Menoufia University
Faculty of Engineering
Shebin El-Kom
First Semester Examination
Academic Year: 2015-2016
Department: Civil Eng.

Year: 2nd Civil
Subject: Soil Mechanics
Code: CVE 213
Time allowed 3 hours
Date: 13/01/2016
Max. Degree: 90

Marks

Question (1): [25]

a) A core cutter of 100 mm internal diameter and 128 mm height was used to determine the unit weight of soil at a site. The total weight of core cutter and soil was 3015 g and empty weight of core cutter was 1374 g. A representative sample of soil was kept in a steel cup of weight 60 g for the determination of water content. Weights of cup and soil before and after placing in oven were respectively 106.4 g and 92 g. Find dry unit weight of soil and degree of saturation if $G_s = 2.7$. If the obtained laboratory dry density equals 11.25 kN/m^3, is this soil suitable as fill under SOG. [9] [10]

b) Classify soil (1) using USCS only and soil (2) using AASHTO classification system.

Sieve No.		4	10	30	40	60	100	200
Percentage Finer	Soil (1)	100	100	98	93	88	83	77
	Soil (2)	92	75	60	55	35	20	8
Soil (1)	Soil is inorganic, LL= 63, PL= 38							
Soil (2)	Soil is inorganic, LL= 0, PL= 0							

[6]

c) Answer the following:

1- Classify the soil with relation to their formation and explain the factors that effect on its formation.

2- Define soil profile and give a typical one showing its component.

3- Show the general types of soil and what is meant by loess soil?

Question (2): [14]

a) Answer the following: [5]

1- Outline the rules governing the construction of a flow net in a hydraulically isotropic soil and give an example of studied one.

2- Show schematically the different types of soil structures as per soil type.

3- Define clay minerals and show different usages of them.

b) The results of a standard Proctor test are given in the following table. Determine the maximum dry density (kg/m^3) of compaction and the optimum moisture content. If Gs = 2.65, calculate the specific volume and the saturation ratio at the maximum dry density. [9]

w (%)	10.45	12.5	15.1	17.65	19.7
γ_d (kg/m^3)	1566	1733	1755	1640	1554

Question (3): [24]

a) Describe by means of an annotated diagram the principal features of a falling head permeameter. Give two reasons why this laboratory test might not lead [6]

[illegible] of the effective permeability of a large volume of

b) An office block with an adjacent underground car park is to be built at a site where a. 6m-thick layer of saturated clay (γ = 20 kN/m^3) is overlain by 4m of sands and gravels (γ =18 kN/m^3). The water table is at the top of the clay layer, and pore water pressures are hydrostatic below this depth. The foundation for the office block will exert a uniform surcharge of 90 kPa at the surface of the sands and gravels. The foundation for the car park will exert a surcharge of 40 kPa at the surface of the clay, following removal by excavation of the sands and gravels. Calculate the initial and final vertical total stress, pore water pressure and vertical effective stress, at the mid-depth of the clay layer, (a) beneath the office block, and (b) beneath the car park. Take the unit weight of water as 9.81kN/m^3. [7]

c) A well pumping test was carried out to determine the bulk permeability of an unconfined aquifer. Two observation wells were executed at 3.0 and 6.0 m from the center of test well. After a period of pumping when steady-state conditions had been reached, the following observations were made. Pumped flowrate q = 38.33 liters/second, depth of water table = 16.0 m, drawdown at outer observation well = 0.5 m, drawdown at inner observation well = 1.5 m. Determine the bulk permeability of the aquifer. If specific surface area (s) equals to 20 mm^2/mm^3 for a sample taken from the same soil, voids ratio (e) = 0.5 and shape factor (f) = 1.1, calculate (k) using Kozeny formula. Comment on the obtained results from both methods. [11]

Question (4): [15]

a) Answer the following: [4]

1- Show how compaction can effect on the characteristics of soil.

