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15CV45

## Fourth Semester B.E. Degree Examination, July/August 2022 Basic Geotechnical Engineering

Time: 3 hrs.

Max. Marks: 80

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

### Module-1

- 1 a. With the help of three-phase diagram of soil, define
  - (i) Water content.
  - (ii) Dry unit weight.
  - (iii) Voids ratio.
  - (iv) Degree of saturation.

(06 Marks)
- b. With usual notations, derive from basic definition of the following phase relation,
 
$$\gamma_d = \frac{(1 - n_a) G \gamma_w}{1 + \omega G}$$

(04 Marks)
- c. A fully saturated soil has a water content of 35% and specific gravity of 2.65. Determine its porosity, saturated unit weight and dry unit weight.
 

(06 Marks)

**OR**

- 2 a. Explain with the help of particle size distribution curve the following:
  - (i) Well graded soils.
  - (ii) Poorly graded soils.
  - (iii) Gap-graded soils.

(04 Marks)
- b. Define Stoke's law. What are its assumptions?
 

(04 Marks)
- c. Explain Plasticity chart and its use.
 

(04 Marks)
- d. The liquid limit test gave the following results on a Clayey sample. Determine liquid limit of the soil.

Number of blows	12	18	22	34
Water content (%)	56	52	50	45

(04 Marks)

### Module-2

- 3 a. Define Adsorbed water. Hence enumerate 'Electrical diffuse double layer' as applied to soil moisture.
 

(04 Marks)
- b. List and explain the structure of three different clay minerals commonly found in soils.
 

(06 Marks)
- c. Distinguish between Flocculated structure and Dispersed structure.
 

(06 Marks)

**OR**

- 4 a. Enumerate Factors affecting compaction.
 

(04 Marks)
- b. Distinguish between light and heavy compaction test.
 

(04 Marks)
- c. During a compaction test, a soil attains a maximum dry density of 18 kN/m<sup>3</sup> at a water content of 12%. Determine the degree of saturation and percent air-voids at maximum dry density. Also find the theoretical maximum dry density corresponding to zero air voids at optimum moisture content. The specific gravity of soil solids is 2.67.
 

(08 Marks)

### Module-3

- 5 a. Explain the following:
  - (i) Coefficients of permeability
  - (ii) Quick sand condition.
  - (iii) Seepage velocity.

(04 Marks)
- b. What are the limitations of Darcy's law?
 

(04 Marks)

- c. A sand sample of 0.25 m length was subjected to a constant head test in a permeameter having an area of  $30 \times 10^{-4} \text{ m}^2$ . A discharge of 100 CC was obtained in a period of 60 seconds under a head of 0.39 m height. The dry sand in the permeameter weighed 1350 gms with  $G = 2.67$ . Determine : (i) Coefficient of permeability. (ii) Superficial velocity. (iii) Seepage velocity. (08 Marks)

OR

- 6 a. What are Flow nets? Lists its characteristics and uses. (08 Marks)  
b. Calculate and draw total, effective and pore water pressure distribution for a soil profile with properties shown in Fig. Q6 (b). Assume specific gravity of soil = 2.70. (08 Marks)

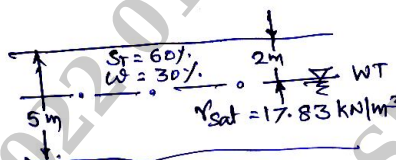


Fig. Q6 (b)

**Module-4**

- 7 a. Explain mass-spring analogy of consolidation of soils. (06 Marks)  
b. Explain normally consolidated, under consolidated and over-consolidated soils. (04 Marks)  
c. In a consolidation test, the voids ratio of soil sample decreases from 1.20 to 1.10, when the pressure was increased from 160 to 320  $\text{KN/m}^2$ . Determine coefficients of consolidation if the coefficient of permeability of soil is  $8.0 \times 10^{-7} \text{ mm/sec}$ . (06 Marks)

OR

- 8 a. Explain the significance of Pre-consolidation pressure. Describe Casagrande's method of determining the same. (08 Marks)  
b. A bed of compressible clay 4 m thick has pervious sand on the top and impervious rock at the bottom. In a consolidation test on an undisturbed sample of clay deposit from this deposit, 90% settlement was reacted in 4 hours. The sample was 20 mm thick. Estimate the time in years for the building founded on this deposit to reach 90% of its final settlement. (08 Marks)

**Module-5**

- 9 a. Explain Mohr-Coulomb's shear strength theory with its assumptions. (04 Marks)  
b. Explain the limitations of direct shear test. (04 Marks)  
c. The stress on a failure plane in a drained test on a cohesionless soil are as under:  
Normal stress ( $\sigma$ ) = 100  $\text{KN/m}^2$   
Shear stress ( $\tau$ ) = 40  $\text{KN/m}^2$   
(i) Determine angle of shear resistance and angle which the failure plane makes with major principal plane.  
(ii) Major and Minor principal stresses. (08 Marks)

OR

- 10 a. Classify the shear test on the basis of drainage conditions and suggest their suitability. (04 Marks)  
b. Explain Vane shear test with a neat sketch. (04 Marks)  
c. The triaxial test was carried out on soil samples which gave the following:

Confining pressure, $\text{kN/m}^2$	50	100	150
Deviator stress, $\text{kN/m}^2$	76	132	186
Pore water pressure, $\text{kN/m}^2$	35	59	83

Plot Mohr's circle and obtain effective shear parameters.

(08 Marks)

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