QP Code : 1824

(3 Hours)   **[Total Marks : 100**

N. B.:   (1) Question No. 1 is compulsory.

(2) Attempt any four from remaining six 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) Mention the scope of Geotechnical Engineering in the design of structures.   [05]

(B) What are the uses of flow net?   [05]

(C) Write a detailed note on 'thixotropy' and 'activity' of clays.   [05]

(D) Explain immediate compression and primary consolidation.   [05]

Q.2   (A) A fully saturated soil sample has a volume of 28 cc. The sample was dried in oven and the weight of dry soil pat was found to be 48.86 grams. Determine the void ratio, moisture content, saturated density and dry density of soil mass. Given $G = 2.68$.   [10]

(B) Name the method of determining permeability of sandy soil. Derive the expression to find out coefficient of permeability for the same case. Also mention effect of temperature on coefficient of permeability.   [10]

Q.3   (A) A relative density test conducted on a sandy soil yielded the following results $e_{max} = 1.30$, $e_{min} = 0.40$, $I_D = 50\%$, $G = 2.75$. Find the dry unit weight of soil for this condition. If 6 m thickness of this soil is to be densified to a relative density of 72%, how much the soil will reduce in thickness?   [10]

(B) Explain the different drainage conditions in a triaxial test. Explain UU test.   [10]

Q.4   (A) The Atterberg limits of a clay soil are $W_L = 75\%$, $W_P = 45\%$ and $W_S = 25\%$. If a sample of this soil has a volume of 30 cc at the liquid limit and 16.6 cc at shrinkage limit, determine the specific gravity of solids, shrinkage ratio and volumetric shrinkage.   [10]

(B) Describe the advantages and disadvantages of: Test pits, Hand augers, and Wash boring.   [10]

Q.5   (A) In a site reclamation project, 2.5 m of graded fill with $\Gamma = 22$ kN/m³ were laid in compacted layers over an existing layer of silty clay with $\llcorner = 18$ kN/m³ which was 3 m thick. This was underlain by a 2 m thick layer of gravel (with $\llcorner = 20$ kN/m³). Assuming that the water table remains at the surface of the silty clay, draw the effective stress profile for case (i) before the fill is placed and (ii) and after the fill has been placed.   [10]

(B) Explain field compaction and its control.   [10]

Q.6   (A) Given standard soil compaction test results as follows: $G = 2.65$

QP-Con. 11863-15.   **[TURN OVER**

Trial No.	1	2	3	4	5
Water content (%)	8.3	10.5	11.3	13.4	13.80
Bulk unit weight (kN/m³)	19.8	21.3	21.6	21.2	20.8

Plot the following: (i) Moisture – dry density curve, (ii) zero air voids curve, and (iii) Ten percent air content curve. Determine the OMC and corresponding MDD.   [10]

(B) Describe in detail the Indian System of soil classification. When would you use dual symbols for soils?   [10]

Q.7   (A) The following data relate to a triaxial compression test performed on a soil sample:

Test No.	Cell Pressure	Maximum deviator stress	Pore pressure at maximum deviator stress
1	80 kN/m²	175 kN/m²	45 kN/m²
2	150 kN/m²	240 kN/m²	50 kN/m²
3	210 kN/m²	300 kN/m²	60 kN/m²

Determine the total and effective stress parameters of the soil   [10]

(B) The void ratio of clay A decreased from 0.572 to 0.505 under a change in pressure from 120 to 180 kg/m². The void ratio of clay B decreased from 0.612 to 0.597 kg/m² under the same increment of pressure. The thickness of sample A was 1.5 times that of B. Nevertheless the time required for 50% consolidation was three times longer for sample B than for sample A. What is the ratio of the coefficient of permeability of A to that of B?   [10]