Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER–III (NEW) EXAMINATION – WINTER 2024

Subject Code:3130606 Date:21-11-2024

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)**	Define the term "Soil" and "Geotechnical Engineering".	**03**
	(b)	Differentiate between coarse grained and fine grained soil.	**04**
	(c)	List out various method of Water content determination and explain any one in details.	**07**
Q.2	**(a)**	Explain Darcy's law with its limitations.	**03**
	(b)	Differentiate between Compaction and consolidation.	**04**
	(c)	A soil sample has a porosity of 35 %. The specific gravity of solids is 2.7 . Calculate (i) Void ratio (ii) dry density (iii) unit weight of soil when 45% saturated and (iv) unit weight when completely saturated.	**07**
		OR	
	(c)	List out various soil classification systems and explain textural classification in details.	**07**
Q.3	**(a)**	How we will determine the pre-consolidation pressure? Explain it.	**03**
	(b)	Explain Max. Dry density and Optimum moisture content.	**04**
	(c)	Two identical specimen 38mm dia. and 76mm height were tested in tri-axial test under undrained condition. Determine the value of c and ϕ.	**07**

Failed at	Axial load in kg	Cell pressure in kg/cm2
Specimen-1	80	1.5
Specimen-2	100	2

		OR	
Q.3	**(a)**	Define (i) Compression index, (ii) Coefficient of volume change.	**03**
	(b)	Describe the assumptions of Rankine's theory.	**04**
	(c)	Write the procedure of Box shear test with neat sketch.	**07**
Q.4	**(a)**	Describe various factor of safety in respect to slope.	**03**
	(b)	Differentiate between active and passive earth pressure.	**04**
	(c)	A sample of clay is tested in consolidation test. the void ratio changes from 0.85 to 0.60 when load was increased from 70 kN/m^2 to 140 kN/m^2. Determine coefficient of volume change, coefficient of Compressibility and Compression index.	**07**
		OR	
Q.4	**(a)**	Write a short note on Newmark's influence chart.	**03**
	(b)	Define Taylor's stability number and its uses.	**04**
	(c)	An Embankment is compacted at a water content of 15%. The bulk density is 18 kN/m^3. Determine the void ratio and degree of saturation of compacted soil if the specific gravity of soil is 2.75. What would be the theoretical dry unit weight?	**07**

Q.5	**(a)**	Describe various drainage conditions under which shear tests are performed.	**03**
	(b)	For a point load of 100 kN at ground level, compute vertical stress on a horizontal plane located 1.5m depth at radial distance of 2m. Use Boussinesq's theory.	**04**
	(c)	A retaining wall of height 10m with a horizontal sandy backfill of ($\phi=32^0$ and $\gamma= 18$ kN/m^3) and a surcharge of 40 kPa acting over backfill. Draw active earth pressure diagram and Calculate total active thrust acting on wall.	**07**

OR

Q.5	**(a)**	Give the application of flow net.	**03**
	(b)	Explain Factors affecting Selection of type of foundation.	**04**
	(c)	Describe plate load test with neat sketch.	**07**

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Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–III (NEW) EXAMINATION – WINTER 2023

Subject Code:3130606 Date:12-01-2024

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)**	Define the following term (i) Degree of saturation (ii) Liquid limit (iii) Void ratio	**03**
	(b)	Derive the relation between Specific Gravity (G), void ratio (e), degree of saturation (S) and density (ρ).	**04**
	(c)	A soil sample has wet weight of 20 kN/m^3 and water content 10%, specific gravity 2.7. Calculate dry unit weight, void ratio, and degree of saturation.	**07**
Q.2	**(a)**	Classify the soil based on IS soil classification with following results. 1. 60 % soil retain on 4.75 mm sieve, C_u = 5, C_c = 0.85. 2. 70% soil passes through 75 μ, LL = 60%, plasticity above A line.	**03**
	(b)	430 ml of water is collected in 10 minutes under constant head permeability test. The length and cross-sectional area are 6 cm and 50 cm^2 respectively. Determine co-efficient of permeability if constant head is 40 cm.	**04**
	(c)	Describe standard proctor compaction test.	**07**
		OR	
	(c)	Enlist factors affecting permeability of soil and illustrate any two in detail.	**07**
Q.3	**(a)**	Define following terms: (i) Coefficient of consolidation. (ii) Co-efficient of volume change. (iii) Compression index.	**03**
	(b)	Differentiate between consolidated drain and consolidated undrain test.	**04**
	(c)	A retaining wall 4.5 m in heights supports cohesionless back fill up to top surface. It also supports UDL 30 kN/m. The soil is having γ = 18 kN/m^3 and ϕ = 30 °. Draw pressure distribution diagram for active earth pressure and determine total pressure intensity at base, horizontal thrust and its location from bottom.	**07**
		OR	
Q.3	**(a)**	Describe spring analogy methos for consolidation.	**03**
	(b)	Draw neat diagram for triaxial test and labels all the parts.	**04**
	(c)	A retaining wall 5 m high with vertical back, supports cohesive soil. The unit weight of soil is 18 kN/m^3 and angle of internal friction is zero. Determine (i) Pressure intensity at top (ii) Pressure intensity at base (iii) Depth of tension crack. Take C = 20 kN/m^2	**07**
Q.4	**(a)**	Describe various types of slope failures.	**03**
	(b)	Derive the equation for factor of safety for infinite slope and cohesion less soil	**04**

