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

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

Question (1): — Marks (10)

a) Define the following: degree of saturation, water content, and void ratio. (3)

b) The natural dry unit weight of a soil deposit was found to be 1.75 t/m^3. A sample of the soil was brought to the laboratory and the minimum and maximum dry unit weights were found as 1.60 t/m^3 and 1.90 t/m^3 respectively. The specific gravity of the soil grains is 2.72. Calculate the relative density for the soil deposit. (4)

c) Write a short note about organic soil. Using laboratory testing, explain how to determine whether a soil sample is MH or OH. (3)

Question (2): — (15)

a) Explain in detail the procedure for determination of grain size distribution of a coarse soil by sieve analysis. (4)

b) The following index properties were determined for two soils A and B: (6)

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; **b-** has a greater void ratio;
c- has a greater saturated unit weight; **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 (2-b), using the plasticity chart. Equation of A-line $[I_P = 0.73(L.L - 20)]$, equation of U-line $[I_P = 0.90(L.L - 8)]$. (5)

Question (3): — (15)

a) Explain using sketches the following terms: (5)

- Effective stress.
- Pore water pressure.
- Pressure bulb.

b) A sand layer 8.0 m thick overlies a layer of soft clay. The ground water table is located 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_s is given as 2.68. Compute the total vertical pressure at the top of soft clay layer. (5)

c) A vertical concentrated load of 100 ton acts on the surface of a homogeneous soil mass. 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. (5)

Question (4): **(10)**

a) State Coulomb's law of shear strength and describe its terms. Draw the shear strength failure envelope for different types of soils. (5)

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^2, what shear force would be required to cause failure?

Question (5): **(10)**

a) Discuss using sketches the effect of ground water table on the bearing capacity of shallow foundations. (4)

b) A square footing of width 2.0 m carries a load of 51.0 ton. The supporting soil having the following properties: C= 0.20 t/m^2, ϕ=20° and γ_{bulk}=1.80 t/m^3. Find the depth at which the footing is to be located such that a factor of safety of 3.0 is assumed. (6)
For $\phi=20^o$ $\left[N_c=17.7, N_q=7.4, N_\gamma=5.0\right]$

With my best wishes,
Dr.Ahmed Abdel-Galil