Course syllabus of Soil Mechanics II

Course Title: Soil Mechanics II

Course Code: A024008

Academic Credit: 2

Total Hours of Instruction/Laboratory work: 36/4 (36 hours of direct instruction, including 4 hours laboratory work)

Status of Course: Compulsory

Course Type: Fundamental

Core Course (Y/N): N

Department in Charge: Department of Geotechnical Engineering, College of Civil Engineering

Major: Civil Engineering

Prerequisite: Engineering Geology, Mechanics of Material, Mechanics of Elasticity

Textbooks and Suggested Readings：

1. Textbooks：
   - Liao hongjian, Su Lijun, Li Hangzhou, Xiao Zhenhua. Soil Mechanics[M], Xi'an Jiaotong University Press, 2015.
   - Shi Jianyong. Soil Mechanics[M], China Communication Press, 2004.
2. Suggested Readings：
   - 冯志焱，土力学与基础工程（第二版）[M]. 武汉理工大学出版社, 2018.
   - 陈仲颐，土力学（第三版）[M]. 清华大学出版社, 1997.
   - 王铁行，冯志焱. 土力学与基础工程（第二版）[M]. 中国电力出版社, 2013.
   - 曹卫平. 土力学（第二版）[M]. 北京大学出版社, 2010.

Course Reform(Y/N): N

1. Course Objects

This course is a fundamental requirement for civil engineering students. It is designed to equip them with a comprehensive understanding of the fundamental principles of soil mechanics and the associated geotechnical engineering challenges, including seepage, deformation, and shear strength. Students will develop the capability to independently analyze and address complex geotechnical problems, while cultivating a deep appreciation for specialized ethics and codes. Furthermore, the course emphasizes the importance of cultivating a strong sense of social responsibility in the practice of engineering.

The detailed information for each object is as follows:

1. Establish the concept of the basic knowledge of the course.; Master the basic concepts of stress in soil, calculation methods, and their distribution laws; Master the basic concepts and theories of soil strength; Understand the principle of effective stress. 【Index 1.2 for the Degree of Civil Engineering according to the Bachelor Training Program of Civil Engineering】
2. Master the concepts of soil compressibility and the methods for calculating ground settlement; Understand the concept of soil stress history and gain proficiency in the theory of one-dimensional consolidation; Develop a thorough understanding of earth pressure theories; Master the calculation methods for ground bearing capacity and soil slope stability. 【Index 2.2 for the Degree of Civil Engineering according to the Bachelor Training Program of Civil Engineering】
3. Master the testing methods for determining soil compressibility and strength indices; Develop the ability to independently conduct tests and accurately interpret the resulting data.【Index 4.2 for the Degree of Civil Engineering according to the Bachelor Training Program of Civil Engineering

2. Teaching contents

Chapter 0 General introduction

(1) **Teaching contents**: the significance of soil mechanics and its foundational role in civil engineering; the historical development of soil mechanics; the key topics and structure of the course

(2) **Leaning expectation**: be aware of the fundamental problems addressed in soil mechanics, the characteristics of the course as well as the recommended learning strategies

(3) **Keys**: /

(4) **Difficulties**: /

(5) **Index for the teaching objects**: 1

Chapter 1 Physical Properties of soils

(1) **Teaching contents**: overview; formation of soils; constitution of soils; structure of soils; physical property indices; relative density; consistency and compaction of soils

(2) **Leaning expectation**: be aware of the formation processes, structural characteristics of soils, the classification systems for soils; Master the relevant physical property indices calculation

(3) **Keys**: Physical property indices calculation and related experiment

(4) **Difficulties**: three-phase diagram

(5) **Index for the teaching objects**: 1, 3

Chapter 2 Flow of water through soils

(1) **Teaching contents**: overview; permeability of soils and associated problem; 2-d seepage and flow net, seepage force and related problems

(2) **Leaning expectation**: be aware of the mechanism of failure caused by seepage; understand the constant head method measuring hydraulic conductivity and volumetric water flow by 2D flow net; master the volumetric water flow of 1D problem

(3) **Keys**: mechanism of failure due to seepage

(4) **Difficulties**: hydraulic conductivity determination according to the constant head method; flow net and related calculation

(5) **Index for the teaching objects**: 1

Chapter 3 Stress in soils

(1) **Teaching contents**: overview; principle of effective stress; calculation of effective geostatic stress in soils; calculation of stress increment in soil; calculation of contact pressure under footing

(2) **Leaning expectation**: be aware of the stress states in soils and contact pressure distribution under footing; understand the principle of effective stress; master the effective geostatic stresses calculation and stresses increment calculation by corner point method

(3) **Keys**: principle of effective stress; vertical stress increment and effective geostatic stress calculation

(4) **Difficulties**: distribution of stresses increment under footing

(5) **Index for the teaching objects**: 1

Chapter 4 Compressibility of soils

(1) **Teaching contents**: overview; compressibility of soils; settlement according to the layer-wise summation method; consolidation of saturated soils

(2) **Leaning expectation**: be aware of the mechanisms of compressibility of soils, the methods of measuring various compressibility indices, layer-wise summation method, as well as the derivation of 1D consolidation model; understand the assumptions adopted for 1D consolidation model, the concepts of degree of consolidation; master the various compressibility indices calculation and degree of consolidation

(3) **Keys**: compressibility of soils and their related tests; ground settlement calculation; one-dimensional consolidation theory

(4) **Difficulties**: degree of consolidation and associated calculation

(5) **Index for the teaching objects**: 1

Chapter 5 Strength of soils

(1) **Teaching contents**: overview; shear strength and failure theory of soils; shear strength testing methods; various types of shear strength indices

