Code No: R1941012 **R19** **Set No. 1**

IV B. Tech I Semester Regular Examinations, November – 2022
GEOTECHNICAL ENGINEERING - II
(Civil Engineering)

Time: 3 hours **Max. Marks: 75**

Answer any FIVE Questions
ONE Question from Each unit
All Questions Carry Equal Marks
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UNIT-I

1 a) An SPT is conducted at a depth of 3m in fine sand deposit below water table (the WT is at the GL) and the N value reported in 32. The density of the soil deposit is 18 KN/m^3. What is the corrected value of N? [7]

b) Explain the procedure to conduct the Standard Penetration test? [8]

(OR)

2 a) Draw a typical borelog and explain its including its significance? [7]

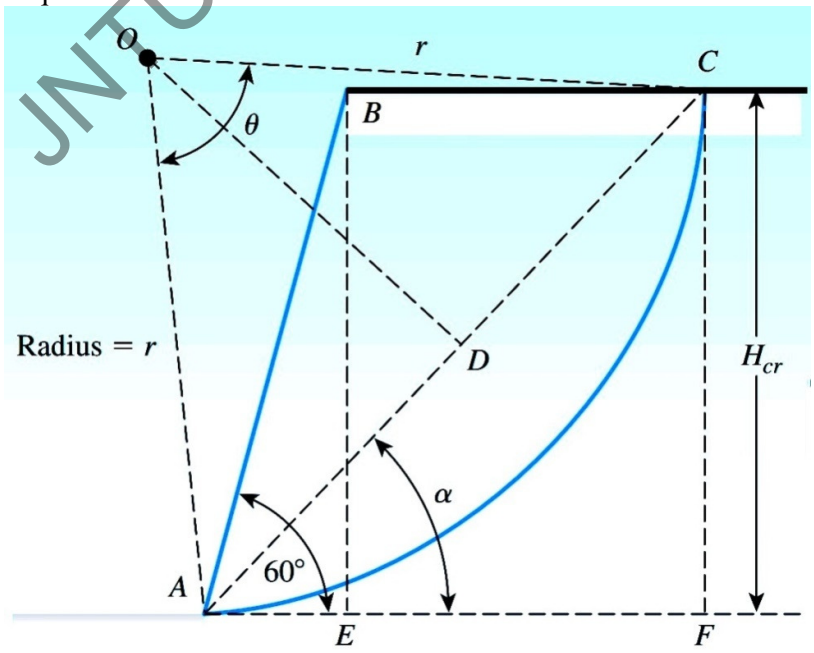
b) The inner diameters of a sampling tube and that of a cutting edge are 68mm and 66mm respectively, their outer diameters are 70mm and 72mm respectively. Determine the inside clearance, outside clearance and area ratio of the sampler. [8]

UNIT-II

3 a) A cut slope is to be made in a soft saturated clay (see figure below) with its sides rising at an angle of 60^0 to the horizontal. c_u=40KPa and γ=17.50KN/m^3. Assume stability number = 0.195 [7]

i) Determine the maximum depth up to which the excavation can be carried out.

ii) Find the radius, r, of the critical circle when the factor of safety is equal to 1.



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b) Explain the Culmann's graphical method? [8]

(OR)

4 a) A retaining wall retains a soft saturated clay backfill 6m high. For the undrained condition ($\Phi=0^0$) of the backfill, determine the maximum depth of tensile crack and the magnitude of the active thrust developed after the occurrence of the tensile crack? [7]

b) Derive the expression to determine the factor of safety of a dry infinite earth slope made of cohesionless soil? [8]

UNIT-III

5 a) Explain the Meyerhof's bearing capacity theory? [7]

b) What is the ultimate bearing capacity of a rectangular footing, 2m x 2.5m, on the surface of saturated clay of unconfined compression strength of 120KN/m^2 ? [8]

(OR)

6 a) What are the factors which govern the minimum depth of a shallow foundation? [7]

b) A footing 2m x 2m rests at a depth of 1m below the ground level in sand. The saturated unit weight of the sand is 19KN/m^3 and the unit weight of the sand above the water table is 15kN/m^3. The shear parameters are c=0 and $\Phi=40^0$. Determine the ultimate net bearing capacity when the water table is 3m below the ground level. If the water table rises to the foundation level, what will be the percentage change in the value of the net ultimate bearing capacity. The bearing capacity factors, N_c, N_q, N_γ for the sand are 72, 64 and 95 respectively for $\Phi=40^0$. [8]

