

Subject Description Form

Subject Code	CSE6012
Subject Title	Advances in Geotechnical and Pavement Engineering
Credit Value	3
Level	6
Pre-requisite / Co-requisite/ Exclusion	<p><u>Recommended background knowledge:</u></p> <p>Students should have a knowledge and understanding of engineering mathematics, engineering mechanics, soil mechanics, and foundation engineering consistent with undergraduate level study in civil engineering.</p>
Objectives	<ol style="list-style-type: none"> 1. To provide students with the knowledge about the fundamental properties and behavior of earth materials, mathematical models, and methods of analysis for different conditions. 2. To provide students with in-depth analysis and design of common geotechnical structures and solutions to real problems. 3. To provide students with practical knowledge of pavement material and pavement behavioral analysis
Intended Learning Outcomes	<p>Upon completion of the subject, students will be able:</p> <ol style="list-style-type: none"> a. to apply the knowledge about the behavior of earth materials and their constitutive models in geotechnical analyses; b. to apply advanced pavement knowledge in design and analysis of pavements c. to perform critical thinking on design methods and solutions; and d. to understand the performance of geotechnical structures.
Subject Synopsis/ Indicative Syllabus	<p><u>Keyword Syllabus</u></p> <p><u>(i) Geotechnical testing and soil behavior (2.5 weeks)</u></p> <p>Conventional and advanced lab/field testing in geotechnics, Introduction to centrifuge modelling and particle image velocimetry, Mechanical behavior of soils.</p> <p><u>ii) Constitutive modeling of soils(2.5 weeks)</u></p> <p>Introduction of elasticity and plasticity; Nonlinear stress dependent elastic model; Mohr-Coulomb model; Cam-clay and Modified Cam-clay models; advances of soil modeling</p> <p><u>iii) Advances in geotechnical applications (2 weeks)</u></p> <p>Advances in slope stability analysis, foundation (pile group/piled raft) analysis, Uncertainty and reliability approaches in geotechnical engineering.</p>

	<p><u>iv) Pavement structure and materials (1 week)</u></p> <p>Introduction to pavement type and structure; rheological properties and characterization of bitumen and bituminous materials.</p> <p><u>v) Mechanical models of bituminous pavements (3 weeks)</u> Mechanical models of bituminous mixtures; pavement temperature prediction; dynamic traffic loads, pavement responses and distress evolution.</p> <p><u>vii) Pavement condition and evaluation (2 weeks)</u></p> <p>Pavement functional properties; pavement structural properties; non-destructive pavement evaluation techniques, such as falling weight deflectometer and ground penetration radar.</p>																																							
Teaching/Learning Methodology	<ol style="list-style-type: none"> 1. Lectures to deliver teaching materials. 2. Journal papers on new methods, advanced techniques or basic theory. 3. Assignments related to the subject contents. 4. Project reports 																																							
Assessment Methods in Alignment with Intended Learning Outcomes	<table border="1" data-bbox="411 965 1433 1442"> <thead> <tr> <th rowspan="2">Specific assessment methods/tasks</th> <th rowspan="2">% weighting</th> <th colspan="6">Intended subject learning outcomes to be assessed (Please tick as appropriate)</th> </tr> <tr> <th>a.</th> <th>b.</th> <th>c.</th> <th>d.</th> <th></th> <th></th> </tr> </thead> <tbody> <tr> <td>1. Continuous Assessment</td> <td>50%</td> <td>✓</td> <td>✓</td> <td>✓</td> <td>✓</td> <td></td> <td></td> </tr> <tr> <td>2. Individual report on a special study topic</td> <td>50%</td> <td>✓</td> <td>✓</td> <td>✓</td> <td>✓</td> <td></td> <td></td> </tr> <tr> <td>Total</td> <td>100 %</td> <td colspan="6"></td> </tr> </tbody> </table> <p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p>Continuous assessment is based on assignment/quiz/test/project paper for all lectures (50%).</p> <p>Each student shall submit an individual report on a special study topic which will be given by a lecturer in his field (50%).</p> <p>Students must attain at least Grade D in the coursework and continuous assessment in order to attain a passing grade in the overall result.</p>		Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)						a.	b.	c.	d.			1. Continuous Assessment	50%	✓	✓	✓	✓			2. Individual report on a special study topic	50%	✓	✓	✓	✓			Total	100 %						
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Student Study Effort Required	<p>Class contact:</p> <ul style="list-style-type: none"> ▪ Lectures ▪ Examination 	<p>39 Hrs.</p> <p>--</p>																																						

