

Fifth Semester B.E. Degree Examination, Feb./Mar. 2022 Applied Geotechnical Engineering

Time: 3 hrs.

Max. Marks: 80

Note : 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. Assume any missing data, suitably.

Module-1

- 1 a. Explain the objective of Subsurface exploration. (04 Marks)
- b. List out the recommendations for a typical Borehole log. (06 Marks)
- c. A sampling tube has inner diameter 70mm with diameter of cutting edge 68mm. Their outer diameters are 72 and 74mm respectively. Determine the inside clearance , outside clearance and area ratio of the sampler. (06 Marks)

OR

- 2 a. Explain with a neat sketch, Seismic Refraction method of soil exploration. (04 Marks)
- b. Describe Electro osmosis method of dewatering. (04 Marks)
- c. To establish the location of ground water table in a clayey strata, water in the borehole is bailed out to a depth of 12m below ground surface. Rise in water was recorded at 24 hrs interval is : First day = 0.6m , Second day = 0.55m , Third day = 0.5m. Estimate the position of ground water table. (08 Marks)

Module-2

- 3 a. List the assumptions of Boussinesq's theory. Write the equation with all notations used to determine vertical stress at any depth z below the point load. (04 Marks)
- b. Explain the principle and use of Newmark's chart to find vertical pressure at a point. (06 Marks)
- c. A circular area on the ground surface, 8m in diameter carries a uniformly distributed load of 5kN/m². Find the vertical pressure at a depth of 5m below the centre of the loaded area. Use Boussinesq's theory. (06 Marks)

OR

- 4 a. Define the following terms : i) Immediate settlement ii) Consolidation settlement
iii) Secondary settlement iv) Total settlement v) Differential settlement. (08 Marks)
- b. A 6m thick clay layer is overlaid by a sand layer of 4m thick. Calculate the settlement of clay layer , increment in stress due to a surcharge acting at ground surface is 100kN/m² , Water table is 4m below ground level.
Properties of sand : $G = 2.66$; $e = 0.72$.
Properties of clay : Liquid limit = 60% , $e = 0.9$, $r_{sat} = 19.37 \text{ kN/m}^3$. (08 Marks)

Module-3

- 5 a. Define : i) Active Earth Pressure ii) Passive Earth Pressure. (04 Marks)
- b. A 6m high vertical wall retains a sandy clay having bulk unit weight 18kN/m³ , $C = 15 \text{ kPa}$ and $\phi = 20^\circ$. Determine the depth of tension crack in the fill and critical depth of unsupported fill. (04 Marks)
- c. The top 4.5m of fill behind a retaining wall with vertical back of 7.5m height has $r_1 = 20 \text{ kN/m}^3$, $\phi_1 = 35^\circ$. For the lower 3m , the values are $r_2 = 18 \text{ kN/m}^3$, $\phi_2 = 30^\circ$. Find the magnitude and point of application of lateral thrust on the wall per linear meter. (08 Marks)

OR

- 6 a. What is Stability Number? Discuss the use of stability chart. (04 Marks)
 b. Differentiate between : i) Face failure and Toe failure ii) Finite slopes and Infinite slopes (04 Marks)
 c. A embankment 6m high has a slope of 1V : 2H. The material of slope has $\phi = 30^\circ$, $C = 5\text{kN/m}^2$, $r = 19\text{kN/m}^3$. A trial slip circle has a radius of 8.8m with its centre at the same level as the top of the embankment and passes through the toe. Find the FOS using method of slices. (08 Marks)

Module-4

- 7 a. Discuss the effect of ground water table on bearing capacity of soils. (04 Marks)
 b. What is Standard Penetration test? Explain. (04 Marks)
 c. What will be the gross and net safe bearing pressure of sand having $\phi = 36^\circ$ and effective unit weight of 19kN/m^3 under :
 i) 1.2m wide strip footing ii) 1.2m wide square footing
 iii) 1.2m diameter circular footing.
 The footing is located at a depth of 1.2m below GL with water table found to be at great depth. Use Terzaghi's theory with $FS = 3$, $N_q = 47$, $N_r = 43$, $C = 0$. (08 Marks)

OR

- 8 a. Write the Salient features and assumptions associated with Terzaghi's B.C theory. (08 Marks)
 b. A 2.5m square footing is located in a dense sand at a depth of 1.5m with soil having $C = 0$, $\phi = 38^\circ$. Determine the ultimate b.c for the following water table positions :
 i) W.T. at ground surface ii) W.T. at 1m below ground surface
 iii) W.T. at base of footing.
 Data : $r = 18\text{kN/m}^3$, $r_{\text{sat}} = 20\text{kN/m}^3$ for $\phi = 38^\circ$, $N_q = 48.9$, $N_r = 58.9$. (08 Marks)

Module-5

- 9 a. Enumerate with neat sketch, the classification of pile foundations on the basis of function, material. (04 Marks)
 b. List the circumstances under which pile foundations are recommended. (04 Marks)
 c. A 12m long, 300mm diameter pile is driven in uniform deposit of sand with $\phi = 40^\circ$. The W.T. is at great depth. The average dry unit weight of sand is 18kN/m^3 and angle of pile wall friction (δ) = 30° . Determine the safe load on the pile using static formula with $N_q = 137$. Take $K = 2.0$ and critical depth = $15d$ where d = diameter of the pile. (08 Marks)

OR

- 10 a. What is meant by 'Group Efficiency of Pile'? Hence explain Feld's rule for the same. (04 Marks)
 b. Define 'Negative Skin Friction' as applied to pile foundation. (04 Marks)
 c. Calculate the safe load carrying capacity of a friction pile group with 16 piles of 400mm in diameter, 9m in length and at a spacing of 1.2m C/c. The soil is 14m deep clay having $C_u = 50\text{kN/m}^2$, $\alpha = 0.7$, $r = 16\text{kN/m}^3$, $r' = 9\text{kN/m}^3$. Water table is 1m below GL. Use $FS = 2.5$. (08 Marks)
