Subject Description Form

Subject Code	CSE40411
Subject Title	Rock Engineering
Credit Value	3
Level	4
Pre-requisites / Exclusion	Pre-requisites: CSE206 Geology for Engineers or CSE20206 Geology for Engineers Exclusion: CSE411 Rock Engineering
Objectives	This subject aims to • Train students in acquisition of properties of intact rock and rock discontinuities and characterization of rock masses; • Enable students to apply rock mechanics techniques, tools and design methods to solve engineering problems of rock slope stability and tunneling. • Provide students with hands-on experience in basic laboratory techniques for determining the rock properties for design purpose.
Intended Learning Outcomes	Upon completion of the subject, students will be able: a. to apply fundamental mechanics to understand the properties of intact rock and rock masses for civil engineering purposes; b. to provide solutions for rock engineering projects including slopes and tunnels; c. to analyze and derive the properties of rock from laboratory testing for effective solutions to engineering problems through teamwork; d. to explain the problem of rock engineering projects and their solutions logically through drawing, calculation and writing; e. to have critical and creative thinking in solving rock engineering problems and have an ability to work independently.
Subject Synopsis/ Indicative Syllabus	1. Index Properties of Rock and Rock Mass Classification (1.5 weeks)

	Geological classification of rocks, index properties of rock: porosity, density, permeability, strength, slaking and durability, and degree of fissuring; classification of rock masses. 2. Rock Strength and Failure Criteria (2.5 weeks) Types of rock failure and laboratory measurements, stress-strain behaviour, failure criteria, effect of water, size, and anisotropy on the strength of rock specimens. 3. Planes of Weakness in Rock (3 weeks) Stereographic projection; joint roughness and its measurement; shear strength measurement; effect of water on jointed rock. 4. Rock Slope Engineering (3 weeks) Stereographic projection in rock slope stability analysis; plane and wedge failure analyses; design and control. 5. In-situ Stresses (1 week) Estimating the initial vertical and horizontal stresses; their field measurement and use. 6. Tunnelling (2 weeks) Rock mechanics analysis applied to different geological conditions of rock mass for design and construction of underground excavation; stresses around the excavation; rock support systems. 7. Laboratory Work There are four laboratory sessions throughout the course: Lab 1: Sample preparation & Index tests; Lab 2: Sample preparation & Sonic velocity test; Lab 3: Uniaxial compressive strength test and Point load test; Lab 4: Direct shear test.
Teaching/Learning Methodology	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 and problem-solving sessions to supplement understanding from lectures. Laboratory

<table>
<tr><td></td><td>work will help students 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="6">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><td>e</td><td></td></tr>
<tr><td>(1) Tutorial assignments, lab reports</td><td>20</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td></td></tr>
<tr><td>(2) Mid-term test</td><td>20</td><td>√</td><td>√</td><td></td><td>√</td><td>√</td><td></td></tr>
<tr><td>(3) Final examination</td><td>60</td><td>√</td><td>√</td><td></td><td>√</td><td>√</td><td></td></tr>
<tr><td>Total</td><td>100 %</td><td colspan="5"></td></tr>
</table>
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 required to attend laboratory sessions (including a field trip) and submit laboratory reports. These laboratory sessions will strengthen students with knowledge of the material properties of rock. The works in the laboratory sessions are closely related to practising geotechnical engineering requirements. Students will have to exert engineering judgments to complete the laboratory sessions. The assignments and laboratory sessions together with the report writing are to achieve intended learning outcomes a), b), c), d) and e). The mid-term test will emphasize assessing students' basic concepts and current practices of geotechnical engineering. It is appropriate to achieve intended learning outcomes a), d) and e). The final examination will consolidate students' learning in lectures and tutorials. It is most appropriate to achieve the intended learning outcomes a), b), d) and e).
</td></tr>
</table>

Student Study Effort Expected	Class contact:	Average hours per week
	▪ Lectures / Tutorials / Laboratory	3 Hrs.
	Other student study effort:	
	▪ Reading and studying	4 Hrs.
	▪ Completion of Assignments/ Lab Report	2 Hrs.
	Total student study effort	9 Hrs.
Reading List and References	**<u>Books</u>** Goodman RE, Introduction to Rock Mechanics, 2nd Edition, Wiley (1989). Jaeger JC, Cook NGW, Zimmerman RW, Fundamentals of Rock Engineering, 4th Edition, Blackwell (2007). Hoek E, Brady J, Rock Slope Engineering, 3rd Edition, IMM (2014). Hoek E, Brown ET, Underground Excavations in Rock, IMM (1980). GEO (2017). Guide to Rock and Soil Descriptions, Geoguide 3. Geotechnical Engineering Office (GEO), Civil Engineering and Development Department, HKSARG of China. **<u>Journals</u>** Rock Mechanics and Rock Engineering International Journal of Rock Mechanics and Mining Sciences	