Total No. of printed pages = 4

CE 181605

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Roll No. of candidate | | | | | | | | | | |

2022

B.Tech. 6th Semester End-Term Examination

GEOTECHNICAL ENGINEERING – II

(New Regulation & New Syllabus)

Full Marks – 70 Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer question No. 1 and any *four* from the rest.

1. Answer the following MCQ $(10 \times 1 = 10)$

(i) The angle of internal friction of a dry cohesionless soil is 30°. The coefficient of earth pressure at rest condition is

(a) 0.43
(b) 0.33
(c) 0.59
(d) 0.5

(ii) A strip footing is founded at a depth of 1.2m below the surface of a deep stratum of soft saturated clay having unit weight of 19.5kN/m^3 and unconfined compression strength of 50 kN/m^2. The ultimate bearing capacity according to Terzaghi

(a) 208.65 kN/m^2
(b) 350.22 kN/m^2
(c) 165.9 kN/m^2
(d) 198.4 kN/m^2

(iii) The maximum permissible total settlement recommended by IS: 1904 (1986) for a footing resting on plastic clay is

(a) 40mm
(b) 50mm
(c) 75mm
(d) 70mm

[Turn over

(iv) According to Coulomb's wedge theory, the active earth pressure slides the wedge

(a) down and outward on a slip surface

(b) up and inward on a slip surface

(c) horizontal upward and parallel to base

(d) horizontal upward and parallel to base

(v) When the soil mass is in active Rankine state, two sets of failure planes develop, each inclined at an angle θ to the horizontal. The value θ of is

(a) $65° + \frac{\phi}{2}$ (b) $65° - \frac{\phi}{2}$

(c) $45° - \frac{\phi}{2}$ (d) $45° + \frac{\phi}{2}$

(vi) A pile of 0.50 diameter and length 10m is embedded in a deposit of clay. The undrained strength parameters of the clay are cohesion = 60 $kN/m2$ and the angle of internal friction is = 0°. The skin friction capacity (kN) of the pile for an adhesion factor of 0.6 is

(a) 671 (b) 565.2

(c) 283 (d) 106

(vii) When a retaining wall moves away from the back fill, the pressure exerted on the wall at the instant of full shear strength mobilization is termed as

(a) Passive earth pressure (b) Pore pressure

(c) Active earth pressure (d) None

(viii) Local shear failure will occur in soil when the ϕ value is less than or equal to

(a) 29°

(b) 36°

(c) 40°

(d) 42°

(ix) A test plate 30cm square, settles by 10mm under a load of 9kN in a sand soil. A footing 1.5 m × 1.5m and subjected to a load of 225kN shall settle by

(a) 108 mm

(b) 50 mm

(c) 53 mm

(d) 60 mm

(x) The value of reduction factors Rw1 and Rw2 when the water table is at the base of the footing are

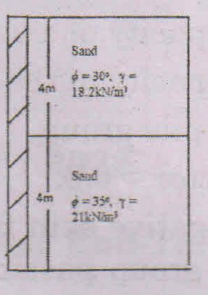
(a) 1.0 and 1.0

(b) 0.5 and 1.0

(c) 1.0 and 0.5

(d) 0.5 and 0.5

2. (a) For the smooth retaining wall shown in the figure, make a sketch of the distribution of active earth pressure on the wall giving the principal values. Compute the total active resultant thrust per metre length of the wall. (5)



(b) Differentiate between Coulomb's earth pressure theory and Rankine's earth pressure theory. (4)

(c) A retaining wall 6m high, has a smooth vertical back. The backfill surface is horizontal and in level with the top of the wall. The unit weight of the backfill soil is $18kN/m^3$, its angle of shearing resistance, ϕ is 30° and the cohesion value, c is $35kN/m^2$. Determine the total active thrust per unit length of the retaining wall and its point of application. (6)

3. (a) A rectangular footing 2m × 3m is placed at a depth of 2m below the ground surface. The properties of the foundation soil are c = $25kN/m^2$, ϕ = 36°, $\gamma = 18kN/m^3$. (8)

For ϕ = 36°, N_c = 50.6, N_q = 37.8, N_γ = 56.5.

The load on the footing is concentric but it acts at an angle of 15° to the vertical.

Determine by IS 6403 (1981) recommendations, the net safe load that can be supported by the footing with a F.O.S. of 3 with respect to shear failure.

(b) A strip footing 2m wide rests on the surface of a dry cohesionless soil having ϕ = 17° and $\gamma = 181<N/m^3$. If the flood causes the water table to rise temporarily to the surface, what percentage of ultimate bearing capacity is reduced? Take $N_q = 5$, $N_\gamma = 4$. (2)

(c) Loose to medium sand extends from ground surface upto a considerable depth. The water table is at depth of 3m from the ground surface. The N-value from standard penetration test at a depth of 5m is 18. Unit weight above the water table is $18kN/m^3$ and saturated unit weight below the water table is $20kN/m^3$. Determine the corrected N- value of the soil. (5)

4. (a) A rectangular footing of size 2.5m × 3.5m is placed at a depth of 1m on a stiff saturated clay. The load acting on it is vertical but it is eccentric in both the x and y direction. The eccentricity is 0.2m in each directions. Compute the safe load on the footing if the factor of safety is three and the settlement is negligible. Take cohesion $c_u = 105KN/m^2$, $\phi_u = 0°$ and $\gamma = 17.8kN/m^3$. Use I.S. code procedure. (6)

(b) Elaborate with a neat sketch the procedure of conducting the seismic refraction test. (6)

(c) What is a bore log? Explain it with the help of a neat sketch. (3)

5. (a) A pile group having nine piles were installed in a square pattern in a homogeneous clay deposit The unconfined compressive strength of the clay deposit is $140kN/m^2$. The piles are 12m long and 400mm in diameter. The spacing between the piles are 900mm. Compute (3+4+2=9)

(i) The load carrying capacity of a single pile.

(ii) The load carrying capacity of the group pile.

(iii) The efficiency of the pile group.

Assume adhesion factor = 0.9.

(b) Elaborate on the term negative skin friction. How can negative skin friction be determined for a pile group passing through a layer of clay of depth H which is susceptible to negative skin friction? (2+4=6)

6. (a) The results of a pile load test are given below. (3+6=9)

Load (kN)	Penetration (mm)
0	0
300	4.5
550	5.5
800	9.5
1050	14.5
1300	21.3
1550	30.0

The load test was carried out on a 300mm diameter pile having length of 10m. Draw the load settlement plot and estimate the allowable load of the pile as per Indian standard code of practice.

(b) Slope stability analysis by the method of slices for a 40° slope on the critical slip plane gave the following results: (4)

Sum of the normal forces = 350kN; Sum of tangential forces = 200kN

Sum of neutral forces = 60kN; Effective angle of internal friction = 35°

Effective cohesion = $25kN/m^2$; Length of failure surface = 18m

Calculate the factor of safety with respect to shear strength.

(c) Define the term stability number S_n. (2)

7. (a) An infinite slope in a c - ϕ soil is inclined at 12° to the horizontal. The water table is at the surface and seepage is parallel to the slope. c = $10kN/m^2$, ϕ = 25° and γ_{sat} = $20kN/m^3$. If a plane slip has developed at a depth of 5m, determine the factor of safety of the slope. (7)

(b) What are the probable types of failure of a slope? (4)

(c) Elaborate on the significance of the term Seat of settlement of a shallow foundation. (4)