U.S.N.										

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

Autonomous Institute Affiliated to VTU

February 2025 Semester End Main Examinations

Programme: B.E. **Semester: IV**
Branch: Civil Engineering **Duration: 3 hrs.**
Course Code: 22CV4PCGTE / 23CV4PCGTE **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)		Sketch the phase diagrams of a dry soil, saturated soil and a partially saturated soil	CO 1	PO1	05
	b)		How many cubic metres of earth fill can be constructed at a void ratio of 0.67 from 1,90,000m^3 borrow material that has void ratio of 1.1.	CO 1	PO2	07
	c)		A partially saturated soil sample obtained from an earth fill has a moisture content of 22% and bulk unit weight of 2g/cc. Assuming specific gravity of solids as 2.7 and density of water as 1g/cc, compute i. degree of saturation ii. void ratio iii. if subsequently the soil gets saturated, determine its unit weight	CO 1	PO2	08
			OR			
2	a)		Compare i. Density of soil solids and dry density ii. Percent air voids and air content	CO 1	PO1	04
	b)		An earthen dam is to be constructed from a borrow area soil. After compaction the void ratio is 0.85. Three borrow pits A, B and C are available near dam location. Given the following details, estimate the most economical borrow pit to construct the dam with a total volume of 5 x 10^5 m^3	CO 1	PO2	08
	c)		For a given soil having specific gravity of 2.67, unit weight of 17.6kN/m3 and moisture content of 10.8%. Determine dry unit weight, voids ratio, porosity and degree of saturation. For the same soil, determine the weight of water in kN to be added per cum of soil to achieve 80% degree of saturation	CO 1	PO2	08

Pit	Void ratio	Soil transportation cost/m^3
A	0.95	Rs. 1.50
B	1.90	Rs. 1.35
C	1.65	Rs. 1.45

			UNIT – II			
3	a)	In order to classify a soil sample, 500g of soil was taken and sieved using 75µ I.S. Sieve. It was observed that only 50g of soil sample was retained on 75µ I.S. Sieve. The Liquid limit was determined from a percussion cup device is given below Number of blows, N: 16, 19, 23, 26, 35 Water content, (%): 61.8, 61.0, 59.4, 58.4, 56.6 The plastic limit obtained from rolling thread method was found to be 22%. Classify the soil as per I.S. classification system.	***CO*** 1	***PO2***	**12**
	b)	Discuss the various field identification tests	***CO*** 1	***PO1***	**08**
		OR			
4	a)	The following data shows the results of grain size analysis conducted on 500g soil sample. The % finer for each size is given. Plot the grain size curves. Represent the results in a tabular form. Sieve size (mm): 4.75, 2.36, 1.16, 0.425, 0.2, 0.15, 0.075, 0.002, W_L%, W_P % Soil A % Finer: 100, 99, 94, 75, 66, 61, 56, 40, 23, 14 Soil B % Finer: 99, 91, 45, 28, 16, 12, 4, -, Non Plastic i) find Cu & Cc. ii) Calculate the percentages of gravel, sand, silt & clay iii) Classify the soils as per ISC	***CO*** 1	***PO2***	**14**
	b)	What are the assumptions and limitations of Stoke's law?	***CO*** 1	***PO1***	**06**
		UNIT - III			
5	a)	Discuss the major clay minerals with neat sketches	***CO*** 2	***PO1***	**08**
	b)	A layer of sand 8m thick lies above clay layer. The water table is 1m below the top surface of sand layer. Above the water table the sand is saturated with capillary moisture. The specific gravity G of sand =2.65, void ratio = 0.587. Calculate total stress, neutral stress, and effective stress at depth of 0m, 1m, 5m and 8m from the top surface of sand. Sketch the pressure diagrams. Tabulate the results.	***CO*** 2	***PO2***	**08**

