

B.E. CIVIL ENGINEERING 2nd Year; 2nd Semester EXAMINATION 2023
Geotechnical Engineering - I

Total Time: Three Hours

Full Marks 100
(Part I: 50 + Part II: 50)

Use a separate Answer-Script for each part. Assume any data, with proper justification, if required.

Part I (50 Marks)

Attempt All :			
1	(a) Why soil is defined as '3-Phase System'? Derive the equation to calculate the Relative density (I_D) of a dry soil sample 'in terms of unit weight'.	(5)	CO1
	(b) Explain, in details, the fundamental theory of 'Defuse Double Layer' in connection to 'Adsorbed Water' with neat sketch.	(7.5)	
2	(a) What is 'Capillary Siphoning'? How can it be restricted? Why we should have proper information regarding permeability of a soil and corresponding geotechnical structure?	(5)	CO1
	(b) The capillary rise in soil-1 with average particle size $D_1 = 0.05$ mm is 0.6 m. Estimate the capillary rise in soil-2 with average particle size $D_2 = 0.1$ mm assuming it has the same void ratio as soil-1. Consider $T_s = 75 \times 10^{-6}$ kN/m.	(7.5)	
3	(a) Mention briefly the factors affecting Permeability of a soil.	(5)	CO2
	(b) Calculate the coefficient of permeability of a soil sample 6 cm in height and 50 cm^2 in cross-sectional area, if a quantity of water equal to 430 cc passed down in 10 minutes under an effective constant head of 40 cm. On over drying, the test specimen weighted 4.98 N. Taking $G = 2.65$, calculate the seepage velocity of water during the test.	(7.5)	
4	(a) What is Consistency Index? How is it related to Liquidity Index of soil? What is Activity Number and Sensitivity of soil?	(7.5)	CO1
	(b) In an earthen embankment under construction the bulk unit weight is 16.5 kN/m^3 at water content of 11%. If the water content is to be raised to 15%, compute the quantity of water required to be added per cubic meter of soil. Assume no change in void ratio.	(5)	

[Turn over

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Time: 3 Hours

PART II (50 Marks)

Full Marks: 100

*Answer should be brief and to the point.**Assume any data reasonably if needed***Attempt All Questions**

1.	a)	Define 'preconsolidation pressure'. What is the importance of its determination in soil engineering practice? Describe a suitable procedure for determining the preconsolidation pressure.	[1+2+3]	CO3
	b)	The void ratio of clay A decreased from 0.572 to 0.505 under a change in pressure from 120 to 180 kg/m ² . The void ratio of clay B decreased from 0.612 to 0.597 under the same increment of pressure. The thickness of sample A was 1.5 times that of B. Also, the time required for 50% consolidation was three times longer for sample B than for sample A. What is the ratio of the coefficient of permeability of A to that of B?	[6]	
	c)	What is the significance of relative compaction? Explain the nature of compaction curve of sand. Calculate the ratio of compaction energy in standard Proctor test and modified Proctor test.	[2+2+4]	
2.	a)	With the aid of Mohr's circle diagram explain what does it mean by active and passive Rankine states in a cohesionless soil. Hence obtain an expression for the intensity of passive earth pressure behind a vertical wall and explain why for this condition there is an implied assumption of smooth wall.	[10]	CO5
	b)	What are the probable modes of failure in finite slope? Discuss the favorable condition for each mode.	[4]	
	c)	Calculate the factor of safety of an infinite slope under seepage pressure for cohesive-frictional soil.	[6]	
3.	a)	The inner diameters of a sampling tube and that of a cutting edge are 70 mm and 68 mm respectively, their outer diameters are 72 and 74 mm respectively. Determine the inside clearance, outside clearance and area ratio of the sampler. Will you recommend this tube for better soil sampling and why?	[5]	CO6
	b)	What is the use of disturbed soil samples? Describe any one procedure of obtaining undisturbed samples.	[5]	