2- What are the different forms of soil water?

b) Point (A) is located at the periphery of circular flexible area with radius of 4 m is uniformly loaded with q= 300 kN/m^2. Determine the vertical stress increase at point A, at a depth of Z= 4 m by means of Newmark's chart. [6]

c) Refer to Figure (1). Determine the vertical stress increase, (σ_z) at point A with the following values: q_1 = 300 kN/m, q_2 = 75 kN/m, z = 3 m, X_1= 4m, X_2= 3m. [5]

Question (5): [12]

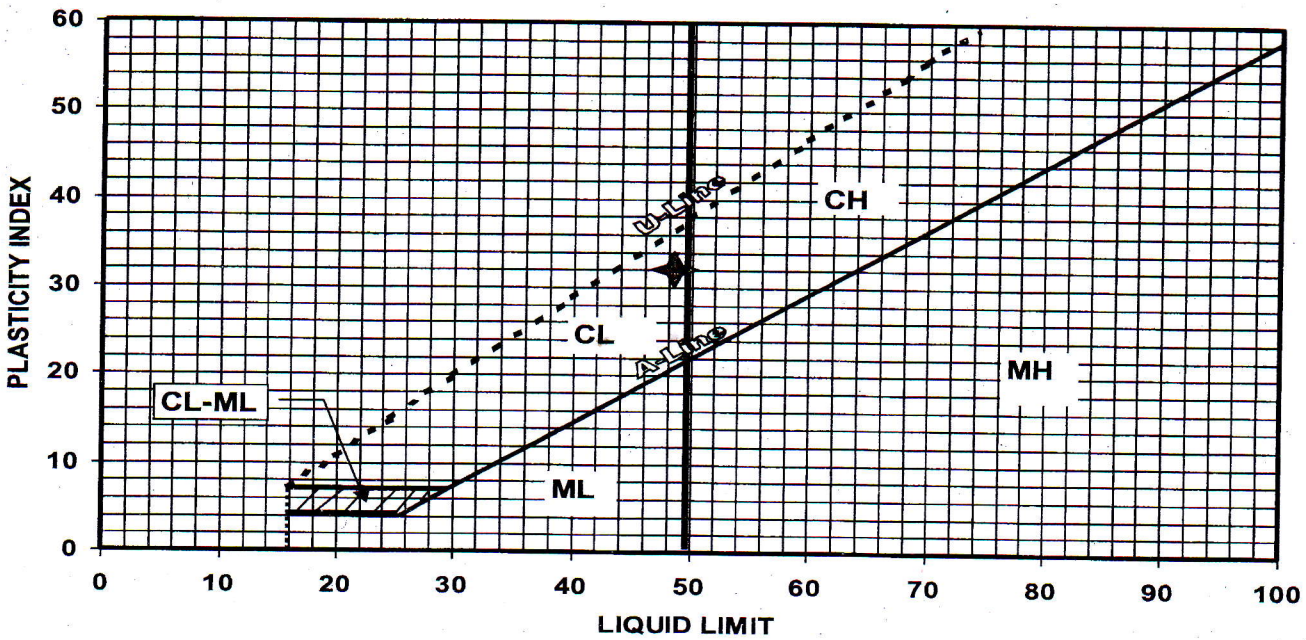
a) Answer the following : (4)

1- Explain different factors affecting on soil contact pressure.

