Ref. No. : Ex/PG/CE/T/128C/2024

M.E. CIVIL ENGINEERING FIRST YEAR SECOND SEMESTER – 2024
SUBJECT : RETAINING STRUCTURES AND UNDERGROUND CONSTRUCTION (SMFE)
Time : 3 HOURS Full Marks :100
(50 Marks for each Part)
Use Separate Answer scripts for each PART
Assume reasonable values of data not supplied

PART I (50 Marks)

1. A 22m wide and 12m deep braced excavation is to be constructed in connection with underground project at a site with the soil profile given below. Take a surcharge of 4 t/ m^2 on the ground level. Horizontal struts are provided at 2m, 6m and 10m below ground level. Take horizontal spacing of struts 4m c/c.

Stratum I : Soft clay of thickness 17.0m with undrained cohesion Cu = 25kPa, γ_{sat}=17.5kN/m^3, Cc/1+e0 = 0.13.
Stratum II : Stiff over-consolidated clay with undrained cohesion Cu = 75kPa, γ_{sat}=19kN/m^3, Cc/1+e0=0.07 down to 25.0m below ground level.
Stratum III: A deep deposit of sand (below 25.0m) of angle of shearing resistance 34^0 and bulk density 19.5kN/m^3.
GWT is at the ground level.

a. Check the stability of excavation and suggest the depth of braced wall
b. Draw the earth pressure diagram on the braced wall. Show the detail calculations
c. Determine the magnitude of horizontal forces in the struts, design moments and shear forces in the waler beams and diaphragm wall.
d. Draw the expected ground settlement profile behind the wall and deformed shape of the wall.
7+8+8+7=30

2. A 5.5m diameter tunnel with centre 14.0 m below ground level is to be constructed at a site with soil stratification and properties given in Q1 above.
Estimate the magnitude of expected ground loss. How this can be reduced so that the construction may be done with ground loss within tolerable limit?
Draw the expected final ground settlement profile after the completion of tunnelling. 7+8+5 = 20

[Turn over

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M. E. CIVIL ENGINEERING FIRST YEAR SECOND SEMESTER EXAM – 2024

RETAINING STRUCTURES AND UNDERGROUND CONSTRUCTION

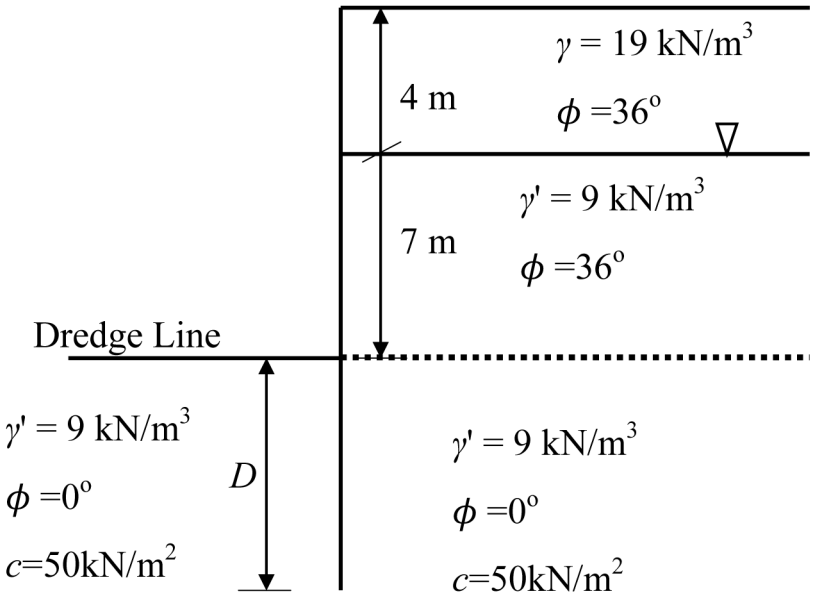
TIME: Three Hours FULL MARKS: 100 (50+50)

PART-II

Answer all the questions

Assume any data if needed, reasonably

1. Explain the methodology to find the embedment depth of a cantilever sheet pile for granular soil.[10]
2. Calculate the embedment depth (D) of the sheet pile shown in the figure. [15]



3. What are the different types of anchored sheet pile? Write the differences between them.[5]
4. Derive the necessary expression to calculate the embedment depth and force in a tie rod. Assume granular soil and any of the types of anchored sheet pile. [10]
5. Explain the process of designing the anchor bulkhead both for continuous and discontinuous case. [10]