Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

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VI SEMESTER B.TECH. (CIVIL ENGINEERING)
END SEMESTER EXAMINATIONS, APRIL/MAY 2019

SUBJECT: APPLIED SOIL ENGINEERING [CIE 3201]

REVISED CREDIT SYSTEM
(25/04/2019)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

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

Q. No	QUESTION	Mark	CO
1A.	The following data: 5/21/11 and 21/18/12 was obtained when a SPT test was conducted in a site comprising of fine sand at 2 m and 3.5 m depth respectively. Applying the necessary corrections, calculate the corrected N value at 3.5 m depth assuming that the sample is collected in the dry season. Further, if in the rainy season, if the water table is raised to 1.5m from ground level, find the N value after applying the necessary corrections, assuming the SPT data as same. Take average γ=16 kN/m^3 (above water table) and γ_{sat}=18 kN/m^3 (below water table).	**4**	**CO1**
1B.	For the soil sample collected from a construction site, area Ratio is found to be 13.75, outside diameter of cutting edge is 50.8mm, inside diameter of sample tube is 45.63 mm and thickness of sampling tube is 2mm. Find the inside clearance and outside clearance. Comment on the results in accordance with IS 1892-1979.	**3**	**CO1**
1C.	A new canal is excavated to a depth of 5m below ground level, through a soil having the following characteristics: c=14kN/m^2, ϕ=15˚, e=0.75 and G=2.8. If the slope angle of banks is 45˚, calculate the factor of safety with respect to cohesion when the canal runs full. If it is suddenly and completely emptied, what will be the factor of safety?	**3**	**CO3**
2A.	A retaining wall 5m high supports a two layered backfill with water table at 4m from the top horizontal ground level. The top layer is 3m deep with c=7kPa, ϕ=20˚ and γ=18kN/m^3. The bottom layer is 2m deep with c=10kPa, ϕ=20˚, γ=17kN/m^3 and γ_{sat}=20kN/m^3. Plot the active earth pressure distribution, calculate the magnitude and point of application of the active lateral force.	**6**	**CO2**
2B.	Explain the forces acting on the failure wedge in Coulomb's wedge theory for active case and give the expression for coefficient of active earth pressure.	**2**	**CO2**
2C	With a neat sketch explain under reamed pile foundation.	**2**	**CO5**
3A.	With a neat sketch explain negative skin friction.	**3**	**CO5**
3B.	Using Friction Circle method, determine the factor of safety against sliding for a slope of height 12m and slope angle 36^0 . The slip circle of radius 18m and central angle 75^0 , passes through the toe at the bottom. The properties of soil are c=24kN/m^2, ϕ=20° and γ=20kN/m^3. The C.G of weight is at a horizontal distance of 8.6m from the center of slip circle. Take a scale of 1cm = 2m to	**7**	**CO3**

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	plot the slope.		
4A.	A rectangular footing 1.8m x 2.2 m carries a load intensity of 900 kPa, at a depth of 1.5 m in a soil deposit. The unit weight of soil above and below the water table is 18 kN/m^3 and 20.5 kN/m^3 respectively. The shear strength parameters of soil are c=20 kN/m^2 and ϕ=35^0 . Determine the factor of safety with respect to shear failure for the following cases of location of water table: (i) when the water table is 1m below ground level and (ii) when the water table is 2m below ground level. Assume general shear failure. Take N_c=46.12, N_q=33.3 & N_γ=48.03. Use IS recommendations.	**6**	**CO4**
4B.	A circular footing is located at a depth of 1.4m below ground level has to carry a gross safe load of 500 kN. Find the size of the footing if the desired factor of safety is 3. The soil has the following properties: e=0.6, S=60%, G=2.65, c=12 kN/m^2, ϕ=25^0 . Use Terzaghi's analysis. Take N_c'=14.8, N_q'=5.6 & N_γ'=3.2	**4**	**CO4**
5A.	A square group of 9 piles was driven into soft clay. The diameter and length of the piles are 45cm and 12m respectively. The unconfined compressive strength of the clay near the ground level and near the bottom of the pile is 90 kN/m^2 and 120 kN/m^2 respectively. The pile spacing is 120 cm c/c. Determine the safe load carrying capacity of pile foundation. Assume factor of safety as 2.5 and adhesion factor as 0.7.	**4**	**CO5**
5B.	A square group of 16 piles of 400mm diameter and 900mm c/c spacing is subjected to a net load of 2500 kN as shown in **Q.No.5B**. Compute the settlement of the pile group. Assume the load is transferred at 2/3 length of the pile with 30^0 load distribution.	**6**	**CO5**

ϕ_m / i	0°	5°	10°	15°	20°	25°
90°	0.261	0.239	0.218	0.199	0.182	0.166
75°	0.219	0.195	0.173	0.152	0.134	0.117
60°	0.191	0.162	0.138	0.116	0.097	0.079
45°	(0.170)	0.136	0.108	0.083	0.062	0.044
30°	(0.156)	(0.110)	0.075	0046	0.025	0.009
15°	(0.145)	(0.068)	0.070	(0.023)	—	—

[Note. Figures in brackets are for the most dangerous circles through the toe when a more dangerous circle exists below the toe].