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15CV45

Fourth Semester B.E. Degree Examination, Aug./Sept.2020 Basic Geotechnical Engineering

Time: 3 hrs.

Max. Marks: 80

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

Module-1

- 1 a. Differentiate between : i) Water content and degree of saturation.
ii) Air content and percentage air voids iii) Specific gravity and mass specific gravity. (06 Marks)
- b. With usual notations, derive the relation
$$\gamma = \frac{(G + Se)\gamma_w}{1 + e}$$
 (04 Marks)
- c. A saturated soil has a total volume of 1300CC, total mass of 240g and oven dry mass of 180g. using fundamentals, calculate i) Water content ii) Specific gravity of soil solids and iii) Voids ratio of soil. (06 Marks)

OR

- 2 a. What are the three corrections to be applied to the hydrometer reading in the sedimentation analysis? Explain briefly. (06 Marks)
- b. With a neat sketch, explain the use of 'Plasticity chart' in classifying the fine grained soils as per Indian standards. (05 Marks)
- c. A soil has particles 86% finer than 4.75mm 7% finer than 75 microns, $C_u = 6.8$, $C_c = 1.4$, Liquid limit = 60%, Plastic limit = 25%. Classify the soil as per I.S. (05 Marks)

Module-2

- 3 a. Explain the clay minerals – Kaolinite and Montmorillonite using neat sketches of their structures. (06 Marks)
- b. The data from a standard compaction test on a soil is given below :

Water Content %	8.5	12.2	13.75	15.5	18.2	20.2
Bulk Unit weight γ kN/m ³	17.64	19.0	19.6	20.09	19.89	19.4

- i) Plot the compaction curve and determine OMC and MDD.
- ii) Determine the degree of saturation at OMC.
- iii) What is the range of water content to be used in field to achieve 95% relative compaction? (10 Marks)

OR

- 4 a. What are the factors affecting compaction? Explain any two of them. (06 Marks)
- b. Compare I.S Light compaction test and I.S Heavy compaction test. (04 Marks)
- c. A highway embankment is required to be constructed with a bulk unit weight of 20.34kN/m³ at a water content of 13% for a total volume of 8000m³. How much soil is required from a borrow pit which has a bulk unit weight of 19kN/m³ and water content of 8%. Also calculate the extra water to be added. (06 Marks)

Module-3

- 5 a. State the Darcy's law along with the assumptions used. (06 Marks)
- b. Derive the formula to determine the coefficient of permeability in falling head permeability test. (06 Marks)
- c. During a variable head permeability test the water head dropped from 120cm to 100cm in 4 minutes. What would be the water head after another 4 minutes? (04 Marks)

OR

- 6 a. What are the characteristics of flow – net? (04 Marks)
 b. Derive the formula to calculate seepage loss through isotropic soil below a concrete dam. (06 Marks)
 c. The soil profile at a site is shown in the figure below. Calculate and draw the variation of σ , u and σ' . (06 Marks)

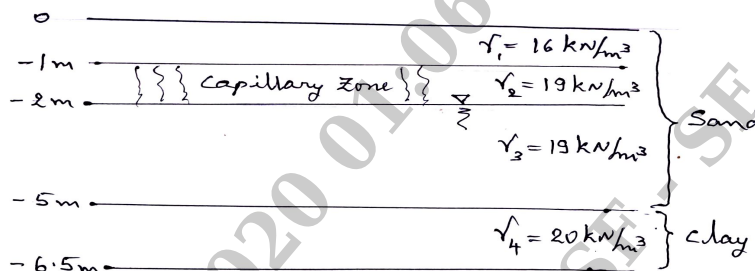


Fig.Q6(c)

Module-4

- 7 a. Define the following : i) N.C clay ii) O.C clay and iii) U.C clay. (06 Marks)
 b. Explain with neat sketches the “Square Root of time method” to determine the coefficient of consolidation in the laboratory. (06 Marks)
 c. A clay specimen 20mm thick has reached 50% consolidation in 6 hours under double drainage. What will be the time taken for the same clay in the field to reach 90% consolidation under double drainage , if the clay layer is 2m thick. (04 Marks)

OR

- 8 a. Differentiate between the following :
 i) Compression Index and Coefficient of consolidation.
 ii) Coefficient of compressibility and coefficient of volume compressibility. (04 Marks)
 b. What is Pre – consolidation pressure? How is it determined by Casagrande’s method? (06 Marks)
 c. Calculate the primary consolidation settlement of the clay layer shown in the fig.Q8(c) , if the increase in effective stress is 15kN/m^2 at the centre of clay layer. (06 Marks)

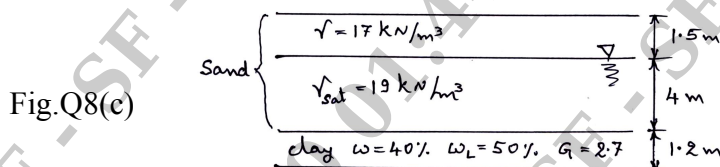


Fig.Q8(c)

Module-5

- 9 a. Derive the relation between major and minor principal stresses in a Triaxial test with a neat sketch. (06 Marks)
 b. The data from direct shear tests on a soil are given below. Shear box has internal dimensions of $60\text{mm} \times 60\text{mm}$. Plot the graph and determine the shear parameters. If the same soil is tested in Triaxial compression with a cell pressure of 100kN/m^2 , what will be σ_1 at failure?

Normal load (KN)	100	200	300
Shear force at failure (KN)	90	181	270

(10 Marks)

OR

- 10 a. What are the advantages and disadvantages of Direct shear test compared to Triaxial test? (06 Marks)
 b. Consolidated undrained tests were done on a soil. Given the following data , determine the shear strength parameters based on : i) Total stresses and ii) Effective stresses. (10 Marks)

Cell pressure (kN/m^2)	150	300
Diameter stress at failure (kN/m^2)	102	200
Pore water pressure (kN/m^2)	80	156