	(c)	Two-line load located at 3 m distance carries 80 kN/m and 60 kN/m load. Determine the vertical stress at 0.8 m below each line and at the center of both the line.	**07**

OR

Q.4	**(a)**	Derive the equation for critical height for cohesive soil in infinite slope.	**03**
	(b)	Describe the method for locating the center for critical circle.	**04**
	(c)	A concentrated load of 750 kN acts on the surface of soil. Calculate variation of vertical stress up to 4.0 m horizontal distance at 1 m interval and depth of 1.5 m. Also plot the stress distribution curve.	**07**
Q.5	**(a)**	Differentiate between General shear failure and Local shear failure	**03**
	(b)	List out assumption made in Terzaghi's bearing capacity theory.	**04**
	(c)	Explain the effects of water table on bearing capacity of soil	**07**

OR

Q.5	**(a)**	Differentiate between end bearing pile and friction pile.	**03**
	(b)	Provide detail classification of the pile foundation	**04**
	(c)	Describe the under-ream pile foundation	**07**

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Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER– III(NEW) EXAMINATION – WINTER 2022

Subject Code:3130606 Date:20-02-2023

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)**	Do as directed i Define degree of saturation ii Draw phase diagram for dry soil iii State the equation for relative density.	**03**
	(b)	Derive the relation between void ratio (e), water content (w), specific gravity (G), and degree of saturation.	**04**
	(c)	An undisturbed sample of soil has a volume of 200 cm^3 and mass 395 g. On oven drying for 24 hour the mass reduced to 320 g. If the specific gravity of the grains is 2.64, determine water content, void ratio, and degree of saturation.	**07**
Q.2	**(a)**	A total of 2000 gm of soil is applied the sieve analysis. 1250 gm soil passes from 4.75 mm sieve, and 300 gm soil passes from 75 μ sieve. If D_{10}, D_{30}, and D_{60} values are 0.4, 1.3 and 2.5 respectively. Classify the soil.	**03**
	(b)	Illustrate the process for determination of grain size by Hydrometer	**04**
	(c)	Describe Atterberg limits with proper sketch. Define plasticity index, Consistency index and Liquidity index.	**07**
		OR	
	(c)	Draw the textural classification chart and described the classification process.	**07**
Q.3	**(a)**	Differentiate light weight and heavy weight compaction test.	**03**
	(b)	Describe piston and spring analogy method of consolidation.	**04**
	(c)	A horizontal stratified soil deposits consist of three uniform layer of thickness 6, 4, and 12 m respectively. The permeability of these layers are $8x10^{-4}$ cm/s, $52x10^{-4}$ cm/s, and $6x10^{-4}$ cm/s. Calculate effective average permeability of the deposits if flow is in horizontal direction and vertical direction.	**07**
		OR	
Q.3	**(a)**	Enlist methods of compaction in field and describe any one in detail.	**03**
	(b)	Describe Square root of time fitting for consolidation.	**04**
	(c)	In falling head permeameter test the initial head is 40 cm. The head drops by 5 cm in 10 minutes. Calculate time required to run the test for the final head to be at 20 cm. Take sample 6 cm in height, 50 cm^2 in area and area of stand pipe 0.5 cm^2.	**07**
Q.4	**(a)**	Describe the method to locate the center of critical circle.	**03**
	(b)	Draw the CULMANN's graphical method for active pressure	**04**
	(c)	Two crane line A and B carries load of 60 kN/m and 80 kN/m respectively at a distance 4.0 m. Determine intensity of stress at 2 m below each line and at the center of both line.	**07**

OR

Q.4 **(a)** Enlist the types of slope failure and explain in detail. **03**

(b) Describe Newmark's Influence chart. **04**

(c) A cylindrical soil sample fails under an axial vertical stress of 160 kN/m^2, when it is laterally unconfined. The failure plane makes an angle of 50° with horizontal. Calculate the value of cohesion and angle of internal friction of the soil. **07**

Q.5 **(a)** Derive the equation for active, and passive pressure intensity at the base of retaining wall for cohesionless soil. **03**

(b) Enlist assumption made by Terzaghi to derive bearing capacity equation. **04**

(c) A retaining wall 6 m in height supports cohesionless soil. The unit weight of the soil is 17 kN/m^3, angle of internal friction 30°. The wall also support surcharge 21 kN/m^2. Evaluate pressure intensity at base, horizontal thrust and its point of application. **07**

OR

Q.5 **(a)** Derive the equation for depth of tension crake and unsupported height of cohesive soil. **03**

(b) Suggest suitable pile foundations for following soil with reasons. **04**

1. Soft clay
2. Stiff clay

(c) A new canal is excavated to a depth of 5 m, below ground level, through a soil having the following characteristics. C= 14 kN/m^2, Ø = 15°, void ratio 0.8, and G= 2.7. The slope of bank is 1:1. Calculate the factor of safety with respect to cohesion, when canal is running full. If it is suddenly and completely emptied, what will be the factor of safety? **07**