

- N.B 1. Attempt any 4 out of six questions  
2. Question 1 is compulsory  
3. Assume any suitable data where ever required

- Q.1 Attempt any four
- Classify the shear tests based on drainage conditions and how these are simulated to field conditions 05
  - Write a short note on Atterberg limits and show their variation with respect volume of soil 05
  - Briefly explain different design features for sampler to obtain undisturbed soil sample 05
  - A sample of inorganic soil has following grain size characteristics the liquid limit is 55% and plastic limit is 31% classify the soil as per IS classification system 05

| Size(mm) | %passing |
|----------|----------|
| 2.0      | 95       |
| 0.075    | 78       |

- Mention the scope of Geotechnical engineering in construction of various civil engineering works 05
- Q.2
- Derive the expression for dry density and percentage air voids of soil by using the three phase diagram 05
  - 50 grams of oven dried soil sample is taken for sedimentation analysis. The hydrometer reading in a 100ml soil suspension, 30minutes after the commencement of test is 24.5. The effective depth for hydrometer reading 25 found from calibration curve is 10.7cm. The composite correction is -2.5 take  $G=2.75$  viscosity of water is 0.008poise. calculate the particle size that would have settled during this 30minutes and also % finer 05
  - For the construction of embankment, the soil is transported from the borrow area using a truck which can carry  $6m^3$  of soil at a time. With the following details determine the number of truck loads required to obtain  $100m^3$  compacted earth fill and volume of soil to be excavated from borrow pit 10

| Property         | Borrow area (insitu)  | Truck(loose)          | Field(compacted)      |
|------------------|-----------------------|-----------------------|-----------------------|
| Bulk unit weight | 16.6kN/m <sup>3</sup> | 11.5kN/m <sup>3</sup> | 18.2kN/m <sup>3</sup> |
| Water content    | 8%                    | 6%                    | 14%                   |

- Q.3
- Define Relative Density and Activity of soil along with the applications in the field 05
  - A saturated soil sample has a volume of  $23cm^3$  at liquid limit. The shrinkage limit and liquid limit are 18% and 45% respectively. The specific gravity of solids is 2.73 find the minimum volume which can be attained by the soil 05
  - A layer of sand 8m thick lies over the layer of clay. The water table is at a depth of 1m below ground surface. above the water table, the sand is saturated with capillary moisture. the saturated unit weight of sand is  $20kN/m^3$  and its dry unit weight is  $17kN/m^3$  plot the total stress neutral stress and effective stress at a depth of 8m below ground level 10

[Turn Over]

Q.4 a. Describe in detail the design criteria for geotextile filter 05

b. An aquifer of 20m thickness is overlain by an impermeable layer of 30m thickness. The test well of 0.5m diameter and two observation wells at a distance of 10m and 60m from the test well are drilled through the aquifer. After pumping at a rate of  $0.1\text{m}^3/\text{s}$  for a long time, the following draw downs are stabilized in these wells, first observation well 4m, second observation well 3m. Show the arrangement in diagram and find the coefficient of permeability and drawdown in the test well 08

c. Write a short notes on utilization of flow nets in seepage analysis 07

Q.5 a. Define (i) relative compaction (ii) placement water content also enlist the factors effecting compaction 06

b. Define preconsolidation of soil and explain graphical method for finding preconsolidation pressure 04

c. A CU triaxial tests were performed on two identical samples of saturated remolded clay the observations are find the total and effective shear parameters. If in another CU test on identical sample is consolidates to the cell pressure of  $400\text{kN/m}^2$ , what would be the deviator stress at failure 10

| Test No. | Cell pressure( $\text{kN/m}^2$ ) | Deviator stress( $\text{kN/m}^2$ ) | Pore pressure( $\text{kN/m}^2$ ) |
|----------|----------------------------------|------------------------------------|----------------------------------|
| 1        | 250                              | 179                                | 101                              |
| 2        | 350                              | 242                                | 145                              |

Q.6 a. A layer of clay 2m thick is subjected to a loading of  $0.5\text{Kg/cm}^2$  one year after loading, the average consolidation is 50% the layer has double drainage 10

(i) What is the coefficient of consolidation

(ii) If the coefficient of permeability is  $3\text{mm/year}$ , what is the settlement after one year and

(iii) How much time will the layer take to reach 90% consolidation

b. Write a short notes on bore hole log 05

c. Explain Mohr-Coulomb's criteria for shear strength of soils 05