Subject Description Form

Subject Code	CSE578
Subject Title	Soil and Behaviour and Geotechnical Engineering
Credit Value	3
Level	5
Pre-requisite/ Co-requisite/ Exclusion	Students should have a knowledge and understanding of engineering geology, soil mechanics, and foundation engineering consistent with undergraduate level study in civil engineering.
Objectives	1. To provide students with the knowledge about advanced soil lab tests, stress-strain behaviour of soils, and their constitutive modelling. 2. To provide students with the knowledge on time-dependent stress-strain behavior of soils and Elastic Visco-Plastic modelling. 3. To equip students with methods for analysis and calculation of consolidation settlements of soils exhibiting creep
Intended Learning Outcomes	Upon completion of the subject, students will be able: (a) to apply in-depth knowledge about the fundamental soil behavior in geotechnical engineering; (b) to perform critical thinking on engineering design methods; and, (c) to understand the performance of geotechnical engineering structures.
Subject Synopsis/ Indicative Syllabus	i) <u>Laboratory tests and real stress-strain behaviour of soils (3 weeks)</u> Oedometer test, conventional and stress-path triaxial test, true triaxial test; stress-strain behavior of clay soils and sand; shear strength; elastic and plastic behavior; viscous behavior, non-linearity; isotropic and anisotropic behavior; dilatancy; correlations of parameters and properties of soils. ii) <u>Commonly used constitutive models (4 weeks)</u> Linear isotropic elasticity; linear anisotropic elasticity; hyperbolic model; KGJ model; Mohr-Coulomb elastic-plastic model; critical state models. iii) <u>1D viscous behaviour of soils and 1D elastic visco-plastic models (2 weeks)</u> Strain/stress rates effects and creep of soils in oedometer tests; Maxwell rheological model; 1D Elastic Visco-Plastic (1D EVP) model; 1D non-linear creep of soils; verification and applications.

iv) Simple methods for consolidation settlement calculation of soils exhibiting creep (2 weeks)

A simplified Hypothesis B method for calculating consolidation settlement of one layer of a clayey soil with creep; extension of this method for two layers of clayey soils with creep; a general simple method for calculating consolidation settlements of layered clayey soils without/with Prefabricated Vertical Drains (PVDs) under any staged loading; verification and applications.

v) 2D/3D viscous behavior of soils and 3D elastic visco-plastic models (2 weeks)

Strain/stress rates effects and creep of soils in triaxial tests; a 3D Elastic Visco-Plastic (3D EVP) model; verification and applications; further research topics.

Teaching/Learning Methodology

1. Lectures to deliver teaching materials.
2. Technical seminars delivered by practicing engineers.
3. Tour to Soil Mechanics Laboratory in PolyU.
4. An individual report on detailed study of a project problem.
5. Assignments related to the subject contents.
6. Examination.

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)		
		a	b	c
1. Continuous Assessment	40%	✓	✓	✓
2. Written Examination	60%	✓	✓	✓
Total	100 %			

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Assignment to problems relevant lecture contents will help the students to understand and apply the concepts and methods for real applications. The individual report is good for each student to have critical thinking and apply their knowledge to solve a geotechnical engineering problem. The final examination will check the intended learning outcomes of the whole subject.

	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.	
Student Study Effort Expected	Class contact:	
	▪ Lecture / Talk	26 Hrs.
	▪ Tutorial / Lab Visit	13 Hrs.
	Other student study effort:	
	▪ Self-study and homework	78 Hrs.
	Total student study effort	117 Hrs.
Reading List and References	**Books:** Wood DM (1990). Soil Behaviour and Critical State Soil Mechanics, Cambridge University Press. Potts DM and Zdravkovic L (1999). Finite Element Analysis in Geotechnical Engineering: Theory. Thomas Telford Publishing Ltd, U.K. (ISBN: 0 7277 2753 2). Potts DM and Zdravkovic L (2001). Finite Element Analysis in Geotechnical Engineering: Application. Thomas Telford Publishing Ltd, U.K. Yin JH and Zhu GF (2020). Consolidation Analyses of Soils. CRC Press of Taylor & Francis Group (ISBN 9780367555320). For more information see https://www.routledge.com/Consolidation-Analyses-of-Soils/Yin-Zhu/p/book/9780367555320. **Manuals:** Buildings Department (2017). Code of Practice for Foundations 2017. Buildings Department, HKSARG. Guide to Retaining Wall Construction (2020) by GEO (Geotechnical Engineering Office), HKSARG. Guide to Site Investigation (2017). GEO, HKSARG. Geospec 3 Model Specification for Soil Testing (2017). GEO, HKSARG. Review of Design Methods for Excavations (1990). GEO, HKSARG. Foundation Design and Construction (2006). GEO, HKSARG. These manuals from GEO can be found at: https://www.cedd.gov.hk/eng/publications/geo/index.html	

	published by the Geotechnical Control Office (GEO), Civil Engineering Services Department (CEDD), HKSARG of China. **Papers:** Yin JH and Feng WQ (2017). A new simplified method and its verification for calculation of consolidation settlement of a clayey soil with creep. Canadian Geotechnical Journal, 54(3), 333–347. Feng WQ and Yin JH (2017). A new simplified Hypothesis B method for calculating consolidation settlements of double soil layers exhibiting creep. International Journal for Numerical and Analytical Methods in Geomechanics, 41, 899–917. Yin JH, Chen ZJ, and Feng WQ (2022). A general simple method for calculating consolidation settlements of layered clayey soils with vertical drains under staged loadings. Acta Geotechnica, 1-28.