Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.TECH(CE)/SEP.SUPPLE/SEM-7/CE-703/2012

2012

FOUNDATION ENGINEERING

Time Allotted : 3 Hours *Full Marks* : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP – A
(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following :

$10 \times 1 = 10$

i) As per Terzaghi's equation, the bearing capacity of strip footing resting on cohesive coil (c = 10 kN/m^2) for unit depth and unit width (assume N_c as 5·7) is

a) 47 kN/m^2 b) 57 kN/m^2

c) 67 kN/m^2 d) 77 kN/m^2.

ii) Maximum centre to centre spacing of friction piles (D) as per BIS code is

a) 1·5 D b) 2 D

c) 2·5 D d) 3 D.

iii) A good quality undisturbed soil sample is one which is obtained using a sampling tube having an area of

a) 8% b) 16%

c) 24% d) 32%.

iv) Actual observed value of standard penetration resistance, *'N'*, is greater than 15 in a fine sand layer below water table. Then the equivalent penetration resistance will be

a) $15+\left[\frac{(N+15)}{2}\right]$ b) $15-\left[\frac{(N+15)}{2}\right]$

c) $15+\left[\frac{(N-15)}{2}\right]$ d) $15+\left[\frac{(15-N)}{2}\right]$.

v) Mechanical stabilization of soil is done with the help of

a) cement b) lime

c) bitumen d) proper grading.

vi) Settlement group of friction piles as compared to that of single pile is

a) same b) less

c) more d) none of these.

vii) Rise of water table in cohesive soils up to ground surface reduces the net ultimate bearing capacity approximately by

a) 25% b) 50%

c) 75% d) 90%.

viii) According to IS specifications, the minimum depth of foundation in sand and clay should be respectively

a) 600 mm & 700 mm b) 800 mm & 900 mm

c) 1 m & 800 mm d) 1 m & 1·2 m.

ix) For plate loading Test for determining the bearing capacity of soil, the size of square bearing capacity of soil, the size of square bearing should be

a) less than 300 mm

b) between 300 mm and 750 mm

c) between 750 mm and 1 m

d) greater than 1 m.

x) A raft of 6 × 9 is founded at depth of 3 m in a cohesive soil having C = 120 kN/m^2. The ultimate net bearing capacity of soil using Terzaghi's theory will be nearly

a) 820 kN/m^2 b) 920 kN/m^2

c) 1036 kN/m^2 d) 1067 kN/m^2.

xi) For undisturbed sampling, the area ratio for a thin-wall sampler should not normally exceeds

a) 15% b) 25%

c) 30% d) 35%.

xii) Due to negative skin friction on pile, its load-carrying capacity

a) increases b) decreases

c) unaffected d) cannot be said.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. Derive the expression for consolidation settlement $S_c = \frac{C_e}{1+e_0} \log \frac{\sigma_0 + \Delta\sigma}{\sigma_0} \cdot H$, where symbols have usual meaning.

3. Discuss with suitable illustration the field situation where use of geotextiles may be beneficial as a method of ground improvement.

4. A 4 × 3 pile group has the following details :

   Diameter of each pile = 350 mm

   C/c spacing of pile = 1050 mm

   Capacity of single pile = 400 kN

   Determine the efficiency of free-standing pile group.

5. What is the probable wall thickness of the sampling tube of 75 mm external dia which is required for sampling in stiff to very stiff clay soil ? Assume area ratio = 15%.

6. Sample has been extracted with a split spoon sampler of outside dia = 50·8 mm, inside dia 34·93 mm. Comment on the nature of the soil sample.

7. a) Write down the governing equation for :

   i) Combined vertical and radial consolidation

   ii) Average degree of consolidation due to combined effect of vertical and radial flow.

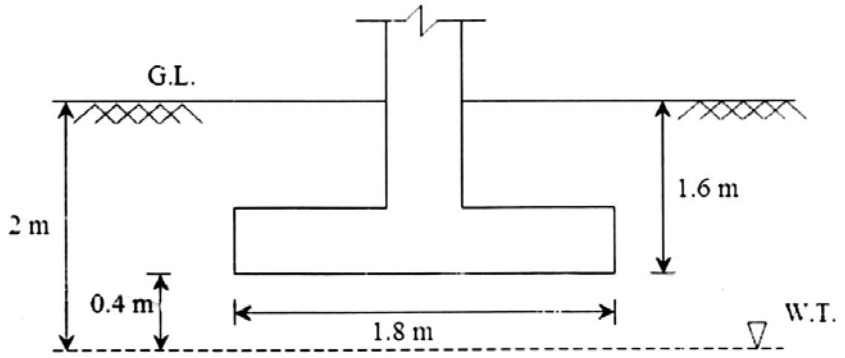
   b) Draw a neat sketch showing component parts of Well Foundation. 1 + 1 + 3

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

8. Calculate the net ultimate bearing capacity of a rectangular footing 1·8 m × 3·8 m in plan foundation at a depth of 1·6 m below the ground surface. The load on the footing acts at an angle of 16° to the vertical and is eccentric in the direction of width by 15 cm. The unit weight of the soil is 18 kN/m^3. The rate of loading is slow and hence the effective shear strength parameter can be used in the analysis, having c'=15kN/m^2 and ϕ' = 30° natural water table is at a depth of 2 m below the ground surface. Use IS : 6404-1981.



3 + 3 + 3 + 6

9. a) Derive the expression for Vane shear test :

$$T = c_u.\pi\left[\left(\frac{d^2h}{2}\right)+\left(\frac{d^3}{12}\right)\right]$$

b) In an in situ vane shear test on a saturated clay, a torque of 35 Nm was required to shear the soil. The dia of the vane was 50 mm and length 90 mm. Calculate the undrained shear strength of the soil. The vane was rotated rapidly to cause remoulding of the soil. The torque required to shear the soil in remolded state was 7 Nm. Determine the sensitivity of the clay. 8 + 7

10. a) Design a friction pile group to carry a load of 300 tonnes including the weight of the pile cap at a site where the soil is uniform clay to a depth of 20 m underlain by rock. Average unconfined compression strength of the clay is 0·7 kg/cm^2. The clay may be assumed to be of normal sensitivity and normal loaded with liquid limit 60%. A factor of safety of 3 is required against shear failure.

b) A precast concrete pile was driven in sand, using a 4 tonnes hammer having a free fall of 1·0 m. If the penetration of the pile in the last blow of the hammer was noted as 8 mm, determine the load carrying capacity of the pile in kN, using the Engineering News Formula. 9 + 6

11. a) Write down the different stages of site investigation for major Civil Engineering Project.

    b) Describe a stress bulb.

    c) Explain the meaning of significant depth.

12. Write short notes on any *three* of the following : 3 × 5

    a) Soil stabilization by use of admixtures

    b) Sand drains

    c) Grouting technique for foundation improvement

    d) Vibro-flotation and stone columns

    e) Dewatering of ground soils.

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