GUJARAT TECHNOLOGICAL UNIVERSITY
BE- SEMESTER–V (NEW) EXAMINATION – WINTER 2024

Subject Code:3150615   **Date:05-12-2024**
Subject Name:Soil Mechanics
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)**	Explain the terms 'inside clearance' and 'outside clearance' as applied to a sampler.	**03**
	(b)	Explain the principle of the direct shear test. What are the advantages of this test? What are its limitations?	**04**
	(c)	Use Boussinesq's theory and compute vertical stress values on a vertical plane located at radial distance of 1m away from a 200 kN point load acting at ground level. Compute the vertical stress values at 2 m, 3 m & 4 m depth.	**07**
Q.2	**(a)**	What are the criteria for deciding the depth of foundations?	**03**
	(b)	Explain Fellenius method for locating centre of slip circle.	**04**
	(c)	A long natural slope in a C-φ soil is inclined at $12^{°}$ to the horizontal. The water table is at the surface and the seepage is parallel to the slope. If a plane slip has developed at a depth of 4 m, determine the factor of safety. Take C = 8 kN/m^2, ϕ = 22° and γ_{sat} =19 kN/m^3.	**07**

OR

	(c)	Determine the area ratio for the following soil samples and comment on the nature of samples obtained in each of the samples.	**07**

Soil sampler	Outer diameter (mm)	Inner diameter (mm)
(a) Core cutter	165	150
(b) Split barrel	51	35
(c) Seamless tube	51	48

Q.3	**(a)**	What are the assumptions made in Terzaghi's analysis of bearing capacity of a strip footing?	**03**
	(b)	Explain the concept of 'Pressure Bulb' in soils.	**04**
	(c)	A clay specimen has unconfined strength of 100 kPa & is subjected to UU Triaxial test under a cell pressure of 100 kPa. Find its axial stress at failure.	**07**

OR

Q.3	**(a)**	Explain the basic difference in the bearing capacity computation of shallow and deep foundations.	**03**
	(b)	Describe with a neat sketch how will you carry out the wash boring method of soil exploration.	**04**

	(c)	In an unconfined compression test, a cylindrical sample of clay 8 cm long and 4 cm in dia., fails under a load of 80 N. Evaluate shearing resistance if failure occurs at 10% strain.	07
Q.4	**(a)**	Explain unconfined compression test.	03
	(b)	Derive the principle of construction of Newmark's chart.	04
	(c)	Determine the safe bearing capacity of a strip footing 1.5 m wide & 1.5 m depth, resting on a deep sand bed, consider $\gamma = 18$ kN/m^3, and bearing capacity factors, $N_C = 35.5$, $N_q = 23.2$, $N_\gamma = 22$ corresponding to $\phi=38°$ and factor of safety = 3. Use Terzaghi's equation.	07

OR

Q.4	**(a)**	Explain in brief about any two types of geosynthetic.	03
	(b)	Explain friction circle method of analysing the stability of slopes.	04
	(c)	Compute the safe bearing capacity of a square footing 2.0 m × 2.0 m, located at a depth of 1.5 m below the ground level in a soil of unit weight 19 kN/m^3,φ = 20°, $N_c = 17.7$, $N_q =7.4$, $N_\gamma = 5.0$. Take factor of safety = 3. The water table is very deep. If the water table touches the base of the footing, find the reduction in safe bearing capacity. Use Terzaghi's equation.	07

Q.5	**(a)**	Discuss the various factors that affect the bearing capacity of a shallow footing.	03
	(b)	What are the different applications of geotextile, and geocell.	04
	(c)	A 60 cm diameter pile is driven into a homogeneous clay having, C = 50 kPa, $\alpha = 0.7$. If the embedded length is 10 m, estimate the safe load. Take FOS = 2, and $N_C = 9$.	07

OR

Q.5	**(a)**	Explain about electrical resistivity method.	03
	(b)	Explain Engineering News formula.	04
	(c)	A concrete pile of 45 cm diameter was driven into sand of loose to medium density to a depth of 15 m. The following properties are known: Average unit weight of soil along the length of the pile, $\bar{\gamma} = 17.5$ kN/m^3, average $\varphi = 30°$, average $\overline{K_s} = 1.0$ and $\delta = 0.750$. Calculate the allowable load with FS = 2.5. Take $N_q = 16.5$.	07

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