Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

VI SEMESTER B.TECH (CIVIL ENGINEERING)

END SEMESTER EXAMINATIONS, MAY/JUNE 2022

SUBJECT: **APPLIED SOIL ENGINEERING [CIE 3251]**

REVISED CREDIT SYSTEM

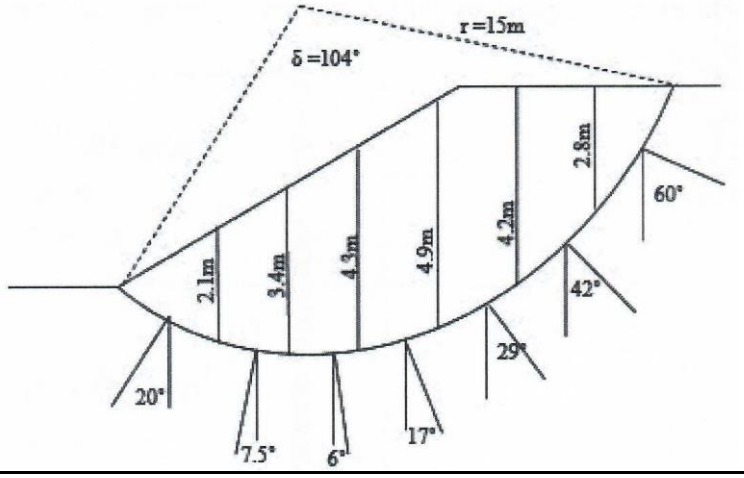
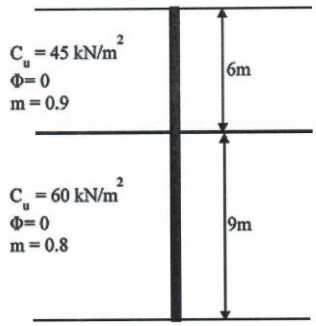
(_ / / 2022)

Time: 3 Hours Max. Marks: **50**

Instructions to Candidates:

- Answer ALL the questions
- Missing data may be suitable assumed.

Q.No		Marks
1A.	A site consists of 2m thick coarse sand lying over a layer of silty clay. The water table is at 1.2m below ground level. The observed SPT value at a depth of 1.5m and 3m are 7/9/12 and 10/14/18 respectively. Apply the necessary corrections and calculate the corrected N value. The unit weight of coarse sand layer and silty clay layer are 17 kN/m^3 and 18.5 kN/m^3 respectively. The saturated unit weights of coarse sand layer and silty clay layer are 18.5 kN/m^3 and 20.5 kN/m^3 respectively.	05
1B.	Determine the required slope angle for an embankment of height 10m constructed with soil properties c= 21 kN/m^2, φ = 25° and γ = 18 kN/m^3, Factor of safety= 1.25. Also find the factor of safety if the slope is 1 V: 2H and has same soil properties as above.	03
1C.	Write a short note on bored compaction pile.	02
2A.	A retaining wall with smooth vertical back is supporting a backfill 8m high made of two layers sandy soil carrying a surcharge of $10kN/m^2$. The Properties of top sand layer: (0 - 4m): ϕ= 30°; γ = $16kN/m^3$ and γsat= $18kN/m^3$. Properties of bottom sand layer are (4 - 8m): ϕ = 33°; γ = $17kN/m^3$ and γsat = $20kN/m^3$. If the water table is at 6m below the GL which is horizontal, plot the active earth pressure distribution and determine the magnitude of total lateral thrust.	03
2B.	A frictionless retaining wall with smooth vertical back is 7m high and supports a c-ϕ soil for top 0 - 2m and a cohesion less soil for bottom 2m - 7m. The top c-ϕ soil has c = $16kN/m^2$, ϕ = 21° and γ = $18kN/m^3$. The bottom ϕ soil has c = 0, ϕ = 32° and γ =$19kN/m^3$. Plot the active earth pressure distribution after the occurrence of cracks and calculate the total earth pressure.	03
2C.	A retaining wall with smooth vertical back retains sand backfill for a depth of 6m. The backfill with horizontal surface has the properties: ϕ = 30°; y = 17kN/m3 and γsat = $20kN/m^3$. (i) Calculate the magnitude of total thrust against the wall when the backfill is fully drained, and restrained against yielding. (ii) If the wall is free to yield and the wall moves towards the backfill, calculate the total lateral thrust.	02
3A.	Determine the factor of safety against sliding for the slip surface shown in figure. The properties of soil are c= 20 kN/m^2, φ = 20° and y = 18 kN/m^3. Use Swedish circle method of slices. The width of slice adjacent to toe is 4m and remaining slices are 3m wide. The mid-ordinate of slices shall be taken as the average of its sides.	05

		
3B.	Explain the Friction circle method to find the factor of safety with respect to cohesion.	4
3C.	A slope has granular soil with ϕ = 33°; γ= 17kN/m^3 and γ_{sat} = 19kN/m^3. If a factor of safety of 1.4 is needed against slope failure, determine the safe slope angle when (i) slope is dry or submerged without seepage, (ii) seepage occurs parallel to surface and water table is at surface. If the slope angle is 20° with seepage parallel to surface and water table at surf ace, what is the factor of safety?	03
4A.	A square footing of size 2m x 2m is to be constructed at a depth of 1.6m in a soil deposit having γ_{sat} = 19.8 kN/m^3, γ = 18.9 kN/m^3, c = 12 kN/m^2 and ϕ= 27°. The ground water table rises up to lm below ground level during rainy season. Calculate the safe bearing capacity by IS code method, and take factor of safety as 2.5.	04
4B.	A rectangular footing of size 2m x 3m in a deposit of sand with angle of internal friction 35° is proposed. TI1e ground water table may rise up to 0.4m below foundation level during rainy season. Using Terzaghi's method and assuming general shear failure, calculate the safe bearing capacity of the footing founded at a depth of 1.6m with a factor of safety of 2. Given γ_{sat} = 18.5 kN/m^3 and γ = l 7.0kN/m^3.	03
4C.	Calculate the ultimate bearing capacity of (i) a strip footing 1.2m wide (ii) Circular footing 1.7m diameter and (iii) Square footing 2m wide founded at depth of 1.5m in a deposit of soil having γ_{sat} = 18.4 kN/m^3, γ = 17.3 kN/m^3, c = 5 kPa and ϕ = 38°. The ground water table is 4.5m below ground level during rainy season. Take FOS = 2. Use Terzaghi's analysis.	03
5A.	In a two layered cohesive soil, bored piles of 500mm diameter are installed. The top layer has a thickness of 6m and the bottom layer is of considerable depth. The undrained cohesion of the top layer is 60 kN/m^2 and that of the bottom is 120 kN/m^2. Determine the length of the bored pile required to carry a safe load of 400kN, allowing a factor of safety of2.5. Take m = 0.6.	03
5B.	A group of 9 piles was installed in a layered clay soil deposit as shown in the figure. The diameter of each pile is 600 mm and their center to center distance is 1.2 m. Calculate the safe load carrying capacity of the group with a factor of safety of 2.0. 	04
5C.	Explain Negative skin friction.	03