CS/B.Tech/CE/SEM-8/CE-801/4/2013

2013
ADVANCED 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 × 1 = 10

   i)   The allowable bearing capacity at 25 mm allowable settlement for a footing in a sandy soil is 15 t/m^2. The allowable bearing capacity for the same footing permitting a settlement of 40 mm is

   a)   24 t/m^2 b)   30 t/m^2

   c)   35 t/m^2 d)   40 t/m^2.

   ii) An RC pile is driven with a drop hammer weighing 18 kN and having a free fall of 1·5 m. The penetration in last blow is 5 mm. The load carrying capacity of the pile as per engineering news formula will be

   a)   100 kN   b)   150 kN

   c)   90 kN   d)   180 kN.

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iii) The total passive earth pressure per unit length against a retaining of height of 3 m with backfill of unit weight $1 \cdot 8$ t/m^3 and angle of internal friction 30° will be

    a) $21 \cdot 2$ t/m   b) $22 \cdot 8$ t/m

    c) $24 \cdot 3$ t/m   d) $26 \cdot 5$ t/m.

iv) A gravity retaining wall of top width 1 m, base width 3 m and total height of 10 m is retaining dry cohesionless backfill of unit weight 20 kN/m^3 and angle of shearing resistance 30°. Then the factor of safety against sliding will be $\left(\gamma_{wall} = 2 \ kN/m^3 \right)$

    a) $2 \cdot 5$ b) $3 \cdot 3$

    c) $1 \cdot 3$ d) $2 \cdot 3$.

v) A cast *in situ* bored pile $0 \cdot 50$ m diameter and 10 m deep is placed in a purely cohesive soil. If cohesion of the soil is 6 t/m^2 and adhesion between the pile and the soil is half value of cohesion, then the ultimate bearing capacity of pile is given by

    a) $56 \, \pi/8$ b) $127 \, \pi/8$

    c) $133 \, \pi/8$ d) $107 \, \pi/8$.

vi) Standard penetration test is carried out with the help of

    a)   Open drive sampler   b)   Piston sampler

    c)   Split spoon sampler   d)   Dutch cone.

vii) Geophones are used to record velocity in

    a)   Seismic refraction method

    b)   Electrical resistivity method

    c)   Wash boring method

    d)   Shell and auger boring method.
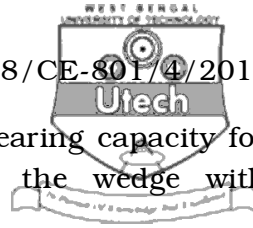
viii) According to Terzaghi's analysis of bearing capacity for clay, the failure curve connecting the wedge with passive zone is

a) Log spiral   b) Circle

c) Parabola   d) Hyperbola.

ix) When a retaining wall moves towards the backfill, then the pressure developed is

a) zero   b) active

c) passive   d) none of these.

x) For developing zero tension at the heel, the resultant force on the base of a retaining wall should pass through a point where eccentricity from the centre of the base with width b is

a) $b / 6$ b) $b / 3$

c) $b / 2$ d) b.

xi) In expansive soils, suitable piles are

a) driven cast *in situ* piles

b) driven precast piles

c) under-reamed piles

d) timber piles.
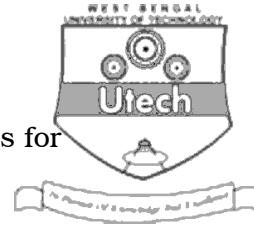
xii) In pile foundation, block failure occurs for

a) closely spaced piles in sand

b) widely spaced piles in sand

c) closely spaced piles in clay

d) widely spaced piles in clay.

GROUP – B
(Short Answer Type Questions)
Answer any *three* of the following. 3 × 5 = 15

2. Illustrate with a neat sketch/diagram, the modes of vibration of a dynamic base.

3. What is the effect of ground water table on bearing capacity of foundation ?

4. What is raft foundation ? Under what circumstances is it required ?

5. Discuss about the negative skin friction and effect thereof on the pile.

6. Write short notes on any *one* of the following :

a) Seismic refraction survey with respect to Geophysical exploration of soil

b) Sub-soil investigation report.

7. What are the limitations of plate load test ?

GROUP – C

(Long Answer Type Questions)

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

8. a) Define and describe different types of raft foundation.

   b) Discuss on the types of loading and selection of raft foundation.

   c) A raft (20 m × 10 m) exerts a gross pressure of 200 kN/m^2 at foundation level. The depth of foundation is 2·5 m. If the soil is clay (ϕ^I = 0°, Cu = 80 kN/m^2, γ = 19 kN/m^3), determine the factor of safety. The raft is for a basement. Use Skempton's or other suitable equation.   4 + 4 + 7

9. Draw neat sketch and check the stability of the cantilever retaining wall of top width 0·4 m, base width 0·6 m, height 5·0 m. The total width of the footing of retaining wall is 3·50 m, which is combination of toe, base of retaining wall and heel of retaining wall (0·6 m + 0·6 m + 2·3 m). The thickness of footing is 0·6 m and founded below 1·0 m from G.L. with top of the footing below G.L. 0·40 m. The backfill (γ = 18 kN/m^3, ϕ^I = 34°, δ = 25°, i = 15°) is sloped at an angle of 15°. The allowable soil pressure is 500 kN/m^2.   15

10. a) State the limitations of Terzaghi's theory in predicting the bearing capacity of a shallow foundation footing on a cohesive deposit.

    b) A footing of 2 m square is laid at a depth of 1·3 m below the ground surface. Determine net ultimate bearing capacity using IS code method. Given

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γ = 20 kN/m^3	Φ^I = 30°	c^I = 0
N_c = 30·14	N_q = 18·4	N_γ = 22·4
S_c = 1·3	S_q = 1·2	S_γ = 0·8
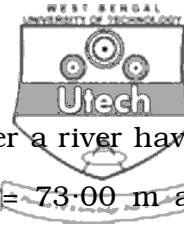
11. A bridge 120 m long, is to be constructed over a river having Q_{max} = 2418 m^3/s. HFL = 81·17 m, LWL = 73·00 m and existing bed level = 72·00 m. The subsoil consists of loose silty sand layer $\left(N_{cor} = 10\right)$ 3·5 thick, underlain by a thick stratum of medium to coarse sand $\left(N_{cor} = 24\right)$. Determine the founding level and allowable bearing capacity of a 4·5 m diameter abutment well. The weighted mean diameter of the bed material up to relevant depth is 0·275 mm and permissible settlement is 45 mm.

12. a) Describe the steps in checking the stability of a retaining wall.

    b) A vertical retaining wall has to retain a horizontal backfill up to a height of 7·0 m above GL.

       The properties of this backfill are as follows :

       From GL to 3·0 m Φ = 32° γ = 1·8 t/m^3

       From 3·0 m to 7·0 m Φ = 33° γ = 1·83 t/m^3

       Draw the active earth pressure diagram for the wall. Determine the resultant pressure and its point of application.
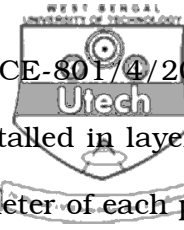
13. A group of 16 piles (4 in each row) was installed in layered clay soil deposit as shown in figure. The diameter of each pile is 500 mm and their c/c distance is 1 m. The length of the pile group is 18 m . Estimate the safe load capacity of the group with a factor of safety of 2·5. The adhesion factor (α) between the pile and soil in each soil layer are shown in the figure :

GL ————————————————————

8m C_u=25 KPa Φ=0

      $\alpha = 1.0$

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     C_u=40 KPa Φ=0

16 m $\alpha = 0.7$

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