



End Term (Even) Semester Examination May-June 2025

Roll no.....

Name of the Program and semester: B.Tech Civil Engineering, IV Semester

Name of the Course: Soil Mechanics

Course Code: TCE403

Time: 3 hour

Maximum Marks: 100

Note:

- (i) All the questions are compulsory.
- (ii) Answer any two sub questions from a, b and c in each main question.
- (iii) Total marks for each question is 20 (twenty).
- (iv) Each sub-question carries 10 marks.

Q1.

(2X10=20 Marks) CO-1

a. Explain the following transported soil based in the transporting agent and method of deposition

- Alluvial Deposit
- Lacustrine Deposit
- Marine Deposit
- Aeolian Deposit
- Glacial Deposit

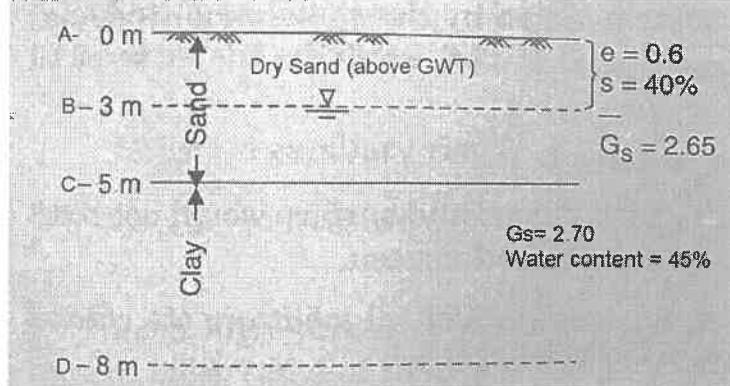
b. A saturated clay sample originally 25 mm thick and at a initial void ratio of 1.12 was subjected to a compressive load. After the clay sample was completely consolidated, its thickness was measured to be 23.5 mm. Compute the final void ratio of the soil sample.

c. The in situ unit weight of a medium to coarse sand used as subgrade for a highway was 16 kN/m³. It was decided to improve that soil by mechanical stabilization. When 5.5 kN of a mixture of dry sand and silt was added to 1 m³ of this subgrade, the volume was increased by 20%. How much reduction in porosity of the soil was achieved. Take G_s = 2.65 for all soil type mixed.

Q2.

(2X10=20 Marks) CO-2

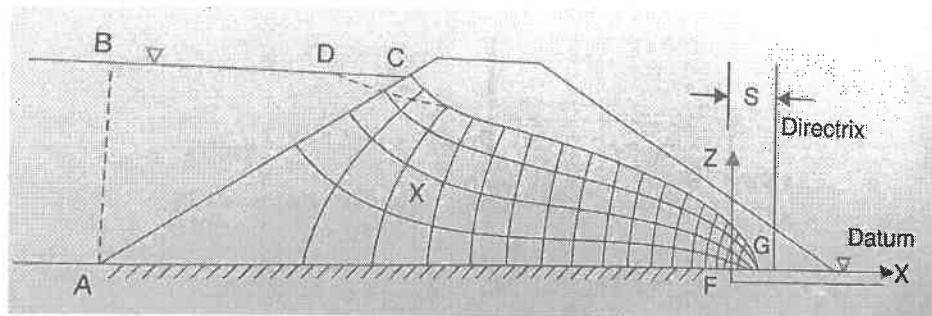
a. Calculate Total stress, Effective stress and pore water pressure values at points A, B, C, and D as indicated in the following figure.



b. With reference to the following figure, estimate the seepage discharge through the foundation of concrete dam. The length of the dam is 500m. Coefficient of permeability of the homogeneous earth dam is 1.15×10^{-5} m/sec. Water level of the U/S side is 50m.



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- c. Explain Darcy's Law. Discuss the factors that affect the coefficient of permeability of soil. Derive expression for obtaining the coefficient of permeability of soil using laboratory's Falling Head Method.

Q3.

(2X10=20 Marks) CO-3

- a. The *in situ* void ratio of a granular soil deposit is 0.50. The maximum and minimum void ratios of the soil were determined to be 0.75 and 0.35. Specific gravity of the soil solid is 2.67. Determine the relative density and relative compaction of the soil deposit.

- b. The following data refers to a compaction test as per Indian Standard (light compaction):

Water Content (%)	8.5	12.2	13.75	15.5	18.2	20.2
Weight of wet sample (kg)	1.80	1.94	2.00	2.05	2.03	1.98

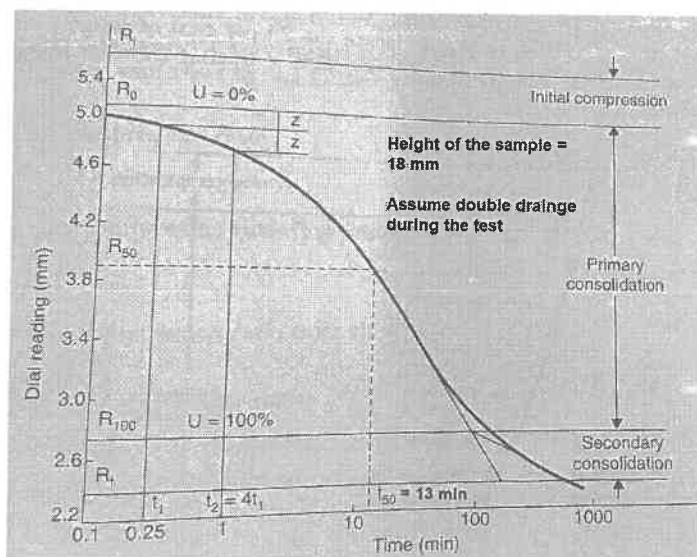
If the specific gravity of the soil grains was 2.70, obtain the MDD and OMC values from the compaction curve. Also, if RC to be achieved in the field is 90%, estimate the range of moisture content to be allowed in the field compaction.

- c. Explain the difference between compaction and consolidation. What kind of improvement of the engineering properties of a soil mass can be brought about through compaction.

Q4.

(2X10=20 Marks) CO-4

- a. Calculate the coefficient of consolidation (in cm^2/s) of the soil from the graph provided pertaining to Casagrande Method





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- b. A 8 meter thick clay layer with single drainage settles by 120 mm in 2 years. The coefficient of consolidation for this clay was found to be $6 \times 10^{-3} \text{ cm}^2/\text{sec}$. Calculate the likely ultimate consolidation settlement and find out how long it will take to undergo 90% of this settlement.
c. Representative samples of a layer of silty clay, 5 m thick were tested in a cosolidometer and the following results were obtained

Initial void ratio = 0.90

Preconsolidation stress = 120 kPa

Compression index = 0.27

Recompression index = 0.03

Estimate the consolidation settlement if the present overburden stress of the layer is 70 kPa and the increase in average stress in the layer is 80 kPa.

Q5.

(2X10=20 Marks) CO-5

- a. In a direct shear test conducted on a dense sand, the sample fails at a shear stress of 75 kPa, when the normal stress was held constant at 100 kPa. Determine the angle of shear resistance, orientation of major and minor principal planes as well as orientation of plane of maximum shear stress. Use Mohr-circle diagram for the same.
b. In a CU test on a normally consolidated clay, a sample consolidated under a stress of 200 kPa failed at an additional axial stress of 150 kPa. The pore pressure at failure was 75 kPa. Determine analytically the shear strength parameters both in terms of total and effective stress.
c. Using the following diagram, estimate the amount of stress developed at depth 10 m due to embankment loading. Take $a = 5\text{m}$ and $b = 3\text{m}$, $q = 250 \text{ kPa}$.



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