**Subject Description Form**

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| **Subject Code** | CSE10256 |
| **Subject Title** | Soil Mechanics |
| **Credit Value** | 3 |
| **Level** | 1 |
| **Pre-requisite/ Co-requisite/ Exclusion** | Nil |
| **Objectives** | To enable students to acquire basic knowledge of soil mechanics; to train students with basic laboratory techniques in soil testing; and to enable students to make basic engineering judgment on geotechnical design. |
| **Intended Learning Outcomes** | Upon completion of the subject, students will be able to:<br><br>a. apply the fundamentals of science and mathematics to understand the properties and behaviour of soils and their application in civil engineering;<br>b. carry out standard laboratory tests and data analysis to measure the basic properties of soils, including grain sieving test, Atterberg limit test, oedometer test and triaxial test;<br>c. work in small groups as teams and build both team and individual responsibility in laboratory tests. |
| **Subject Synopsis/ Indicative Syllabus** | 1. <u>Basic characteristics of soils</u> (2 weeks, including Introduction)<br>Soil and rock; particle size analysis; plasticity of fine-grained soils; soil classification; phase relationships; soil compaction.<br>2. <u>Seepage</u> (2 weeks)<br>Fluid flow in soil; permeability; seepage theory; flow nets; homogeneity and isotropy.<br>3. <u>Effective stress</u> (1 week)<br>Principle of effective stress; stress in soil; seepage and effective stress.<br>4. <u>Shear strength</u> (2 weeks)<br>Normal and shear stresses on a plane; Mohr's circle; Mohr-Coulomb failure criterion; experiments for shear strength (direct shear test; triaxial test; vane shear test).<br>5. <u>Stresses and displacements</u> (2 weeks)<br>Elasticity and plasticity; Boussinesq solution; chart solutions; surface displacement.<br>6. <u>Lateral earth pressure</u> (2 weeks)<br>Lateral earth pressure for at-rest, active and passive conditions; Rankine's theory; Coulomb's theory; design considerations of retaining walls.<br>7. <u>Consolidation theory</u> (2 weeks)<br>Geostatic stress state; 1-dimensional compression and settlement; Terzaghi's 1-dimensional consolidation theory and time-dependent settlement; normally consolidated and over-consolidated soils.<br>8. <u>Laboratory tests</u><br>Lab 1: Atterberg limits (liquid and plastic limits);<br>Lab 2: Dry sieving & permeability (falling head and constant |

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| | head);<br>Lab 3: Direct shear test. |
| **Teaching/Learning Methodology** | Fundamental principles will be covered in lectures.<br>Tutorials will provide opportunities for classwork, questions and discussions.<br>Three laboratory sessions will provide practice of performing some standard tests of soils for civil engineering purposes.<br>Students are expected to work independently on assigned reading, exercises and laboratory reports. |
| **Assessment Methods in Alignment with Intended Learning Outcomes** | |

| Specific assessment methods/tasks | % weighting | Intended subject learning outcomes to be assessed | | |
|---|---|---|---|---|
| | | a | b | c |
| 1. Assignment | 10 | ✓ | ✓ | |
| 2. Laboratory Report | 10 | ✓ | ✓ | ✓ |
| 3. Mid-term Test | 10 | ✓ | ✓ | |
| 4. 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 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., the laboratory session and assignment, mid-term written tests and a final examination. The students will be required to attend laboratory sessions and submit individual laboratory reports. This work will enable students to acquire basic laboratory and report writing techniques and best to achieve intended learning outcomes b), c) and to some extent a). The mid-term tests will emphasize on assessing students' knowledge of basic concepts of soil mechanics and their application. It is appropriate to achieve intended learning outcomes a) and b). The examination will consolidate students' learning in lectures, laboratory and tutorials. It is most appropriate to achieve the intended learning outcomes a) and b).

| **Student Study Effort Expected** | | **Average hours per week** |
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| | Class contact: | |
| | ▪ Lectures/ Tutorials/ Laboratory | 3 Hrs. |
| | Other student study effort: | |
| | ▪ Homework, reading and studying | 3 Hrs. |
| | ▪ Laboratory report and assignment | 2 Hrs. |
| | Total student study effort | 8 Hrs. |

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| **Reading List and References** | **<u>Essential Texts</u>**<br>Craig, R. F. (2012). "*Craig's Soil Mechanics*" 8th edition, Spon Press, London.<br><br>**<u>Reference Texts</u>**<br>Atkinson, J. (2007). The Mechanics of Soils and Foundations, 2nd edition, Taylor and Francis.<br>Braja, M. Das. (2010). Principles of Geotechnical Engineering, SI edition, 7th edition, Cengage Learning, Stamford, Conn.<br>Das, B. M. and Sivakugan, N. (2019). Principles of Foundation Engineering. 9th International Edition. Publisher: Cengage Learning.<br>GEO (2020). Guide to Retaining Wall Design, Geoguide 1. Geotechnical Engineering Office (GEO), Civil Engineering and Development Department, HKSARG.<br>GEO (2017). Guide to Site Investigation, Geoguide 2. Geotechnical Engineering Office (GEO), Civil Engineering and Development Department, HKSARG.<br>GEO (2017). Guide to Rock and Soil Descriptions, Geoguide 3. Geotechnical Engineering Office (GEO), Civil Engineering and Development Department, HKSARG.<br>Lambe T.W. and Whitman R.V. (1979). Soil Mechanics, SI Version, Wiley, New York.<br>Sutton B.H.C. (1993). Solving Problems in Soil Mechanics, 2nd Edition, Longman.<br>Terzaghi, Karl, Ralph B., Peck, and Gholamreza Mesri. (1996). Soil Mechanics in Engineering Practice, 3rd Edition, Wiley: New York. |