



## Term Evaluation (Even) Semester Examination March 2025

Roll no.....

Name of the Course: B.Tech Civil Engineering

Semester: IV

Name of the Paper: Soil Mechanics

Paper Code: TCE403

Time: 1.5 hour

**Maximum Marks: 50**

**Note:**

- (i) Answer all the questions by choosing any one of the sub-questions
- (ii) Each question carries 10 marks.

Q1.

CO-1 (10 Marks)

a.

The bulk unit weight ( $\gamma_b$ ) of the soil is 18.6 kN/m<sup>3</sup> and the moisture content (w) is 15%. Obtain the following: (i) Dry unit weight of the soil ( $\gamma_d$ ), (ii) Void ratio (e), (iii) porosity (n), (iv) degree of saturation (S), and (v) Saturated density ( $\gamma_{sat}$ ). Consider unit weight of water 10 kN/m<sup>3</sup> and specific gravity  $G_s = 2.65$

OR

b.

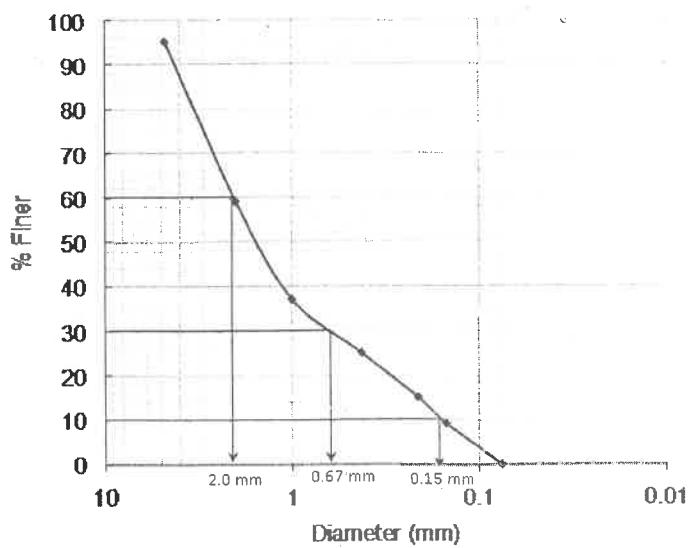
Discuss the *step by step* procedure for obtaining the moisture content of soil using Pycnometer method. Derive the expression as well in terms of measurements made and specific gravity of soil solids ( $G_s$ )

Q2.

CO-2 (10 Marks)

a.

Define the following parameters; coefficient of uniformity and coefficient of curvature and obtain the values using the following diagram





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b.

The following data were obtained from the shrinkage limit test using mercury displacement method. Obtain the specific gravity and shrinkage limit of the soil.

Initial weight of the saturated soil = 0.954 N

Weight of the oven dried soil = 0.431 N

Initial volume of the saturated soil =  $0.0685 \times 10^{-3} \text{ m}^3$

Final volume of dry soil (mercury displacement) =  $0.0241 \times 10^{-3} \text{ m}^3$

Q3.

CO-1 (10 Marks)

a.

Draw the detailed phase diagram of the following different soil states: (i) Dry state (ii) Partially Saturated state (iii) Saturated state

Derive expression for bulk unit weight in terms of moisture content, void ratio and specific gravity of the soil solids

OR

b.

Discuss in detail the soil formation process and also draw the soil horizons indicating different layers.

Q4.

CO-2 (10 Marks)

a.

A fine grained soil has the liquid limit and plastic limit values of 60% and 35%, respectively. When the soil at its liquid limit was dried, the % decrease in volume of soil was 45% of its dry volume. When it was dried from its plastic limit, % decrease in volume was 10% of its dry volume. Determine the shrinkage limit and shrinkage ratio of the soil.

OR

b.

Define the following engineering properties of soil: Permeability, Activity, Sensitivity, Thixotropy, Relative Density

Q5.

CO-1 (10 Marks)

a.

Discuss in detail the areal distribution of the soil in India. Also discuss the engineering problems associated with black cotton (expansive) soil found in India

OR

b. Discuss the engineering problems associated with the following soil types: LOESS, PEAT, HARD PAN, EXPANSIVE SOIL