

15CV45

# USN

## Fourth Semester B.E. Degree Examination, June/July 2017

## **Basic Geotechnical Engineering**

Time: 3 hrs.

Max. Marks: 80

Note: 1. Answer FIVE full questions, choosing one full question from each module. 2. Assume missing data, if any, suitably.

Module-1

- With the help of phase diagram of sol, define the terms:
  - i) Void ratio

iii) Degree of saturation

ii) Water content

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)

- 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)
  - 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<sup>3</sup>. 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

- Distinguish between:
  - i) Primary and secondary valence bonds
  - ii) Dispersed and flocculent structures
  - iii) Structure of Kaolinite and Montmorillonite

iv) Isomorphism substitution and base exchange capacity

(10 Marks)

b. Differentiate between standard and modified proctor tests.

(06 Marks)

Explain the factors affecting the degree of compaction.

(04 Marks)

List the differences between compaction and consolidation.

(04 Marks)

In a standard proctor test. Following results were obtained:

Mass of compacted soil in grams | 1700 | 1890 | 2003 1960 11.5 Water content % 7.7

- i) Draw the compaction curve showing OMC and maximum dry density.
- ii) Determine the void ratio and degree of saturation.

Given, volume of mould = 950 cc and G = 2.65.

(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 × 10<sup>-5</sup> m/sec and 1 × 10<sup>-5</sup> 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

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

a. Explain mass-spring analogy of consolidation of soils.

(08 Marks)

b. In a consolidation test, the void ratio of soil sample decreases from 1.20 to 1.10 when the pressure increases from 160 to 320 kN/m<sup>2</sup>. Determine the coefficient of consolidation, if the coefficient of permeability is 8 × 10<sup>-7</sup> mm/sec. (08 Marks)

#### OR

- 8 a. Explain under consolidated, normally consolidated and over consolidated soil. (06 Marks)
  - b. How preconsolidation pressure is determined by Casagrande's method?

(06 Marks)

c. A soil sample 2 cm thickness take 20 minutes to reach 20% consolidation. Find the time for a clay layer 6 cm thick to reach 40% consolidation. Assume double drainage in both cases.

(04 Marks)

#### Module-5

9 a. Briefly explain Mohr-Coulomb's shear strength theory.

(06 Marks)

b. In a direct shear test on sand, sample failed at a shear strength of 70 kN/m² when normal stress was 100 kN/m². Determine angle of internal friction. Draw Mohr circle at failure. Mark major and minor principal planes. What are the values of major and minor principal stresses?

#### OR

10 a. Mention the advantages and disadvantages of direct shear test.

(04 Marks)

b. Classify shear tests based on drainage conditions.

(03 Marks)

- c. A soil has unconfined compression strength of 120 kN/m². In triaxial compression test, specimen of same soil (under similar conditions) when subjected to cell pressure of 40 kN/m², failed at an additional stress of 160 kN/m². Determine:
  - i) Shear strength parameters
  - ii) Angle made by failure plane with axial stress direction in case of triaxial test. (09 Marks)

\* \* \* \* \*