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M.Tech.(Geo Technical Engineering/Soil Mechanics & Foundation Engineering) (2013 Batch) (Sem.–2)

STRUCTURAL DESIGN AND FOUNDATION ENGINEERING

Subject Code : CESF-16

Paper ID : [E0981]

Time : 3 Hrs. **Max. Marks : 100**

INSTRUCTION TO CANDIDATES :

1. **Attempt any FIVE questions out of EIGHT questions.**
2. **Each question carries TWENTY marks.**
3. **Assume any data, suitably, if not given.**

1. Consider the foundation of a tower of two legs subjected to the following loadings :

   The left leg loadings at the base :

   Vertical downward thrust (unfactored), $V_1 = -2000$ KN↓

   The right leg loadings at base :

   Vertical downward thrust (unfactored), $V_2 = 2500$ KN↓

   The size of columns 600 mm × 600 mm; the foundation depth from ground level = 2.0 m; the spacing of column is 6.0m.

   Geotechnical data of ground : The top 300 mm of soil is made up of ground underlain by sandy clay of considerable depth.

   Design a combined spread footing for the above mentioned data.

2. A building consists of 12 columns 400 mm × 400 mm sizes arranged in 3 rows of four each. The distance between the column is 5.0 m each. The loads carried by four corner columns is 500 KN each, that carried by exterior column is 550 KN each and that carried by interior column is 900 KN each. The allowable soil pressure is 50KN/m^2. Design the raft foundation.

3. A pile group has to be designed to carry a compressive load of 3000 kN. Total nos. of piles in the group = grouped 3 nos. in each row of 3.

Size of pile = 300 mm^2 pre-stressed pre cost concrete.

The piles are to be driven into clay to a depth of 18.5 m from ground level.

Design pile capacity of single one when acting individually and total capacity. Also design the pile capacity when acting in a group. The geotechnical properties of the ground are given in the following table :

Soil type	Depth below GL (m)	Y_b (KN/m^3)	C_u (KN/m^2)	ϕ^1 (degrees)	δ (degrees)	K_a	K_P	K_o	N	N_q
Made Ground	0.0	18	20	25	16.7	0.36	3.2	0.6	0-4	12
Alluvium	4.0	18	20	25	16.7	0.36	3.2	0.6	4-10	12
Gravel river Terrace deposits	7.0	20	0	35	23.3	0.27	3.7	0.5	10-15	45
London City	9.0	19	55-210	20	14	0.44	2.7	1.0	20-60	8
Woolwich and Reading beds	20.0	20	150	29	19.3	0.35	2.9	0.5	60-80	23

Also given that C_u at 9.0 m = 75 KN/m^2 and C_u at 20 m = 210 KN/m^2.

4. A T-shaped cantilever retaining wall to retain earth embankment 3.5 m high above ground level. The embankment is surcharged at an angle of 18° to the horizontal. The unit weight of earth is 19 KN/m^3 and its angle of repose is 30°. The safe bearing capacity is 110 KN/m^2 at a depth of 1m below the ground. The coefficient between concrete and soil may be taken as 0.5. Use M20 concrete and HYSD steel bars. Proportion the wall and check its stability.

5. The sheet piling wall is to retain 5m of earth above the excavation level. Determine the minimum depth of embedment in soil with a safety factor 1.5 in permanent construction. Design the section of steel sheet piling. The geotechnical soil parameters are as follows :

Y_b = 20 KN/m^3; ϕ' = 30°; δ = 2/3 ϕ' (1/2 ϕ' on active and passive sides)

Coefficient of active earth pressure (K_a) = 0.28 and Coefficient of passive earth pressure (K_p) = 4.6 [Hydrostatic pressure (assumed) = 0]

6. Design the pier and well foundation for a balance cantilever bridge for the following data:

Main Span	= 30 m
Suspended Span	= 15 m
Cantilever Span	= 7.5 m
Loading	= IRC Class A Loading
Footpath load	= 2 KN/m^2
Road width	= 8m
Footpath width	= 1.7m
Maximum design discharge	= 7000 m^3/sec
Average Velocity of Flow	= 1.5 m/sec
Dead load of main span	= 4500 KN
Allowable soil pressure	= 450 KN/m^2 (static case)
Area of Elevation	= 150 m^2
Depth of c.g. of area of elevation below road level	= 1.75 m
Lacey's silt factor	= 1.0
Formation level of bridge	= 480.00 m
Bed level	= 462.50 m
H.F.L.	= 473.50 m
Level of bearing pins	= 475.45 m
Level of bearing below bearing Pins	= 475.20 m
Width of bearing	= 500 mm
Length of Outer edges of bearings	= 4.0 m

7. (a) Show the different components of well foundation with the help of a neat sketch. Explain briefly their functions.

   (b) What is the difference between open caisson and pneumatic caisson?

8. What do you mean by tilt and shift in well foundation? How would you rectify tilt and shift while sinking a well foundation? Discuss with neat sketches.