Subject Description Form

Subject Code	CSE579
Subject Title	Advanced Rock Engineering
Credit Value	3
Level	5
Pre-requisite / Co-requisite/ Exclusion	Recommended background knowledge: Students have had a fundamental understanding of engineering geology, and basic concepts in solid mechanics. Exclusion: CSE40411 Rock Engineering
Objectives	a. To identify the methods and procedures for determining the mechanical properties of intact rock and rock discontinuities, and characterization of rock masses. b. To apply techniques, tools and design methods to solve engineering problems in rock. c. To acquire knowledge of construction of rock engineering structures, eg. tunnels.
Intended Learning Outcomes	Upon completion of the subject, students will be able: a. to apply fundamental mechanics and physics to identify the properties of intact rock and rock masses for civil engineering purposes; b. to critically analyze and interpret data in rock mechanics and rock engineering; c. to provide design solutions for engineering projects in rocks including slopes, foundations and tunnels; d. to apply analytical and numerical modelling techniques to rock engineering design and safety analysis.
Subject Synopsis/ Indicative Syllabus	**Keyword Syllabus** i) Intact Rock (2.5 weeks) Index properties of rocks; rock strength; failure criteria; effects of confining pressure, water, size and anisotropy. ii) Planes of Weakness (2.5 weeks) Types of planes of weakness; influence of planes of weakness; stereographic projection; laboratory tests to determine shear strength of rock joints; empirical shear strength equations. iii) Rock Slope Engineering (3 weeks)

<table>
<tr><td></td><td>Failure modes of rock slopes; graphical presentation of geological data; kinematic analysis for plane, wedge and toppling failures; limiting equilibrium analysis for plane and wedge failures; remedial measures for stabilizing and protecting rock slopes.

iv) <u>Underground Excavations</u> (2.5 weeks)

The instrumentation for measuring the initial stress of rock around underground excavations; failure mechanisms of underground excavation; stresses surrounding underground openings; multiple openings and pillars; openings in joined rock mass; assessment of rock pressures on tunnel supports; methods of tunnel support design; application of geomechanics classification to underground openings.

v) <u>Numerical methods in rock engineering</u> (2.5 weeks)

Introduction of various types of numerical methods for rock engineering; Introduction of the hybrid finite discrete element method; application of numerical simulation methods to rock engineering design projects and safety analysis .</td></tr>
<tr><td>Teaching/Learning Methodology</td><td>a. Lectures to deliver teaching materials.
b. Tutorials to demonstrate examples and discuss contents in each topic.</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. Continuous Assessment</td><td>40%</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>2. 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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Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Continuous assessment is based on tutorial exercise and mid-term test.

Written examination is the form of final exam.

Students must pass the final examination and achieve a passing overall score/ grade to pass the subject.</td></tr>
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Reading List and References	**<u>Books</u>** Chau KT, Analytic Methods in Geomechanics, CRC Press (2013). Goodman RE, Introduction to Rock Mechanics, 2nd Edition, Wiley (1989). Jaeger JC, Cook NGW, Zimmerman RW, Fundamentals of Rock Engineering, 4th Edition, Blackwell (2007). Wyllie DC, Mah CW, Rock Slope Engineering, 4th Edition, CRC Press (2004). **<u>Journals</u>** International Journal of Rock Mechanics and Mining Sciences Rock Mechanics and Rock Engineering