40+40+40 +21 (141)

T.E. Civil - VI C - Scheme 12.5.23

(3Hours) Max Marks=80

Note 1. Question 1 is compulsory
2. Attempt any 4 out of six questions
3. Assume any suitable data where ever required

Q.1 Attempt any **four**

a. Two plate load tests were conducted at the level of foundation in cohesionless soil close to each other. The following data are given: 05

Size of plate	Load applied, kN	Settlement recorded, mm
0.3mx0.3m	30	25
0.6mx0.6m	90	25

If a square footing is to carry a load of 1000kN, determine the required size of the footing for the same.

b. A retaining wall with a smooth vertical back retains a purely cohesive backfill. Height of wall is 12m. Unit weight of fill is 20kN/m3. Cohesion of the back fill is 10kN/m2. What is the total active Rankine thrust on the wall. At what depth is the intensity of pressure is zero and where does the resultant thrust act. 05

c. A cutting is to be made in clay for which the cohesion is 35kN/m2 and angle of internal friction is 0^0. The density of soil is 20kN/m3. Find the maximum depth for a cutting of side slope $1\frac{1}{2}$ to 1if the factor of safety is to be 1.5. Take stability number for $1\frac{1}{2}$ to 1 slope and $\phi = 0^0$ as 0.17. 05

d. Classify the pile based on load transfer mechanism. A timber pile was driven by a drop hammer weighing 30kN with a free fall of 1.2m. The average penetration of the last few blows was 5mm. What is the capacity of the pile according to ENR formula. 05

e. Define primary consolidation. In a consolidation test the following results have been obtained. When the load was changed from 50kN/m2 to 100kN/m2, the void ratio changed from 0.7 to 0.65. Determine the coefficient of volume decrease and the compression index. 05

Q.2 a. Explain with a neat diagram plate load test. 05

b. Calculate the net ultimate bearing capacity of a rectangular footing 2mx4m in plan founded at a depth of 1.5m below the ground surface. The load on the footing acts at an angle of 15^0 to the vertical. The saturated unit weight of the soil is 18kN/m3. The cohesion of the soil is 15kN/m2 and angle of internal friction is 25^0. Natural water table is at a depth of 2m below the ground surface. Use IS: 6403-1981 method of analysis. Take Nc = 20.7, Nq = 10.7 and Nγ = 10.9. 05

c. Explain the effect of water table on the bearing capacity of the soil. A strip foundation at a depth of 1.5m below ground surface. Water table is close to the ground level and the soil is cohesionless. The footing is supposed to carry a net safe load of 400kN/m2 with FOS = 3. Given saturated unit weight as 20.85kN/m3 and angle of internal friction equal to 35^0, find the width of the footing, under general failure criteria of Terzaghi. 10

ϕ	Nc	Nq	Nγ
35	57.8	41.4	42.4
40	95.7	81.3	100.4

Q.3 a. Explain step wise construction of Rehbann's Graphical method for determination of earth pressure of soil. 05

b. A smooth rigid retaining wall 6m high carries a uniform surcharge load of 12kN/m2. The backfill is clayey sand with the following properties. Unit weight 05

T.E Civil - VI e-scheme 12.5.23

(141)

of soil is 16.0kN/m3, angle of internal friction = 25^0 and cohesion = 6.5kN/m2. Determine the passive earth pressure and draw the pressure distribution diagram.

c. A gravity retaining wall retains 12m of a backfill with unit weight 17.7kN/m3 and angle of internal friction = 25^0 with a uniform horizontal surface. Assume the wall to be vertical, determine the magnitude and point of application of total active pressure. If the water table is at a height of 6m, what is the change in the magnitude and point of application of active pressure. 10

Q.4 a. Derive an expression for factor of safety of a slope of infinite extent made up of cohesionless soil when (a) the soil is dry (2) when the slope is submerged (3) when there is steady seepage parallel to the surface of the slope. 05

b. Define negative skin friction. A 400mmx400mm reinforced concrete pile is driven through a deposit of fine loose sand and soft clay 20m thick, to a depth of 1m into an underlying stratum of dense sand. The water table is located close to the ground surface. In the submerged state, the angle of shearing resistance of sand was 35^0 and unit weight 10kN/m3. Calculate the point bearing resistance of the pile. 05

c. Explain punching shear failure. 200mm diameter, 8m long piles are used as foundation for a column in a uniform deposit of medium clay with unconfined compressive strength of 100kN/m2. The spacing between the piles is 500mm. There are 9 piles in the ground arranged in a square pattern. Calculate the ultimate pile load capacity of the group. Assume adhesion factor = 0.9. 10

Q.5 a. Write a note on Terzaghi's Spring analogy. A soil sample has a compression index of 0.3. If the void ratio e at a stress of 1.4kg/cm2 is 0.5 compute (1) the void ratio if the stress is increased to 2 kg/cm2 and (2) the settlement of a soil stratum 4m thick. 10

b. There is a bed of compressible clay of 4m thickness with pervious sand on top and impermeable rock at the bottom. In a consolidation test on an undisturbed specimen of clay from this deposit 90% settlement was reached in 4 hours. The specimen was 20mm thick. Estimate the time in years for the building founded over this deposit to reach 90% of its final settlement. 10

Q.6 a. A series of shear tests were performed on a soil. Each test was carried out until the sample sheared and the principal stresses for each test is listed below. Plot the Mohr's circles and hence determine the strength envelope and angle of internal friction of the soil. 10

Test No.	σ1, kN/m2	σ3, kN/m2
1	200	600
2	300	900
3	400	1200

b. Give the graphical solution for a cylindrical specimen of a saturated soil that fails under an axial stress 150kN/m2 in an unconfined compression test. The failure plane makes an angle of 52^0 with the horizontal. Calculate the cohesion and angle of internal friction of the soil. Verify results analytically. 10