

(REVISED COURSE)

(3 Hours)

MASPA  
 [ Total Marks : 100

- N.B.**(1) Question No. 1 is compulsory.  
 (2) Attempt any four questions from the remaining.  
 (3) Graphs papers to be provided.

1. (a) If you are in-charge of sub-soil exploration of important structures, how do you decide the depth of exploration. List out factors you will consider and their importance. 10  
 (b) List five different types of samplers. Explain any two with proper labelled sketch, and their importance. 10
2. (a) A laboratory specimen of clay 20 mm thick, drained at the top and bottom, has taken 360 s to reach 50% consolidation when the pressure was increased from 75 to 150 kN/m<sup>2</sup>. The initial void ratio was 0.80, and the final void ratio due to the increment of load 0.45. Determine the coefficient of permeability of the clay ( $T_{v50} = 0.197$ ). 10  
 (b) Explain with a neat labelled sketch the procedure to determine pre-consolidation pressure (any method). 10
3. (a) Define initial tangent modulus, tangent modulus at 50% load/ stress, secant modulus at 50% load/stress. Draw a typical stress strain curve for Dense sand and Loose sand. 10  
 (b) Derive the relation between maximum and minimum principal stress. 10

$$\sigma_1 = \sigma_3 N\phi + 2C \sqrt{N\phi}$$

4. (a) Construct Newmarks chart upto 5th circle. 10  
 (b) An overhead water tank is supported at a depth of 3 m by four isolated footing 2 m x 2 m side each placed in a square pattern with a centre-to-centre spacing of 8 m. Compute the vertical stress at the foundation level— 10  
 (i) at the centre of the four footings, and  
 (ii) at the centre of one footing. Adopt Boussinesq's point load approximation. The load on each footing is 700 kN.

5. (a) Determine the ultimate bearing capacity of a strip footing, 1.5 m wide, with its base at a depth of 1 m, resting on a dry sand stratum. Use Terzaghi's Theory 10  
 Take  $\gamma_d = 17 \text{ kN/m}^2$ ,  $\phi^1 = 38^\circ$ ,  $c_l = 0$ .  
 $N_q = 60$  and  $N_{\gamma} = 75$ .  
 (b) Explain the effect of water table on the bearing capacity of shallow foundation. 10
6. (a) List the circumstances under which a pile foundation becomes necessary. Justify the same. 10  
 (b) The following data was obtained in a vertical pile load test on a 300 mm diameter pile. 10

|                    |     |     |     |      |      |      |      |
|--------------------|-----|-----|-----|------|------|------|------|
| Load in (kN)       | 50  | 100 | 200 | 300  | 400  | 500  | 600  |
| Settlement in (mm) | 2.5 | 4.0 | 9.5 | 16.5 | 27.0 | 40.5 | 61.0 |

Plot the load settlement curve and determine the allowable load as per IS 2911 parts 4.

7. (a) Explain the procedure and derive the relation to determine the capacity of stone column. 10  
 (b) Draw a neat labelled figure for accelerating settlement of 15 m soft clay layer. A 9 m high embankment has to be constructed on this improved ground. Also indicate the location of instruments on the same. 10