



Fifth Semester B.E. Degree Examination, July/August 2021 Applied Geotechnical Engineering

Time: 3 hrs.

Max. Marks: 100

**Note: 1. Answer any FIVE full questions.
2. Use of IS : 6403 is permitted.**

1.
 - a. What are the objectives of soil exploration? List the methods of exploration. (08 Marks)
 - b. Explain the terms with the help of a neat sketch of sampling tube :
 - i) Inside clearance. (07 Marks)
 - ii) Outside clearance. Determine the area ratio for a sampler having outer diameter of cutting edge as 75mm and wall thickness as 1.7mm. Also state the type of sampler. (05 Marks)
 - c. Explain various types of soil samples. (05 Marks)

2.
 - a. List the methods of dewatering during excavation and construction of foundations. Explain any one. (06 Marks)
 - b. Predict the ground water table given the following data :
Depth upto which water is boiled out = 18m , Water rise in I day = 0.95m , II day = 0.86m and III day = 0.78m. Use Hvorslev's method for predicting ground water table. (06 Marks)
 - c. Explain Seismic refraction method of exploration, with a neat sketch. (08 Marks)

3.
 - a. Distinguish between Boussinesq's and Westergaard's theory of stress distribution. (04 Marks)
 - b. Find the intensity of vertical pressure at a point 4m directly below a 20kN point load acting on a horizontal surface. What will be the vertical pressure at a point 2m horizontally away from the axis of loading and also at the same depth of 4m? (06 Marks)
 - c. Construct an Isobar for a vertical stress of 20kN/m² when ground surface is subjected to a concentrated load of 500kN. (10 Marks)

4.
 - a. Explain equivalent point load method for determining vertical stress at any point within the loaded area. (04 Marks)
 - b. Explain components of settlement with its formula. (08 Marks)
 - c. A stratum of clay with an average liquid limit of 45% is 6m thick. Its surface is located at a depth of 8m below the ground surface. The natural water content of the clay is 40% and specific gravity is 2.7. Between ground surface and clay the subsoil consists of fine sand. The water table is located at a depth of 4m below the ground surface. The average submerged unit weight of sand is 10.5kN/m³ and the unit weight of sand above the water table is 17kN/m³. The weight of building that will be constructed on the sand above clay increases the overburden pressure on the clay by 40kN/m². Estimate the settlement of building. (08 Marks)

5.
 - a. Distinguish between Active earth pressure and Passive earth pressure with sketch. (04 Marks)
 - b. Explain Culmann's graphical method of finding Active earth pressure. (06 Marks)
 - c. A retaining wall 5m high retains a cohesion less backfill. The top 2.5m of the fill has a unit weight of 17kN/m³ and $\phi = 35^\circ$. Water table is at a depth of 2.5m from ground surface. The bottom 2.5m has a saturated unit weight of 18kN/m³ and $\phi = 38^\circ$. Draw active earth pressure distribution diagram. Determine total active earth pressure and its point of application. (10 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and/or equations written eg, 42+8 = 50, will be treated as malpractice.

- 6 a. List the assumptions made in slope stability analysis. (04 Marks)
- b. Calculate the factor of safety with respect to cohesion of a clay soil laid at a slope angle of 26.5° to a height of 10m, if $\phi = 10^\circ$, $C = 25\text{kN/m}^2$ and $\gamma = 19\text{kN/m}^3$. What will be the critical height of the slope in this soil? For $\beta = 26.5^\circ$ and $\phi = 10^\circ$, $S_n = 0.064$. (04 Marks)
- c. A cutting 8.5m deep is to be made in a cohesive soil whose shear strength increases with depth. The slope of the cutting is 2H:1V. The properties of the soil are effective cohesion = 30kN/m^2 , Angle of internal friction = 20° and Unit weight = 19kN/m^3 . Determine the FOS for a trial slip circle passing through the toe of the slope by method of slices. The centre of slip circle can be located by Fellenius directional angles. For $\beta = 26.6^\circ$, $\alpha_A = 25^\circ$ and $\alpha_B = 35^\circ$. (12 Marks)
- 7 a. With the help of sketch, explain effect of eccentric loading on bearing capacity of soil. (04 Marks)
- b. Explain different modes of shear failure, with neat sketches. (06 Marks)
- c. A column carries a load of 1000kN. The soil is a dry sand weighing 19kN/m^3 and having $\phi = 40^\circ$. A minimum factor of safety of 2.5 is required and Terzaghi's factors are required to be used $N_r = 42$, $N_q = 21$.
- i) Find the size of square footing if placed at the ground surface.
- ii) Find the size of square footing if placed at 1m below ground surface with water table at ground surface. Assume $\gamma_{\text{sat}} = 21\text{kN/m}^3$. (10 Marks)
- 8 a. Explain the procedure for determining the ultimate load capacity of soil by plate load test with a neat sketch. List its limitations. (08 Marks)
- b. Calculate the net ultimate bearing capacity of a rectangular footing $1.8\text{m} \times 3.6\text{m}$ in plan founded at a depth of 1.6m below the ground surface. The load on the footing acts at an angle of 16° to the vertical and it is eccentric in the direction of width by 15cm. The unit weight of soil is 18kN/m^3 . The shear parameters are $C' = 15\text{kN/m}^2$ and $\phi' = 30^\circ$. Natural water table is at a depth of 2m below the ground surface. Use BIS recommendations as contained in IS6403 – 1981. (12 Marks)
- 9 a. Explain in detail classification of piles based on material and function. (10 Marks)
- b. A group of 9 piles, 10m long is used as a foundation for a bridge pier. The piles used are 30cm diameter with centre to centre spacing of 0.9m. The subsoil consists of clay with unconfined compressive strength of 15kN/m^2 . Determine the efficiency neglecting the bearing action. Take adhesion factor as 0.9. (10 Marks)
- 10 a. With the help of sketch, explain : i) Negative skin friction ii) Under reamed piles. (10 Marks)
- b. A group of 9 piles arranged in a square pattern with diameter and length of each pile as 25cm and 10m respectively, is used as a foundation in soft clay deposit. Taking the unconfined compressive strength of clay as 120kN/m^2 and the pile spacing as 100cm center to center. Find the capacity of the group, Assuming bearing capacity factor $N_C = 9$, Adhesion factor = 0.75 and FOS = 2.5. (10 Marks)

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