

[Total No. of Questions - 9] [Total No. of Printed Pages - 4]
(2064)

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B. Tech 4th Semester Examination

Soil Mechanics (O.S.)

CE-4004

Time : 3 Hours

Max. Marks : 100

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Attempt five questions selecting one question from each section A, B, C and D. Question 9 is compulsory. All questions carry equal marks. Non-programmable calculator is allowed.

SECTION - A

1. (a) By three phase soil system, show that saturated unit weight γ_{sat} in terms of specific gravity G , void ratio e and degree of saturation S , is given by the expression:
$$\gamma_{sat} = (G + e) \gamma_w / (1+e).$$
- (b) Calculate plastic limit and plasticity index of a soil sample from following data: Mass of 3 mm crumbles soil threads = 17.1 g. Liquid limit of soil sample = 35.2 % Mass of oven dried soil threads = 14.82 g. Also classify the soil.
(10+10=20)

OR

2. (a) Sketch the plasticity chart for classifying fine grained soil in IS soil classification system. Define and explain with sketch uniformity coefficient and coefficient of curvature.
- (b) Discuss various types of soil structure giving neat sketches.
(10+10=20)

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SECTION - B

3. (a) Derive an expression for the coefficient of permeability of stratified soils.
- (b) In a falling head permeameter, the initial head ($t=0$) is 40 cm. The head drops by 5 cm in 10 minutes. Calculate the time required to run the test for the final head to be at 20 cm. If the sample is 6 cm in height and 50 cm^2 in cross-sectional area, calculate the coefficient of permeability taking area of stand pipe as 0.5 cm^2 . (10+10=20)

OR

4. (a) For a homogeneous earth dam of 62 m height and 2 m free board, the flownet was constructed and following results were obtained: Number of potential drops = 30, Number of flow channels = 6. The dam has a horizontal filter of 50 m length at its downstream end. Calculate the discharge per metre length of the dam if the coefficient of permeability of the dam material is $2 \times 10^{-3} \text{ cm/sec}$.
- (b) Derive Laplace's equation for flow of water through porous media.
- (c) Explain how the compaction of soils is controlled in the field. (6+8+6=20)

SECTION - C

5. (a) Explain the term 'pressure bulb'. Derive an expression for vertical pressure under a strip load.
- (b) A circular area of 10 m radius on the surface of an elastic mass of great extent carries a uniformly distributed load of 125 kN/m^2 . Determine the intensity of vertical pressure at a point 15 m beneath the centre of the circular loaded area. (10+10=20)

OR

6. (a) Discuss square root time fitting method for determining consolidation coefficient.
- (b) A clay layer whose total settlement under a given loading is expected to be 12 cm settles 3 cm at the end of 1 month after the application of load increment. How many months will be required to reach a settlement of 6 cm? How much will be the settlement after 10 months? (10+10=20)

SECTION - D

7. (a) Discuss Culmann's graphical method for determining active earth pressure behind a retaining wall.
- (b) A retaining wall 5 m high has a vertical back and supports cohesive backfill whose surface is level with the top of the wall. The properties of the backfill are:
- Angle of friction $\phi =$ zero, unit weight $\gamma = 18 \text{ kN/m}^3$ and cohesion $c = 20 \text{ kN/m}^2$. Determine the magnitude and point of application of the active earth pressure per metre length of the wall considering the effect of development of tension cracks. (10+10=20)

OR

8. (a) Compare the methods of determining shear strength of soils by the direct shear test and triaxial shear test.
- (b) A saturated specimen of cohesionless sand was tested in triaxial compression and the sample failed at a deviator stress of 482 kN/m^2 when the cell pressure was 100 kN/m^2 under drained conditions. Determine effective angle of shearing resistance of sand. Determine major principal stress and deviator stress at failure for identical specimen if tested under cell pressure of 200 kN/m^2 . (10+10=20)

[P.T.O.]

SECTION - E (Compulsory)

9. (a) A soil sample has liquid limit 45% and plastic limit 25%. Determine its plasticity index.
- (b) Define and explain uniformity coefficient and coefficient of curvature.
- (c) If the critical hydraulic gradient of a soil is 1.0 and its specific gravity is 2.70, then determine its void ratio.
- (d) Define and explain coefficient of consolidation.
- (e) Explain total stress and effective stress.
- (f) Discuss dispersed soil structure.
- (g) Differentiate between active and passive earth pressures.
- (h) A soil has a discharge velocity of 6×10^{-7} m/s and a void ratio of 0.5. Determine the seepage velocity of the soil.
- (i) Define and explain optimum moisture content and maximum dry density.
- (j) Explain the term 'contact pressure'. (10×2=20)