(Time: 3 Hours) **Max Marks: 80**

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**

a. Derive the relation between Bulk unit weight, Specific gravity ,void ratio and degree of saturation starting from fundamentals **05**

b. Explain the principle of sedimentation analysis for determining the particle size distribution of soil passing through 75 μ and explain the corrections applied in hydrometer analysis **05**

c. What will be the ratio of average permeability in horizontal direction to that of vertical direction for the soil deposit consisting of three horizontal layers, if the thickness and permeability of second layer twice of first ,and those of third layer twice those of second **05**

d. Explain briefly the effect of compaction on engineering properties of soil **05**

e. Define liquidity index and flow index. Also classify the soil having w_L=56% and w_p=25%and comment on its use as embankment material **05**

Q.2 **a.** Derive the expression for determining moisture content by pycnometer method **05**

b. Soil is required to be excavated from borrow pits for building an embankment of height 6m ,top width 2m and side slopes 1:1. The unit weight of undisturbed soil in wet condition is 18kN/m^{3}and natural water content is 8% and dry density required in embankment is 20kN/m^3 with water content of 10%.G=2.7. Estimate the quantity of soil to be excavated from borrow area to construct one meter length of embankment. If each truck has a capacity to carry 80kN/trip, calculate how many truck loads are required? What are the values of porosity and degree of saturation of embankment **10**

c. Write a short notes on Atterberg limits **05**

Q.3 **a.** The plastic limit of soil is 25% and plasticity index is 8%.when the soil is dried from its state at plastic limit, the volume change is 25% of its volume at plastic limit. Similarly the corresponding volume change from liquid limit to dry state is 34% of its volume at liquid limit. Find the shrinkage limit and shrinkage ratio **06**

b. Sieve analysis was performed on 1000 gm of dry soil sample and the following observations were made: **10**

Sieve Size (mm)	20	10	4.75	2	1	0.6	0.425	0.3	0.212	0.15	0.075
Mass Retained (gm)	33	49	85	140	160	142	118	82	56	35	23

If the liquid limit and plasticity index of the sample is 15% and 20% respectively, classify the soil sample as per IS classification.

	c.	Explain the role of Montmorillonite and Kaolinite minerals in producing plastic behaviour	**04**
Q.4	**a.**	A laboratory constant head permeability test was conducted in a silty specimen of void ratio 0.45. The cylindrical specimen had a diameter of 7.3cm and height of 16.8cm.the head during the test was 75cm.after one minute of testing a total 775.6gm of water was collected. Compute the coefficient of permeability in m/sec. If the void ratio changes to 0.38 what would be the change in permeability. Also calculate the seepage velocity for both the void ratios	**10**
	b.	A granular soil deposit 8m deep over an impermeable layer. The ground water table is 4m below ground level. The deposit has a zone of capillary rise of 2m with a saturation of 50%. Plot the variation of total, pore water and effective pressure diagram with e=0.6 and G=2.65.	**10**
Q.5	**a.**	A pumping out test was carried out in the field in order to determine the average coefficient of permeability of 18m thick sand layer. The ground water table is at a depth of 2.2m below the ground level. A steady state was reached when the discharge from the well was 21.5lt/sec. A this stage the drawdown in the test well was 2.54m while the drawdown in the two observation wells situated at 8m and 20m from the test well were found to be 1.76m and 1.27m respectively. Find coefficient of permeability and radius of influence	**10**
	b.	Define Darcy's Law and list out the assumptions of Laplase equation for Two dimensional flow	**05**
	c.	A 1.25m layer of soil n=35%, G=2.65 is subjected to an upward seepage head of 1.85m. What depth of coarse sand would be required Above the existing soil to provide a factor of safety of 2 against piping? Assume the coarse sand has the same porosity and specific gravity as soil and there is negligible head loss in sand	**05**
Q.6	**a.**	Define relative compaction , placement water content and zero air voids line	**05**
	b.	Explain the corrections applied for standard penetration test	**05**
	c.	A core cutter 12.6cm in height and 10.2cm in diameter weighs 1071gm when empty. It is used to determine the insitu unit weight of an embankment. Height of the core full of soil is 2970gm. If the water content is 6%, what are the insitu dry density and porosity? If the embankment is fully saturated due to heavy rains what will be the increase in water content and bulk density if there is no change in porosity. Given G=2.69	**10**