CBCS SCHEME

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18CV62

Sixth Semester B.E. Degree Examination, Dec.2024/Jan.2025
Applied Geotechnical Engineering

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. List the objectives of subsoil exploration. **(06 Marks)**

b. Differentiate between
i) Sampling and sounding ii) Disturbed and Undisturbed samples. **(08 Marks)**

c. A sampling tube has inner diameter 70 mm with inner diameter of cutting edge being 68 mm. Their outer diameters are 72 and 74 mm respectively. the tube is pushed at the bottom of a bore hole to a distance of 550 mm and the soil sample length recovered from the sample is 530 mm. Determine area ratio, inside clearance, outside clearance and recovery ratio. Comment on the type of sampler. **(06 Marks)**

OR

2 a. Explain with a neat sketch, the seismic retraction method of soil exploration. **(06 Marks)**

b. List the different methods of lowering GWT in an excavation. Explain any two methods. **(06 Marks)**

c. To establish the location of GWT in a clayey strata, water in the bore hole is boiled out to a depth of 12 m below ground surface, Rise in water was recorded at 24 hrs interval as below:
First day = 0.6 m ; Second day = 0.55 m ; Third day = 0.5.
Estimate the position of GWT. **(08 Marks)**

Module-2

3 a. Enlist the assumptions made in deriving Boussinesq's equation. What are its limitations? **(06 Marks)**

b. Explain in brief, the construction principle and use of Newmark's chart. **(08 Marks)**

c. A water tank is supported on a ring foundation having outer diameter of 10m and inner diameter of 8 m. The intensity of loading on the foundation is 150 kN/m^2. What is the vertical stress at a depth of 5 m below the centre of foundation? **(06 Marks)**

OR

4 a. Differentiate between :
(i) Immediate and consolidation settlements
(ii) Total and differential settlements. **(06 Marks)**

b. How differential settlements are detrimental to structure? What is the BIS specification for differential settlement? **(06 Marks)**

c. A proposed new building is underlaid by 8 m thick clay layer. The existing overburden pressure at the centre of clay layer is 300 kN/m^2. The stress due to construction of a new building increases by 150 kN/m^2. The liquid limit of the soil is 65%. Water content of soil is 50%. Specific gravity of soil grains is 2.65. Estimate the consolidation settlement. **(08 Marks)**

Module-3

5 a. Define and write down the equations for coefficient of earth pressure for active, passive and at rest conditions. **(06 Marks)**

b. Explain step-by-step procedure of Culmann's graphical construction for the determination of active earth pressure. **(06 Marks)**

c. A vertical retaining wall 6 m high retains a horizontal backfill with a surcharge load of 45 kN/m^2. The soil properties ate as below:
For the 1st 3m height : $\phi_1 = 36°$; $\gamma_1 = 19.8$ kN/m^3
For the 2nd 3m height : $\phi_2 = 32°$; $\gamma_2 = 19$ kN/m^3
(bottom portion)
Find the magnitude and position of active earth pressure. **(08 Marks)**

OR

6 a. Define infinite and finite slopes. With neat sketches, discuss the types of failures encountered in finite slopes. **(06 Marks)**

b. Explain Swedish slip circle method for determining FS of a finite slope in C-ϕ soils. **(08 Marks)**

c. A canal has to excavated through a soil strata having $C_u = 15$ kN/m^2, $\phi_u = 20°$, $e = 0.9$ and $G = 2.67$. The side slope of canal is 1:1 and depth of canal is 6 m. Find the FS with respect to cohesion when canal runs full. Also find the factor of safety when the canal is rapidly emptied. Use stability numbers 0.06 and 0.114 for canal full and canal empty condition respectively. **(06 Marks)**

Module-4

7 a. With neat sketches, explain the modes of shear failure. **(05 Marks)**

b. Enlisting the assumptions of Terzaghi's b.c. theory. Write down the general b.c. equation. **(06 Marks)**

c. What will be the gross and net safe bearing pressure of sand having $\phi = 36°$, $\gamma = 19$ kN/m^3 under :
(i) 1.2 m wide strip footing?
(ii) 1.2 m wide square footing?
(iii) 1.2 m diameter circular footing?
Assume that the footing is placed at 1.2 m below ground surface and W.T. is at great depth. Use Terzaghi's b.c. equations with $N_q = 47$ and $N_r = 43$. **(09 Marks)**

OR

8 a. Explain the concept of 'useful width' for designing footings with eccentric load. **(06 Marks)**

b. Explain IS procedure for conducting plate load test. Discuss the validity of the result in the design of foundation. **(06 Marks)**

c. Calculate the safe load carried by a square footing of side 1.2 m located at a depth of 1 m. The soil properties are : $C = 15$ kN/m^2, $\gamma = 18$ kN/m^3, $\phi = 25°$, $\gamma_{sat} = 20$ kN/m^3. What will be the change in the load, if W.T. rises to GL.
Take $N_q = 10$, $N_c = 20$ and $N_\gamma = 5$ for $\phi = 25°$ and FS = 3. **(08 Marks)**

Module-5

9 a. Explain the classification of piles on the basis of material used, method of installation and its function. **(06 Marks)**

b. What is an underreamed piles? Indicate the situation where it is used. **(06 Marks)**

c. A 12 m long, 300 mm diameter pile is driven in uniform deposit of sand with $\phi = 40°$. The water table is at great depth. The unit weight of sand is 18 kN/m^3. Using $N_q = 137$, calculate the safe load carrying capacity of single pile with a FS = 2.5 and $\delta = 30°$ (angle of skin friction). Assume k = 2.0 and critical depth = 15 × diameter of pile. **(08 Marks)**

OR

10 a. What is 'group efficiency'? Explain 'Feld's rule' for determining the same. **(06 Marks)**

b. What is 'negative skin friction' of a pile? How do you estimate the same in granular and clayey soil? **(06 Marks)**

c. A group of 9 piles with 3 piles in each row were driven into a soft clay to a depth of 12m, from GL. The diameter of the pile is 400 mm and piles are spaced at 850 mm centre to centre. If the unconfined compressive strength of clay is 60 kPa, compute the safe load on the pile group for a FS = 2.5. Take adhesion factor $\alpha = 0.7$. **(08 Marks)**

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