Roll No. ☐☐☐☐☐☐☐☐☐☐☐   **Total No. of Pages : 02**

Total No. of Questions : 08

M.Tech.(CTM)   (Sem.–2)
FOUNDATION DESIGN AND CONSTRUCTION
Subject Code : CT-505
Paper ID : [E0816]

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

INSTRUCTION TO CANDIDATES :
1. **Attempt any FIVE questions out of EIGHT questions.**
2. **Each question carries TWENTY marks.**

Q.1 a) What are essential requirements of a good foundation? What are the criteria for estimation of ultimate bearing capacity of a shallow foundation?

   b) A lm wide long footing at a depth of 1.5m from the ground surface. The supporting soil is sand and has $\phi = 29°, \gamma = 18 kN/m^3$. The water is at base of footing. Determine the safe load that can be carried by footing per meter length of the wall if the permissible settlement is 40 mm. Use IS code methods.   (8,12)

Q.2 a) What do you mean by frost heave? How does it affect the depth of foundation?

   b) Determine the safe load which can be imposed normal to the base of a strip footing which is 1.2m wide and has its base inclined at 12° from horizontal. One corner of footing is located at 1.2m from ground surface. The footing rests on a saturated cohesive soil with a cohesion of $75 kN/m^2$ and unit weight $18.2 kN/m^3$. Use Skempton's method.   (8,12)

Q.3 a) Explain the load transfer mechanism of single pile subjected to vertical load.

   b) What do you mean by *"negative skin friction"*? How does it influence the design of pile?   (10, 10)

Q.4 The soil profile at a site for bridge pier is as follows. Determine the capacities of 400mm, 900 diameter bored piles extending to depth of 29m.   (20)

Depth(m)	Type of soil	Cohesion(kg/cm²)	Angle of friction	Density (kg/cm³)
0-5	Filling	0.05	15°	1300
5-21	Soft clay	0.3	NA	1600
21-25	Stiff clay	0.5	NA	1800
25-29	Medium Sand	NA	30°	1720
Below 29m	Rock	NA	38°	2000

Q.5 a) What are different checks to be applied for stability of counterfort retaining wall?

b) An anchored bulkhead of total height 12m is constructed in a cohesionless soil. The ground surface on the back of bulkhead is horizontal. The dredge line is at 8m below the top. The water level is at a height of 7m above the dredge line on either side of the bulkhead. Horizontal anchors rods are provided at a depth of 1.5m below the top. $\gamma = 17 kN/m^3$ and $\gamma_{sub} = 10 kN/m^3$. $\phi = 30°$. Assuming free earth support, determine the factor of safety with respect to ultimate passive resistance of soil for the depth of penetration. What is the pull in anchor rod per unit length of the bulkhead?   (5,15)

Q.6 a) What is "underpinning"? What is its necessity in foundations?

b) A strutted excavation 1.75m wide is made in stiff clay of unit weight $18.5 kN/m^3$. If the un- drained shear strength of clay is $40 kN/m^2$ and the cut is made up to a depth of 5m. Draw the earth pressure envelope and scheme of strutting. Determine the strut loads, the section modulus of sheet pile section and section modulus for the wales. Use $\sigma_{all} = 17 \times 10^4 \ kN/m^2$.

Also check the safety against base failure.   (5,15)

Q.7 a) List various methods to improve the granular soils. Discuss roller compaction in detail.

b) What do you mean by grouting? What is its function? Discuss in detail the soil- bentonite mix.   (10,10)

Q.8 Write short notes on the following :

a) Electrical method of dewatering

b) Function of geo-synthetics

c) Measures for Construction of foundation under water

d) Wick drain   (4×5=20)