

Minufiya University Faculty of Engineering Final Exam Academic Year: 2017-2018 Department: Architectural Eng.



Year: 2<sup>nd</sup> Arch. Subject: Soil Mechanics & Foundations Code: CVE 227 Time allowed: 3 hours Date: 21/5/2018 Max. Degree: 60

Marks

(10)

(3)

(6)

# Question (1):

- a) Define the following: degree of saturation, water content, and void ratio.
- b) The natural dry unit weight of a soil deposit was found to be 1.75 t/m<sup>3</sup>. A sample of the (4) soil was brought to the laboratory and the minimum and maximum dry unit weights were found as 1.60 t/m<sup>3</sup> and 1.90 t/m<sup>3</sup> respectively. The specific gravity of the soil grains is 2.72. Calculate the relative density for the soil deposit.
- c) Write a short note about organic soil. Using laboratory testing, explain how to (3) determine whether a soil sample is MH or OH.

## Question (2):

- a) Explain in detail the procedure for determination of grain size distribution of a coarse soil by sieve analysis.
- b) The following index properties were determined for two soils A and B:

Property	Soil (A)	Soil (B)	
Liquid limit	65%	40 %	
Plastic limit	35 %	25 %	
Water content	38 %	28 %	
Degree of saturation	100 %	100 %	
Specific gravity of solids	2.72	2.67	

Which of these soils:

a- has a greater plasticity index;c- has a greater saturated unit weight;

b- has a greater void ratio;d- has a greater dry unit weight?

Give reasons for your answers.

c) Draw the plasticity chart, and then classify soils (A) and (B), described in question (5) (2-b), using the plasticity chart. Equation of A-line  $[I_p = 0.73(L.L - 20)]$ , equation of U-line  $[I_p = 0.90(L.L - 8)]$ .

Question (3):	(15)
<ul> <li>a) Explain using sketches the following terms:</li> <li>Effective stress.</li> <li>Pore water pressure.</li> <li>Pressure bulb.</li> </ul>	(5)
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- b) A sand layer 8.0 m thick overlies a layer of soft clay. The ground water table is located (5) at a depth 2.0 m below the ground surface. The degree of saturation of sand above the ground water table is 40%, the void ratio of sand is 0.65 and G<sub>s</sub> is given \_\_\_\_\_\_\_\_ as 2.68. Compute the total vertical pressure at the top of soft clay layer.
- c) A vertical concentrated load of 100 ton acts on the surface of a homogeneous soil mass. (5) Use Boussinesq's equation to compute the total increase in vertical stress directly under the load at a depth of 3m, 6m, 9m, 12m, and 15m; draw the vertical stress distribution along the line of action of the concentrated load.

## Question (4):

- a) State Coulomb's law of shear strength and describe its terms. Draw the shear strength failure envelope for different types of soils.
- b) The following results were obtained at failure from direct shear tests on samples of soil: (5)

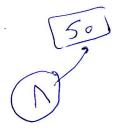
Normal load (kg)	36	54	72
Shear force (kg)	90	108	126

- Find the shear strength parameters.
- For a normal stress of 2.50 kg/cm<sup>2</sup>, what shear force would be required to cause failure?

### Question (5):

- a) Discuss using sketches the effect of ground water table on the bearing capacity of <sup>(4)</sup> shallow foundations.
- b) A square footing of width 2.0 m carries a load of 51.0 ton. The supporting soil having (6) the following properties: C= 0.20 t/m<sup>2</sup>,  $\phi = 20^{\circ}$  and  $\gamma_{\text{bulk}} = 1.80$  t/m<sup>3</sup>. Find the depth at which the footing is to be located such that a factor of safety of 3.0 is assumed. For  $\phi = 20^{\circ} \left[ N_c = 17.7, N_q = 7.4, N_{\gamma} = 5.0 \right]$

### With my best wishes, Dr.Ahmed Abdel-Galil



(10)

(5)

(10)