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# INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

M.Tech II Semester End Examinations (Regular) - May, 2019

Regulation: IARE-R18

## ADVANCED DESIGN OF FOUNDATION

**Time: 3 Hours**

**(STE)**

**Max Marks: 70**

**Answer ONE Question from each Unit**

**All Questions Carry Equal Marks**

**All parts of the question must be answered in one place only**

### UNIT – I

1. (a) How will you stabilize a bore hole at a site characterized by a clay layer underlain by a fine sand layer in which artesian conditions are known to exist. [7M]
- (b) A SPT was conducted in a dense sand deposit of 22m, and a value of 48 was observed for N. The density of the sand was  $15\text{kN}/\text{m}^3$ . What is the value of N corrected for overburden pressure? [7M]
2. (a) Describe cone penetration test. How this test differs from standard penetration test? [7M]
- (b) Compute the area ratio of a thin walled tube samples having an external diameter of 8cm and a wall thickness of 3.25mm. Do you recommend the sampler for obtaining undisturbed soil samplers? Why? [7M]

### UNIT – II

3. (a) What are the principle modes of failures of soils. Explain shear failure and its pattern of failure with neat sketch. [7M]
- (b) A continuous footing of width 2.5m rests 1.5m below and ground surface in clay. The unconfined compressive strength of the clay is  $150\text{ KN}/\text{m}^2$ . Calculate the ultimate bearing capacity of the footing, when there is no effect of water table and when water reaches ground surface. Take  $\gamma = 18\text{ KN}/\text{m}^3$ ,  $\gamma_{sat} = 20\text{ KN}/\text{m}^3$ . [7M]
4. (a) How generalized bearing capacity equation differs from Terzaghis bearing capacity equation. [7M]
- (b) A 3 m X 4 m rectangular footing is eccentrically loaded. The resultant is 0.2 m outside of centroid width wise, and 0.3 m outside of centroid length wise. If  $c = 10\text{kPa}$ ,  $\phi = 25^\circ$ ,  $\gamma = 16\text{kN}/\text{m}^3$ , find the safe load carried by footing. What would have been the increase in load carried, if the load was concentric? Take  $N_c=25.1$ ,  $N_q = 12.7$ ,  $N\gamma = 9.7$ . [7M]

### UNIT – III

5. (a) What is settlement of footing as per plate load test? Discuss various dynamic formulae? What are their limitations? [7M]
- (b) A 40cm diameter pile, 11m long has a bell of 2m diameter and 1m height. If the soil has  $\phi = 25^\circ$ ,  $C_u = 20\text{ KN}/\text{m}^2$  and  $\gamma = 19\text{ KN}/\text{m}^3$  Estimate the allowable pull-out resistance. Take FS=3. [7M]

6. (a) Define friction pile and end bearing pile. Explain about negative skin friction of pile foundation. [7M]
- (b) A group of 16 piles of 10 m length and 0.5 m diameter is installed in a 10 m thick stiff clay layer underlain by rock. The pile-soil adhesion factor is 0.4. Average shear strength of soil on the sides is 100 kPa. Undrained shear strength of soil at the base is also 100 kPa. Calculate the base resistance of a single pile and the group side resistance assuming 100 % efficiency of group. [7M]

#### UNIT – IV

7. (a) With a neat sketch explain the components of well foundations. [7M]
- (b) Write down the design procedure for lateral stability analysis of well foundation by Terzaghi's Analysis. [7M]
8. (a) Write short notes on any three of the following i) Grip length of well foundation. ii) Scour depth. iii) Dredge level of well foundation. iv) Forces acting on well foundation [7M]
- (b) A circular well of 5m external diameter and staining thickness of 1m is used as foundation for a bridge pier in a sandy stratum. The submerged unit weight of sand is  $1.0t/m^3$ , and angle of shearing resistance  $\phi = 30^\circ$ . The well is subjected to a horizontal force of 50t and a total moment of 500t-m at the sour level. The depth of well to be light, check the lateral stability of the well. [7M]

#### UNIT – V

9. (a) What is a braced cut? When it prefers? Mention various components of braced cut and explain. [7M]
- (b) It is required to construct a braced excavation up to a depth of 7.0 m in stiff clay having a unit weight of  $19kN/m^3$  and an unconfined compressive strength of  $125kN/m^2$ . Bracing systems consisting of struts and Wales are to be installed at 1.5 m, 3.5 m and 6.0 m below ground level. Determine the strut forces and maximum bending moment in the walls. [7M]
10. (a) Briefly discuss different types of cofferdams and their relative merits and demerits. [7M]
- (b) An anchored sheet pile is to support a mass of cohesion less soil up to a height of 6 m above ground level with horizontal anchor ties spaced at 1 m intervals located at 1.0 m below the ground surface. If the unit weight of the soil is  $21kN/m^3$  and its angle of internal friction is  $30^\circ$ , determine the minimum depth of embedment of the sheet pile for stability use approximate method. [7M]