	<p>Other student study effort:</p> <ul style="list-style-type: none"> ▪ Reading of reference materials ▪ Assignments ▪ Project ▪ Total student study effort 	<p>36 Hrs.</p> <p>30 Hrs.</p> <p>30 Hrs.</p> <p>135 Hrs.</p>
<p>Reading List and References</p>	<p><u>Books</u></p> <p>Chau, K.T. (2013) <i>Analytic Methods in Geomechanics</i>, CRC Press, Boca Raton.</p> <p>Chen, W.F., <i>Limit Analysis and Soil Plasticity</i>, Elsevier, (1975).</p> <p>Cheng Y.M. and Lau C.K., <i>Soil Slope Stability Analysis and Stabilization – New methods and insights</i>, 2nd edition, Francis & Taylors (2014).</p> <p>Fleming, Weltman, Randolph and Elson, <i>Piling Engineering</i>, 3rd edition, Taylors and Francis (2009).</p> <p>Muir Wood, David, “Soil Behaviour and Critical State Soil Mechanics”, Cambridge University Press, (1990)</p> <p>Potts, D.M. and Zdravkovic, L. <i>Finite Element Analysis in Geotechnical Engineering – Theory</i>, Thomas Telford Publishing Ltd, U.K. (ISBN: 0 7277 2753 2), (1999).</p> <p>Shukla, Sanjay Kumar and Jian-Hua Yin (2006). “Fundamentals of Geosynthetic Engineering”, published by A.A. Balkema Publishers Taylor & Francis, The Netherlands. (450 pages, 239 illustrations, 42 tables, ISBN 0 415 39444 9).</p> <p>Achenbach, J.D. <i>Wave Propagation in Elastic Solids</i>. North-Holland (1987).</p> <p>Huang Y. H. 2003. <i>Pavement Analysis and Design</i>, 2nd edition. Pearson Prentice Hall, Upper Saddle River, NJ.</p> <p>Roberts, Freddy L., Prithvi S. Kandhal, E. Ray Brown, Dah-Yinn Lee, and Thomas W. Kennedy. "Hot Mix Asphalt Materials, Mixture Design and Construction." (1996).</p> <p>Al-Qadi, I. L. and S. Lahouar, “Measuring Layer Thickness with GPR-Theory to Practice,” <i>Construction and Building Materials</i>, Vol. 19, 2005, pp. 763-772.</p> <p>Lytton, R. L., “Back calculation of Pavement Layer Properties”, <i>Nondestructive Testing of Pavement and Back calculation of Moduli</i>, American Society of Testing and Materials Standard Technical Publication 1026, A. J. Bush III and G. Y. Baladi, Eds., Philadelphia, PA, 1989, pp. 7-38.</p> <p><u>Journals</u></p> <p>Canadian Geotechnical Journal.</p> <p>Computers and Geotechnics.</p> <p>Geotechnique.</p>	

Journal of Geotechnical and Geoenvironmental Engineering, the American Society of Civil Engineers.

Soils and Foundations

Rock Mechanics and Rock Engineering

International Journal of Rock Mechanics and Mining Sciences

International Journal of Pavement Engineering

Transportation Research Record

Manuals

Guide to Retaining Wall Construction (1993), Geotechnical Control Office, (GEO), Hong Kong Government.

Review of Design Methods for Excavations (1990), Geotechnical Control Office, (GEO), Hong Kong Government.

Foundation Design and Construction, GEO Publication No. 1/2006, Geotechnical Control Office, (GEO), Hong Kong Government.

Hong Kong Foundation Handbook, Housing Department, 2011, Hong Kong Housing Authority.

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