Kafrelsheikh University
Faculty of Engineering
Department of Civil Engineering
2nd year, Soil Mechanics
Name: .....

Date: 22- 5 - 2017
Time allowed: (3) hours
Full Mark: 75
Final Exam: 2 pages

Answer all questions; Any missing data to be reasonably assumed.

Question (1): (25 Mark)

a) **Define** : **(i)** Alluvial soils, **(ii)** Aeoline soils, **(iii)** Marine soils, **(iv)** Residual soils, **(v)** Transported soils, **(vi)** Soil, **(vii)** Soil mechanics, **(ix)** Total Stress, **(x)** Pore water pressure, **(xi)** Organic soils; **(xii)** Peat; **(xiii)** Specific yield; **(xiv)** Specific retention, **(xv)** Active depth, **(xvi)** Active zone, **(xvii)** Isobar, **(xviii)** Consistency limits , **(xix)**, Over consolidated soil, **(xx)** Under consolidated soil

b) The wet densities (ρ) and degrees of saturation (S) of a soil are given in the following table. It is required to **determine** void ratio (e) and specific gravity (Gs).

ρ (kg/m^3)	1590	1694	1806
S (%)	30	50	75

c) Soil 1 with a cross-sectional area of 0.01 m^2 is set up in the permeameter in which the specimen is supported by a mesh at the bottom. A constant-head difference across the specimen is maintained as shown in Figure 1. After a constant flow rate is established, the flow rate reaches 2.4×10^{-5}m^3/min. **Determine** the hydraulic conductivity (coefficient of permeability) of Soil 1. Assume that the specimen is fully saturated with water once the constant flow rate is established.

d) **Calculate** the flow rate when Soil 1 is overlain by Soil 2 with a thickness of 0.1 m and a hydraulic conductivity of 1.0×10^{-5} m/s as shown in Figure 2. Assume that Soils 1 and 2 are fully saturated with water, and a constant flow rate is established. **Determine** the hydraulic gradient and the seepage force for soil 1 and soil 2.

Question (2): (25 Mark)

a) **State three** limitations at least for the direct shear test.

b) The stresses at failure on the failure plane in a cohesionless soil mass were: Shear stress = 4 kN/m^2; normal stress = 10 kN/m^2. **Determine** the resultant stress on the failure plane, the angle of internal friction of the soil and the angle of inclination of the failure plane to the major principal plane.

c) **Calculate** the total vertical stress; effective vertical stress and the pore water pressure at points A, B, C and D due to the weight of soil shown in Fig. 3.

d) **Construct** a Newmark chart consists of 10 circles and 16 sectors (take z = 4.0 cm)

e) The plan of a foundation is shown in Fig. 4. The uniform pressure on the soil is 80 kN/m^2. **Determine** the vertical stress increment due to the foundation at a depth of 5 m below the point A.

Question (3): (25 Mark)

a) **What** is the fundamental difference between primary consolidation and secondary consolidation?

b) **Write down** Terzaghi's 1-D consolidation equation. State at least five assumptions employed in deriving this equation.

c) The result of a laboratory consolidation test on a soil sample are given in the following table where the initial water content and specific gravity were equal 70 % and 2.65 respectively:

Applied stress, kN/m^2	30	50	100	200	400	800
Void ratio	1.80	1.76	1.68	1.48	1.16	0.84

- **Plot** an e-log σ curve and e- σ curve
- **It is required to determine** the compression index; coefficient of volume change; the maximum past pressure
- A footing is to be located 2.0 m below ground surface as shown in Figure 3. The base of the footing is 2.0m × 2.0 m, and it carries a total load of 600 kN. **Compute** total expected consolidation settlement for the clay layer?
- **What** is the time for 90% primary consolidation if Cv = 0.0005 m/sec

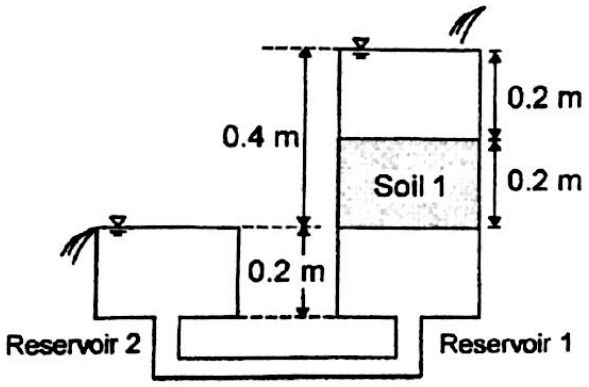

Figure 1

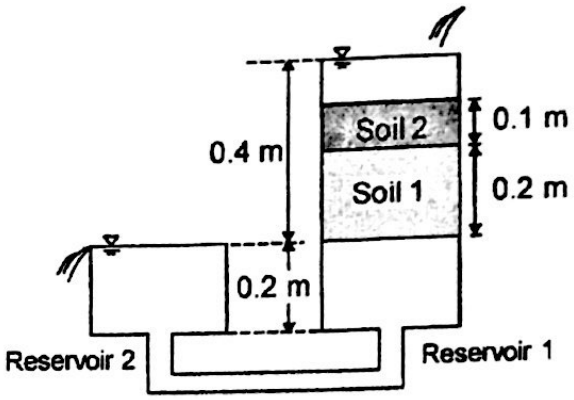

Figure 2

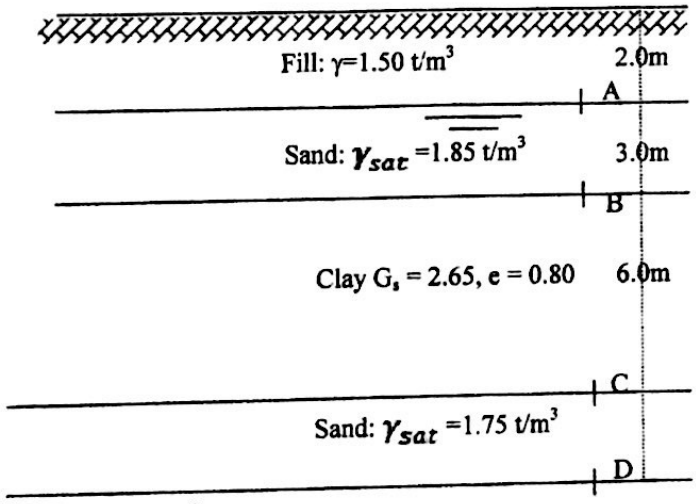

Figure 3

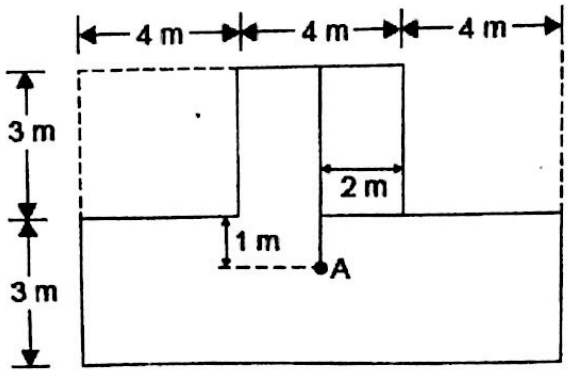

Figure 4

Best wishes **Dr Ali Mohamed Basha**