Name:

Enrolment No:

UPES

End Semester Examination, December 2024

Course: Geotechnical Engineering **Semester: V**

Program: B. Tech Civil Engineering **Time : 03 hrs.**

Course Code: CIVL3020 **Max. Marks: 100**

Instructions: Answer all questions. Draw neat sketch and assume suitable data wherever necessary.

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	Derive the relationship of bulk density and dry of soil density.	**4**	**CO1**
Q 2	Define 'neutral' and 'effective' pressure in soils.	**4**	**CO2**
Q 3	Describe isobar with neat sketch.	**4**	**CO3**
Q 4	How shear strength of the soil be determined?	**4**	**CO3**
Q 5	What is Infinite and Finite slopes? Explain in short with neat sketches.	**4**	**CO4**

SECTION B
(4Qx10M= 40 Marks)

Q 6	(a) Describe critical hydraulic gradient with neat sketch. (b) What is the critical hydraulic gradient of a sand deposit of specific gravity 2.7 and porosity 40%.	**6+4=10**	**CO2**
Q 7	(a) A point load of 500 kN is applied at the ground surface. Calculate vertical stress at point which is 7.5 m away horizontal and 5 m below ground surface using Westergaard's equation. (b) A water tank is supported by a ring foundation having outer diameter is 10 m and inner diameter is 7.5 m. The ring foundation transmits a uniform load intensity of 160 kN/m^2. Compute the vertical stress induced at a depth of 4m below the centre of ring foundation Boussinesq's equation.	**5+5=10**	**CO3**
Q 8	(a) Describe UU, CU, and CD tests with corresponding Mohr circle. (b) A cylindrical specimen of saturated clay, 40 mm in diameter and 90 mm in overall length is tested in an unconfined compression tester. The specimen has cone end and its length between the apices of cones is 80 mm. Find the unconfined compressive strength of clay, if the specimen	**6+4=10**	**CO3**

	fails under an axial load of 46.5 N. The change in the length of specimen at failure is 10 mm.		
Q 9	(a) What are the compressibility characteristics of a soil? (b) In a laboratory consolidation test, the void ratio of the sample reduced from 0.85 to 0.73 as the pressure increased from 1 to 2 kg/cm^2. If the coefficient of permeability of the soil be 3.3×10^{-4} cm/s, determine (i) coefficient of volume change and (ii) coefficient of consolidation Or (a) State the uses of drawing flow net in geotechnical engineering field. (b) A homogeneous earthen dam 30 m high has a free board of 1.5 m. A flow net was constructed and the following results noted: No of potential drop = 12, No of flow channels = 3. The dam has a 18 m long horizontal filter at its downstream end. Calculate the seepage loss across the dam per day if the width of the dam is 200 m and co-efficient of permeability of the soil be 3.55×10^{-4} cm/s.	**2+8=10**	**CO4**
	SECTION-C **(2Qx20M=40 Marks)**		
Q 10	(a) A sand deposit is 10 m thick and overlies a bed of soft clay. The ground water table is 3 m below the ground surface. If the sand above the ground water table has a degree of saturation of 45%, plot the diagram showing the variation of the total stress, pore water pressure and the effective stress. The void ratio of the sand is 0.7 and specific gravity is 2.65. (b) Determine the increase in effective stress at the bottom of sand layer when the water table is lowered by 5 m. Assume that the soil above the water table has the degree of saturation of 45% throughout.	**10+10=20**	**CO3**
Q 11	(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 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. Or 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	**12+8=20**	**CO4**