Reg. No.

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL (A constituent unit of MAHE, Manipal)

VI SEMESTER B.TECH. (CIVIL ENGINEERING) END SEMESTER EXAMINATIONS

MAY 2022

SUBJECT: APPLIED SOIL ENGINEERING [CIE 3251]

Date of Exam: 14 /05/2022

-Time of Exam: **10.00AM -1.00PM**

Max. Marks: 50

Instructions to Candidates:

Answer ALL the questions & missing data may be suitably assumed

Four samples were collected using different type of samplers during soil investigation. The dimensions of the sampling tube and the cutting edge is given in the table below. Calculate the inside clearance, outside clearance, area ratio and comment on the results.

	Sampler	Sampler Sampling tube		Cutting edge			
		Inside	Outside	Inside	Outside		
1A.		diameter	diameter (mm)	diameter	diameter		(05)
	1	(mm) 72	73	71	74	-	
	1	72	,,,	/1			
	2	78	76	74	80		
	3	56	58	54	60		
	4	89	86	88	90		
1B.	A cutting of depth 8 m is to be made in a soil for which the density is 19.2 kN/m ³ and cohesion is 40 kN/m ² . There is a hard stratum under the clay at 16 m below the original ground surface. Assuming $\varphi = 0^{\circ}$, i) Find the slope of the cutting allowing for a factor of safety of 1.5. ii) If the depth of cutting is increased to 10.67m, what is the factor of safety?						(03)
1C.	Explain under what circumstances pile foundations are recommended.						(02)
2A.	A retaining wall with smooth vertical back is supporting a backfill 9m high and made of two layers of sandy soil. The Properties of top sand layer: $(0 - 5m)$: $\phi = 32^\circ$; $\gamma = 17$ kN/m ³ and $\gamma_{sat} = 19$ kN/m ³ . Properties of bottom sand layer: $(5 - 9m)$: $\phi = 36^\circ$; $\gamma = 19$ kN/m ³ and $\gamma_{sat} = 21$ kN/m ³ . If the water table is at 3m below the GL which is horizontal, plot the active earth pressure distribution and determine the total lateral thrust and its point of application.						(05)
2B.	A retaining wall with smooth vertical back is 7m high and supports a cohesive soil having cohesion of 24 kN/m ² and $\gamma = 20$ kN/m ³ . Calculate the total passive earth pressure and its point of application.					(03)	



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3C.	An infinite slope is made of clay with the following properties: $\gamma = 19$ kN/m ³ , $\gamma' = 9$ kN/m ³ , c'=26kN/m ² and $\phi = 20^{\circ}$. If the slope has an inclination of 32° and height equal to 14m, determine the stability of the slope, when: (a) the slope is submerged, and (b) there is seepage parallel to the slope. Also, find the height of the slope if the slope has to remain stable in both the cases.	(02)
4A.	A rectangular footing $1.2m \times 2.4m$ is constructed at a depth of $1.5m$ in a soil deposit having $\gamma_{sat} = 20.5 \text{ kN/m}^3$, $\gamma = 18.5 \text{ kN/m}^3$, $c = 8 \text{ kN/m}^2$ and $\phi = 26^\circ$. The ground water table rises to ground level during rainy season. Nc' = 13.3, Nq'= 5.42 and Nr' = 4.3. Calculate the safe load that can be applied on the footing by IS code method, and take factor of safety as 3.	(04)
4 B .	A square footing is to be constructed at a depth of 1.2 m in a deposit of sand with angle of internal friction 40°. It has to carry a design load of 600 kN with a factor of safety of 2.0. The ground water table may rise to 0.4m below ground level during rainy season. Using Terzaghi's method, determine the plan dimension of footing. Given $\gamma_{sat} = 18.5 \text{ kN/m}^3$ and $\gamma = 17.0 \text{kN/m}^3$.	(03)
4C.	Using Terzaghi's method calculate the safe bearing capacity of a circular footing of diameter 1.8m founded at a depth of 1.5m below ground level in a deposit of soil having $\gamma_{sat} = 19 \text{ kN/m}^3$, $\gamma = 17 \text{kN/m}^3$, $c = 10 \text{kPa}$ and $\phi = 27^\circ$. The ground water table rises to 1.5m below ground level during rainy season. Take FOS = 2.5.	(03)
5A.	A square group of 16 piles are installed in a deposit of 20 m thick stiff clay overlaying rock. The piles are 0.6 m in diameter and are spaced at 1 m c/c in the group. The undrained shear strength of clay at the pile base level is 160 kN/m^2 and the average value of undrained shear strength over the depth of the pile is 120 kN/m^2 . The adhesion factor m is 0.4. Taking factor of safety as 3 against shear failure, find the pile group capacity with consideration to individual and block failure.	(04)
5B.	A pile group consisting of 9 piles in square pattern penetrates through a recently filled soil. The depth of fill is 3m, the diameter of pile is 45cm and the piles are spaced at 1.1m center to center. The soil is cohesive with unconfined compressive strength 50 kN/m ² and $\gamma = 18$ kN/m ³ . Compute the negative frictional load on the pile group. Taking length of pile as 14m, m =0.8 and FoS as 2.5, calculate the safe load that can be applied on the pile group.	(04)
5C.	Differentiate between precast piles and cast in situ piles.	(02)