Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech (CE-NEW)/SEM-8/CE-801/4/2010

2010

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) The maximum depth of a pneumatic caisson is usually limited to

   a) 10·0 m b) 20·0 m

   c) 80·0 m d) 40·0 m.

   ii) The adhesion factors for drilled piers on clay is usually taken as

   a) 1·0 b) 0·80

   c) 0·60 d) 0·40.

   iii) 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) 2·50.

iv) 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) & (b)

d) neither (a) nor (b).

v) A 30 cm diameter friction pile is embedded 10 m into a homogeneous consolidated deposit. Unit adhesion developed between clay and pile shaft is $\frac{4t}{m^2}$ 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.

vi) A rectangular footing 1m × 2m is placed at a depth of 2m in a saturated clay behaving 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.

vii) 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.

viii) 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.

ix) 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.

x) Permissible settlement is relatively higher for

a) isolated footing on clays

b) isolated footing on sands

c) raft on clays

d) raft on sands.

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

a) 15% b) 25%

c) 30% d) 35%.

xii) The gross bearing capacity of a footing is 450 kN/ m^2. If the footing is 1·5m wide at a depth of 1·0m in clayey soil with unit weight of 20 kN/ m^3, then the net bearing capacity (in kN/ m^2) will be

a) 400 b) 430

c) 435 d) 440.

xiii) A 2m wide strip footing rests at a depth of 2·0m below grounds surface in a clay deposit where water table is at ground surface, c = 3t/ m^2 and γ_{sat} = 2t/ m^3. The best estimate of the net ultimate load which the footing can carry is

a) 18t/ m b) 22t/ m

c) 34·2t/ m d) 48t/ m.

xiv) The group efficiency of driven piles in sand at a close spacing may be

a) equal to 100% b) greater than 100%

c) well below 100% d) none of these.

GROUP – B

(Short Answer Type Questions)

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

2. Write short notes of any *one* of the following : 1 × 5

   i) Seismic refraction survey.

   ii) Sub-soil investigation report.

3. A footing of size 4m × 4m is to be constructed at a site at a depth of 2·0m 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 20kg/ cm^2. The soil is cohesive. Determine the safe bearing pressure for settlement of 40mm.

4. Sketch typical sections of a braced excavation and show the various components.

5. What are the different types of sheet pile wall ? Draw the sketches showing the pressure distribution types.

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

7. A pile group consisting of 12 piles is subjected to a load of 4000 kN with eccentricity e_x = 0·30m, e_y = 0·40m. The piles are arranged in 3 (Three) rows, 4 (Four) nos. of piles in each row at 1·0m centre to centre. Determine the maximum load in an individual pile.

GROUP – C

(Long Answer Type Questions)

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

8. a) What are the limitations of plate test ?

   b) Describe briefly the different types of penetration test used in soil engineering and explain their uses in finding bearing capacity of foundations.

   c) What are the general requirements for satisfactory design of machine foundation ?

9. A plan of mat foundation with column loads is shown in fig. below. Calculate the soil pressures at points A, B, C, D, E and F. All the columns are 0·5m × 0·5m in section. Given that, $q_{net\,(all)}$ = 60 kN/m^2. Calculate the soil pressures and check the stability with respect to allowable bearing capacity. All the dimensions in the fig. are in mm.

10. A bridge 120m long, is to be constructed over a river having Q_{max} = 2418 m^3/s, HFL = 81·17m, LWL = 73·00m and existing bed level = 72·00m. The subsoil consists of loose silty sand layer (N_{cor} = 10) 3·5m thick, underlain by a thick stratum of medium to coarse sand (N_{cor} = 24). Determine the founding level and allowable bearing capacity of a 4·5m 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.

11. A gravity retaining wall 6m high vertical back has to retain a cohesionless backfill with horizontal ground surface. The bulk density of the backfill is 16·5 kN/ m^3 and the angle of shearing resistance is 30°. The wall is 1·4m wide at the top. Determine the minimum base width of wall for no tension to develop at the base. Also find the factor of safety against sliding assuming the angle of friction between the base of the wall and the foundation soil as 30°. The density of the wall material is 20 kN/ m^3.

12. Determine force in the tie rod of anchored sheet pile, anchored at a point 1·0m below the top, supporting sides of an excavation 5·0m deep in dry sandy soil having ϕ = 30°, G = 2·6 and e = 1·0 in back and water to a height of 3m 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.