(Module Name) Course Catalogue

2022-2023

College	**Erbil Technology Institute**	
Department	**Department of Building and Construction**	
Module Name	Geotechnical Engineering	
Module Code	**SOF205**	
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)		
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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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- 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
Soil define and soil formation	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
Soil Consistency, Atterberg Limits	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. •
soil classification and soil Grain size distribution .	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.
soil permeability	4th week	A material is permeable if it contains continuous voids. All materials such as rocks, concrete, soils etc. are permeable.
Compaction of soil:	5th week	Increasing the shear strength , Decreasing the compressibility , Decreasing the coefficient of permeability , Increasing bearing capacity of foundation .
soil stresses , total and effective stress	6th week	The principle of effective stress • Response of effective stress to a change in total stress and
Principal Stresses and mohr's Circle	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.

Principal Stresses: .		
Consolidation	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
Bearing capacity	10th week	Foundation design • Ultimate bearing capacity
building Foundation Types of Foundation and their Uses	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	
Water content test	2nd week	Is one of the easiest properties of a soil to obtain, it is also one of the most useful.
Organic content test	3rd week	This test is to determine the ash (ash wood , ash tree ….) content of organic materials.
Specific gravity test	4th week	To determine the specific gravity of soil solids using pycnometer .
sieve analysis	5th week	To determine particle size distribution of soil sample

		using sieve analysis.
Hydrometer test	6th week	To determine grain size distribution of soil, which contains appreciable quantity of soil passing ASTM 200 sieve (0.075 mm).
Liquid limt and plastic limit 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
Constant head permeability test	8th week	Objective To determine the Coefficient of Permeability (k) of coarse sand by constant head method. Equipment
Falling head permeability test	9th week	To determine the Coefficient of Permeability (k) of fine soil by filling head method.
Standared compaction 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.
Modified compaction 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
Core cutter	12th week	Determination of Field Density Test of Soil by Core Cutter Method.

- Examinations (question design):

Q1/ classify the following Soil sample according to unified classification system .

Sieve size (mm): 25 19 12.5 4.75 2 0.42 0.075

% passing: 100 90 70 60 30 11 6

L.L=33%, P.L=45% and D10 = 0.42 mm , D30= 2mm & D60= 4.75mm

Sol :

1- Check passing of sieve No. 200 (0.075 mm) =6<50

˝ the soil is Coarse ----------Gravel

---------- Sand

2- %G=100 - %Passing No. 4

%G=100 – 60= 40%

%S=%Passing No. 4 - %Passing No. 200

%S=60 – 6= 54%

The coarse soil is S

3- Checking passing No. 200 = 6% (5 - 12%)

Case C

4-Compute $\mathbf{C_u} = D_{60} / D_{10}$; $\mathbf{C_c} = (D_{30})^2 / (D_{10} * D_{60})$

$\mathbf{C_c} = (D_{30})^2 / (D_{10} * D_{60}) = 2^2/(0.42*4.75)=2.01$ O.K $1<C_c<3$

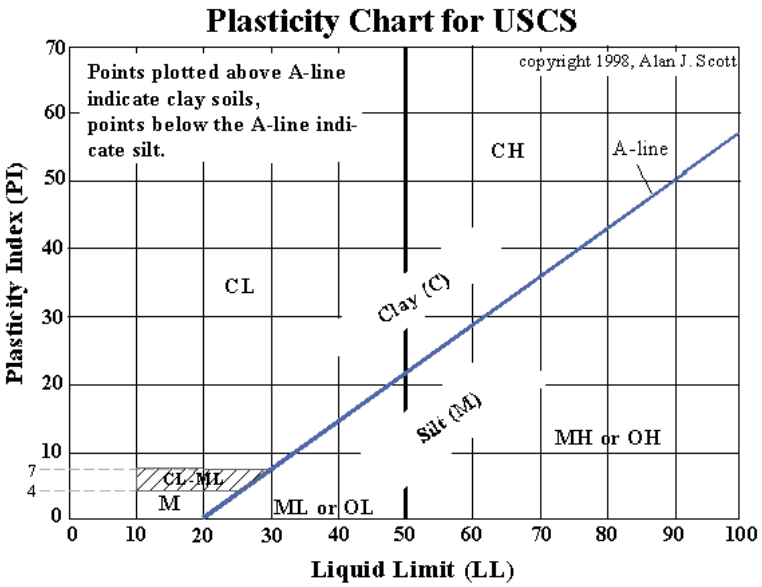
$C_u = D_{60} / D_{10} = 4.75/0.42 = 11.3 > 6$

