Minufiya University
Faculty of Engineering
Final Exam
Academic Year: 2014-2015
Department: Architectural Eng.

Year: 2nd Arch.
Subject: Soil Mechanics & Foundations
Code: CVE 227
Time allowed: 3 hours
Date: 24/5/2015
Max. Degree: 60

Question (1): **Marks (12)**

a) Make a comparison between sand and clay. (4)

b) State whether the following statements are true or false and correct the false statements: (4)

1) The Water content of a soil can not be greater than 100%.
2) Larger voids ratios correspond to larger dry unit weights.
3) The porosity of a soil can be greater than unity.
4) The shear strength of cohesive soil increases if normal stress increases.

c) The minimum and maximum dry unit weights of sand are 1.47 t/m^3 and 1.67 t/m^3 respectively. The specific gravity of the soil grains is 2.7. Calculate the dry unit weight corresponding to a relative density of 0.50. (4)

Question (2): **(12)**

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

b) Draw a sketch of the plasticity chart and discuss the importance of A-line and U- line. (4)

c) The grain size distribution curve of a sample of sand is described as: (4)

$$\rho = \left(\sqrt{\frac{D}{D_{max}}} \right) \times 100$$

Where ρ = percentage passing, D= grain size and D_{max}= maximum grain size within the soil.

- Classify the soil according to the Unified Soil Classification system.

Question (3): **(12)**

a) At what depth would the vertical effective stress in a deep deposit of sand be 10 t/m^2, if the void ratio is 0.65, the specific gravity of the solids is 2.68, ground water is located at a depth 2.0 m below the ground surface, and the degree of saturation of sand above the ground water table is 50%? (4)

b) Two railway wagon lines in a harbour yard are located at 6.0 m centre – to – centre. The loads per meter run in the lines are 10 t/m and 8 t/m. Compute the increase in vertical stress at a depth of 2.0 m and (4)
(i) directly under each load, and (ii) at midway between the two loads.

c) Explain using sketches the approximate method for estimating vertical stress. (4)

Question (4):

(12)

a) Draw a neat sketch for the direct shear test. (4)

b) Discuss the disadvantages of the direct shear test. (4)

c) The soil at a site is formed of sand. The ground water table is located at a depth of 3.0 m below the ground surface. The angle of internal friction of sand is 30°. The void ratio is 0.50, the specific gravity of the solids is 2.70, and the degree of saturation of sand above the ground water table is 50%. Determine the shear strength due to the effective stress on a horizontal plane at depth 2.5 m below the ground surface. If the ground water table rises to the ground surface, find the shear strength due to the effective stress at the same depth. (4)

Question (5):

(12)

a) Using Terzaghi bearing capacity equation, discuss the effect of footing width (B) on the bearing capacity of shallow foundations in case of: (4)

(1) Cohesive soil (2) Cohesionless soil

b) Write Terzaghi bearing capacity equation for square, circular, and strip footings. (3)

c) Compute the ultimate bearing capacity of a rectangular footing of width 1.5 m, located at a depth of 1.0 m below ground surface in a sandy soil having $\phi = 30°$ and $\gamma_{bulk} = 1.85$ t/m^3. The water table is at 5.0 m below the ground surface. If the water table rises to the ground surface, by what percentage is the ultimate bearing capacity of the foundation reduced? Assume the saturated unit weight of sand = 2.08 t/m^3. *For* $\phi = 30^o$ $\left[N_C = 37.2, N_q = 22.5, N_\gamma = 19.7\right]$ (5)

With my best wishes,
Dr.Ahmed Abdel-Galil