DELFT UNIVERSITY OF TECHNOLOGY

Faculty of Civil Engineering and Geosciences

Soil Mechanics II

CT2091

BSc EXAMINATION 2012

MOCK EXAM II

DATE: 2012 TIME: 3 hours

Answer ALL Questions
(Note that the questions carry unequal marks)

Other instructions
Write your name and student number on each answer sheet

Clearly identify the answer in the answer box

1) Three cylindrical specimens of a compacted clay, each with an initial pore suction of 25 kPa, have been subjected to undrained triaxial compression with pore pressure measurement. The results are summarised in the table below.

σ_3, kPa	B	A	$(\sigma_1 - \sigma_3)_f$, kPa
100	0.75	0.3	93
200	0.8	0.3	112
300	0.85	0.3	116

a. Deduce the values of pore pressure in each specimen at the start and the end of the shearing stage of the test. [**8 marks**]

b. Determine the principle effective stresses at failure for each test. Use these values to plot Mohr's circle of effective stress for each specimen at failure, and hence deduce the values of the soil's effective shear strength parameters. [**12 marks**]

2) A breakwater is constructed from concrete caissons (each of width = 12m, length = 20m, height = 5m and wall thickness = 0.25m; γ_{conc} = 25kN/m^3), founded on the sea floor. The caissons are then filled with a granular material (γ = 17.5kN/m^3) to provide resistance to lateral movements. A clay base to the habour is anticipated from a desk-based site investigation with soil properties of γ = 17.5kN/m^3, c = 25 kPa and ϕ =0.

   a. Determine the Factor of Safety against bearing failure for the finished pier. [**10 marks**]

   b. What is the Factor of Safety for a single caisson during construction?

   [**7 marks**]

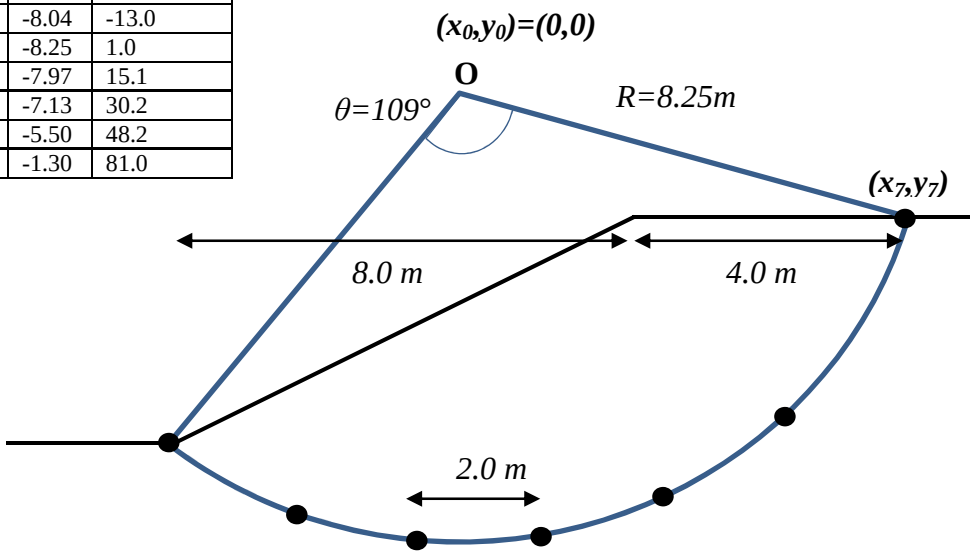
   c. A lateral force of 100 kN per metre is expected due to wave motion. Calculate the Factor of Safety against bearing failure taking this into account. [**8 marks**]

3) A 6m high, 8m long embankment is being constructed for a new road using soil excavated elsewhere along the road route. The soil properties are found to be: γ = 18kN/m^3, c = 30 kPa and ϕ =5°. The most likely failure surface is circular and passes through the embankment toe as shown in the figure below.

   a. Sketch six appropriate slices and the force acting on them. [**5 marks**]

   b. Using an appropriate method, determine the Factor of Safety against overturning. [**20 marks**]

Point	x (m)	y (m)	Angle to vertical (°)
O	0	0	-
1	-3.85	-7.30	-27.8
2	-1.85	-8.04	-13.0
3	0.15	-8.25	1.0
4	2.15	-7.97	15.1
5	4.15	-7.13	30.2
6	6.15	-5.50	48.2
7	8.15	-1.30	81.0



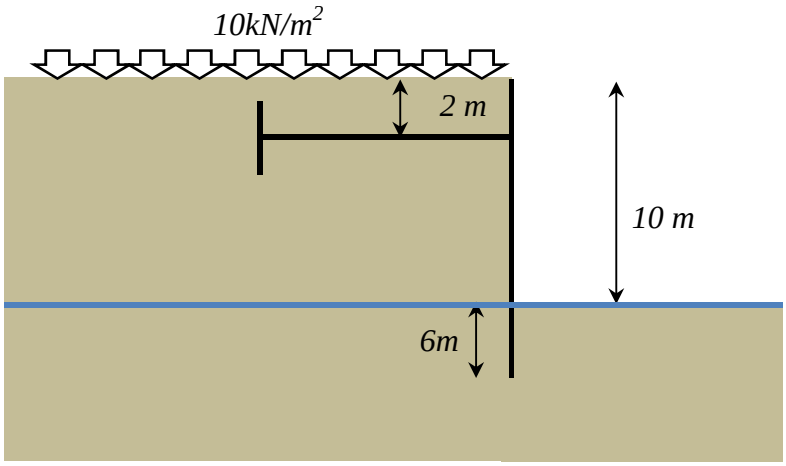
4) A retaining wall is designed to retain soil to a depth of 10m, as shown below. Sheet piles are preferred for the wall to avoid a large concrete wall. A surcharge from a farm track is considered to provide a 10 kN/m^2 load on the retained soil mass and the water table is considered to be at the level of the ground at the lower side throughout. Initially an embedded depth of 6m is considered as 15m sheet piles are easily purchased. The soil properties are found to be: γ = 18kN/m^3, c = 0 kPa and ϕ =35°.

   a. Sketch the forces and the location of the action acting on the sheet pile? [**5 marks**]

   b. Determine the Factor of Safety against rotation at the ground anchor. [**12 marks**]

   c. Determine the minimum force that the anchor is to resist. [**5 marks**]

   d. Determine the minimum length of the tension anchor if the anchor plate acts over the first 3 m of soil. [**8 marks**]



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