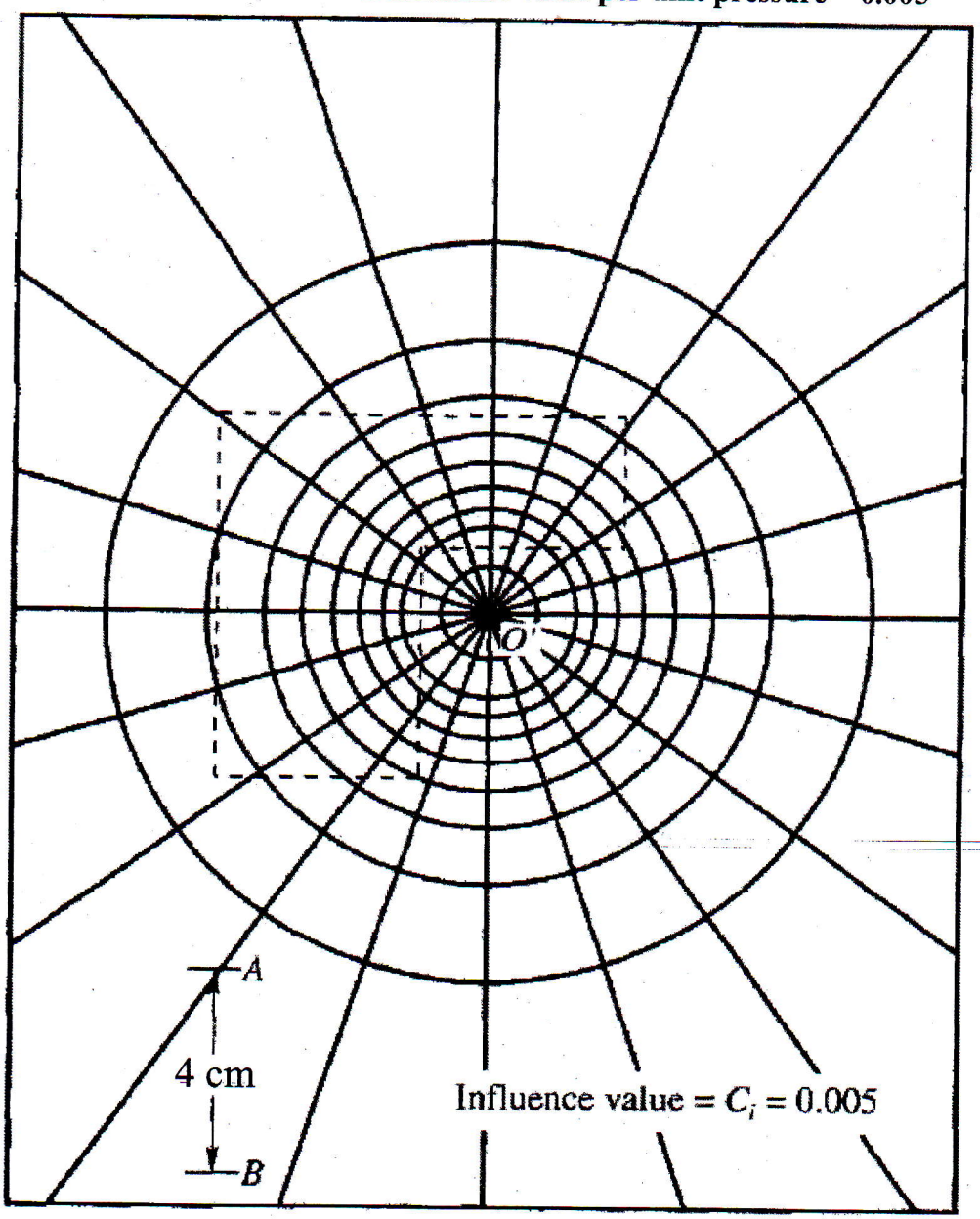
2- List the used methods for measuring soil shear strength parameters and give Coulomb's shear strength equation for different soil types.

b) Figure (2) below illustrates a weir which seepage flow occurs. A flow net is drawn as shown. Calculate the water pressure at point A and determine the seepage quantity if K = 2×10^{-2} m/sec. Also, check F.O.S. against boiling. (8)

