	Questions	Marks
1	Explain the scope of geotechnical engineering in earth retaining structure. (Dec-19) / Explain the scope of geotechnical engineering in analysis and design of earth retaining structure (May-18)	5
2	The bulk unit weight of soil is 17kN/m^3 and water content is 12% calculate the void ratio of soil. If G = 2.65 and γ_w = 9.81kN/m3 (Dec-19)	5
3	A dry soil has porosity 25%. Find who much water required to saturate the 1 m^3 of this soil.(Dec-19)	5
4	1000m^3 of earth fill is to be constructed. How many cubic meter of soil is to be excavated from the borrow pit in which the void ratio is 0.95, if the total void ratio of earth fill is 0.7? (Dec-19)	5
5	Derive the relationship between bulk unit weight, specific gravity, void ratio and degree of saturation starting from fundamentals (May-19, Dec-15)	5
6	Derive the expression for moisture content by pycnometer method. (May-19)	5
7	The soil is required to be excavated from the borrow pit for building of embankment of height 6m top, width is 2m and side slope is 1:1. The unit weight in undisturbed soil in wet condition is 18kN/m^3. and natural water content is 8% the dry density required in the embankment is 20kN/$m^3$with water content of 10%.G=2.7. Estimated the quantity of soil excavated from the borrow area to construct one meter length of embankment. If each truck has capacity to carry 80kN/trip, Calculate how many truck load are required? What are the values of porosity and degree of saturation of embankment? (May-19)	10
8	A Core cutter of 12.6 cm in height and 10.2cm in diameter weights 1071gm when empty. It is used to determine the in-situ unit weight of an embankment. The weight of 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 rain what will be the water content and bulk density if there is no change in porosity. Assume G= 2.69 (May-19)	10

9 Explain the importance of field exploration in geotechnical engineering. (Dec-18) 5

10 Using three phase diagram, derive the expression for submerged density in terms of void ratio. (Dec-18) 5

11 For the construction of an embankment the soil is transported from the borrow area using a truck which can carry 5 m^3 soil at a time. Determine i) The volume of soil to be excavated from the borrow pit and ii) the number of truck load required to obtain 100 m^3 compacted earth fill from the following details 10

Property	Borrow Area	Truck	Field
Bulk Unit Weight (kN/m^3)	17	12	19
Water Content (%)	8.5	6.5	14.5

(Dec-18)

12 Explain the scope of geotechnical engineering in design of deep foundations. (May-18, May-17) 5

13 Explain the role of geotechnical engineer in civil engineering practices. (Dec-17, Dec-16) 5

14 Derive the relationship between unit weight, dry unit weight and moisture content. (Dec-17) 5

15 In the earthen embankment under the construction the bulik unit weight is 16.5kN/m3 and water content of 11%. If the water content is raised to be 11%, Compute the quantity of water required to be added per cubic meter of soil? Assume no change in void ratio. (Dec-17) 5

16 Define A) Porosity (Dec-17) 1

17 A moist soil has a weight of 1260gm and volume of 605cc at a moisture content of 11%. If the specific gravity of soil grains is 2.66, Determine void ratio, degree of saturation and percentage air voids. (May-17) 10

18 Derive the expression for dry density and percentage air voids of soil using three phase diagram. (Dec-16) 5

19 For the construction of an embankment the soil is transported from the borrow area using a truck which can carry 6 m^3 soil at a time. With the following

details determine the number of truck load required to obtain 100 m^3 compacted earth fill and volume of soil to be excavated from the borrow pit

(Dec-16)

Property	Borrow Area	Truck	Field (Compacted)
Bulk Unit Weight (kN/m^3)	16.6	11.5	18.2
Water Content (%)	8	6	14

20 There are two borrow area A and B which have soil with the void ratio have 0.8 an d0.7 resp. The in place the water content is 20% and 15% resp. the fill at the end of construction will have the volume of 10,000m^3, γ = 2Mg/m^3 and placement water content is 22%. Determine the volume of soil to be excavated from both the areas. G = 2.67. the cost of excavation and transportation for A is 200/100m^3 and 220/100m^3 for B. State which borrow pit is economical. (Dec-15) **10**

21 Define Degree of Saturation (Dec-15) **1**

22 A natural soil sample has a bulk density 2g/cm^3 with 6% of water content. Calculate the amount if water required to be added to one cubic meter of soil to raise the water content to 15% while the void ratio remain constant. What is then the degree of saturation? Take G = 2.67 (May-15) **10**

23 What is soil mass identification as three phase diagram and usual notation? Derive from first principal that $S = (w/(\gamma_w/\gamma).(1+w) - (1/G)$ (May-15) **5**

24 What is geotechnical engineering? Explain the scope of soil engineering. (May-15) **5**

[Refer Soil Mechanics and Foundation Engineering by Dr. K.R. Arora Standard Publishers and Distributor (Page no.3-44).].

