زانکۆی پۆلیتەکنیکی هەولێر
ERBIL POLYTECHNIC UNIVERSITY

(Module Name) Course Catalogue

2023-2024

College	**Erbil Technology Institute**	
Department	**Department of Building and Construction**	
Module Name	**Geotechnical Engineering 2**	
Module Code	**GEE351**	
Semester	**2**	
Credit		
Module type	**Core**	
Weekly hours	**4**	
Weekly hours (Theory)	**(2)hr Class**	**( )hr Workload**
Weekly hours (Practical)	**(2)hr Class**	**( )hr Workload**
Lecturer (Theory)		
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Lecturer (Practical)		
Email	**ghazala.asaad@epu.edu.iq**	

Course Book

Course overview: Course overview:

1- This course provides an elementary introduction to Geotechnical Engineering tests , and provides the main information for the basic soil mechanics test .

- 2- This course provides an elementary introduction to Geotechnical Engineering, and provides the basic mechanics necessary for the detailed study of Geotechnical Engineering. This course aims to provide an understanding of: the nature of soils as engineering materials; common soil classification schemes; the importance of water in the soil and the effects of water movement; methods of predicting soil settlements, the stress-strain-strength response of soils, and earth pressures.

- Course objective:

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Aimed at the study of soil mechanics to achieve the following objectives:

1- student mechanical properties of the soil in which they can estimate the seriousness of the choice of definition

The type of foundation and the impact of facilities that are held on different types of soil.

2-rehabilitation of the student and improves their skill required in the classification of the soil and conduct the necessary tests

By (field and laboratory) and the relationship of that constructions, which will be played on them.

- Student's obligation

Students learn to get information on the soil and coarse soil types, for example Halnaamh by the work of some tests, for example, Soil classification , plastic limit and shrinkage limit test , Constant head permeability test , Falling head permeability test and Standared compaction test

and the study of their properties by studying and taking the fashions on the soil, for example Introduction, Soil Composition and soil properties,Soil grain-size distribution,Consistency, Plasticity and Atterberg limits,Permeability ,Stresses in Soil,Soil classification ,Soil stabilization , Consolidation ,Lateral earth pressure ,Soil compaction , CBR California Bearing Ratio,Swelling and Shear stress.

- Forms of teaching

lecture halls with data show equipment for lecture presentations, white board, overhead projector, posters

- Assessment scheme

6% Mid. Theory exam
10% Mid. practical exam
4% Quiz
40% Activity
25% final practical
15% final theory

- Specific learning outcome:

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and the study of their properties by studying and taking the fashions on the soil, for example Introduction, Soil Composition and soil properties,Soil grain-size distribution,Consistency, Plasticity and Atterberg limits,Permeability ,Stresses in Soil,Soil classification ,Soil stabilization , Consolidation ,Lateral earth pressure ,Soil compaction , CBR California Bearing Ratio,Swelling and Shear stress.

- Course Reading List and References:

1- Principles of Geotechnical Engineering by Braja M.Das

2- Physical and Geotechnical Properties of Soil by Joseph E.Bowel

3-Soil Mechanics by William Lambe & Robert V. Whitman

4- Physical and geotechnical properties of soil by joseph E. Bowels.

5-Solving problems in soil mechanics by Sutton

6- Any other text books related to the soils or soil mechanics.

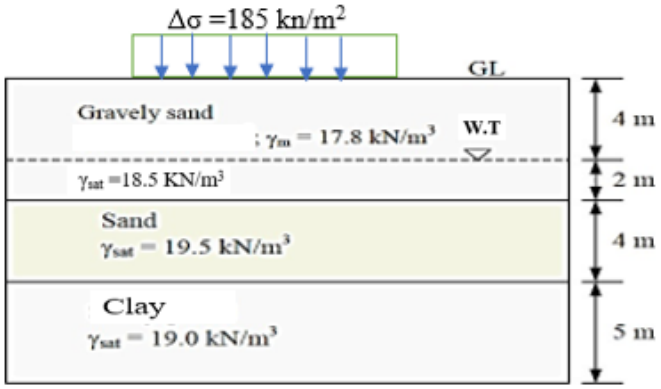
- Course topics (Theory)	Week	Learning Outcome
1. soil texture & strructure	1st week	Learning Outcomes/Expectations/Soils Participants should be able to: 1- identify the factors affecting soil formation and describe processes involved 2- identify soil horizons in

