012), Structural Geology of Rocks and Regions. Second Edition, Wiley.
Fletcher, C.J.N. (2004), Geology of Site Investigation Boreholes from Hong Kong. Applied Geoscience Centre and Hong Kong Construction Association Limited, Hong Kong.
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.
Knappett, J. and Craig, R.F. (2020). Craig's Soil Mechanics, 9th edition, CRC press.
Lisle, R.J. (2021). Geological Structures and Maps. Third Edition,</td></tr>
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	Butterworth-Heinemann. Lutgens, F.K. and Tarbuck, E.J. (2015). Essentials of Geology. Twelfth Edition, Pearson Prentice Hall. Raymond, L.A. (2002), Petrology: The study of Igneous, Sedimentary & Metamorphic Rocks. Second Edition, McGraw Hill. Sewell, R.J., Campbell, S.D.G., Fletcher, C.J.N., Lai, K.W. and Kirk, P.A. (2000). The Pre-Quaternary Geology of Hong Kong. Geotechnical Engineering Office (GEO), Civil Engineering and Development Department, HKSARG.