

- N. B.:
- (1) Question No. 1 is compulsory.
  - (2) Attempt any three from remaining five questions.
  - (3) Figures to the right indicate the full marks.
  - (4) Assume any suitable data if not given and justify the same.

- Q.1 (A) Suggest shear test with drainage condition to be conducted to study the short term stability behavior of a slope made in saturated clay. Give complete justification for your answer. 05
- (B) List the field tests that are conducted during soil exploration at a site having sandy strata. 05
- (C) Define  $D_{10}$ ,  $D_{30}$ , and  $D_{60}$ , and then also explain their use. 05
- (D) Write a note on determination of in-situ permeability. 05
- Q.2 (A) Write scope of Geotechnical Engineering in design of deep foundation. Write five points 05
- (B) The in-situ unit weight of a medium to coarse sand used as a subgrade material for a highway was,  $16 \text{ kN/m}^3$ . It was decided to improve that soil by mechanical stabilization. When  $5.5 \text{ kN}$  of mixture of dry sand and silt was added to  $1 \text{ m}^3$  of this subgrade material, the volume was increased by 20%. How much reduction in porosity of soil was achieved? Take  $G$  as 2.67. 10
- (C) Write the use of flow net. 05
- Q.3 (A) Define the following terms:
- (I) Liquid limit, plastic limit, shrinkage limit and plasticity index. 04
- (II) Liquidity index, consistency index, and flow index. 03
- (III) Toughness index, activity, and Sensitivity. 03
- (B) Explain the primary consolidation by spring analogy system. 05
- (C) For two soils the data is given as below. Classify the soil as per IS: 1498.  
% passing  $75 \mu = 8\%$ , Retained on  $4.75 \text{ mm} = 35\%$ ,  $C_c = 2.5$ ,  $C_u = 7$ ,  $LL = 15\%$  and  $PI = 3\%$ . 05
- Q.4 (A) A test well  $0.5 \text{ m}$  in diameter penetrates through a saturated aquifer  $8 \text{ m}$  thick overlying an impervious layer. A steady discharge of the well is  $18.72 \text{ m}^3/\text{hr}$ . The draw down at a distance of  $R_1 = 15 \text{ m}$  from the centre of test well is found to be  $1.8 \text{ m}$ . What will be the draw down at a distance of  $R_2 = 50 \text{ m}$ , if the permeability of soil is  $3.8 \times 10^{-4} \text{ m/s}$ ? Estimate approximate drawdown at the test well also. 10
- (B) Draw a bore log and show all necessary information on it. 05

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Q.4 (C) Write the assumptions made in derivation of Laplace Equation for seepage. 05

Q.5 (A) Explain with diagram how to prevent the soil migration through graded soil filters. 05

(B) By using data as given below determine the MDD and OMC.  $V_{\text{mould}} = 1000 \text{ cc}$ . 05

Observation No.	1	2	3	4	5	6
Water content (%)	8.7	12.4	13.8	15.6	18.4	20.2
Weight of wet soil (gms)	1805	1950	2012	2064	2034	1992

(C) A direct shear test is to run on medium sand under the normal stress of 60 kPa. The maximum shear stress at failure is measured as 37.5 kPa. Draw Mohr's circle at failure and determine the magnitude and direction of principal stresses in the failure zone. What is the orientation of the plane of maximum shear stress at failure? 10

Q.6 (A) The loading period for a new building continued from July 1965 to July 1967. Estimate the settlement in July 1975 if it was found that the average settlement in July 1970 was 7 cm. Ultimate settlement is expected to be 16 cm. For degree of consolidations 40%, 50% and 75% the corresponding values of time factor are 0.207, 0.281, and 0.540 respectively. 10

(B) Explain the effect of surcharge and capillary rise on effective pressure. 05

(C) Write the procedure to determine the plastic limit. 05

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