		soil pit or photograph 3- describe a soil profile in terms of soil colour, texture, and quantity of organic matter
consolidation of soil	2nd week	• Plasticity is the ability of a soil to undergo unrecoverable deformation at constant volume without cracking or crumbling. It is due to the presence of clay minerals or organic material. • Consistency limits (Atterberg limits): • Atterberg, a Swedish scientist developed a method for describing the limit consistency of fine grained soils on the basis of moisture content. These limits are liquid limit, plastic limit and shrinkage limit. •
Permeability and flow soil	3rd week	Classification of soil is the separation of soil into classes or groups each having similar characteristics and potentially similar behaviour. A classification for engineering purposes should be based mainly on mechanical properties: permeability, stiffness, strength. The class to which a soil belongs can be used in its description.
Stresses in a Soil Mass	4th week	A material is permeable if it contains continuous voids. All materials such as rocks, concrete, soils etc. are permeable.
CBR of soil (Bering capacity of soil)	5th week	Increasing the shear strength , Decreasing the compressibility , Decreasing the coefficient of permeability , Increasing bearing capacity of foundation .
soil stabilization.	6th week	The principle of effective stress • Response of effective stress to a change in total stress and
Retaining Walls .	7th week - 8th week	Stresses acting normal on mutually orthogonal planes with no shear stresses. Principle Planes: The planes on which there is zero shear stresses.

building Foundation Types of Foundation and their Uses	9th week	A stress increase caused by the construction of foundations or other loads compresses the soil layers. The compression is caused by (a) deformation of soil particles, (b) relocations of soil particles, and (c) expulsion of water or air from the void spaces. In general, the soil settlement caused by load may be divided into three broad categories. Consolidation settlement: onedimensional • Settlement by the Skempton– Bjerrum method
Swelling	10th week	Foundation design • Ultimate bearing capacity
soil stability	11th week - 12th week	After this lesson, students should be able to: • Define and describe a foundation for a structure. • Describe two basic types of foundations: shallow and deep. • Discuss several factors that engineers must consider when designing foundations for a bridge, include soil conditions, materials and forces.
- Practical Topics (If there is any)	Week	Learning Outcome
Introduction on the soil lab .	1st week	
Constant head permeability test	2nd week	Is one of the easiest properties of a soil to obtain, it is also one of the most useful.
Falling head permeability test	3rd week	This test is to determine the ash (ash wood , ash tree ….) content of organic materials.
Standard compaction test	4th week	To determine the specific gravity of soil solids using pycnometer .
Modified compaction test	5th week	To determine particle size distribution of soil sample using sieve analysis.

core-cutting-method Filed density	6th week	To determine grain size distribution of soil, which contains appreciable quantity of soil passing ASTM 200 sieve (0.075 mm).
Filed density (sand cone test)	7th week	Is the percentage of water in the sample that can be locked Which has limited dimensions and a number of bars equals 25 strokes Then he worked a thread of diameter (3.25) mm and then the thread began cracking
Consolidation of soil	8th week	Objective To determine the Coefficient of Permeability (k) of coarse sand by constant head method. Equipment
Un confied -Compression	9th week	To determine the Coefficient of Permeability (k) of fine soil by filling head method.
Triaxial shear test	10th week	Compaction is the process of increasing the density of a soil by packing the particles closer together with a reduction in the volume of air only. Compaction increases the dry density and decreases the void ratio.
Triaxial shear test	11th week	Compaction is the process of increasing the density of a soil by packing the particles closer together with a reduction in the volume of air only. Compaction increases the dry density and decreases the void ratio. To determine moisture content and dry density relationship using heavy compaction
	12th week	Determination of Field Density Test of Soil by Core Cutter Method.
- Extra notes:		

Q1/ Consider the soil profile shown in the following figure. The soil is subjected to an uniformly distributed load $\Delta\sigma$ = 185 kN/m^2 on the ground surface, Determine the consolidation settlement of the clay layer if the value of C_c = 0.29, e_0 = 0.81. (50 marks)



$\sigma_t = (4)(17.8) + (2)(18.5) + (4)(19.5) + (5)(19.0) = 281.2\ kPa$

$u = (11)(9.81) = 107.9\ kPa$

$\therefore \sigma'_v = 281.2 - 107.9 = 173.3\ kPa$

for normally consolidated clay: $S_{Ci} = \frac{C_c}{1+e_o} H_t \log_{10} \frac{\sigma'_o + \Delta\sigma}{\sigma'_o}$

S = (0.29 * 5/ 1+ 0.81) log (173.3 +185 /173.3)

S= (1.45 / 1.81) log (2.067)

