U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

September / October 2023 Semester End Main Examinations

Programme: B.E. **Semester: IV**
Branch: Civil Engineering **Duration: 3 hrs.**
Course Code: 22CV4PCGTE **Max Marks: 100**
Course: Geotechnical Engineering - I

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

			UNIT - I	CO	PO	Marks
1	a)		Define the terms: i) Saturated density ii) Percentage air voids iii) Specific Gravity iv) Porosity.	CO1	PO1	**08**
	b)		Derive the relationship between dry unit weight, specific gravity, water content and percentage air voids.	CO1	PO1	**06**
	c)		Soil has been compacted in a embankment at a bulk density of 2.05 g/cm^3 and water content of 13%. The value of specific gravity of soil solids is 2.68. Calculate i) dry density ii) voids ratio iii) degree of saturation	CO3	PO4	**06**
			UNIT - II			
2	a)		List any four methods to determine the moisture content of soil.	CO1	PO1	**04**
	b)		In a liquid limit test specimens of certain sample of clay following readings are obtained: Water content (%): 31.30, 27.00, 25.60, 23.40 No. of blows: 5, 16, 23, 42 The plastic limit of clay is 13% natural water content is 18%. Determine liquid limit, plasticity index, liquidity index, consistency index, flow index and toughness index of soil.	CO3	PO4	**08**
	c)		Following are the properties of two soils, obtained from laboratory tests. Classify them according to Indian Standards by plotting PI-chart. Soil Sample: Soil-A, Soil-B Percentage passing through 0.075mm sieve: 100, 30 Percentage passing through 4.75mm sieve: 100, 100 Liquid Limit (%): 400, 35 Plastic Limit (%): 50, 20	CO1	PO1	**08**

			UNIT - III			
	3	a)	Discuss the types of Soil structure.	*CO1*	*PO1*	**06**
		b)	Explain with neat sketch, Kaolinite clay mineral.	*CO1*	*PO1*	**06**
		c)	Compute the total, effective and pore pressure at a depth of 15 m below the bottom of a lake 6 m deep. The bottom of the lake consists of soft clay with a thickness of more than 15 m. The average water content of the clay is 40% and the specific gravity of soils may be assumed to be 2.65.	*CO3*	*PO4*	**08**
			UNIT - IV			
	4	a)	Discuss the factors affecting Permeability of soil.	*CO2*	*PO2*	**06**
		b)	Determine the ratio of average permeability in horizontal direction to that in the vertical direction for a soil deposit consisting of three horizontal layers. If the thickness and permeability of the second layer are twice of those of first layer, and the thickness and permeability of the third layer are twice of those of second layer.	*CO2*	*PO2*	**06**
		c)	The observations of a standard proctor test are given below: Water content (%): 7.70, 11.50, 14.60, 17.50, 19.70, 21.20 Mass of compacted soil (g): 1700, 1890, 2030, 1990, 1960, 1920 Volume of the mould used was 945 cm^3. Make necessary calculations and plot the compaction curve and also determine OMC and MDD.	*CO3*	*PO4*	**08**
			OR			
	5	a)	Differentiate between standard proctor test and modified proctor test.	*CO2*	*PO2*	**04**
		b)	List and discuss the factors affecting compaction.	*CO2*	*PO2*	**08**
		c)	From an undisturbed chunk soil sample obtained from the field, a portion of the undisturbed sample was extracted to fit into in a standard permeameter apparatus such that the stratification of the soil in the field was retained in the laboratory. The soil sample was 150 mm long and 3848.45 mm^2 in cross-section. A constant head of 220 mm was maintained such that the flow was perpendicular to the stratification. The discharge yielded was. $250x10^2$ mm^3 in a time of 2.5 mins. Compute the coefficient of hydraulic conductivity, coefficient of percolation, the seepage velocity and discharge velocity, given that the void ratio of the soil sample is 0.58. Based on the results obtained comment on the type of soil.	*CO3*	*PO4*	**08**
			UNIT - V			
	6	a)	Explain Mohr-Coulomb theory as applied to soils.	*CO2*	*PO2*	**08**
		b)	Discuss the advantages of triaxial compression test over direct shear test.	*CO2*	*PO2*	**04**

		c)	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 3.5m. 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?	*CO3*	*PO4*	**08**
			OR			
	7	a)	Discuss the types of shear tests based on drainage conditions.	*CO2*	*PO2*	**06**
		b)	Two samples of soil were tested in a triaxial machine. The all-round pressure maintained for the first sample was 200 kN/m^2 and failure occurred at additional axial stress of 770 kN/m^2, while for the second sample, these values were 500 kN/m^2 and 1370 kN/m^2 respectively. Determine the cohesion and angle of internal friction.	*CO3*	*PO4*	**06**
		c)	In a direct shear test on a specimen of **clean dry sand**, a normal stress of 145 kN/m^2 was applied and failure occurred at a shear stress of 60 kN/m^2. **Determine graphically**: (i) the angle of shearing resistance, (ii) the principal stresses during failure, and (iii) the directions of the principal planes with respect to the direction of the plane of shearing.	*CO3*	*PO4*	**08**

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