4	Write short note on Atterberg limits. (May-19, Dec-18) / Write short note on Atterberg limits and show their variation with respect to volume change of soil (Dec-16)	5
5	The Plastic limit of soil is 25% and plasticity index is 8% when the soil is dried from its state to plastic state the volume changes of 25% of its volume to plastic limit. Similarly the corresponding volume change from liquid state to dry state is 34% of volume at liquid limit. Find shrinkage limit and shrinkage ratio. (May-19, Dec-17)	6/10
6	Explain the role of montmorillonite, illite mineral in producing the plastic behavior of soil. (May-19)	4
7	Write short note on activity of clay (Dec-18) / Define Activity of soil along with field application (Dec-16)	5/2.5
8	The mass and volume of saturated soil sample is 30.8gm 18.8cc resp. on oven drying the mass got reduced to 20gm and 9.9cc resp. Calculate the shrinkage limit and shrinkage ratio, Volumetric shrinkage and specific gravity of sample. (Dec-18)	10
9	Define B) Liquidity Index (Dec-17)	1
10	In a liquid limit test the specimen of a certain sample of clay at water content of 31.93, 27.62, 25.51 and 23.30% and 42 blows respectively to close the standard groove. The plastic limit of clay is 13%. Natural water content is 18%. Determine liquid limit, plasticity index, liquidity index, consistency index, flow index and toughness index. (May-17)	10
11	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. (Dec-16)	5
12	The mass of a specific gravity of fully saturated clay having water content of 36% is 1.89. on oven drying the mass specific gravity drops to 1.72. Calculate the specific gravity of clay and its shrinkage limit. (Dec-15)	5
13	Define i) Density Index ii) Sensitivity iii) Flow Index iv) Consistency Index (Dec-15)	4

1 The Soil has liquid limit is 20% and plastic limit is 12%. The following data is available from the sieve analysis. 10

Sieve Analysis	% Passing
4.75 mm	90
0.425 mm	85
0.075 mm	38

Classify the soil according to IS classification system (Dec-19)

2 Using the given data classify the soil as per IS 1498 (Dec-19) 10

Liquid Limit = 40%	Plastic Limit = 22%	(02 Marks)
Liquid Limit = 20%	Plastic Limit = 14%	(03 Marks)
Passing 75μ sieve = 10% Passing 4.75 mm sieve =70% $C_u = 8$ $C_c = 2.8$ and $I_p = 4\%$		(05 Marks)

3 Explain the principal of sedimentation analysis. (Dec-18) for the determination of particle size distribution of soil passing through 75μ and explain the correction applied in the hydrometer analysis. (May-19) 5

4 Classify the soil having $W_L = 56\%$ and $W_P = 25\%$. Also comment on its use as embankment material. (May-19) 3

5 Sieve analysis was performed on 1000gm of dry soil sample and 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 soil sample are 15% and 20% resp. Classify the soil as per IS Classification system. (May-19, Dec-18)

6 Write a short note on relative density. (Dec-18)/ Define Relative density of soil along with field application (Dec-16) 5/2.5

7 A soil sample with a specific gravity of 2.67 was filled in a 1000 ml container the loosest possible state and dry weight of the sample was found to be 1475 gm it was then filled at the densest state obtainable and the weight was found to be 1170gm. The void ratio of the soil in the natural state was 0.63.Determine the Density Index at natural State. G=2.67 (May-18) 5

8 Explain the use of plasticity chart given by IS 1498 to classify the soil (May-18) 5

9 Use the following data to classify the soil 5

i) Liquid Limit=40% Plastic Limit=22%

ii) Liquid Limit=20% Plastic Limit=14% (May-18)

10 Explain the wet and dry analysis. (May-18) 5

11 The sample has the following properties, classify the soil according to IS classification system. 5

A) Passing through 75μ = 10%

B) Passing through 4.75mm =70%

C) Uniformity Coefficient = 8

D) Coefficient curvature = 2.8

E) Plasticity Index = 4 (Dec-17)

