Subject Description Form

Subject Code	CSE582
Subject Title	Geo-hazards Risk Management and Mitigation
Credit Value	3
Level	5
Pre-requisite/ Co-requisite/ Exclusion	Recommended background knowledge: Students should have knowledge and basic understanding of engineering geology, soil mechanics, and foundation engineering consistent with undergraduate level study in civil engineering.
Objectives	(a) To enable students to acquire essential knowledge and concepts of different types of geo-hazards such as landslides, debris flows, rock falls, earthquakes, tsunamis and floods; (b) To gain knowledge on fundamental theories and analysis methods of different geo-hazards; (c) To gain knowledge and skills on design of geotechnical structures for geo-hazards mitigation.
Intended Learning Outcomes	Upon completion of the subject, students will be able: (a) to describe the mechanisms of different geo-hazards, including man-made slope and retaining wall failures, natural terrain landslides, debris flows, rockfalls, and earthquakes; (b) to understand and explain the engineering behaviour of rocks and soils in the design of slopes; (c) to analyse the stability of slopes and retaining walls; (d) to choose the proper stabilisation methods for man-made slopes, as well as the mitigation techniques of debris flow hazards on natural terrain; and (e) to work in a team collaboratively and present designs in a professional manner.
Subject Synopsis/ Indicative Syllabus	(1) Fundamental landslide risk management concepts and the Hong Kong Slope Safety System (1 week) Definition of hazard and risk; risk management concepts; components and achievements of the slope safety system in Hong Kong

	(2) Analysis of soil slopes and retaining walls (2 weeks) Fundamental soil mechanics principles for slopes and retaining walls; stability analysis of soil slopes and retaining walls. (3) Stabilisation methods for slopes and retaining walls (2 weeks) Overview of stabilisation methods for slopes; overview and analysis of loose fill slopes in Hong Kong (case study); soil nail design and construction; stabilization of loose fill slopes (4) New risk management tools (2 weeks) Fundamental quantitative risk assessment (QRA) concepts, role and application of QRA; debris mobility modelling; systematic landslide investigation programme (5) Mechanisms and mitigation measures of natural terrain landslides and debris flows (3 weeks) Fundamentals of natural terrain landslides and debris flows; overview of debris flow hazards mitigation; physical modeling and numerical simulation of debris flows and their interactions with structures; design of debris-resisting structures. (6) Earthquake engineering and hazard mitigation (2 weeks) Soil dynamics and soil liquefaction assessment; characterization of ground motion; analysis of dynamic soil-structure interactions; mitigation techniques for earthquake hazards. (7) Impact of climate change and application of innovation and technology (1 week) New challenges imposed by future impacts such as climate change and sea level rise; role of innovation and technology
Teaching/Learning Methodology	(a) Lectures to deliver teaching materials; (b) Technical seminars delivered by practising engineers; (c) Tutorials to discuss case histories for various topics; (d) Assignments; (e) Term project; (f) Examination.

<table>
<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="5">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></tr>
<tr><td>1. Continuous Assessment</td><td>40%</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>2. Written Examination</td><td>60%</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>Total</td><td>100 %</td><td colspan="5"></td></tr>
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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, written report and oral presentation of a term project, and a final examination.

The assignments and final examination are best to assess the intended learning outcomes in a), b), c) and d).

The students need to finish a term project, prepare a final report and make an oral presentation collaboratively. This term project will enable students to acquire basic design methods and communication skills (i.e., the intended learning outcomes in b), c) and e)).

Students must pass the final examination and achieve a passing overall score/ grade to pass the subject.
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<tr><td>Student Study Effort Expected</td><td>
<table>
<tr><td>Class contact:</td><td></td></tr>
<tr><td>▪ Lecture</td><td>26 Hrs.</td></tr>
<tr><td>▪ Tutorial</td><td>13 Hrs.</td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>▪ Self-study and homework</td><td>78 Hrs.</td></tr>
<tr><td>Total student study effort</td><td>117 Hrs.</td></tr>
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<tr><td>Reading List and References</td><td>Books:

Duncan, J. M., Wright, S. G., & Brandon, T. L. (2014). Soil Strength and Slope Stability. John Wiley & Sons.

Hong Kong Geotechnical Engineering Office (2011). Geotechnical Manual for Slopes.
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	Kramer S.L. (1996). Geotechnical Earthquake Engineering. Prentice Hall. Takahashi, T., & Das, D. K. (2014). Debris Flow: Mechanics, Prediction and Countermeasures. CRC Press. Wyllie, D. C. (2017). Rock Slope Engineering: Civil Applications. CRC Press. Ho, K., Lacasse, S. & Picarelli, L. (2017) Slope safety preparedness for impact of climate change. CRC Press. **Journals:** Natural Hazards and Earth System Sciences. Landslides.