

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-V (NEW) EXAMINATION – WINTER 2021****Subject Code:3154007****Date:01/01/2022****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.

- Q.1** (a) Why kaolinite exhibits low plasticity as compared to montmorillonite? **MARKS 03**
 (b) Classify the soil as per IS Classification System: **04**

Soil No.	%Gravel	%Fines	%Sand	LL	PL	Cu	Cc
1.	15	60	25	60	28	6	2
2.	55	25	20	35	20	5	2.5
3.	41	4	55	20	12	5	2
4.	10	75	15	23	16.6	7	3

- (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'

- Q.2** (a) State whether the following statements are true or false: **03**
- 1) The Mohr circle of Unconfined Compressive Strength test passes through origin.
 - 2) In a stress-controlled test, the stress-strain curve can be easily obtained.
 - 3) For the long-term stability of a foundation resting on saturated cohesive soil, Triaxial Consolidated Drained test is recommended.
- (b) Differentiate between: Consolidation and Compaction. **04**

(c) Soil type contains:

07

Soil No.	Liquid Limit, %	Plastic Limit, %	Natural Moisture Content, %	% finer than 2μ
1.	120	40	150	50
2.	80	35	70	55
3.	60	30	30	45
4.	65	32	25	50

Determine the Consistency index, Liquidity index, State of consistency, Activity No. and State of Activity for all types of soils.

OR

(c) Determine the average co-efficient of permeability in the horizontal and vertical directions for a deposit consisting of 3 layers of thickness 5m, 1m and 2.5m and having co-efficient of permeability of 3×10^{-2} mm/s, 3×10^{-5} mm/s and 4×10^{-2} mm/s respectively. 07

Q.3 (a) Distinguish between discharge velocity and seepage velocity. 03

(b) Explain the need of 'Slope Stability Analysis'. Also mention any four methods for analysis of finite slopes of soil. 04

(c) Explain Spring Analogy method for understanding the process of consolidation of soil on field. 07

OR

Q.3 (a) Explain the following term 03
1. Isochrone
2. Secondary Compression

(b) Direct Shear Test is best suited for which type of soil? Also explain limitations of the DST in brief. 04

(c) A retaining structure of 4m height is supporting a backfill soil having properties: cohesion = 12kN/m^2 , angle of internal friction = 30° , unit weight = 19kN/m^3 . If backfill is subjected to a surcharge load of 20kN/m^2 , draw the pressure diagram for Rankine's active state. Also determine the depth of excavation for which retaining structure is not required. 07

Q.4 (a) A retaining structure of 5m height is supporting a cohesionless backfill (angle of internal friction as 31° and bulk unit weight as 21kN/m^3) inclined at an angle of 10° with horizontal. Determine Rankine's total active force per meter length of the wall. 03

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

- (c) In an UCS test, a sample of clay, 76mm long and 38mm diameter fails under a load of 200N at 12% strain. Calculate the undrained shear strength of clay taking into account the effect of change in c/s area of sample **07**

OR

- Q.4 (a)** A sample of saturated soil collected from core-cutter has a water content of 25% and saturated unit weight of 20 kN/m³, determine specific gravity of soil. (Take $\gamma_w = 9.81 \text{ kN/m}^3$.) **03**

- (b) The maximum dry density of a sample by the light compaction test is 1.78gm/cc at an optimum moisture content of 15%. 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) An infinite slope is made of clay with the following properties, $\gamma_{\text{bulk}} = 18 \text{ kN/m}^3$, $\gamma_{\text{sub}} = 9 \text{ kN/m}^3$, $C' = 25 \text{ kN/m}^2$, $\phi' = 28^\circ$ If the slope has an inclination of 35° and height equal to 12 m, determine the stability of slope, **07**

(i) when the slope is submerged (ii) there is seepage parallel to the slope.

- Q.5 (a)** 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 $G = 2.66$. **03**

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

- (c) A specimen of dry, cohesionless sand is tested in shear box and the soil failed at a shear stress of 5kN/m² and normal stress of 10kN/m². Determine: **07**

(i) angle of internal friction and (ii) the magnitude of major and minor principal stress during failure.

OR

- Q.5 (a)** Differentiate between: Rankine's Earth Pressure Theory and Coulomb's Earth Pressure Theory. **03**

- (b) What is Consistency of soil? Explain different states of consistency for soil as given by Atterberg. **04**

- (c) The following results were obtained from a standard proctor test on a sample of soil: **07**

Water content, %	12	14	16	18	20	22
Mass of Wet soil, kg	1.68	1.85	1.91	1.87	1.87	1.85

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