12 Define E) Relative Density (Dec-17) 1

13 Write the use of particular size distribution cure (May-17) 5

14 For two soils the data is given below, classify the soil as per IS:1498 (May-17) 5

Soil	LL	PI	%75μ	% Gravel	% Sand
A	60	30	90	0	10
B	--	NP	100	0	0

of flow net, use of flow net

Solution of Laplace equation by other methods e.g. numerical methods

	Questions	Marks
1	Explain the validity of Darcy's law for the determination of permeability of soil (Dec-19)	5
2	Explain the methods used to determine the in-situ permeability. (Dec-19)	5
3	Explain the characteristics of Flow net (Dec-19, May-18, May-17, Dec-15, M ay-15)	5
4	In the falling head permeability test the length and area of cross section of soil specimen are 0.17m and 21.8X $10^{-4}m^2$ resp. Calculate the time required for head to drop from0.25m to 0.10m. The area of cross section of stand pipe is $0.0002m^2$. The sample has three layers of permeability's 0.00003m/s for first 0.06m, 0.00004m/sec for second 0.06m, and 0.00006m/s for third 0.05m of thickness. Assume the flow is taking place perpendicular to the bending plane. (Dec-19)	10
5	Calculate the equalivant permeability in horizontal and vertical direction of soil deposits consists of three layers 150cm, 180cm and 200 cm with permeability of 10^{-5}, 10^{-7} and 10^{-9} respectively. (Dec-19)	5
6	What will be the ratio of average permeability of horizontal direction to that of vertical direction for the soil deposits consist of three horizontal layer if the thickness of permeability of second layer twice of first and those third layer twice those of second (May-19)	5
7	A laboratory constant head permeability test was conducted in silty specimen of void ratio 0.45. The cylindrical specimen of diameter of 7.3cm and height 16.8cm the during the test was 75cm after the one point of testing the 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 voids. (May-19)	10
8	A pumping out test was to be carried out in the field in order to calculate the average permeability of 18m thick sand layer. The ground water table is at the depth of 2.2m below the ground level. The steady state was reached when discharge from the well was 21.5lit//sec. At this stage the drawdown of the well is 2.54m the test well was found to be 1.76 and 1.27m resp. Find the	10

coefficient of permeability and radius of influence. (May-19)

9	Define Darcy's law and list out the assumptions of Laplase equation for two dimensional flow. (May-19)	5
10	A 1.25m layer of soil, η= 35% and G= 2.65, is subjected to an upward seepage head of 1.85m. What depth of course sand would be required above the existing soil to provide a factor of safety of 2 piping? Assume the course has same specific gravity and porosity as the soil and there is negligible loss of head in sand. (May-19)	5
11	Derive the expression for average coefficient of permeability of stratified soil deposits when flow is parallel to the planes of stratification. (Dec-18)	5
12	In falling head permeability test on a soil sample of length 100mm, head of water in the stand pipe takes 10 sec. to fall from 850 mm to 175mm above the tail water level. Then another soil of length 60mm is placed on top of first soil. The time taken to fall the head to fall between the same limit is 18 sec. The parameter has a cross section area of 5000 mm^2 and stand pipe area is 150 mm^2. Calculate the permeability of second soil. (Dec-18)	10
13	Define i) Flow Line ii) Equipotential Line iii) Flow net iv) Field and v) Flow channel (Dec-18)	5
14	A test well of 0.5m in diameter penetrates through saturated aquifer of 10m thick overlaying an impervious layer. The steady discharge of well is 19.72m^3/hr. The drawdown at the distance of R_1 = 20m, from the centre oftest well is found to be 1.9m. what will be the drawdown at the distance of 50m. If the permeability of soil is 3.8 x10^{-4} m/s. Estimate approximate drawdown of center well also. (Dec-18)	10
15	A glassy cylinder of 5 cm internal diameter with screen at bottom was used as falling head peramemeter. The thickness of sample was 10 cm with the water level in the tube at the start of the test of 50cm above the tail water, it drop by 1 cm in one min. the tail water level remain unchanged. Calculate the value of coefficient of permeability of soil. Comment on nature of soil. (May-18)	10
16	Explain the phenomenon of capillary rise and its application in geotechnical engineering. (May-18)	5
17	Define B) Seepage Pressure (Dec-17)	1