

(3Hours)

Max Marks 80

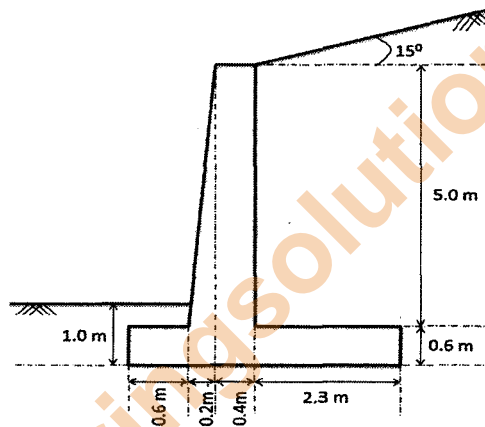
- N.B** 1. Attempt any 4 out of six questions  
2. Question 1 is compulsory  
3. Assume any suitable data where ever required

- Q.1** Attempt any four
- a. Explain the shear strength characteristics of sand in respect to stress-strain and volumetric changes **05**
- b. Briefly explain any one of the fitting methods for finding coefficient of consolidation **05**
- c. **05**  
An embankment inclined at an angle of  $35^\circ$  and its height is 15m. The angle of shearing resistance is  $15^\circ$  and  $C=200\text{kN/m}^2$ .  $\gamma=18\text{ kN/m}^3$ . if  $S_r=0.06$ . find the factor of safety with respect to cohesion
- d. A strip footing is to be designed to carry a gross load of  $900\text{kN/m}$  at a depth of 1m in sand. The shear parameters are  $C=0\text{ kN/m}^2$   $\phi=38^\circ$ . find the width of footing if factor of safety of 3 is assumed water table is at foundation level  $\gamma=18\text{ kN/m}^3$   $\gamma_{\text{sat}}=20\text{ kN/m}^3$  given  $N_q=49$ ,  $N\gamma=67$  **05**
- e. What is negative skin friction and derive the expression for it in single and group piles **05**
- Q.2** a. List out the assumptions and limitations of Terzaghi's one dimensional consolidation theory **05**
- b. Describe Swedish circle method for finding factor of safety on finite slopes in pure clays **05**
- c. A 2m thick layer of saturated clay lies between two permeable layers. Clay has the following properties liquid limit =45%,  $K=2.8 \times 10^{-7}\text{ cm/s}$ ,  $e=1.25$  and initial effective over burden pressure at the middle of clay layer is  $2\text{ kg/cm}^2$  and likely increases to  $4\text{ kg/cm}^2$  due to the construction of new building find  
(1) final void ratio of clay (2) settlement of proposed building (3) time required for 50% consolidation **10**
- Q.3** a. Explain the merits and demerits of direct shear and triaxial test **05**
- b. **10**
- | Sample No. | Cell pressure (kg/cm <sup>2</sup> ) | Deviator stress at failure (kg/cm <sup>2</sup> ) | Pore pressure at failure (kg/cm <sup>2</sup> ) |
|------------|-------------------------------------|--------------------------------------------------|------------------------------------------------|
| 1          | 1.0                                 | 2.02                                             | 0.41                                           |
| 2          | 1.5                                 | 2.18                                             | 0.62                                           |
| 3          | 2.0                                 | 2.37                                             | 0.7                                            |
- Find the shear parameters of soil considering (i) total stress (ii) effective stress and comment on the result
- c. Classify the piles based on load transfer mechanism and method of installation **05**
- Q.4** a. A 10 m high cut has been made at an angle of  $38^\circ$  to the horizontal. A possible circular failure surface has a radius of 22 m and is passing through the toe of the cut slope and through a point 5 m away on the top ground from the edge of the cut. The weight of the failure mass is 1500 kN and its centre of gravity is at a distance 10 m from the centre of the failure circle. The properties of soil are  $c = 40\text{ kN/m}^2$ ,  $\phi = 18^\circ$  and  $\gamma = 20\text{ kN/m}^3$ . Determine factor of safety that would be available on the said failure surface for the cut. Use friction circle method **10**

TURN OVER

- b. Derive the expression for Rankine's Active earth pressure for cohesive soil 05
- c. A 30kN drop hammer was used to drive a R.C pile .it has free fall of 2.0 m .the average penetration recorded in the last few blows is 6mm/blow. Estimate the allowable load on pile according to Engineering news formula 05

- Q.5**
- a. A retaining wall with a smooth vertical back has to retain a backfill of Cohesionless soil of height 5m above ground level. The soil has a void ratio of 0.83 and  $G=2.68$ .the water table is located at a depth of 2.5m below the top of backfill. The soil above the water table is 20% saturated having  $\phi$  above and below water table are found to be  $32^\circ$  and  $28^\circ$  respectively. Plot the variation of active earth pressure and find the magnitude and point of application of resultant thrust. 10
  - b. Check the stability of the cantilever concrete retaining wall shown in Fig. The allowable bearing capacity of the soil is  $500 \text{ kN/m}^2$ . Other properties of the soil are as follows:  $\phi = 36^\circ$ ,  $\gamma = 18 \text{ kN/m}^3$  and  $\delta = 25^\circ$ . 10



- Q.6**
- a. The following data was obtained from Plate load test carried out on a 60cm square plate at a depth of 2m below ground level on a sandy soil. Determine the settlement of foundation 3X3m carrying a load of 110 tons and located at a depth of 2m below ground surface. water table is at greater depth 10

|                                    |   |     |     |     |    |      |      |    |    |
|------------------------------------|---|-----|-----|-----|----|------|------|----|----|
| Load intensity (t/m <sup>2</sup> ) | 0 | 5   | 10  | 15  | 20 | 25   | 30   | 35 | 40 |
| Settlement (mm)                    | 0 | 2.0 | 4.0 | 7.5 | 11 | 16.3 | 23.5 | 34 | 45 |

- b. A raft foundation is supported by a pile group consisting of 15 piles arranged in 3 rows. The diameter and length of pile is 300mm and 15m respectively. The spacing between piles is 1.2m.the foundation soil consists of soft clay having  $C=3.2 \text{ t/m}^2$  and  $\gamma=1.9 \text{ t/m}^3$ . Adhesion factor is taken as 0.5.find the capacity of pile group 10