Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER–V (NEW) EXAMINATION – WINTER 2020

Subject Code:3154007 Date:27/01/2021

Subject Name:Geotechnical Engineering

Time:10:30 AM TO 12:30 PM Total Marks: 56

Instructions:

1. **Attempt any FOUR questions out of EIGHT questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

MARKS

Q.1 **(a)** 1 m3 of wet soil having weight 25 kN, when it dries, becomes 22 kN. If specific gravity of soil is 2.65, determine void ratio in soil. **03**

(b) State and explain different states of consistency for soil as given by Atterberg. **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 retained 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'. Also determine % gravels, % sand and % fines.

Q.2 **(a)** What is the difference between superficial velocity and seepage velocity? **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) An infinite slope is made of clay with the following properties, $\gamma_{bulk} = 18$ kN/m^3, $\gamma_{sub} = 9$ kN/m^3, C'=25 kN/m2, $\varphi' = 28°$ 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.3 **(a)** In-situ porosity of a cohesionless soil is 43%. If the maximum and minimum dry density of the soil determined in the laboratory are 2.00 gm/cc and 1.35 gm/cc respectively, calculate Relative Density of soil. Take G = 2.65. **03**

(b) A sample in a variable head permeameter is 8 cm in diameter and 10 cm high. The permeability of the sample is estimated to be 10*10-4 cm/s. If it is desired that the head in the stand pipe should fall from 24 cm to 12 cm in 3 min, determine the diameter of stand pipe which should be used. **04**

(c) Derive: Terzaghi's 1D consolidation theory. **07**

Q.4 **(a)** State Limitations of Boussinesq's theory. **03**

(b) Classify the following soil as per IS classification system: **04**

Soil No.	% Gravel	%Sand	%Fines	Cu	Cc	LL	PL
1	40	45	15	7	2	28	22
2	10	15	75	5	1.5	23	17

(c) A clay layer 4m thick is subjected to a pressure of 55kN/m2 over a large area. If the layer has double drainage and undergoes 50% consolidation in one year, determine the co-efficient of consolidation. If the co-efficient of permeability is 0.0020m/year, determine the settlement in one year. **07**

Q.5 **(a)** For which value of 'r/z', the vertical stress due to point load by Boussinesq's and Westergaard's theory remains identical? **03**

(b) A retaining structure of 4m height is supporting a cohesionless backfill (angle of internal friction as 33° and bulk unit weight as 20kN/m^3) inclined at an angle of 12° with horizontal. Determine Rankine's total passive force per meter length of the wall. **04**

(c) A line of sheet pile is driven to a depth of 7m into a stratum of 15m thick homogeneous sandy soil having co-efficient of permeability as 3.5 x 10-4 m/s, is underlain by an impermeable stratum. From an original depth of 6.0m, the water level on other side of the piles is reduced by pumping to a depth of 1.0m. Draw a flow net for four flow lines for the seepage conditions when the head drop between successive equipotential is 0.50m and from it, determine the quantity of seepage through single flow channel per meter run of pile. **07**

Q.6 **(a)** Calculate energy transferred during Light Compaction test and Heavy Compaction test. **03**

(b) Explain Fellenius method for the location of most critical circle. **04**

(c) Determine factor of safety of cohesive slope. for following case: '2 m deep tension crack filled with water (From toe to bottom of crack, θ1=76°)', Radius of arc 12 m. Take saturated unit weight of dam soil 18 kN/m3, Cohesion 22 kN/m^2. Total weight 1800 kN of slip circle wedge is acting at a distance of 3 m from center of rotation. **07**

Q.7 **(a)** Differentiate between: Consolidation and Compaction. **03**

(b) Calculate the shear strength of an element at a depth of 4m below the ground surface in a formation of soil when water table is present at a ground level. Soil data given is: void ratio = 0.50, specific gravity G = 2.66, cohesion (c) = 30Kn/m^2, Angle of friction (ø) = 30°. (Take unit weight of water as 10Kn/m^3). **04**

(c) Explain different types of lateral earth pressure conditions depending on the movement of wall with respect to the soil mass retained. **07**

Q.8 **(a)** Explain Mohr-Coulomb failure criterion for deciding the shear failure in soil. **03**

(b) Differentiate between: Rankine's Earth Pressure Theory and Coulomb's Earth Pressure Theory. **04**

(c) A specimen of dry, cohesionless sand is tested in shear box and the soil failed at a shear stress of 5kN/m^2 and normal stress of 10kN/m^2. Determine: (i) angle of internal friction and (ii) the magnitude of major and minor principal stress during failure. **07**

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