U.S.N.										

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

Autonomous Institute Affiliated to VTU

August 2024 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)	A specimen of clay was tested in the laboratory and the following data were collected Mass of wet specimen M1=148.8g Mass of dry specimen M2=106.2g Volume of wet specimen V=86.2cc Specific gravity of particles G=2.70 Determine a) Water content b) Bulk and dry densities c) Void ratio and porosity d) Degree of saturation	***CO*** 1	***PO2***	**7**
	b)	An irregular sample of a firm clay was cut from a trial hole and sent to a laboratory for testing. In order to determine its bulk density the samples was coated with paraffin wax and its volume found by displacement. The following data were collected: Mass of soil as received =924.2g Mass of soil after coating with paraffin wax = 946.6g Volume of water displaced = 513.1ml Specific gravity of wax = 0.9 Determine the bulk density of the soil.	***CO*** 1	***PO2***	**7**
	c)	With help of a phase diagram, define the terms bulk density, dry density and saturated density	***CO1***	*PO1*	**6**
		UNIT - II			
2	a)	After a series of laboratory tests, the following data were established for a fine soil: w_L=45%, w_P=18% Clay content = 24.2% a) Describe the soil according to IS classification system b) Calculate the activity of the soil c) Determine the liquidity index of the soil when its natural moisture content is 29%	***CO*** 1	***PO2***	**10**
	b)	List and discuss the tests involved in field identification of soils	***CO*** 1	***PO1***	**10**
		OR			

	3	a)	A sand replacement test was carried out to determine the in-situ bulk density of a soil. From the following recorded data, determine the value of density required. Mass of soil removed from hole = 2764g Initial total mass of sand pouring cylinder = 5724g Final total mass of sand pouring cylinder = 3172g Volume of cone in sand pouring cylinder = 248 cc Density of pouring sand = 1560 kg/m^3	***CO*** 1	***PO2***	**8**
		b)	In a liquid limit test on a fine grained soil, using a cone penetrometer, the following results were recorded Cone penetration (mm): 15.9, 17.7, 19.1, 20.3, 21.5 Water content (%): 32.6, 42.9, 51.6, 59.8, 66.2 In a plastic limit test on the same soil, the plastic limit was found to be 25%. Determine the liquid limit and plasticity index of the soil and classify it according to IS Classification system	***CO*** 1	***PO2***	**12**
			UNIT - III			
	4	a)	A sediment settling lagoon has a depth of water of 4m above the clay base. The clay layer is 3m thick and this overlies 4m of a medium sand, which in turn overlies impermeable rock. Calculate the effective stresses at the top of the clay and at the top and bottom of the second layer under the following conditions: (a) Initially, before any sediment is deposited (b) after a 2m layer of sediment of silty fine sand has been deposited and (c) after draining the lagoon down to base level, with the same thickness (2m) of sediment still in place. Unit weights of clay=18kN/m^3; sand=20kN/m^3; sediment = 16kN/m^3.	***CO*** 2	***PO2***	**14**
		b)	Discuss any two types of soil structure.	***CO*** 2	***PO1***	**06**
			UNIT - IV			
	5	a)	A stratified soil consists approximately of alternating layers of sand and silt. The sand layers are generally 150mm in thickness and have a permeability of k=6.5x10^{-1} mm/s, the silt layers are 1.80m thick and have a k=2.5x10^{-4} mm/s. Assuming that within each layer flow condition is isotropic, determine the ratio of the horizontal permeability to that of the vertical.	***CO*** 2	***PO2***	**10**
		b)	List and discuss the factors affecting permeability of soil.	***CO*** 2	***PO1***	**10**
			OR			
	6	a)	The observations of a standard proctor test are given below Water content (%): 12.85, 14.28, 15.65, 16.86, 17.89 Bulk density (g/cc): 2.06, 2.10, 2.15, 2.16, 2.14 Plot the compaction curve and determine the OMC and MDD Also plot the Zero Air Void line. Take G =2.72	***CO*** 2	***PO2***	**10**
		b)	List and discuss the factors affecting compaction.	***CO*** 2	***PO1***	**10**

			UNIT - V			
	7	a)	During a shear box test on specimen of a compacted sand the following results were recorded: Normal Load (N): 110, 216, 324, 432 Ultimate shear load (N): 66, 131, 195, 261 Peak shear load (N): 85, 170, 253, 340 Determine the peak and ultimate angles of friction.	***CO*** 2	***PO2***	**10**
		b)	A drained triaxial compression test carried out on three specimens of the same soil yielded the following results: Test No. 1, 2, 3 Cell pressure (kPa): 100, 200, 300 Ultimate deviator stress (kN/m^2): 210, 438, 644 Draw the shear strength envelope and determine the shear strength parameters, assuming that the pore pressure remains constant during the axial loading stage.	***CO*** 2	***PO2***	**10**

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