

Register Number: .....

**M.E. DEGREE EXAMINATIONS: JUNE 2012**

Second Semester

**STRUCTURAL ENGINEERING**

SEE506: Design of Substructures

**Time: Three Hours**

**Maximum Marks: 100**

(Use of IS 1892, IS 1904, IS 6403, IS 8009 (Part I), IS : 2911 ( Part I / Sec 3 ), IS:802 (Part 1/Sec 1), IS:4091, IS : 2974 ( Part II ) and other relevant IS codes are permissible inside the examination hall.)

**Answer all the Questions:-**

**PART A (10 x 2 = 20 Marks)**

1. What do you mean by 'significant depth' in soil exploration?
2. Compute the area ratio of a thin walled tube sampler having an external diameter 60 mm and wall thickness 2.5 mm.
3. Explain why Terzaghi's bearing capacity theory is stated to give a conservative estimate on bearing capacity?
4. List the various components of settlement in any structure.
5. What do you mean by a friction pile?
6. Why under-reamed piles are not normally recommended for cohesionless soil?
7. What do you mean by grip length? List out its importance in a well foundation?
8. Mention the two types of piling systems used for soil support in excavations.
9. Define: Frequency ratio.
10. Explain the special features of machine foundations.

**PART B (5 x 16 = 80 Marks)**

11. a) (i) Briefly explain how do you decide on the layout of boreholes, number of boreholes, depth of boreholes and the spacing of boreholes during soil investigation with neat sketches (8)
- (ii) Briefly explain the informations to be present in a soil investigation report. (8)

**(OR)**

- b) (i) Briefly explain plate load test. What are the limitations of this test? (8)

- (ii) A standard penetration test was conducted in a dense sand deposit at a depth of 20 m and the value of  $N$  was observed as 54. The density of sand was  $16 \text{ kN/m}^3$ . What is the value of  $N$ , corrected for overburden pressure? (8)

12. a) Compute the safe bearing capacity of a continuous strip footing, 1.5m wide, located at a depth of 1.2m below the ground level in a soil with unit weight  $\gamma = 20 \text{ kN/m}^3$ ,  $c = 20 \text{ kN/m}^2$ , angle of shearing resistance  $\phi = 20^\circ$ , Assuming a factor of safety of 2.5, Terzaghi's bearing capacity factors for  $\phi = 20^\circ$  are  $N_c = 17.7$ ,  $N_q = 7.4$ ,  $N_\gamma = 5.0$ . What is the permissible load per metre run of the footing? Assume that the water table is located at the base of the footing.

(OR)

- b) (i) Briefly explain how proportioning of a trapezoidal combined footing is done with diagrams. (8)

- (ii) What are the conditions stipulated in IS 1904 : 1988, for locating the foundations of a new structure adjacent to an existing structure so as to avoid damage to the existing structure? (8)

13. a) What do you mean by negative drag force? List out two possible situations where negative drag force shall mobilize.

(OR)

- b) A group of 16 piles of 400 mm diameter is arranged in a square pattern with centre to centre spacing of the square group as 1.2 m. the piles are 10 m long and are embedded in soft clay with  $c = 30 \text{ kN/m}^2$ , reduction factor for shear mobilization around each pile  $m=0.60$ . Determine the ultimate load carrying capacity of the pile group. Comment whether failure would occur with pile acting individually or as a group. Neglect bearing at the tip of the pile.

14. a) Design a suitable tower foundation for a  $20^\circ$  angle tower to be used in a double circuit 132 kV transmission line for the following specifications. The foundation is to be located in dense sand with  $\phi = 30^\circ$ ,  $\gamma = 18 \text{ kN/m}^3$ , allowable bearing pressure as  $250 \text{ kN/m}^2$ . Terzaghi's bearing capacity factors for  $\phi = 30^\circ$  are  $N_c = 37.2$ ,  $N_q = 22.5$ ,  $N_\gamma = 19.7$ . The water table is located at a depth of 3 m below the existing GL.

S.No	Nature of Load	Actual Load	
		NC	BWC
1	Downward load	350 kN	500 kN
2	Upward load	275 kN	425 kN
3	Shear in transverse direction	5 kN	30 kN
4	Shear in longitudinal direction	0	20 kN

(OR)

b) Briefly explain SHIFTS & TILTS in well foundation. What precautions would you take to avoid them?

15. a) List the various design criteria for machine foundation used for a reciprocating engine.

(OR)

b) A single cylinder engine with the following particulars is to be placed on a concrete foundation. Calculate the maximum unbalanced force generated by the engine for the following data.

Crank radius = 0.08 m

Length of the connecting rod = 0.28 m

Operating frequency = 1800 rpm

Weight of the reciprocating parts = 49 N.

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