

**GEOTECHNICAL ENGINEERING - II**

(Civil Engineering)

Time: 3 hours

Max. Marks: 70

**PART - A**  
(Compulsory Question)

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- 1 Answer the following: (10 X 02 = 20 Marks)
- What is "Standard penetration resistance"? Name the corrections to be applied to it.
  - List various types of failures that occur in infinite and finite slopes.
  - State the limitations of Rankine's earth pressure theory.
  - Distinguish between "Cantilever" and "Counterfort" retaining walls.
  - Distinguish between "Safe bearing capacity" and "Allowable bearing capacity" of soils.
  - What is a "Routine test" conducted on pile foundation?
  - What is meant by "Tilt" and "Shift" of foundation?
  - What is "Negative skin friction" on piles? When does it occur?
  - How does Bishop's method of analysis of finite slope stability differ from Swedish circle method of analysis?
  - Explain "Modified engineering news record" formula used in pile load capacity estimation.

**PART - B**  
(Answer all five units, 5 X 10 = 50 Marks)**UNIT - I**

- 2 (a) Distinguish between "Undisturbed" and "Disturbed" soil samples.  
(b) Describe various methods of boring in soils and discuss their suitability to various soils.

**OR**

- 3 (a) Describe "Plate load test" used in bearing capacity determination of soils.  
(b) How do you decide the extent and depth soil exploration in various civil engineering projects?

**UNIT - II**

- 4 (a) Describe Swedish circle method of slices used in stability analysis of finite slopes.  
(b) A long natural slope in an overconsolidated clay ( $c = 10 \text{ kN/m}^2$ ,  $\phi' = 25^\circ$ ,  $\gamma_{sat} = 20 \text{ kN/m}^3$ ) is inclined at  $10^\circ$  to the horizontal. The water table is at the surface and seepage is parallel to the slope. If a plane slip had developed at a depth of 5 m below the surface, determine factor of safety.

**OR**

- 5 (a) Explain the conditions under which stability of slopes of earthen dams is to be checked.  
(b) Determine the factor of safety for a  $45^\circ$  slope, 12 m high in clay ( $c = 50 \text{ kN/m}^2$ ,  $\gamma = 20 \text{ kN/m}^3$ ,  $\phi = 0^\circ$ ) having a rock stratum at a depth of 12 m below the toe. For  $D_f = 2$ , and  $i = 45^\circ$ , Taylor's stability number,  $S_n = 0.177$ .

**UNIT - III**

- 6 (a) Distinguish between "Rankine" and "Coulomb" theories of earth pressures.  
(b) Derive expression for determination of active earth pressure on retaining wall with smooth vertical back due to cohesionless backfill with surface inclined at an angle " $\beta$ " to the horizontal.

**OR**

- 7 (a) Describe Culmann's graphical method to determine active thrust on back of a retaining wall.  
(b) Determine active thrust on smooth vertical back of a retaining wall of 7.5 m high, retaining cohesive backfill ( $c = 35 \text{ kN/m}^2$ ,  $\phi = 20^\circ$ ,  $\gamma = 20 \text{ kN/m}^3$ ) with horizontal surface. Also plot the variation of active earth pressure distribution on back of retaining wall and locate the point of action of active thrust on wall.

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## UNIT - IV

- 8 (a) State the assumptions made in Terzaghi's bearing capacity theory. Write expressions for determination of ultimate bearing capacity of square, circular footings in general and local shear failure conditions.
- (b) Determine factor of safety with respect to shear failure of a circular footing of 2.5 m diameter installed in clayey sand ( $\gamma = 19 \text{ kN/m}^2$ ,  $C_u = 25 \text{ kN/m}^2$ ,  $\Phi_u = 28^\circ$ ) at a depth of 1.2 m. The water table is at a depth of 0.5 m below ground level. For  $\Phi_u = 28^\circ$ , take local shear bearing capacity factors as  $N_c = 14$ ,  $N_q = 5$  and  $N_\gamma = 4$ .

OR

- 9 (a) Describe "Schmertmann" and "Hartman" method of determination of settlement of footings in granular soils.
- (b) Determine allowable bearing capacity of a square footing of size 1.8 m x 1.8 m installed in clayey sand Strata (standard penetration resistance,  $N = 22$ ) at 1.5 m depth below ground level. The desired factor of safety against shear failure is 3 and settlement of the footing is not to exceed 30 mm. The unit weight of soil is  $19 \text{ kN/m}^3$ .

## UNIT - V

- 10 (a) What is "Group efficiency" of piles? What are the factors that influence group efficiency of piles? Describe "Converse Lebarre" equation used in pile group efficiency estimation.
- (b) Determine allowable load capacity of a bored cast in-situ pile of 400 mm diameter and 6 m length installed in a clayey sand deposit ( $c = 30 \text{ kN/m}^2$ ,  $\phi = 25^\circ$ ,  $\gamma = 19 \text{ kN/m}^3$ ). Take critical depth as 15 times diameter of pile and  $K = 0.6$ . For  $\phi = 25^\circ$ ,  $N_q = 28$ . Use a factor of safety of 2.5.

OR

- 11 (a) Distinguish between "Open Caissons" and "Box Caissons".
- (b) Describe cyclic pile load test used in separation of load capacity of pile into skin friction and end bearing components.

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