		c)	With neat sketch distinguish between flocculated and dispersed structure	*CO* 2	*PO1*	**04**
			OR			
	6	a)	What is diffused double layer? Discuss its importance	*CO* 2	*PO1*	**04**
		b)	Discuss the following terms i. Flocculent structure ii. Adsorbed water	*CO* 2	*PO1*	**04**
		c)	At a location the ground is made up of clayey sand upto a depth of 5m and the water table is below 1.20m below the ground surface. The properties of soil above and below ground water table is same. Assuming the soil layer 1.2m above the water table consists of capillary water with saturated water content of 28% and G=2.67, Compute the effective stress at the ground level, 1.2m and 5m depth. Plot the total, pore and effective pressure diagrams Later, the water table was lowered to a depth of 4m from the ground surface. Considering capillarity for the entire soil layer above water table, calculate the effective stress at 5m depth. What change do you observe in effective stress?	*CO* 2	*PO2*	**12**
			UNIT – IV			
	7	a)	From an undisturbed soil sample obtained from the field, a portion of the undisturbed sample was extracted to fit into a standard permeameter apparatus such that the stratification of the soil in the field was retained in the laboratory. The soil sample was 150mm long and 3848.45 mm^2 in cross section. A constant head of 250mm was maintained such that the flow was perpendicular to the stratification. The discharge yielded was 225 x 10^2 mm^3 in a time of 2 minutes. Compute the coefficient of hydraulic conductivity, coefficient of percolation, the seepage velocity and discharge velocity. Given e=0.58	*CO* 2	*PO2*	**08**
		b)	What are the effects of compaction on the soil properties	*CO* 2	*PO1*	**06**
		c)	Discuss the factors affecting permeability of soil	*CO* 2	*PO1*	**06**
			OR			
	8	a)	Discuss the factors affecting compaction	*CO* 2	*PO1*	**06**

		b)	A standard proctor compaction test conducted on a clayey sand having G= 2.70 and using 1000 cc mould gave the following results: Mass of compacted soil, g: 1962.2, 2135.5, 2191.6, 2166.1, 2110.0 Water content, %: 10, 12, 14.3, 16.1, 18.2 i) Analyse the results to plot the compaction curve. ii) Determine optimum moisture content and Maximum dry density. iii) Express maximum dry density in kN/m^3 iv) Find the degree of saturation at maximum dry density	***CO*** 2	***PO1***	**14**
			UNIT – V			
	9	a)	A direct shear test was carried out on a cohesive soil sample and the following results were obtained. Normal stress (kN/m^2): 150, 250 Shear stress at failure (kN/m^2): 110, 120 What would be the deviator stress at failure if a triaxial test is carried out on this soil with cell pressure of $150kN/m^2$?	***CO*** 2	***PO2***	**10**
		b)	Undrained triaxial compression tests are carried out to failure on three specimens of clayey silt, with pore pressure measurements as shown below Specimen No. / Major principal stress (kg/cm^2) / Minor principal stress (kg/cm^2) / Pore pressure (kg/cm^2) 1: 1.57, 0.17, 0.12 2: 2.04, 0.44, 0.20 3: 2.25, 0.55, 0.22 By solving analytically i. Determine the shear parameters constituting the shear strength of the soil	***CO*** 2	***PO2***	**10**
			OR			
	10	a)	Explain the sensitivity of clays.	***CO*** 2	***PO1***	**04**
		b)	Classify shear test based on drainage conditions and explain them along with their practical applications	***CO*** 2	***PO1***	**06**
		c)	The following data relate to a CU triaxial compression test performed on a fully saturated clay soil sample. Calculate effective stress parameters and plot the Mohr circle for effective stress condition and find the effective shear strength parameters Sample No. / Cell pressure (kPa) / Deviator stress (kPa) / Pore pressure (kPa) 1: 200, 118, 110 2: 400, 240, 220 3: 600, 352, 320	***CO*** 2	***PO2***	**10**

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