Name: **Enrolment No:**	UPES UNIVERSITY OF TOMORROW

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, December 2022

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	Classify soil particle based on grain size following IS: 1498-1970.	4	CO1
Q 2	What is stability number? How is stability number utilized in slope stability analysis?	4	CO2
Q 3	Draw a typical compaction curve showing the relation between MDD-OMC and explain the terms MDD, OMC and Zero air-void line.	4	CO3
Q 4	Describe in detail the shear strength parameters.	4	CO4
Q 5	Define Overconsolidated and Normally consolidated clay.	4	CO5

SECTION B

Q 6	(a) A soil has a plastic limit of 28% and plasticity index of 30%. If natural water content of soil is 32%, what is the liquidity and consistency index? Classify the soil according to the liquidity index. (b) Write a short note on Plasticity Chart used for classification of fine-grained soil.	10	CO1
Q 7	(a) Determine the vertical stress intensity at a depth of 6 m below the centre of a square loaded base of size 4 m X 4 m carrying a load of 400 kN/m2 is using equivalent point method (b) An infinitely long slope having an inclination of 26° in an area is underlain by firm cohesive soil (G = 2.72 and e = 0.50). There is a thin, weak layer of soil 6 m below and parallel to the slope surface (c ′ = 25 kN/m2, φ′ = 16°). Compute the factor of safety when the slope is dry. **OR** (a) A normally consolidated clay stratum of 3 m thickness has two permeable layers at its top and bottom. The liquid limit and the initial void ratio of the clay are 36% and 0.82 respectively, while the initial overburden pressure at the middle of the clay	10	CO2 CO5

	layer is 2 kg/cm^2. Due to the construction of new building this pressure increases by 1.5 kg/cm^2. Compute the probable consolidation settlement of the building. (b) Define overconsolidation ratio.		
Q 8	(a) To compute the seepage loss through the foundation of a dam, flownet was drawn. The flownet study gave number of flow channels $N_f = 8$ and number of equipotential drops $N_d = 18$. The head of water lost during seepage was 6 m. If the coefficient of permeability of foundation soil is 4×10^{-5} m/min, compute the seepage loss per meter length of dam per day. (b) State and explain the factors affecting compaction of soil.	**10**	**CO3**
Q 9	(a) In case of Direct shear test, the value of normal stresses and corresponding shear stresses are given below: σ = 75KPa, τ = 61.3kPa, σ = 125 kPa, τ = 90.13 kPa, σ = 175 kPa, τ = 119.04 kPa. Determine the cohesion and angle of internal friction of soil. (a) State two major drawbacks of direct shear test.	**10**	**CO4**
	SECTION-C		
Q 10	(a) 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. (b) Write a short note on (i) Isober and (ii) UU, CU, and CD tests.	**20**	**CO1** **CO3** **CO4**
Q 11	(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) Field compaction control Or (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	**20**	**CO1** **CO3** **CO4**