

Time: 3 Hours

Max Marks: 80

Note 1. Question 1 is compulsory

2. Attempt any 4 out of six questions
3. Assume any suitable data where ever required

Q.1 Attempt any **four**

- a. A saturated sample of undisturbed clay has a volume of 19.2cc and weight as 32.5gm. After oven drying the soil sample, the weight reduces to 20.2gm. Determine saturated unit weight of the clay sample. Draw a phase diagram. **05**
- b. Explain a method of determining the gran size distribution of cohesionless soils. **05**
- c. Calculate the value of permeability of a sample of 6cm height and 50cm² cross-sectional area, if a quantity of water of 430cc flows down in 10min under an effective constant head of 40cm. On oven drying the test specimen weighed 498gm. Assuming $G = 2.65$, calculate the seepage velocity of water during the test. **05**
- d. A sample of clay has a void ratio of 0.70 in the undisturbed state and of 0.50 in a remoulded state. If the specific gravity of solids is 2.65, determine shrinkage limit in each case. **05**
- e. Compute the area ratio of a sampling tube given the outside diameter = 100mm and inside diameter = 94mm. In what types of soil can this tube be used for sampling. **05**

Q.2

- a. Explain factors affecting compaction **05**
- b. Write a note on methods of boring. **05**
- c. The following are the results of standard compaction test performed on a sample of soil: **10**

Water content, %	5	10	14	20	25
Bulk density, gm/cc	1.77	1.98	2.1	2.18	2.16

Plot compaction curve and obtain maximum dry density and optimum moisture content. Calculate the water content necessary to completely saturate the sample at its maximum density, assuming no change in the volume. Take $G = 2.7$.

Q.3

- a. What are different types of soil structures which can occur in nature? Describe in brief. **05**
- b. How would you determine the average permeability of a soil deposit consisting of number of layers. Discuss in detail with neat diagram. **05**
- c. The water table in a certain deposit of soil is at a depth of 2m below the ground surface. The soil strata consist of clay up to a depth of 4m from the ground surface and below which lies sand. The clay stratum is saturated above the water table. Given Clay stratum: $w = 30\%$, $G = 2.72$; Sandy stratum: $w = 26\%$, $G = 2.64$. Determine and construct pressure distribution diagram of total pressure, pore water pressure and effective pressure at a depth of 8m below the ground surface. Also determine change in the effective pressure if the water table is brought down to a level of 4m below the ground surface by pumping. **10**

- Q.4**
- a. What are the various factors that affect coefficient of permeability? Discuss. **05**
 - b. The minimum and maximum dry density of a sand were found to be 1.50 and 1.70gm/cc. Calculate the dry density corresponding to relative densities of 50% and 75%. **05**
 - c. A pumping test was carried out in an unconfined aquifer out to determine the coefficient of permeability of soil at a site which was selected for the construction of an earth dam. The observation wells were established at distance of 3 and 6 m from the test well. The following data were obtained: **10**
 Depth of water table = 16m, discharge under steady condition = 2.3m³/min, draw down at outer well = 0.5m, draw down at inner well = 1.5m. Draw a neat diagram and determine the coefficient of permeability of the soil.
- Q.5**
- a. Define Seepage and Discharge velocity. Determine the coefficient of permeability (in m/day) of a soil sample 6cm in diameter and 15cm in height. The diameter of stand pipe is 2cm. The test results show head of water before the start of test as 45cm and final head after 2minutes of commencement of test as 30cm. **10**
 - b. A sand deposit consists of two layers. The top layer is 2.5m thick with bulk density 1.71 gm/cc and the bottom layer is 3.5m thick with saturated density 2.06 gm/cc. The water table is 3.5m from the surface and the zone of capillary saturation is 1m above the water table. Draw the diagram showing the variation of total stress, neutral stress and effective stress. **10**
- Q.6**
- a. What are the purposes of site investigation. A sample of clay has liquid limit of 62% and plasticity index 32%. (a) What is the state of consistency of the soil if the soil has its natural water content of 34%. (b) Calculate the shrinkage limit if the void ratio of the sample at the shrinkage limit is 0.70. Assume $G = 2.70$ **10**
 - b. An air-dried soil sample weighing 25 kg was sieved in a laboratory. The results are given below. **10**

IS sieve size	2.0	1.0	600 μ	425 μ	212 μ	150 μ	75 μ	Pan
Mass retained, gm	0	2020	3510	7530	8150	2810	900	80

Draw the grain size distribution curve and determine coefficient of curvature and coefficient of uniformity.
