

Try all questions; Any missing data to be reasonably assumed; Time allowed 3 hrs; Total Mark (45).

Question (1): 9 (2 + 2 + 5)

- 1.1. Define the relative density of sand.
- 1.2. How to describe the state of sand using the relative density.
- 1.3. Use the relation of the relative density to complete the following table and describe the soil.

Soil	e_{max}	e_{min}	e	D_r	Description
A	0.91	0.30	0.6	0.71 0.8	Very loose
B	0.86	0.41			
C	0.94		0.56		
D	0.9	0.45			

Question (2): 9 (3 + 6)

- 2.1. Using clear sketch, show how to find out the in-situ density in case of cohesive soil.
- 2.2. In a field density test, a core cutter weighing 970 gm is driven into the ground. The weight of the cutter filled with soil is 2890gm. considering that the cutter is 10cm diameter & 13 cm height, find the in-situ bulk density. If the natural water content is found to be 23%, find the in-situ dry density.

Question (3): 9

- 3.1. A multistory building was founded on a raft foundation of dimensions 12 X 16m² as shown in figure (1.a). The Oedometer test was carried out on a sample of the clay layer. The results obtained were as shown in figure (1.b). Find the expected settlement for the structure due to consolidation of the clay layer.

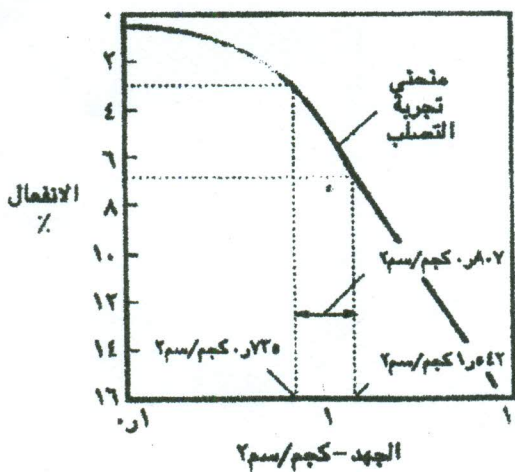


Figure (1.b)

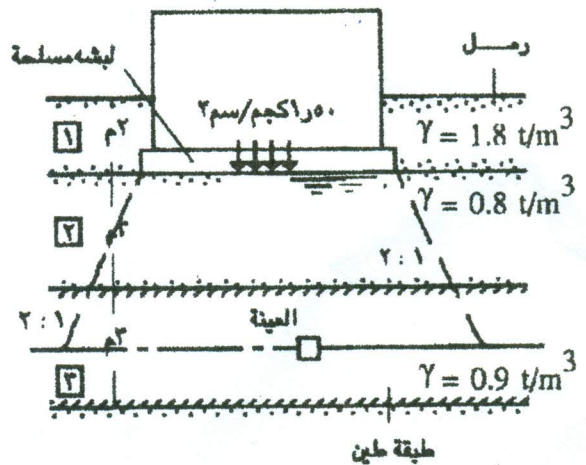


Figure (1.a)

Question (4): **9 (3 + 6)**

- 4.1. What is the main function of smells?. What are the different factors to be considered in the design?. Using clear sketches show the different smell's locations. What is your comment on these different locations?.
- 4.2. Using clear sketches show the different types of shallow foundations.

Question (5): **9 (2 + 4 + 3)**

- 5.1. Differentiate between Pile load test and Pile integrity testing. Using clear sketch show how a pile load test can be performed in a construction site.
- 5.2. A bored pile, 750mm diameter and 12.0m long, is to be installed on a site where two layers of clay exist:
- Upper firm clay; 8.0m thick; undrained shear strength = 50.0 kN/m².
 - Lower stiff clay; 12.0m thick; undrained shear strength = 120.0kN/m².
- Determine the working load the pile could support assuming the following:
- $\alpha = 0.7$ for firm clay and 0.5 for stiff clay ; $N_c = 9$
 - Factors of safety of 1.5 and 3.0 are applied to the shaft load and base load respectively
 - The top 1.0m of the firm clay is ignored due to clay/concrete shrinkage.
- 5.3. For the ground conditions and assumptions described above, determine the length of pile required to support a working load of 1200 kN.

Best of LuckProf. Dr. Mohamed A. Sakr.

