GUJARAT TECHNOLOGICAL UNIVERSITY
BE – SEMESTER- V EXAMINATION-SUMMER 2023

Subject Code: 3154007   **Date: 26/06/2023**

Subject Name: Geotechnical Engineering

Time: 02:30 PM TO 05:00 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)**	What is void ratio?	03
	(b)	Calculate the void ratio and dry density of the soil sample with 25% porosity if the specific gravity is 2.75.	04
	(c)	The plastic limit and plasticity index of the soil are 12% and 10 respectively. If the natural water content of the soil is 19%. Determine the following. a) Liquid Limit b) Liquidity Index c) Consistency Index	07
Q.2	**(a)**	Define: (a) Effective stress, (b) Pore water pressure, (c) Pressure bulb	03
	(b)	What is Stokes's law? What are its limitations?	04
	(c)	An embankment having total volume of 3000 m^3 is to be constructed having bulk density of 1.7 gm/cm^3 and placement water content of 17%. The soil is to be obtained from either site A or site B which has void ratio of 0.78 and 0.68 respectively. The water contents of these areas 17% and 13% respectively. If the cost of excavation is Rs. 45/m^3 from each site. The cost of transportation is Rs.45 and Rs.49 per m^3 from site A and site B respectively. Which site will be more economical? Take specific gravity of soils as 2.7.	07

OR

	(c)	Explain with sketch: the spring analogy for the consolidation.	07
Q.3	**(a)**	What is seepage?	03
	(b)	Explain constant head method to determine the permeability.	04
	(c)	A soil sample has the following properties: Cu=6, Cc=2, Gravel = 22%, Sand =80%. Classify the soil and give the justifications.	07

OR

Q.3	**(a)**	What is one-dimensional consolidation.	03
	(b)	Explain falling head method to determine the permeability.	04
	(c)	A partially saturated sample from a borrow pit has a natural water content of 16% and bulk unit weight of 17 kN/m3. The specific gravity of solids is 2.70. Determine the void ratio and degree of saturation. What will be the unit weight of the sample on saturation?	07
Q.4	**(a)**	What is maximum dry density?	03
	(b)	What is factor of safety in the slope stability?	04
	(c)	Define uniformity coefficient and coefficient of curvature and explain its importance.	07

OR

Q.4	**(a)**	What is optimum moisture content?	03
	(b)	Enlist the types of the slope failure. Explain anyone.	04

(c)	A direct shear test was conducted on a dense sand. The sample failed at a shear stress of 70 kN/m^2 when the normal stress was held constant at 100 kN/m^2. Draw the Mohr's circle for the failure condition. Find (a) the angle of shearing resistance and (b) the magnitude and the orientation		**07**

Q.5 (a) What is unconfined compression test?   **03**

(b) What are the assumptions of Boussinesq's theory?   **04**

(c) Determine the ratio of average coefficient of permeability in the horizontal to vertical direction for a deposit consists of three layers 8m, 3m and 4.5m and having coefficient of permeability $3.2 \text{X} 10^{-2}$ mm/s, $4.2 \text{X} 10^{-5}$ mm/s, $5.2 \text{X} 10^{-2}$ mm/s. Assume the layer to be isotropic.   **07**

OR

Q.5 (a) What is vane shear test?   **03**

(b) A gravity retaining wall retains 12 m of a backfill, $\gamma = 17.7 \text{ kN/m}^3$, $\varphi = 23^O$ with a uniform horizontal surface. Assume the wall interface to be vertical, determine the magnitude and the point of application of the total active pressure.   **04**

(c) What is flow net? Explain in detail with sketch. Also explain its use.   **07**