Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

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

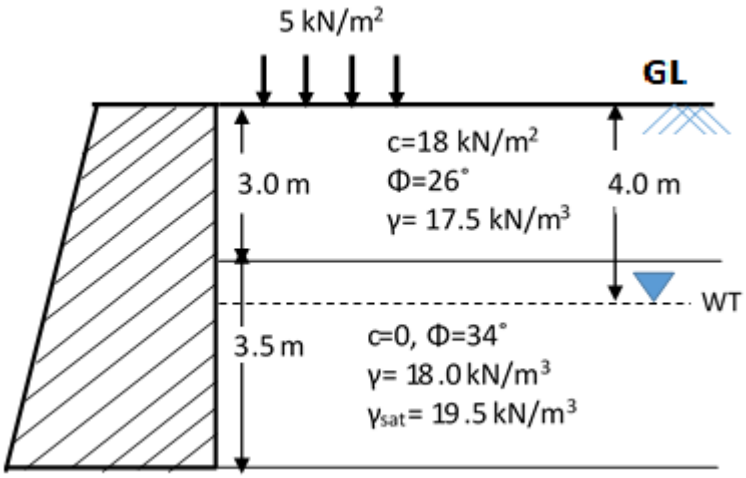
MAY 2024

SUBJECT: APPLIED SOIL ENGINEERING [CIE 3251]

Date of Exam: **13/05/2024** Time of Exam: **2.30 – 5.30pm** Max. Marks: **50**

Instructions to Candidates:

- Answer ALL the questions & missing data may be suitably assumed

Q. NO	QUESTION	MARKS	CO	BL
1A	A 6.5 m high retaining wall with a smooth vertical back retains two layered soil as shown in figure. Compute the magnitude and point of application of Rankine's active earth pressure when the water table is 3.5 m below the ground level.  	**5**	**CO2**	**4**
1B	A retaining wall of 7.5 m high supports three layered backfill with the following properties: **Depth** / **Cohesion (kN/m²)** / **Angle of Internal friction (°)** / **Unit weight of soil (kN/m³)** 0-2.5 m / 0 / 25 / 16 2.5 m to 5 m / 10 / 0 / 19 5 m to 7.5 m / 8 / 32 / 18 Analyze and plot Rankine's active earth pressure diagram.	**3**	**CO2**	**4**
1C	Explain at-rest earth pressure with an example. What is the approximate maximum depth of an unsupported vertical cut that can be made in a saturated clay with γ=20.5 kN/m^3 and an unconfined compressive strength 60 kN/m^2.	**2**	**CO2**	**3**
2A	An embankment of 8m height is made in soil with c=12kN/m^2, ϕ=32°	**6**	**CO3**	**4**

	and γ=18kN/m^3. The sides of the cut make an angle of 40^o with the horizontal. Estimate the factor of safety of a trial slip circle with a radius as 12m and δ=72^o by plotting the slope and using method of slices. Take 6 slices of 2m width from the toe and one slice of the remaining width. (Scale: use 1cm=2m)			
2B	A canal is to be excavated to a depth of 4m below ground level, in soil having cohesion 10 kN/m^2, angle of internal friction 15^o, voids ratio 0.80, and specific gravity 2.70. The slope of the bank is 45^o. Determine the factor of safety with respect to cohesion when the canal runs full. What will be the factor of safety, in case of sudden draw down condition?	**2**	**CO3**	**3**
2C	Derive an expression for the factor of safety of an infinite slope in a submerged cohesionless soil.	**2**	**CO3**	**2**
3A	Determine the depth at which a circular footing of 2m diameter is to be founded if it must carry a safe load of 3450kN with a factor of safety of 3. The foundation soil has Φ = 37˚, c = 12kN/m^2 and γ =18.4kN/m^3, γ_{sat} = 19.5kN/m^3. Use Terzaghi's Method, general shear failure and water table at large depth below the ground level.	**3**	**CO4**	**3**
3B	For 1.8m depth of foundation with water table at foundation level, determine the gross safe load that can be carried by a square footing of size 1.8m × 1.8m if the load is inclined at an angle of 12˚ to vertical. Take factor of safety as 2, use IS code method and assume local shear failure. Soil Properties: Φ= 34.98˚, c = 7kN/m^2 and γ_{sat} = 21kN/m^3, γ = 19kN/m^3.	**4**	**CO4**	**3**
3C	Explain the plate load test used to determine the bearing capacity of soil in field.	**3**	**CO4**	**2**
4A	A square group of 9 piles are installed in a deposit of 24 m (length of pile) thick stiff clay overlaying rock. The piles are 0.8 m in diameter and spaced at 1.1 m c/c in the group. The undrained shear strength of clay at the pile base level is 180 kN/m^2 and the average value of undrained shear strength over the depth of the pile is 110 kN/m^2. The adhesion factor m is 0.4. Taking factor of safety as 3 against shear failure, compute the safe pile group load carrying capacity with consideration to individual and block failure.	**4**	**CO5**	**4**
4B	A square concrete pile of size 300mm, is driven into a deep deposit of uniform clay. Laboratory unconfined compression tests on undisturbed samples indicated an average q_u = 106 kN/m^2. Compute the length of the pile to be provided such that the ultimate load capacity of the pile is 900kN. Take m = 0.8.	**3**	**CO5**	**4**
4C	Differentiate between precast piles and cast in situ piles.	**3**	**CO5**	**2**
5A	Compute the settlement of the square group of piles assuming the load to be transferred at 2/3 length of the pile for the following data. Q = 3800kN, diameter of pile d = 0.4m, spacing s= 3d, no:of piles n =25, Length of pile L = 12m, Liquid limit w_L = 55%, γ = 17.5 kN/m^3 , e_o =0.95. Hard rock is 23m below ground level. The bottom of the pile cap is located at the ground surface. Assume three layers for settlement	**5**	**CO5**	**4**

	calculation.			
5B	Discuss the standard penetration test in soil exploration.	**3**	**CO1**	**2**
5C	A strip footing 1.2m wide is located at a depth of 1.6m in a non cohesive soil deposit, for which corrected N value is 23. Water table is located at 2m below ground level. Determine allowable pressure in soil if γ=17.6kN/m^3 and permissible settlement is 25mm using Teng's equation.	**2**	**CO4**	**3**