GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–V (NEW) EXAMINATION – WINTER 2022

Subject Code:3154007   **Date:06-01-2023**
Subject Name:Geotechnical Engineering
Time:10:30 AM TO 01:00 PM   **Total Marks:70**
Instructions:
1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

			MARKS
Q.1	**(a)**	Sketch the phase diagram for a soil and indicate the volumes and weights of the phases on it.	**03**
	(b)	Differentiate between compaction and consolidation. What is the relation between optimum moisture content and maximum dry density?	**04**
	(c)	In a tri-axial test at failure, major principal stress was 180 kPa, minor principal stress was 100 kPa, and pore water pressure was 20 kPa. Compute the angle of shearing resistance for this soil sample.	**07**
Q.2	**(a)**	Define the natural water content, liquid limit, plastic limit and shrinkage limit.	**03**
	(b)	What do you understand by grain size distribution curve for coarse grain soil? Draw the gradation curves for uniformly graded sand and gap graded gravel.	**04**
	(c)	The porosity and degree of saturation of a soil sample are 0.60 and 35% respectively. For 50 m^3 volume of the soil sample, determine the volume of air.	**07**

OR

	(c)	A saturated sand sample has dry unit weight of 18 kN/m^3, and specific gravity of 2.65. Find out the water content of the soil sample assuming unit weight of water as 10 kN/m^3.	**07**
Q.3	**(a)**	Define IS Soil Classification system for coarse grained soil.	**03**
	(b)	For a fine-grained soil, the liquid limit and plastic limit are determined as 48% and 26% respectively. The natural water content of the soil is 39%. Classify the soil and determine its activity if the soil consists of clay, silt and sand in a ratio of 2.5:6.5:1.	**04**
	(c)	Discuss in detail the different clay minerals with their structural diagrams.	**07**

OR

Q.3	**(a)**	Define soil capillarity. How are the Darcian velocity and the seepage velocity related.	**03**
	(b)	A soil stratum consists of 3 layers of thickness 1m, 1.5m and 2.0 m having the coefficient of permeability of 2 X 10^{-3} cm/s, 1.5 X 10^{-3} cm/s and 3 X 10^{-3} cm/s respectively. Estimate the average co-efficient of permeability in the direction i) parallel to the bedding plane ii) normal to the bedding plane.	**04**
	(c)	Based on continuity equation, derive the two-dimensional steady state seepage for a rectangular soil element.	**07**

Q.4 **(a)** State the assumptions made in Terzaghi's theory of one-dimensional consolidation. **03**

(b) The following values of sand are given: $D_{60} = 0.77$ mm, $D_{30} = 0.41$ mm and $D_{10} = 0.30$ mm. Determine, C_u and C_c and state if it is a well graded or poorly graded soil? **04**

(c) Discuss in detail the procedure for constant head permeameter. **07**

OR

Q.4 **(a)** What do you understand by total stress, effective stress and pore water pressure of a soil mass? How are they related? **03**

(b) Explain any one method to compute coefficient of consolidation. **04**

(c) A soil stratum consists of two layers having thickness 5m and 6m respectively. The ground water table is at the surface. The saturated unit weights for the soil layers are computed as 1.92 Ton/m^3 and 2 Ton/m^3. Draw the total stress, pore water pressure and effective stress diagrams for the soil stratum. **07**

Q.5 **(a)** State the assumptions of Rankine's earth pressure theory. **03**

(b) Draw the change of volumetric strain pattern for loose, medium and dense saturated sand for CD testes performed at the same effective confining stress. **04**

(c) Compute the Factor of Safety (FoS) for a dry cohesionless infinite slope. **07**

OR

Q.5 **(a)** State the assumptions of Terzaghi's one dimensional consolidation theory. **03**

(b) Describe various modes of slope failures. **04**

(c) A UU test is carried out on a saturated normally consolidated clay sample at a confining pressure of 3 kg/cm^2. The deviator stress at failure is 1 kg/cm^2. Determine its total stress strength parameters. **07**

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