Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

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

Subject Code:3154007 Date:07-12-2023

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)** What are the purposes of the soil classification? **03**

(b) Define: Flow line and Equipotential line. Also state the characteristics of flow net. **04**

(c) A 400 gm of soil gives following data on performing dry sieve analysis: **07**

Sieve Size, mm	4.75	2.36	1.18	0.600	0.425	0.300
Weight retainer on each sieve, gms	8	12	32	75	64	70

Sieve Size, mm	0.212	0.150	0.075	Receiver
Weight retained on each sieve, gms	65	42	20	12

Plot 'Grain Size Distribution Curve'

Q.2 **(a)** 1 m^3 of wet soil having weight 22 kN, when it dries, it becomes 19.5 kN. If specific gravity of soil is 2.62, determine void ratio in soil. **03**

(b) Define: Normally Consolidated Clay and Over Consolidated Clay with neat sketch. **04**

(c) A retaining structure of 4m height is supporting a cohesionless backfill (angle of internal friction as 30° and bulk unit weight as 22kN/m^3) inclined at an angle of 10° with horizontal. Determine Rankine's total passive force per meter length of the wall. **07**

OR

(c) A specimen of dry, cohesionless sand is tested in shear box and the soil failed at a shear stress of 9 kN/m^2 and normal stress of 18kN/m^2 . Determine: (i) angle of internal friction and (ii) the magnitude of major and minor principal stress during failure. **07**

Q.3 **(a)** Define the following terms: (i) porosity (ii) Air content (iii) Bulk Unit weight **03**

(b) The following results were obtained from a standard proctor test on a sample of soil: **04**

Water content, %	15	16	17	18	19	20
Mass of Wet soil, kg	1.5	1.62	1.68	1.65	1.65	1.63

The volume of mold is 950cc. Make necessary calculations and plot the 'compaction curve'.

(c) Define with sketch Flow net. Its characteristics and its application. **07**

OR

Q.3 **(a)** Define Safe, Allowable and Ultimate bearing capacity of soil. **03**

(b) Determine time t, in minutes, for a particle of diameter 0.006mm to fall a height of 10cm from the surface of water. Take $\mu = 0.00815$ poise and G = 2.66 **04**

(c) What is the difference between superficial velocity and seepage velocity? **07**

Q.4 **(a)** A sample of saturated soil collected from core-cutter has a water content of 30% and saturated unit weight of 22 kN/m^3 , determine specific gravity of soil. (Take $\gamma_w = 9.81$ kN/m^3 .) **03**

(b) Determine C_u and C_c for the soil sample with below data. D60 = 0.81 mm, D30 = 0.37 mm and D10 = 0.35 mm. Decide the type of soil; well graded or poorly graded **04**

(c) A clay layer 4m thick is subjected to a pressure of 60 kN/m^2 over a large area. If the layer has double drainage and undergoes 60% consolidation in one year, determine the co-efficient of consolidation. If the co-efficient of permeability is 0.003m/year, determine the settlement in one year. **07**

OR

Q.4 **(a)** Explain the phase diagram for a soil. **03**

(b) Explain in brief: tri-axial compression test for UU condition. **04**

(c) An infinite slope is made of clay with the following properties, γ_{bulk} =18 kN/m^3 , γ_{sub} = 9 kN/m^3 , C'=25 kN/m^2, φ'=28° If the slope has an inclination of 35° and height equal to 12 m, determine the stability of slope, (i) when the slope is submerged (ii) there is seepage parallel to the slope. **07**

Q.5 **(a)** What are different factors of safety used in the stability of slopes? Discuss briefly. **03**

(b) Explain the following terms 1. Isochrone 2. Secondary Compression **04**

(c) Differentiate between General shear failure and Local shear failure with neat sketch. **07**

OR

Q.5 **(a)** Explain factors affecting permeability of soils **03**

(b) The maximum dry density of a sample by the light compaction test is 1.8 gm/cc at an optimum moisture content of 18%. Find the degree of saturation. What would be the corresponding value of dry density on the 'zero air void line' at optimum moisture content? Take G=2.67. **04**

(c) Differentiate between the process of consolidation and compaction. **07**

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