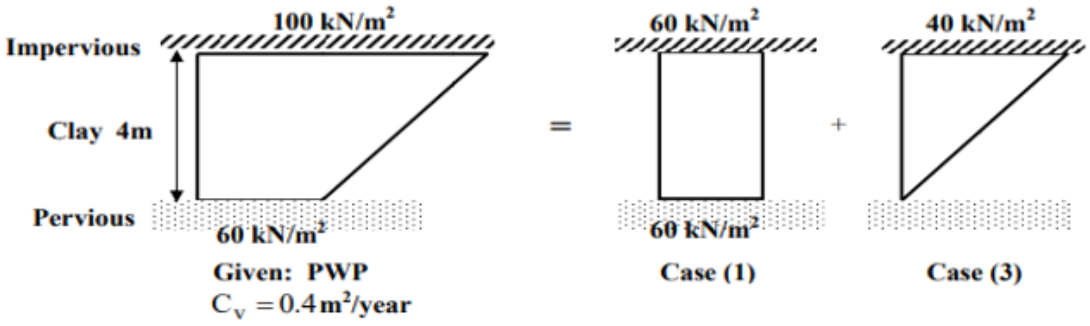
S= 0.8011 * log 2.067

S= 0.8011 *0.315 = 0.252 m =252mm

Q2/

(degree of consolidation)

For pore water pressure distribution across a clay soil layer shown below, find the average degree of consolidation after (15) years.



$C_v = 0.4\,m^2/year$

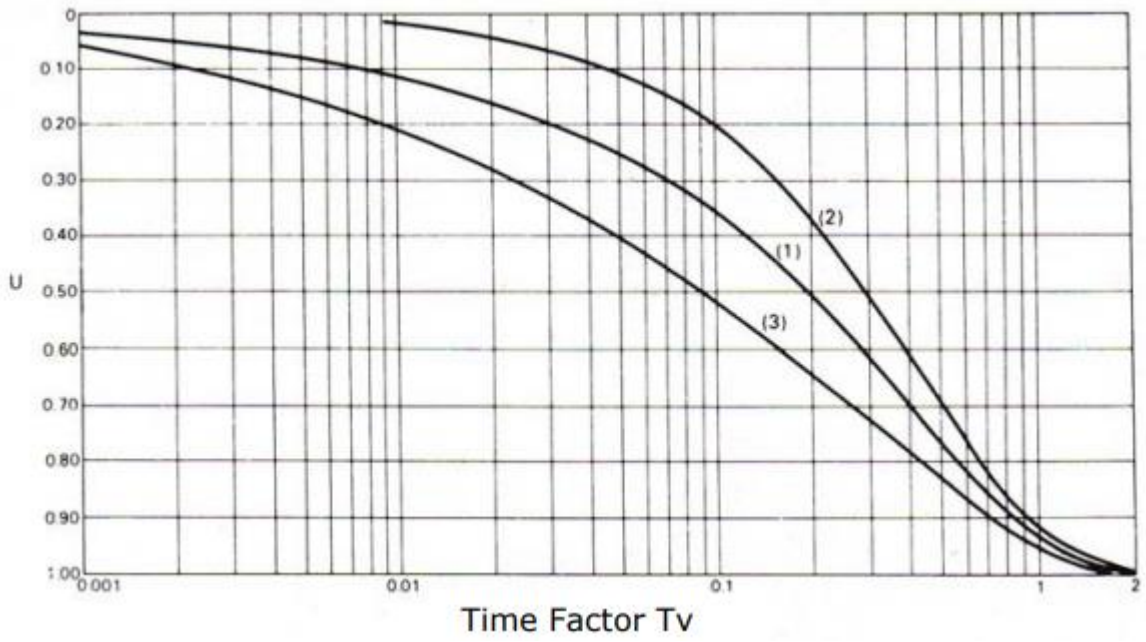
Solution:

$$T_v = \frac{C_v.t}{(H_d)^2} = \frac{(0.4)(15)}{(4)^2} = 0.375$$

From **Fig.(5.8)** for $T_v = 0.375$; $U_1 = 65\%$ **(curve 1)** and

for $T_v = 0.375$; $U_2 = 75\%$ **(curve 3)**

$$U_{avg.} = \frac{U_1.A_1 + U_2.A_2}{\sum A} = \frac{0.65(4)(60) + 0.75(4)(40)/2}{(\frac{100+60}{2})(4)} = 0.675 = 67.5\%$$



Practical part /

Q3/ / The results of a constant-head permeability test for a sands ample. diameter of sample . 150 mm and a length of 300 mm follows: (50 marks)

Constant head difference : 500 mm

Time of collection of water : 5 min

Volume of water collected : 350c cm^3

Temperature of water - 24"C

Find the permeability of the soil at 20"C.

Table 1: Variation of $\frac{\eta_T}{\eta_{20}}$

Temperature ,T(°C)	$\frac{\eta_T}{\eta_{20}}$	Temperature ,T(°C)	$\frac{\eta_T}{\eta_{20}}$
15	1.135	23	0.931
16	1.106	24	0.910
17	1.077	25	0.889
18	1.051	26	0.869
19	1.025	27	0.850
20	1.000	28	0.832
21	0.976	29	0.814
22	0.953	30	0.797