O.K

The coarse soil is well graded

5-Compute P.I

P.I=L.L-P.L=45-33=12%



From the plasticity chart the fine soil is ML

The soil is SW – SM

Q2/ For the following soil profile shown

a/ Determine Effective ,total and neutral stresses at point A.

b/ Determine the total settlement of sandy silt layers if Δσ =85 kn/m2 , Cc = 0.27 and ei of sandy clay = 0.95.

Answer

σ´ = (ɣ sat *h1) + (ɣ sat *h2) + (ɣ sat *h3) + (ɣ sat *h4)

σ´ = (9*2) + (9.5*3.5) +(10.5*4) +(15*5.5)+(17*6) =18+ 33.25+42+82.5+102

σ´ = 277.75 kn / m3

water pressure (U) = ɣ(w *h4)

(U) = 10* (6)

(U) = 60 kn / m3

σt = σ´ - U

σt = 277.75 – 60

σt = 217.75 kn / m^3

B/

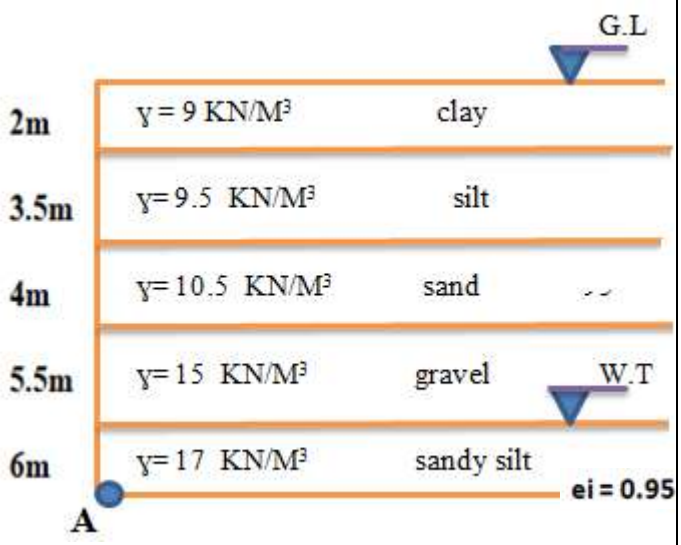
S= (Cc *h / 1+ei) * log (σ´i + Δ σ / Δ σ´i)

S = 0.27 * 6 / 1+ 0.95) log (217.75 + 85/ 217.75)

S= 1.62 / 1.95) log 1.39

S= 0.8307 * log 1.39

S= 0.118 M = 118 mm



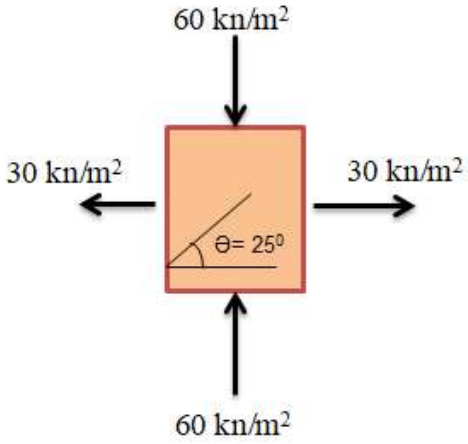
Q3/ For the following element , determine the normal and shear stresses with angle Ə= 250 by equation method .

$$\sigma_\theta = \frac{\sigma_1 + \sigma_3}{2} + \frac{\sigma_1 - \sigma_3}{2} \cos 2\theta$$

σ_θ = (-60 + 30 /2) + (- 60 - 30/2) cos (2*25) = -15 -45 COS 2*25

= -15 - 28.92

σ_θ = -43.92 kn/m^2 (compretion)



$$\tau = \frac{(\sigma_1 - \sigma_3)}{2} \sin 2\theta$$

τ = (- 60- 30/2) sin (2*25)

τ = - 34.47 kn/m2 (anticlock wise)

- Extra notes:

30Mark