(2) **Leaning expectation**: be aware of the significance of strength of soils and the properties and shear strength indices of soils under various drainage conditions; Understand the Mohr-Coulomb failure theory; Master the evaluation of the state of soil according to the Mohr-Coulomb failure theory, as well as the strength characteristics of soils under triaxial test conditions, direct shear test and oedometer test

(3) **Keys**: Mohr-Coulomb strength theory and limit equilibrium; testing of shear strength; characteristics of strength parameters under various drainage conditions;

(4) **Difficulties**: evaluation of the state of soil according to Mohr-Coulomb strength theory; characteristics of strength parameters under various drainage conditions

(5) **Index for the teaching objects**: 1,

3. Contents and Learning Expectations of In-class Practice

No.	Types of In-class Practice	Contents	Learning Expectations
1	Experiment	Bulk density, Plastic limit, liquid limit	1. The cutting ring method and other related methods for determine bulk density. 2. Oven drying method to determine water content. 3. Plastic limit and liquid limit determination with cone penetrometer device.
2	Experiment	Shear strength parameters	The determination of shear strength parameters with direct shear test.

4. Schedule

Contents	Hours						Total
	Lecture	Lab	Work with Computer	Discussion	Exercise	Others	
Chapter 0 General introduction	2						2
Chapter 1 Physical properties of soils	4	2					6
Chapter 2 Flow of water through soils	6						6
Chapter 3 Stress in soils	6						6
Chapter 4 Compressibility of soils	8						8
Chapter 5 Strength of soils	6	2					8
Total	32	4					36

5. Ideological and Political Education (IPE)

No.	Objects of (IPE)	Related chapter	Teaching contents related to IPE
1	Engineering Ethics and Social Responsibility	Chapter 0	To develop students' awareness of engineering ethics and emphasize the importance of responsible decision-making in their future careers, discuss the ethical issues in soil mechanics practice, such as ensuring public safety in engineering design and construction, environmental protection, and addressing engineering failures.
2	Technological Innovation and Societal Advancement	Chapter 0	To encourage students to embrace technological innovations and recognize their impact on societal advancement, discuss recent technological advancements and innovations in soil mechanics, such as new soil testing methods and the application of geosynthetics, and their contributions to societal progress.
3	Sustainability and Environmental Protection	Chapter 1	To enhance students' understanding of sustainable development and encourage them to consider the environmental impacts of their engineering practices, explore the role of soil mechanics in sustainable construction and environmental protection, including the environmental impacts of soil improvement technologies and the long-term effects of ground settlement on buildings
4	National Infrastructure and Development	Chapter 3	To highlight the critical role of soil mechanics in supporting national development and foster a sense of contribution to national progress, introduce case studies of major infrastructure projects involving soil mechanics, such as large-scale water conservancy projects and transportation infrastructure, and discuss their importance to national economic and social development
5	Professional Integrity and Ethical Decision-Making	Chapter 5	To foster professional integrity and ethical decision-making in students' future engineering practices, examine case studies involving ethical dilemmas in soil mechanics, such as issues related to safety margins, project management, and compliance with regulations

6. Assessment and Grading

（1）Assessment

This course is primarily assessed through a combination of final examination and usual performance, which includes group discussion, assignments, and laboratory work.

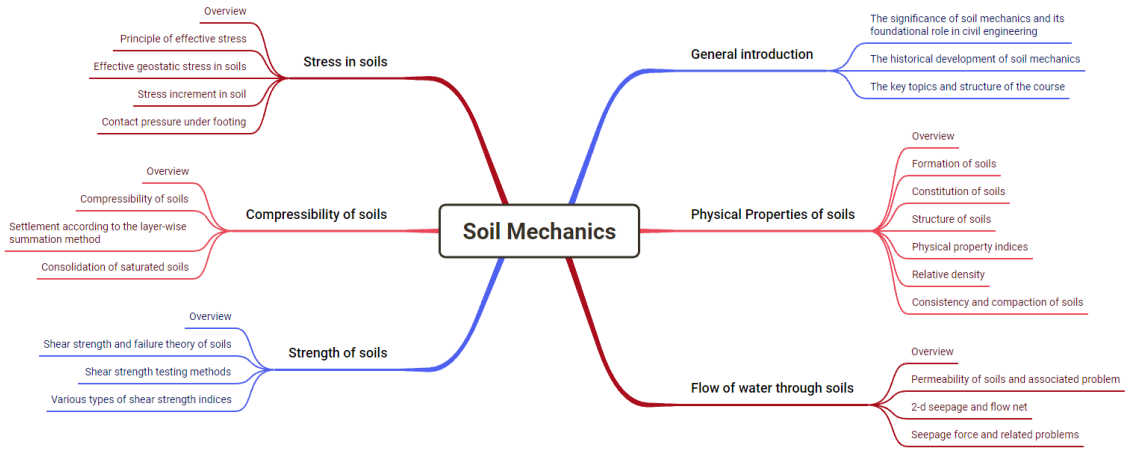
（2）Grading

	Constitution of Assessment		Portion（%）	Teaching Objects
Course Grading	Final exam		30	1
			20	2
			10	3
	Usual performance	Discussion	3	1
			3	2
			4	3
		Quiz	5	1
			5	2
		Experiment	20	3
Total			**100**	/

7. Brief Introduction of Curriculum Reform

The fundamental course is one of the most important course for students whose major is civil engineering. These courses are designed to provide students with the essential groundwork, including subject background, theories, and practical applications. Through these courses, students will gain an understanding of and become familiar with the core concepts, theoretical models, and practical skills relevant to their professional areas.

8. Knowledge Graph



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