UNIT-IV

7 a) In a plate load test, a plate of size 30cm x 30cm recorded a settlement of 5mm. Determine the size of the square footing to carry a net load of 4000KN in a sandy soil, with a maximum settlement of 25mm. [7]

b) Discuss any two methods of computing settlements? [8]

(OR)

8 a) Explain any one formula to determine the SBC using N value? [7]

b) A footing, 2m square, is founded at a depth of 2m in a sand deposit, for which the corrected value of N is 32. The water table is at a depth of 1.5m below the ground surface. Determine the net allowable bearing pressure, if the permissible settlement is 40mm and a factor of safety of 3 is desired against shear failure. [8]

UNIT-V

9 a) Explain pile load test? [7]

b) In what different situations pile & well foundations are used? [8]

(OR)

10 a) Explain the procedure to determine the steining thickness? [7]

b) Draw different shape of wells? [8]

Code No: R1941012 **R19** **Set No. 2**

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UNIT-I

1 a) Discuss about the guidelines for depth, spacing and number of boreholes? [7]
b) Explain the need for soil exploration? [8]

(OR)

2 a) Explain the dynamic cone penetration test? [7]
b) Discuss about the contents of a geotechnical investigation report? [8]

UNIT-II

3 a) Discuss the stability of an earth slope subjected to sudden drawdown? [7]
b) A retaining wall 5m high retains sand with $\Phi=30^0$ and unit weight $22KN/m^3$ up to a depth of 3m from top. From 3m to 5m, the material is a cohesive soil with $c=18KN/m^2$ and $\Phi=20^0$. Unit weight of cohesive soil is $18KN/m^3$. A uniform surcharge of $120KN/m^2$ acts on the backfill. Determine the total active lateral thrust acting on the wall? [8]

(OR)

4 a) A 6m high wall retains sand having a unit weight of $21KN/m^3$ and angle of internal friction of 30^0. If the surface of the backfill slopes upwards at 10^0 to the horizontal, find the active thrust per unit length of the wall, using Rankine's theory. [7]
b) Explain the Fellinius method to determine the centre of the critical slip circle? [8]

UNIT-III

5 a) Explain 'general shear failure', local shear failure' and 'punching shear failure'? [7]
b) A strip footing to carry a load of 700KN/m at a depth of 2m in a c-Φ soil having $\gamma=18KN/m^3$ and the shear parameters are $c=20KPa$, $\Phi=25^0$. Determine the width of the footing for a FOS=3 against shear failure. Use Terzaghi's theory. $N_c=25.10$, $N_q=12.70$, $N_\gamma=9.70$ and FOS=3.0 [8]

(OR)

6 a) Explain Skempton's bearing capacity theory? [7]
b) A rectangular footing of size 2m x 3m has to transmit the load of a column at a depth of 1.50m. Calculate the safe load which the footing can carry for a factor of safety of 3 against shear failure. Use IS code method. The soil has the following properties : n = 40%; G = 2.67; w = 15%, $c=10KN/m^2$; $\Phi = 32^0$. $N_c=38$, $N_q=26$, $N_\gamma=35$ [8]

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UNIT-IV

7 a) Discuss the effect of size of footing on settlement? [7]

b) A footing of size 3m x 3m is to be constructed at a site at a depth of 2m below the ground surface. The water table is at the base of the foundation. The average static cone penetration resistance obtained at the site is 2MPa. The soil is cohesive. Determine the safe bearing pressure for a settlement of 40 mm. Assume WT correction factor=0.50 [8]

(OR)

8 a) Discuss the allowable settlements of structures with examples? [7]

b) A rectangular footing 3m x 2m carries a concentric load of 900KN, and is placed at a depth of 1m below ground level in a deep layer of clay. The undrained elastic modulus of clay is 50MN/m^2. The unit weight of clay is 20KN/m^3. Calculate the immediate avenge settlement under the load. Assume any necessary data. [8]

UNIT-V

9 a) Summarise tilts and shifts of wells? [7]

b) A 9-pile group, 10m long is used as the foundation for a column. The piles are 40cm diameter with centre to centre spacing at 1000mm. The subsoil consists of clay with unconfined compressive strength of 250KPa. Estimate the safe load. Assume factor of safety = 4.00. [8]

(OR)

10 a) Explain the shapes of well foundations? [7]

b) Draw well foundation and mention the components? [8]

