Annexe A: New/Revised Course Content in OBTL+ Format

Course Overview

Expected Implementation in Academic Year (New format)	AY2021-2022
Semester/Trimester/Others (specify approx. Start/End date)	Semester 1
Course Author * Faculty proposing/revising the course	Lee-Chua Lee Hong
Course Author Email	clhlee@ntu.edu.sg
Course Title	Geo-Environment and Soil Mechanics
Course Code	EN2004
Academic Units	3
Contact Hours	39
Research Experience Components	Not Applicable

Course Requisites (if applicable)

Pre-requisites	
Co-requisites	
Pre-requisite to	
Mutually exclusive to	
Replacement course to	
Remarks (if any)	

Course Aims

This course aims to provide you with a basic knowledge of 1) the essential concepts of the physical and chemical properties of soils; 2) soil as an important component in the environment; and 3) the fundamental principles of soil mechanics. It is designed for environmental engineering students to understand the fundamental concepts in geoenvironmental and geotechnical engineering and their applications in environmental engineering works.

Course's Intended Learning Outcomes (ILOs)

Upon the successful completion of this course, you (student) would be able to:

ILO 1	Identify and explain basic concepts in soil which are pertinent to environmental science and engineering.
ILO 2	Explain the factors affecting underground environmental quality.
ILO 3	Identify and describe conditions and processes related to ground contamination.
ILO 4	Identify and describe the physical and mechanical soil properties that control soil behavior.
ILO 5	State the effective stress principle and describe how pore water pressure and seepage affect soil response.
ILO 6	Apply basic modelling and analysis techniques used in soil engineering.

Course Content

S/N	Topic	Lecture Hrs	Tutorial Hrs
1	Soil classification, indices, and properties	3	2
2	Phase relationships and soil compaction	2	1
3	Flow of water in soils, flow nets, and effective stress concept	4	2
4	Soil compressibility and consolidation	4	2
5	Soil and the environment	3	1
6	Vadose zone and unsaturated soil	2	1
7	Site investigation and soil characterization	4	2
8	Ground contamination and remediation	4	2
	Total:	26	13

Reading and References (if applicable)

1. Lecture slides and additional reading materials where needed.
2. Recommended text and reference materials.

Planned Schedule

Week or Session	Topics or Themes	ILO	Delivery Mode	Activities	Readings
1	Soil classification, indices, and properties.	3, 4, 5		Tutorials and lectures	
2	Soil composition. Phase relationships and soil compaction	3, 4		Tutorials and lectures	
3	Seepage. Permeability tests.	4, 5		Tutorials and lectures	
4	Flow nets and effective stress principle.	5, 6		Tutorials and lectures	
5	Compressibility. Consolidation process. Oedometer test.	4, 5		Tutorials and lectures	
6	Settlement calculation.	4, 6		Tutorials and lectures	
7	Terzaghi's consolidation theory. Time-rate consolidation.	4, 5, 6		Tutorials and lectures	
8	Soil and the environment	1, 2, 3		Tutorials and lectures	
9	Vadose zone and unsaturated soil.	3, 4, 5		Tutorials and lectures	
10	Soil and groundwater sampling. Sample characterization.	3, 4, 5		Tutorials and lectures	
11	Site investigation. Geotechnical and geophysical methods.	3, 4, 5		Tutorials and lectures	

Week or Session	Topics or Themes	ILO	Delivery Mode	Activities	Readings
12	Sources, detection, and processes of ground contamination.	3, 4		Tutorials and lectures	
13	Prevention and remediation of ground contamination.	3, 4		Tutorials and lectures	

Learning and Teaching Approach

Approach	How does this approach support you in achieving the learning outcomes?
Lectures	Formal lectures on topics which cover soil properties, soil mechanics, and soil environment. The lectures will focus on the key concepts on how soil characteristics affect the engineering properties and behaviour of geo-materials. The application of these concepts will be illustrated through analysis and problem solving.
Tutorials	Reinforces concepts of lectures with example problems. To promote peer discussion and group interaction in problem solving.

