CBCS SCHEME

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15CV45

# Fourth Semester B.E. Degree Examination, Dec.2023/Jan.2024
# 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. With the help of phase diagram of sol, define the terms:
i) Void ratio ii) Water content
iii) Degree of saturation iv) Unit weight of soil **(08 Marks)**

b. Following results were obtained from liquid limit test on a clay sample, whose plastic limit is 13% and natural water content is 18%. Determine the following:
i) Liquid limit ii) Flow index iii) Consistency index.

| Number of blows | 5 | 16 | 23 | 42 |
|---|---|---|---|---|
| Water content % | 32 | 27.8 | 25.5 | 23.3 |

**(08 Marks)**

**OR**

2 a. Sketch a typical grain-size curve for (i) Well graded soil, (ii) Uniformly graded soil. Calculate uniformity coefficient and coefficient of curvature from the curve. **(04 Marks)**

b. Explain the salient features of I.S. plasticity chart for classification of fine grained soils. **(06 Marks)**

c. A partially saturated sample from a borrow pit has a natural water content of 14% and bulk unit weight of 19 kN/m$^3$. The specific gravity of solids is 2.70. Determine the void ratio, and degree of saturation. What will be the unit weight of the sample on saturation? **(06 Marks)**

## Module-2

3 a. Explain with neat sketches, the soil structure. **(08 Marks)**

b. Describe the three principal clay minerals. **(08 Marks)**

**OR**

4 a. What are the objectives of compaction? **(04 Marks)**

b. List the factors affecting compaction. **(04 Marks)**

c. Following are the observations of compaction test:

| Water content % | Weight of wet soil (N) |
|---|---|
| 7.7 | 16.67 |
| 11.5 | 18.54 |
| 14.6 | 19.92 |
| 17.5 | 19.52 |
| 19.5 | 19.23 |
| 21.2 | 18.83 |

If the volume of compaction mould is 950 CC and G = 2.65, determine the dry unit weight and OMC. **(08 Marks)**

## Module-3

5 a. Define Darcy's law. Derive an expression to relate discharge velocity and seepage velocity. **(06 Marks)**

b. Explain the following terms:
i) Total stress ii) Neutral stress
iii) Effective stress iv) Quick sand condition **(06 Marks)**

c. An earthen dam is built on a impervious foundation with a horizontal filter under the downstream slope. The horizontal and vertical permeability of the soil material in the dam are respectively $4 \times 10^{-5}$ m/sec and $1 \times 10^{-5}$ m/sec. Full reservoir level is 20m above downstream filter. Flow net consists of 4 flow channels and 15 equipotential drops. Estimate the seepage loss per meter length of the dam. **(04 Marks)**

**OR**

6 a. List the properties and use of flow nets. **(04 Marks)**

b. In a falling head permeameter test, the initial head is 300 m it drops by 1 cm in 3 minutes. How much longer should the test to be continued, if the head is to drop to 180 m? **(04 Marks)**

c. Explain with neat sketch the method of locating the phreatic line in a homogenous earth dam with horizontal filter. **(08 Marks)**

## Module-4

7 a. Define the following :
i) N.C clay ii) O. 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 filed to reach 90% consolidation under double drainage, if the clay layer is 2m thick. **(04 Marks)**

**OR**

8 a. Differentiate between the following :
Compression index and coefficient of consolidation
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 center of clay layer.

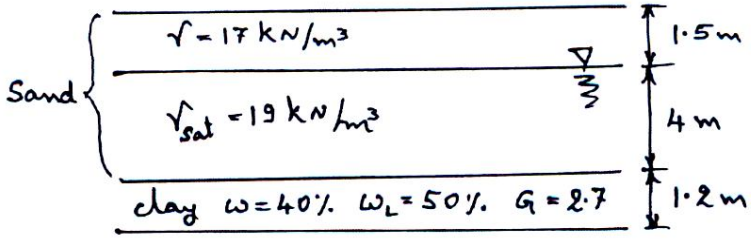


Fig.Q8(c) **(06 Marks)**

## Module-5

9 a. Explain Mohr's Coulombs failure theory and draw the failure envelope for different soils. **(08 Marks)**

b. What are the factors affecting the shear strength of soil? **(04 Marks)**

c. What are the advantages and disadvantages of direct shear test? **(04 Marks)**

**OR**

10 a. Explain triaxial compression test and what are the advantages of triaxial test. **(08 Marks)**

b. Following results are obtained from a direct shear test on a soil at failure ;

| Normal load (N) | 100 | 200 | 300 | 400 |
|---|---|---|---|---|
| Shear load (N) | 90 | 181 | 270 | 362 |

Size of the box = 6cm × 6cm. Determine shear strength parameters. **(08 Marks)**

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