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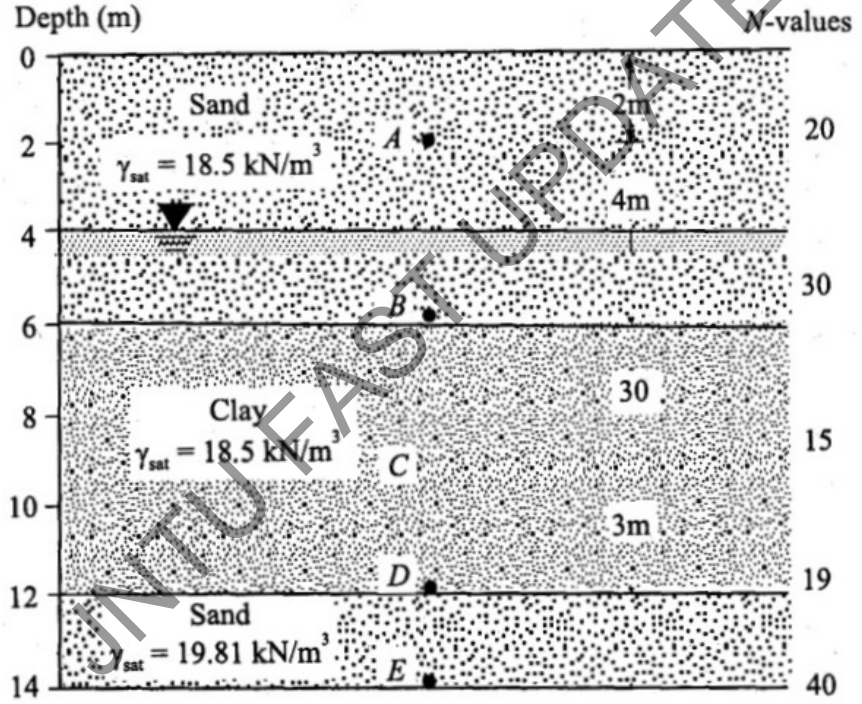
UNIT-I

1 a) Discuss the planning involved for carrying out soil exploration? [7]
b) Explain the wash boring method? [8]

(OR)

2 a) Write a note on types of samples with suitable example. [7]
b) [8]



For the soil profile shown above, compute the corrected N for standard energy of 70%.

UNIT-II

3 a) A retaining wall with a smooth vertical back is 8m high and retains a two-layered sand backfill. The top layer is 3m thick having $\Phi = 30^0$ γ=20KN/cu.m. The bottom layer has $\Phi=35^0$, and γ=22KN/cu.m. Determine the total active thrust on the wall and its point of application? [7]
b) Explain about the types of failure of finite earth slopes? [8]

(OR)

4 a) A 6m high retaining wall retains a stratified backfill with a surcharge of 10kPa. The top 3m is made up of γ=15KN/m^3, Φ=30^0, c=0, and the layer below is made up of γ=20KN/m^3, Φ=10^0, and c=10KPa. Determine the magnitude of the resultant passive earth thrust on the wall and its point of application? [7]

b) Discuss Swedish method of slices? [8]

UNIT-III

5 a) Describe the IS code method of determination of bearing capacity? [7]

b) Compute the safe bearing capacity of a continuous footing 2.5m wide and resting on a clayey sand at a depth of 2m, if c=17KN/m^2, Φ=24^0, γ_{sat}=18KN/m^3, N_c=25, N_q=12.50, N_γ=10 and FOS=3.0 [8]

(OR)

6 a) Discuss the criteria for choice of a foundation? [7]

b) A strip footing, 1m wide at its base is located at a depth of 800mm below the ground surface. The properties of the foundation soil are : γ = 18KN/m^3, c = 30KN/m^2 and Φ= 20°. Determine the safe bearing capacity, using a factor of safety of 3. Use Terzaghi's analysis. Assume that the soil fails by local shear [8]

UNIT-IV

7 a) Critically write about the settlement of foundations. [7]

b) Two load tests were conducted at a site, one with a 500mm square test plate and the other with a 75cm square test plate. For a settlement of 20mm, the loads were found to be 70KN and 120KN, respectively in the two tests. Determine the allowable bearing pressure of the sand and the load which a square footing, 2m x 2m, can carry with the settlement not exceeding 25mm. [8]

(OR)

8 a) Discuss the components of total settlement? [7]

b) A plate load test using a plate of size 30cm x 30cm was carried out at the level of a prototype foundation. The soil at the site was cohesion less with the water table at a great depth. The plate settled by 12mm at a load intensity of 180KN/m^2. Determine the settlement of a square footing of size 2m x 2m under the same load intensity. [8]

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UNIT-V

9 a) Discuss the construction aspects of well foundations. [7]

b) A 16 pile-group of 400mm diameter is arranged with a centre to centre spacing of 1.5m. The piles are 10m long and are embedded in soft clay with cohesion 40KPa. End-bearing resistance may be neglected for the piles. Adhesion factor is 0.50. Determine the ultimate load capacity of the pile group. [8]