Unified Soil Classification System Plasticity Chart



Newmark's Chart. Influence value per unit pressure = 0.005



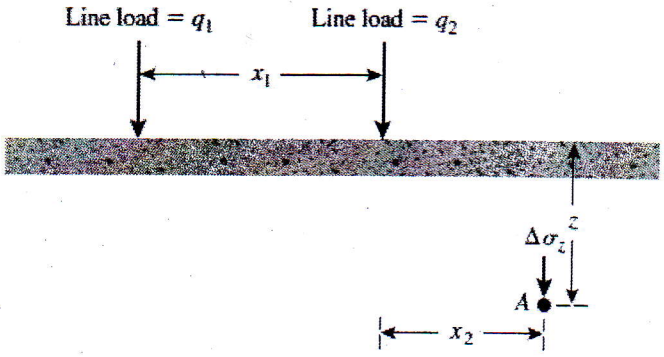


Figure (1)

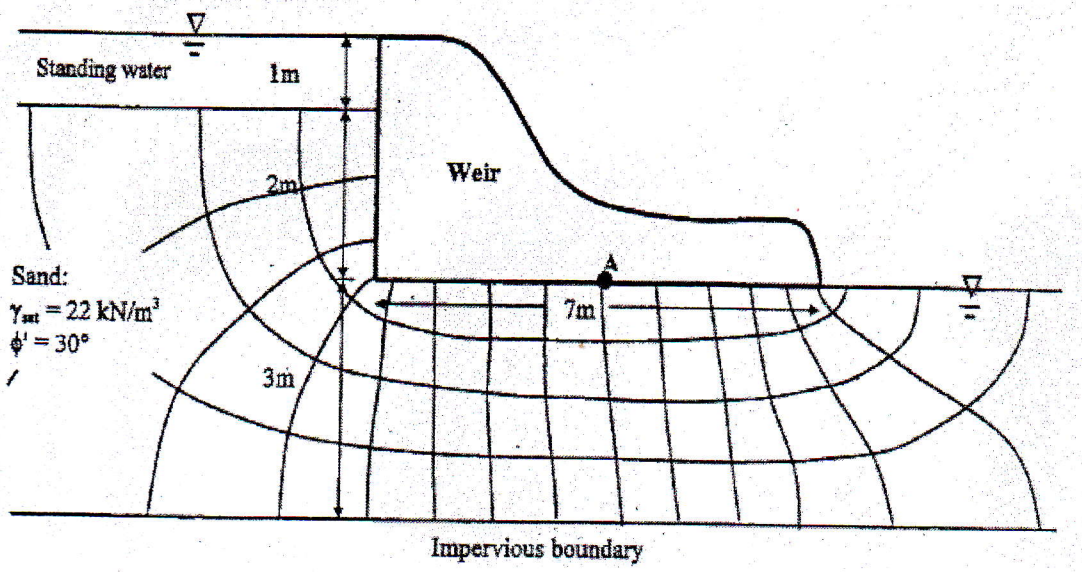


Figure (2)

AASHTO Classification

General Classification	Granular Materials (35% or less passing No. 200 sieve)							Silt-Clay Materials (More than 35% passing No. 200 sieve)			
Group Classification	A-1		A-3	A-2				A-4	A-5	A-6	A-7
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5 A-7-6
Sieve Analysis, Percent passing:											
No. 10 (2.00 mm)	50 max.	....	....	....	....	....	....	....	....	....	....
No. 40 (0.425 mm)	30 max.	50 max.	51 min.	....	....	....	....	....	....	....	....
No. 200 (0.075 mm)	15 max.	25 max.	10 max.	35 max.	35 max.	35 max.	35 max.	36 min.	36 min.	36 min.	36 min.
Characteristics of Fraction Passing No. 40 (0.425 mm)											
Liquid limit	....		....	40 max.	41 min.	40 max.	41 min.	40 max.	41 min.	40 max.	41 min.
Plasticity index	6 max.		N.P.	10 max.	10 max.	11 min.	11 min.	10 max.	10 max.	11 min.	11 min.
Usual Types of Significant Constituent Materials	Stone Fragments, Gravel and Sand		Fine Sand	Silty or Clayey Gravel and Sand				Silty Soils		Clayey Soils	