Name: Enrolment No:	UPES UNIVERSITY OF TOMORROW

UPES, Dehradun

End Semester Examination, December 2023

Programme Name: B Tech Civil Engineering
Semester : V
Course Name : Geotechnical Engineering **Time : 3 hrs**
Course Code : CIVIL 3020 **Max. Marks: 100**
Nos. of page(s) : 3

Instructions: Assume suitable data if necessary.

SECTION A

S. No.		Marks	CO
Q 1	Describe in short the importance of three phase diagram and index properties of soil in Geotechnical Engineering?	4	CO1
Q 2	What are the Infinite and Finite slopes? Describe major causes of failure of slopes.	4	CO2
Q 3	Describe critical hydraulic gradient with neat sketch.	4	CO3
Q 4	Describe, in short, the shear strength parameters of soil and its importance.	4	CO4
Q 5	What is the similarity and difference between compaction and consolidation?	4	CO5
	SECTION B		
Q 6	(a) A soil has a plastic limit of 30% and plasticity index of 32%. If natural water content of soil is 36%, what is the liquidity and consistency index? Classify the soil according to the liquidity index. (b) Define Cc and Cu. Give the IS criteria for classification of soil based on the values of Cc and Cu.	5+5 = 10	CO1
Q 7	(a) Calculate the vertical stress distribution on a vertical plane at 4 m from the axis of point load of 60 kN using Boussinesq's equation. (b) An infinitely long slope having an inclination of 26° in an area is underlain by firm cohesive soil (G = 2.7 and e = 0.52). There is a thin, weak layer of soil 4 m below and parallel to the slope surface (c ′ = 28 kN/m2, φ′ = 18°). Compute the factor of safety when the slope is dry. **OR** (a) A normally consolidated clay stratum of 4 m thickness has two permeable layers at its top and bottom. The liquid limit and the initial void ratio of the clay are 34% and 0.84 respectively, while the initial overburden pressure at the middle of the clay	4+6 =10 **OR** 6+4 =10	CO2

	layer is 3 kg/cm^2. Due to the construction of new building this pressure increases by 2 kg/cm^2. Compute the probable consolidation settlement of the building. (b) Describe time factor and degree of consolidation in Geotechnical Engineering.		
Q 8	(a) What do you mean by placement water content and degree of compaction? (b) To compute the seepage loss through the foundation of a dam, flownet was drawn. The flownet study gave the number of flow channels N_f = 6 and number of equipotential drops N_d = 16. The head of water lost during seepage was 4 m. If the coefficient of permeability of foundation soil is 3×10^{-5} m/min, compute the seepage loss per meter length of dam per day.	**4+6 =10**	**CO3**
Q 9	(a) State two major advantages of triaxial shear test. (b) A cohesive soil has an angle of shearing resistance of 18° & cohesion of 36 kN/m^2. If a specimen of this soil is subjected to a triaxial compression test, find the value of lateral pressure in the cell for failure to occur at a total axial stress of 200 kN/m^2.	**4+6 =10**	**CO4**
	SECTION-C		
Q 10	(a) Calculate the potential shear strength on a horizontal plane at a depth of 3 m below the surface in a formation of cohesionless soil when the water table is at a depth of 3.5 m. The degree of saturation may be taken as 0.5 on the average. Void ratio = 0.50; grain specific gravity = 2.70; angle of internal friction = 30°. What will be the modified value of shear strength if the water table reaches the ground surface? (b) Define sensitivity and thixotropy. (c) Write a short note on Vane shear test OR (a) A given soil mass has a moisture content of 10.5% and a void ration of 0.67. The specific gravity of soil solids is 2.68. It is required to construct three cylindrical test specimens of diameter 3.75 cm and height 7.5 cm from this soil mass. Each specimen should have a moisture content of 15% and a dry density of 1.6 gm/cc. Determine: (i) The quantity of the given soil to be used for the purpose (ii) Quantity of water to be mixed with it (b) Write a short note on (i) piping failure and (ii) Quicksand condition	**8+12 =20**	**CO5**
Q 11	(a) Write a short note on (i) Isober and (ii) UU, CU, and CD tests. (b) Following data are available in connection with the construction of a road embankment: Soil from borrow pit: natural density 1.75 Mg/m^3, natural moisture content 12%. Soil after compaction in the embankment: compacted density 2 Mg/m^3, water content 18%. For every 100 m^3 of compacted soil of the embankment, calculate: (i) the quantity of soil excavated from the borrow pit, and (ii) the amount of water to be added.	**8+12 =20**	**CO4**