(OR)

10 a) Explain the design criteria for well foundation. [7]

b) A bored pile in a clayey soil failed at an ultimate load of 500KN. If the pile is 50cm diameter and 15m long, determine the capacity of a group of nine piles, spaced 2m centre-to-centre both ways. Assume adhesion factor=0.50. [8]

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UNIT-I

1 a) Summarise static cone penetration test? [7]
b) Write how to prepare a soil investigation report? [8]

(OR)

2 a) Draw sketches of a hand auger and different drill bits and explain their uses? [7]
b) Discuss about any two samplers? [8]

UNIT-II

3 a) A long natural slope in a cohesive-frictional soil is inclined at 15^0 to the horizontal. The water table is at the surface and the seepage is parallel to the slope. If the plane slip has developed at a depth of 3m, determine the factor of safety? c=10KPa, $\Phi = 20^0$, γ_{sat} = 20KN/cu.m [7]
b) Summarise Coulomb's theory of earth pressure? [8]

(OR)

4 a) A 5m high gravity retaining wall retains a backfill made of c=0, $\Phi=25^0$, γ_{sat}=24KN/m^3. The water table is at the GL. Determine the resultant thrust due to at rest condition, an also its point of application? Assume γ_w=10KN/cu.m [7]
b) Discuss the stability of an earth slope subjected to steady seepage? [8]

UNIT-III

5 a) Explain the terms : ultimate bearing capacity, net ultimate bearing capacity, allowable bearing pressure? [7]
b) Determine the net safe bearing capacity of a square footing, 3m x 3m, placed at a depth of 3m in a soil having γ=16KN/m^3, c=12KPa and ϕ=35°. Use a factor of safety of 3.0. Assume Terzaghi's bearing capacity factors as N_c = 45.0, N_q = 33.3 and N_γ= 33.9. If the water table rises to the ground level, then what is the percentage change in the value of bearing capacities. Assume γ_{sat}=18KN/cu.m and γ_w=10KN/cu.m [8]

(OR)

6 a) Summarise the types of shallow foundations and their selection criteria for a specific project? [7]
b) A strip footing 1m wide at its base is located at a depth of 80cm below the GL. The properties of the foundation soil are γ=18KN/m^3, c=30KPa, $\Phi=20^0$. Determine the SBC, using a FOS =3. Assume Local shear failure by applying Terzaghi's theory. The bearing capacity factors are 11.80 (cohesion), 3.90 (surcharge), 1.70 (density). Assume the WT is located at the base of the footing. Assume γ_{sat} = 19KN/m^3 and γ_w=10KN/cu.m [8]

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UNIT-IV

7 a) Summarise the harmful effects of differential settlement on structures? What are the possible remedial measures? [7]

b) A rectangular footing (2m x 4m) exerts a pressure of 200KPa on a cohesive soil (E_s = 5 x 10^4 KPa and μ = 0.50). Determine the immediate settlement below the centroid of the plan area of the footing assuming (a) the footing is flexible (b) the footing is rigid. [8]

Values of Influence Factor I.

Shape	*Flexible footing*			*Rigid footing*
	Centre	*Corner*	*Average*	
Circle	1.0	0.64 (edge)	0.85	0.79
Square	1.12	0.56	0.95	0.82
Rectangle *L/B* = 1.5	1.36	0.68	1.20	1.06
L/B = 2.0	1.53	0.77	1.31	1.20

(OR)

8 a) Explain any one formula to determine the safe bearing pressure based on N- value? [7]

b) The following readings were obtained when a plate load test was conducted on a plate 300mm x 300mm on dry sand. [8]

Load (KPa)	50	100	150	200	250
Δ (mm)	1.60	3.20	6.40	12.20	40.0

Determine the settlement of a square footing of 1.50m x 1.50m, when the load intensity is 120KN/m^2.

UNIT-V

9 a) What are the functions of various components of a well foundation? [7]

b) Summarise the types of pile foundations? [8]

(OR)

10 a) Discuss the different shapes of cross-sections of wells used in practice, and mention the merits and demerits of each. [7]

b) An RC pile weighing 40KN (including helmet and dolly) is driven by a drop hammer weighing 40KN with an effective fall of 1m. The average penetration per blow is 20mm. The total temporary elastic compression of the pile, pile cap and soil may be taken as 20mm. Coefficient of restitution 0.40. What is the allowable load on the pile with a factor of safety of 3? Use Hiley's formula. [8]