CBCS SCHEME

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21CV54

Fifth Semester B.E. Degree Examination, Dec.2023/Jan.2024
Geotechnical Engineering

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. With the help of 3-phase diagram, explain:
(i) Void ratio (ii) Porosity (iii) Air content (iv) Degree of saturation **(10 Marks)**

b. With usual notations, derive the relation $Y_d = \frac{(1-n_a)GY_w}{WG+1}$. **(10 Marks)**

OR

2 a. Explain the following:
(i) Liquid limit (ii) Shrinkage limit (iii) Plastic limit
(iv) Activity of clay (v) Relative density **(10 Marks)**

b. Classify following soils as per IS classification:

Soil	% passing 4.75 mm	% passing 75 micron	C_u	C_c	W
A	98	02	6.7	1.2	$I_p = 2.2$
B	100	100	-	-	$W_L = 400$
					$W_p = 50$

(10 Marks)

Module-2

3 a. Define permeability and explain factors affecting permeability. **(10 Marks)**

b. The discharge of water collected from a constant head permeameter in a period of 15 minutes is 400 ml. The internal diameter of permeameter is 6cm and measured difference in heads between the two gauging points 15 cm apart is 40. Calculate the coefficient of permeability. If the dry weight of 15 cm long sample is 7N and specific gravity of the solids is 2.65. Calculate seepage velocity. **(10 Marks)**

OR

4 a. Explain effective stress and total stress concept. **(08 Marks)**

b. Write a note on quick sand phenomena. **(06 Marks)**

c. Explain impact of effective stress in construction of structures. **(06 Marks)**

Module-3

5 a. Discuss the factors affecting compaction of soils. **(05 Marks)**

b. Write difference between standard and modified proctor's compaction. **(03 Marks)**

c. The following are the results of compaction test:

Water content (%)	8	11.5	14.5	17.5	19.5	21.5
Mass of wet soil (gm)	1700	1900	2000	1980	1950	1920

If volume of mould used was 950 cc and specific gravity was 2.65:
(i) Draw dry density versus water content curve, find OMC and MDD.
(ii) Plot 100% saturation line **(12 Marks)**

OR

6 a. Write assumptions and Terzaghi's one dimensional consolidation theory. **(06 Marks)**

b. With neat sketch, explain how pre-consolidation pressure is determined by Casagrande's method. **(06 Marks)**

c. A soil sample of 20 mm thick take 20 minutes to reach 20% consolidation. Find the time taken for a clay layer 6m thick to reach 40% consolidation. Assume double drainage in both cases. **(08 Marks)**

Module-4

7 a. Explain Mohr's Coulomb's theory as applied to soil strength. **(06 Marks)**

b. Write note on total and effective shear strength. **(06 Marks)**

c. A specimen of clean dry, cohesionless sand is tested in shear box and soil is failed at shear stress of 40 kN/m^2 when the normal load on the specimen was 50 kN/m^2. Determine:

(i) Angle of shearing resistance

(ii) The principal stresses during the failure **(08 Marks)**

OR

8 a. List the factors affecting shear strength of soils. **(04 Marks)**

b. Explain Thixotrophy and sensitivity. **(06 Marks)**

c. Two identical soil specimens were tested in triaxial apparatus. The first specimen failed at a deviator stress of 770 kN/m^2. When the cell pressure was 200 kN/m^2. Second specimen failed at deviator stress of 1370 kN/m^2 under pressure of 400 kN/m^2. Determine the value of cohesion and angle of internal friction analytically. If soil is tested in a direct shear apparatus with normal stress of 600 kN/m^2. Estimate shear stress at failure. **(10 Marks)**

Module-5

9 a. Explain modes of shear failure. **(06 Marks)**

b. Discuss effect of water table on bearing capacity with neat sketch. **(06 Marks)**

c. Compute the SBC of continuous footing at 1.8 m wide and locate at depth of 1.2 m below ground level in soil. Unit weight is 20 kN/m^3 and cohesion 20 kN/m^2 and internal friction 20°. Assume F.S. = 2.5. When is the permissible load per meter run of footing? Given $N_c = 17.7$, $N_g = 7.4$, $N_y = 5$ **(08 Marks)**

OR

10 a. What are the different types of settlements of footing? Explain. **(06 Marks)**

b. Define differential and total settlement. **(04 Marks)**

c. A soft normally consolidated clay layer is 18 m thick. The natural water content is 45%. The saturated unit weight is 18 kN/m^3. The grain specific gravity is 2.7 and liquid limit is 63%. The vertical stress increment at the center of layer due to foundation load is 9 kN/m^2. The ground water table is at the surface of the clay layer. Determine the settlement of foundation. **(10 Marks)**

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