CBCS SCHEME

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15CV45

# Fourth Semester B.E. Degree Examination, June/July 2018
## Basic Geotechnical Engineering

Time: 3 hrs. Max. Marks: 80

**Note: 1.** ***Answer any FIVE full questions, choosing one full question from each module.***
**2.** ***Missing data, if any, may be suitably assumed and clearly stated.***





### Module-1

1 a. With the help of phase diagrams, explain : i) Dry soil ii) Partially saturated soil iii) Saturated soil. **(06 Marks)**

b. 500g of dry soil was subjected to a sieve analysis. The weight of soil retained on each sieve is as follows :

| I.S. Sieve size | Wt. of soil, g | I.S. Sieve size | Wt. of soil. g |
|---|---|---|---|
| 4.75mm | 10 | 212 μ | 40 |
| 2.00mm | 165 | 150 μ | 30 |
| 1.00mm | 100 | 75 μ | 50 |
| 425 μ | 85 | | |

Plot the grain size distribution curve and determine the following :
i) Percentage of gravel , coarse sand , medium sand , fine sand and silt – clay fraction as per IS : 1498 – 1970.
ii) Effective size iii) Uniformity coefficient iv) Coefficient of curvature
v) The gradation of the soil. **(10 Marks)**

**OR**

2 a. List the consistency limits and their indices. **(04 Marks)**

b. Explain the Indian standard soil classification system and mention the use of plasticity chart. **(06 Marks)**

c. The weight of soil coated with the thin layer of paraffin wax was 6.90 N. The soil alone weighs 6.83 N. When the sample is immersed in water it displaces 360 mℓ of water. The specific gravity of soil is 2.73 and that of wax is 0.89. Find the void ratio and degree of saturation, if the moisture content is 17%. **(06 Marks)**

### Module-2

3 a. List and explain various soil structures. **(08 Marks)**

b. The following results refers to compaction test as per IS light compaction :

| Water content (%) | 8.5 | 12.2 | 13.75 | 15.5 | 18.2 | 20.2 |
|---|---|---|---|---|---|---|
| Wt. of wet soil (kg) | 1.8 | 1.94 | 2.00 | 2.05 | 2.03 | 1.98 |

If the specific gravity of soil is 2.7 and volume of compaction mould is 1000 CC. Plot the compaction curve and obtain the maximum dry unit weight and optimum moisture content. **(08 Marks)**

**OR**

4 a. With the help of neat sketches, explain any two clay minerals. **(08 Marks)**

b. During compaction test on soil having specific gravity of 2.7 gave a maximum dry unit weight of 18kN/m$^3$ and the water content of 15%. Determine the degree of saturation , air content and percentage air voids at the maximum dry unit weight. What would be the theoretical maximum dry unit weight corresponding to zero air void at the optimum water content? **(08 Marks)**

## Module-3

5 a. Explain : i) Superficial velocity ii) Seepage velocity iii) Capillary rise of water in soil. **(06 Marks)**

b. A soil stratum with permeability $K = 5 \times 10^{-7}$ cm/s overlies an impervious stratum. The impervious stratum lies at a depth of 18m below the ground surface. A sheet pile wall penetrates 8m into the permeable soil stratum. Water stands to a height of 9m on upstream side and 1.5m on downstream side above the surface of soil stratum. Sketch the flow net and determine i) Quantity of seepage ii) Seepage pressure at 'P' located 8m below the surface of soil stratum and 4m away from the sheet pile wall on its upstream side. **(10 Marks)**

**OR**

6 a. What is a Flownet? What are its characteristics and uses? **(06 Marks)**

b. A clay strata 6m thick laying below sand layer 5m thick. The water table is located at a depth of 2m from surface. The sand has porosity of 38% and specific gravity of 2.7. The sand above the water table may be taken as dry. The water content of clay layer if 60% and G = 2.65. Calculate total stress, pore water pressure and effective stress at the middle of clay layer and draw the distribution diagram. **(10 Marks)**

## Module-4

7 a. Explain Mass – Spring analogy theory of consolidation of soil. **(06 Marks)**

b. A saturated soil stratum 5m thick lies above an impervious stratum and below a pervious stratum. It has a compression index of 0.25 and coefficient of permeability $3.2 \times 10^{-4}$ cm/s void ratio at stress 150kN/m$^2$ is 1.9. Compute i) Change in void ratio due to increase of stress to 200kN/m$^2$ ii) Settlement due to increased load iii) Time required for 50% consolidation. **(10 Marks)**

**OR**

8 a. With the help of neat sketch, explain determination of pre-consolidation pressure by Casagrende's method. **(06 Marks)**

b. Differentiate between Normally consolidated and Over consolidated soils. **(04 Marks)**

c. A 3m thick layer of saturated clay in the field under a surcharge loading with achieve 90% consolidation in 75 days in double drainage conditions. Find the co-efficient of consolidation of the clay. **(06 Marks)**

## Module-5

9 a. Explain Mohr – Coulomb failure theory of soil. **(06 Marks)**

b. Compute the shear strength of soil along a horizontal plane at a depth of 5m in a deposite of sand having the following particulars : Angle of internal friction , $\phi = 36^0$ ;
Dry unit weight , $\gamma_d = 17$ kN/m$^3$ ; Specific gravity , G = 2.7.
Assume the ground water table is at a depth of 2.4m below the ground level. Also determine change in shear strength if water level raises to ground level. **(10 Marks)**

**OR**

10 a. Explain the types of shear test based on different drainage conditions. **(06 Marks)**

b. In a drained triaxial compression test, a saturated sandy sample failed at a deviator stress of 360kN/m$^2$ and cell pressure of 100kN/m$^2$. Find the effective shear parameters of sand. If another identical sample is tested under a cell pressure of 200kN/m$^2$ , determine graphically the deviator stress at which the specimen fails. Check the results analytically. **(10 Marks)**

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