Mansoura University
Faculty of Engineering
Civil Engineering Dept.

Soil Mechanics & Foundation
B.Sc. Students. 20102/2013
Total Time: 4 Hours

Final Examination

N.B. This examination is OPEN BOOK and the use of lectures notes and textbooks is permitted.
Attempt all questions and assume missing data reasonably.

B) Soil Hydraulics

1- A source with strength $Q=3m^3/s$ and a sink with strength $Q= -3m^3/s$ are located in positions a& b respectively as shown in Figure 1. One side of the land is impermeable and another one is a water body. It is required to:

i. Write the equation for the equipotential lines and streamlines.
ii. Sketch (without calculation) the flow net
iii. Sketch (without calculation) the water pressure distribution on the walls

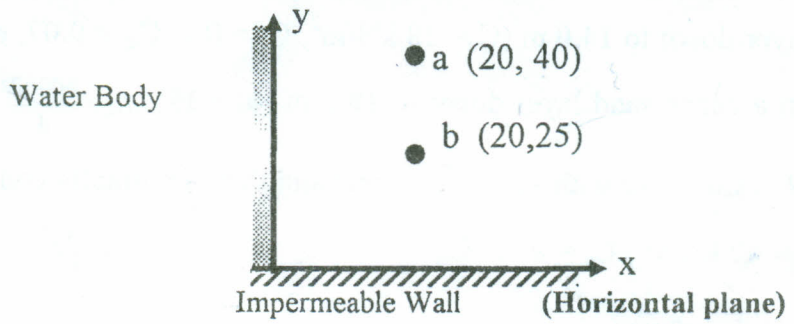

Figure 1

(20 POINTS)

2- Water Flows Downwards From the high tank to the lower tank through the thin tube ABC. Part AB is filled with a soil1 with constant hydraulic conductivity k=1 m/d, while soil in BC has a conductivity k= 1/(1+y) m/d. It is required to calculate the total head, the pressure head and the velocity at point B.

(assume one dimensional flow, constant tube diameter)

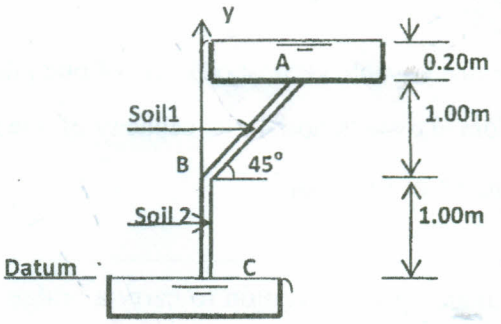

Figure 2

(20 POINTS)

3- The sheet pile shown in Figure three penetrates a thick dry sandy soil layer as shown in Figure 3. Check the stability of the sheet pile and find the force in the supporting strut.
The strut inclines 60° to the horizontal, there is one strut every 4,5m.
Soil properties: c= 0, $\gamma=1.6t/m^3$, $\varphi=32°$

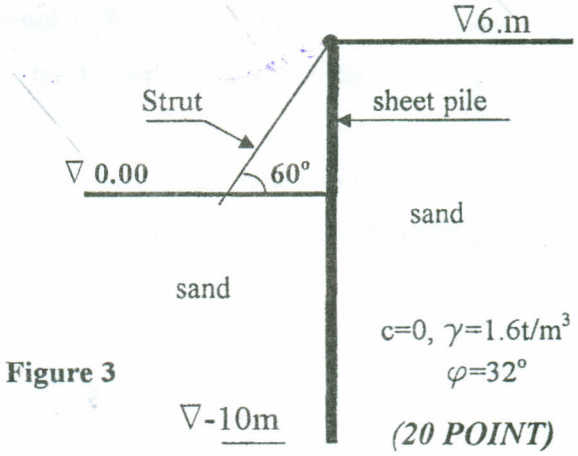

Figure 3

(20 POINT)

Examiner

Prof. Ahmed El Nimr

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Final Examination

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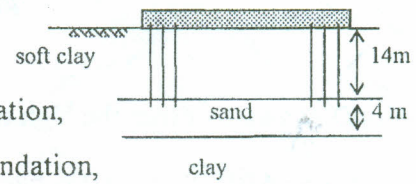
A) Pile Foundation

1- A new Hospital with 12 stories tall is to be constructed, weighs 1500 MN, and the foot print area of the hospital is 75 m by 75 m. The building rests on 10,000 driven concrete piles, 15 m long(below foundation), 0.3 m in diameter, and driven with a spacing of 0.75 m center to center. The pile has the following characteristics: $E_p = 1.9 \times 10^7$ kN/m^2 and yield moment $M_u = 120$ kN.m. The soil is made of a normally consolidated soft clay layer down to 14.0 m (C_u= 18 kN/m^2, $C_c = 0.1$, $C_{cr} = 0.07$, $e_o = 0.45$, $K_h = \frac{3000Z}{d}$ and $\gamma = 20$ kN/m^3), then a dense sand layer down to 18.0 m ($\phi_u = 35°$, $K_h = \frac{6000Z}{d}$, $\gamma = 22$ kN/m^3 and average corrected SPT N' value = 30 with safety hammer) and then a normally consolidated clay down to a depth of 200 m ($C_u = 40$ kN/m^2, $C_c = 0.06$, $C_{cr} = 0.04$, $e_o = 0.40$, $K_h = \frac{4000Z}{d}$ and $\gamma = 19$ kN/m^3). The water table is at the ground surface.



Calculate:

A) the maximum allowable vertical capacity of one pile of the hospital foundation,

B) the maximum allowable horizontal capacity of one pile of the hospital foundation,

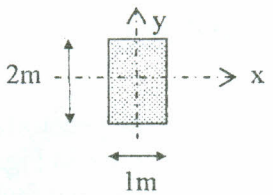
C) the settlement of the hospital. ***(40 point)***

2- Design a suitable pile foundation to carry a bridge column (100 x 200 cm^2) shown in figure for the following data:

Vertical Load P = 16000 kN,

M_x = 6750 kN.m , (**due to vehicle loads**)

M_y = 4500 kN.m **(due to wind loads)**



The used piles are 80 cm in diameter and have a safe allowable bearing capacity of 2600 kN for each pile. The level of the top of pile cap is 2.0 m below the ground surface. Draw a neat sketch showing reinforcement details.

(20 point)

Examiner

Prof. Adel Dif

Please turn over