Name : ……………………………………………………

Roll No. : …………………………………………………

Invigilator's Signature : …………………………………….

CS/B.TECH (CE)/SEM-8/CE-801/4/2012

2012

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.
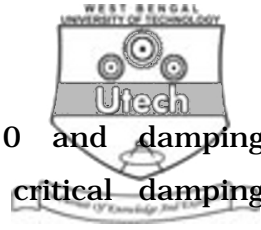
GROUP – A

(Multiple Choice Type Questions)

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

$$10 \times 1 = 10$$

  i) A raft of 6 m × 9 m is founded at a depth of 3 m in a cohesive soil having $C = 120$ kN/m^2. The ultimate net bearing capacity of the 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 .

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ii) Given, that damping ratio = 0·10 and damping coefficient = 225 kN sec/m, the critical damping coefficient in kN sec/m will be

    a)   22·5   b)   225

    c)   2250   d)   22500.

iii) Degree of freedom of a block type machine foundation is

    a)   2   b)   3

    c)   4   d)   6.

iv) No tension should develop at the base of rectangular well foundation or at any horizontal section within the well. For no tension at the base, the resultant of P_a (total active thrust) and W (weight of soil and well above the base) must pass through middle

    a)   half of the base   b)   third of the base

    c)   quarter of the base   d)   of the base.

v) A retaining wall retains a sand strata with $\phi = 30°$ up to its top. If a uniform surcharge of 12 t/m^2 is subsequently put on the sand strata, then the increase in the lateral earth pressure intensity on the retaining wall will be

    a)   1 t/m^2 b)   2 t/m^2

    c)   4 t/m^2 d)   8 t/m^2 .

vi) The minimum allowable factor of safety against sliding in the case of a cantilever retaining wall is

   a) 2·0   b) 3·0

   c) 1·50   d) 2·5.

vii) In the case of fixed earth support of a bulk head the stability is provided by

   a) the passive resistance of the soil

   b) the force in the anchor

   c) both (a) and (b)

   d) neither (a) nor (b).

viii) A 30 cm diameter friction pile is embedded 10 m into a homogeneous consolidated deposit. Unit adhesion developed between clay and pile shaft is $\dfrac{4t}{m^2}$ and adhesion factor 0·7. The safe load for factor of safety 2·5 will be

   a) 21·50 t   b) 11·57 t

   c) 10·55 t   d) 6·35 t.

ix) A rectangular footing 1 m × 2 m is placed at a depth of 2 m in a saturated clay behaving as an unconfined compressive strength of 100 kN/m^2. According to Skempton, the net ultimate bearing capacity is

   a) 420 kN/m^2 b) 412·5 kN/m^2

   c) 385 kN/m^2 d) 350·0 kN/m^2 .

x) A fully compensated raft foundation for a building is

a) designed as a very rigid raft

b) designed as a completely flexible raft

c) such that the weight of the excavated soil is equal to the load due to the building

d) supported by piles of short length.

xi) For a damped vibrating system with single degree of freedom, resonance occurs at a frequency ratio of

a) 1

b) 0

c) less than 1

d) greater than 1.

xii) At a site having a deposit of dry sandy soil, an average soil of standard penetration resistance N equal to 6 was recorded. The compactness of the soil deposit can be described as

a) very loose   b) dense

c) medium   d) loose.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

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

   a) Stabilisation of bore holes

   b) Advantage of using steel sheet piles.

3. A footing of size 3·50 m × 3·50 m is to be constructed at a site at a depth of 1·50 m below the ground surface. The water table is at the base of the foundation. The average static cone penetration resistance obtained at one site is 20 kg/cm^2. The soil is cohesive. Determine the safe bearing pressure for settlement of 40 mm.

4. Elaborate the advantages and disadvantages of pneumatic caissons over open caissons.

5. A pile group consisting of 16 piles is subjected to a load of 5000 kN with eccentricity e_x = 0·30 m, e_y = 0·40 m. The piles are arranged in 4 (four) rows, 4 (four) nos. of piles in each row at a 1·0 m centre to centre. Determine the maximum load in an individual pile.

6. What is a 'Bore log' ? Sketch a typical 'Bore log'.

GROUP – C

(Long Answer Type Questions)

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

7. Determine force in the tie rod of anchored sheet pile, anchored at a point 1·0 m below the top, supporting sides of an excavation 6·0 m deep in dry sandy soil having $\phi = 30°$, $G = 2·6$ and $e = 1·0$ in back and water to a height of 4 m in front from dredge level. Assuming free earth support, also calculate the depth of penetration of the sheet pile. Detailed solution of cubical equation, if any should be given.

8. a) A straight shaft drilled pier 1·5 m diameter, is constructed in a deposit consisting of loose sand of thickness 8·0 m ($\tan \delta = 0·58$, $k = 0·50$, $\phi = 30°$, $\gamma = 17$ kN/m^3) overlaying dense sand of thickness 4·0 m ($\tan \delta = 0·84$, $k = 0·40$, $\phi = 40°$, $\gamma = 21$ kN/m^3) . Determine the allowable load.

   F.S. = 3, $N_q = 0·140$ for $\phi = 40°$.

   b) Determine the natural frequency of a machine foundation having a base area 2 m × 2 m and a mass of 15 MT, including the mass of the machine.

   Take $C_u = 4 \times 10^4$ kN/m^3. 9 + 6

9. Describe with neat sketches how the depth of exploration and lateral extent of exploration for different kinds of foundation are considered and finalised for execution.

   10 + 5
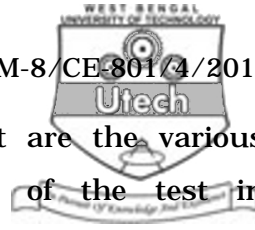
10. Discuss standard penetration test. What are the various corrections ? What is the importance of the test in geotechnical engineering ? $6 + 6 + 3$

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

b) A concrete pile 30 cm diameter is driven into a medium dense sand ($\phi = 35°$, $\gamma = 21$ kN/m^3, $k = 1·0$, tan $\delta = 0·70$) for a depth of 8 m. Estimate the safe load, taking a factor of safety of 2·50. $5 + 10$

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