Assessment Structure

Assessment Components (includes both continuous and summative assessment)

No.	Component	ILO	Related PLO or Accreditation	Weightage	Description of Assessment Component	Team/Individual	Rubrics	Level of Understanding
1	Summative Assessment (EXAM): Final exam(Final Examination)	1, 2, 3, 4, 5, 6	ENE SLOs (a), (b)	60		Individual	Holistic	Relational
2	Continuous Assessment (CA): Test/Quiz(Continuous Assessment 1 (CA1): Quiz 1)	1, 2, 3	ENE SLOs (a), (b)	20		Individual	Analytic	Multistructural
3	Continuous Assessment (CA): Test/Quiz(CA2: Quiz 2)	3, 4, 5	ENE SLOs (a), (b)	20		Individual	Analytic	Multistructural

Description of Assessment Components (if applicable)

* ENE SLOs = Student Learning Outcomes for Environmental Engineering Programme (per BEng Environmental Engineering Accreditation)

Related Programme LO or Graduate Attributes

Engineering knowledge: Apply the knowledge of mathematics, natural science, engineering fundamentals, and an engineering specialisation to the solution of complex engineering problems;

Problem Analysis: Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences;

Design/development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.

Investigation: Conduct investigations of complex problems using research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions

Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT

tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

The engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for the sustainable development.

Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams and in multidisciplinary settings.

Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and economic decision-making, and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

Life-long Learning: Recognise the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

Formative Feedback

1. Feedback will be through the dissemination of the student's performance in quizzes as well as review of the quiz questions in class.

2. Additional channel will be through individual consultation initiated by students on their particular learning needs.

NTU Graduate Attributes/Competency Mapping

This course intends to develop the following graduate attributes and competencies (maximum 5 most relevant)

Attributes/Competency	Level
Care for Environment	Advanced
Global Perspective	Advanced
Transdisciplinarity	Advanced
Design Thinking	Intermediate

Course Policy

Policy (Academic Integrity)

Good academic work depends on honesty and ethical behaviour. The quality of your work as a student relies on adhering to the principles of academic integrity and to the NTU Honour Code, a set of values shared by the whole university community. Truth, Trust and Justice are at the core of NTU's shared values. As a student, it is important that you recognize your responsibilities in understanding and applying the principles of academic integrity in all the work you do at NTU. Not knowing what is involved in maintaining academic integrity does not excuse academic dishonesty. You need to actively equip yourself with strategies to avoid all forms of academic dishonesty, including plagiarism, academic fraud, collusion and cheating. If you are uncertain of the definitions of any of these terms, you should go to the academic integrity website for more information. On the use of technological tools (such as Generative AI tools), different courses / assignments have different intended learning outcomes. Students should refer to the specific assignment instructions on their use and requirements and/or consult your instructors on how you can use these tools to help your learning. Consult your instructor(s) if you need any clarification about the requirements of academic integrity in the course.

Policy (General)

You are expected to complete all assigned readings, activities, assignments, attend all classes punctually and complete all scheduled assignments by due dates. You are expected to take responsibility to follow up with assignments and course related announcements. You are expected to participate in all project critiques, class discussions and activities.

Policy (Absenteeism)

In-class activities make up a significant portion of your course grade. Absence from class without a valid reason will affect your participation grade. Valid reasons include falling sick supported by a medical certificate and participation in NTU's approved activities supported by an excuse letter from the relevant bodies. There will be no make-up opportunities for in-class activities.

Policy (Others, if applicable)

The standing university policy governing student responsibilities shall apply.
No special policy for this course.

This course will adopt NTU's policy on the use of AI for take-home assignments and reports, and project reports and presentation slides. More details could be found via the link https://entuedu.sharepoint.com/sites/Student/dept/ctlp/SitePages/Exploring-the-Impact-of-Generative-Artificial-Intelligence-(GAI)-Tools-on-Education.aspx#1-proper-citations-and-acknowledgements

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Last Updated By: Siti Nur Amirah Binte Suhari