

Fourth Semester B.E. Degree Examination, Dec.2018/Jan.2019
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. Define : i) Void ratio ii) Porosity iii) Degree of saturation iv) Air content. (08 Marks)
 b. Explain the procedure to determine density of soil by core cutter method and sand replacement method. (08 Marks)

OR

- 2 a. Explain Atterberg's limits. (06 Marks)
 b. The liquid and plastic limits of a given soil sample are 65% and 40% respectively. Compute its consistency index, liquidity index, flow index and toughness index. Given that the water content in the soil sample decreases from 80% to 40% for a ten fold increase in the number of blows required to close the groove in the standard liquid limit apparatus. (10 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. Explain the laboratory method of determination of permeability by constant head method and variable head method. (08 Marks)
 b. The following details refer to a test to determine the permeability of soil.
 Thickness of specimen = 25mm
 Diameter of stand pipe = 10mm
 Initial head = 1000mm
 Final head = 800mm
 Determine the permeability of soil. If the void ratio of sample is 0.75, what is the permeability of same soil at a void ratio of 0.9? (08 Marks)

OR

- 6 a. What are the important properties of flow nets? (04 Marks)
 b. The porosity of a certain sample of sand was 50% in the loose state and 34% in the dense state. The specific gravity is 2.70. Estimate the critical hydraulic gradients in loose and dense states. (04 Marks)
 c. A clay strata of thickness 8m is located at a depth of 6m below ground surface. It is overlaid by fine sand. The water table is located at a depth of 2m below the ground surface. For fine sand the submerged unit weight is 10.2 kN/m^3 . The moist unit weight of sand located above the water table is 16 kN/m^3 . For clay layer, $G = 2.76$ and water content = 25%. Compute the effective stress at the middle of clay layer. (08 Marks)

Module-4

- 7 a. Explain Mass-Spring analogy. (08 Marks)
 b. What are the assumptions made in Terzaghis theory of one-dimensional consolidation? (08 Marks)

OR

- 8 a. Explain compressibility of soil and volume change. (04 Marks)
 b. Differentiate between normally consolidated soil and over-consolidated soil. (04 Marks)
 c. A saturated specimen of clay had undergone consolidation under a pressure of 200 kN/m^2 in an oedometer test. The thickness of the specimen was found to be 21.18mm and its water content 12%. Subsequently, with a further increase in pressure of 100 kN/m^2 , the thickness of specimen at the end of 24 hrs was reduced by 1.18mm. Compute the coefficient of volume compressibility and compression index of soil $G = 2.7$. (08 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 = $6 \text{ cm} \times 6 \text{ cm}$. Determine shear strength parameters.

(08 Marks)