Geotechnical Engineering

Q1 Define i) Void ratio ii) Porosity iii) Degree of saturation iv) Water contain v) Dry density vi) Bulk density vii) submerged density.
Q2 The porosity of the soil sample is 35% and G = 2.7. calculate void ratio, dry density, saturated density and submerged density. **(Ans- e=0.54, rd =17.20 Kn/m3 ,rsat = 20.64KN/M3, r=10.83 kn/m3)**
Q3 A soil has a porosity of 40% , G =2.65, and water content of 12%. Determining mass of water required to be added to 100 m3 of this soil for full saturation. (Ans- 20940 kg)
Q4 A barrow area soil has a natural water content of 10% and bulk density 1.80 Mg/m3.
The soil used for an embankment to be compacted at 18% moisture content a dry density of 1.85 Mg/m3Determine the amount of water to be added to 1.0 m3 of barrow soil. How many m3 of excavation is required for 1.0 m3 of compacted embankment?
(Ans w=1.284KN, v =1.131m3)
Q5 State Strokes law. What is the used in sedimentation analysis? What are the assumption and limitation?
Q6 Write note on particle size distribution curve.
Q7 Define I) coefficient of curvature ii) coefficient of uniformity.
State its significance in soil classification.
Q8 In a natural soil deposit has a bulk unit 18.44 KN/ m3 & water content of 5% .calculate the amount of water to be added to 1.0 m3 of soil to raise the water content to 15%. Assuming void ratio constant. What will be degree of saturation? G= 2.67.
Q9 A cube of dried clay having sides 4.0 cm long has a mass of 110 gm. The same cube of soil . when saturated at unchanged volume , same has a mass of 135 gms. Draw a soil element showing a volume& weights of constituent. Determine specific gravity & void ratio.
Q10 Determine the maximum possible void ratio for a uniformly graded sand of perfectly spherical grain.
Q11 A saturated specimen of undisturbed inorganic clay has a volume of 19.2 cm3 and mass 32.5 gm. After oven –drying at 105 **0** for 24 hours, .the mass reduces to 20.9 gms. For the soil in the natural state Find.
i) Water content, ii) Specific gravity,
iii) Voids ratio, iv) Porosity,
v) Saturated density, vi) Dry density. **(W-89) Q12** A saturated sample of soil with specific gravity G = 2.67 and water content data as
follows :
Weight of can + wet soil = 150.63 gms,
Weight of can + dry soil = 131.58 gms,
Weight of can = 26.48 gms.
Q13 Differentiate between saturated and submerged unit weight. **(S.98)**
Q.14.Define and explain the term “Density Index”. **(W.96 S. 98)**
Q15 Following are the date available for construction of embankment:
(i) Density of compaction 2t/m3 at 16% water content.
(ii) Soil from borrow pit 1.7 t/m3 at 10 %
Find the amount of soil to be excavated from borrow pit for 100m3 of compacted soil of embankment and also the water required.
Q16 Complete the following table of sieve analysis plot the grain size distribution curveForm the curve, determine D10,D30,D60, coefficient of uniformity coefficient of curvature,
comment on the gradation of the soil.

PLATICITY CHARACTERSITICS OF SOIL

Q1 Define I) plastic limit ii) shrinkage limit iii) liquid limit
and explain how to determine these parameter in laboratory

Q2 A soil has a liquid limit of 25% and a flow index of 12.5%. if the plastic limit is 15%, determine the plasticity index and toughness index. **(Ans—If =80%, Ip= 50%, Ic =50%)**

Q3 The Atterberg limit of a clay soil are liquid limit =75%, plastic limit =45%, and shrinkage limit = 25%. If the sample of this soil has a volume of 30 cm3 at the liquid limit and a volume 16.6 cm3 at the shrinkage limit, determine the specific gravity of soil, shrinkage ratio, and volumetric Shrinkage.**(Ans—G=2.61, R=1.61, Vs= 80.5%)**

Q4 what is the liquid limit test. **Q16** Complete the following table of sieve analysis plot the grain size distribution curveForm the curve, determine D10,D30,D60, coefficient of uniformity coefficient of curvature,
comment on the gradation of the soil.

SOIL CLASSIFICATION

Q1. What is use of classification of soil?
Q2. Discuss Indian standard classification system.
Q3. Discuss how to identify the soil in field?
Q4. Write a detail note on plasticity chart.

PERMEABILITY OF SOIL

Q1. State and Explain Darcy's law.
Q2. What are the different methods to find the coefficient of permeability and explain any one in detail with derivation, sketch.
Q3. Write a note on validity of Darcy's law.
Q4. Write a note on factors affecting permeability.
Q5. If during the permeability test of soil sample with falling head permeability test, equal time noted of drop of head from h1 to h2 and h2 to h3.
Prove that h2= h1.h3
Q6. Falling head permeability of soil sample of 6.0cm height and 50.0cm2 in crossection. The permeability is expected to be 1X 10-4cm/sec. If it is desired that head stand pipe should fall from 30cm to 10cm in 40min. Calculate size of the stand pipe should use**. (Ans.:- D=1.57cm**)
Q7. Explain the soil characteristics that influence on permeability.
Q8. Define Total pressure, Effective pressure and Neutral pressure.
Q9. A sand deposit consists of two layers. The top layer of 2.5m thick having bulk density 1709.60kg/m3 and bottom layer is of 3.5m thick having γsatis 2064.52kg/m3. The water table at a depth of 3.5m from the surface. The zone of capillary saturation 1.0m above the water table. Draw diagram showing the variation of total stress, neutral stress and effective stress.
Q10 The water table in a certain area is at a depth of 5 m below the ground surface. To a depth of 15 m the soil consists of very fine sand aging porosity of 41.18 %. Above the water table the sand has an average degree of saturation of 50% Calculate the effective pressure on a horizontal plane at a depth 10 m below the ground surface. What will be the increase in the effective pressure of the soil get saturated by a capillarity up to 2 m above the water table ? Assume G=2.65. Show effective pressure diagram for both cases. **(W.90)**
Q.11 Derive the relation for equivalent permeability for anisotropic soils. **(S.96,W.93)**
Q12. The coefficient of permeability of soil sample is found to be 1x 10-3 cm/sec at a void ratio of 0.13. Estimate its permeability at a voids ratio of 0.6. **(W-93)**
Q.13.A falling head permeability test carried on 15 cm long clay sample. The diameter of sample and stand pipe was 9.8 cm and 0.75 cm respectively. The level of water in stand pipe dropped from 60 cm to 45 cm in 12 minutes

Determine:
1. Permeability in m/ day.
2. Time required for level to drop to 10 cm. **(S.98)**
Q.14.Data given below relate to two falling head permeability test performed on different soil.
Stand pipe area = 400mm2
Permeameter sample area = 2800mm2
Permeameter sample height = 50mm
Initial water head in the sand pipe = 1000 mm.
Final water head in stand pipe = 200 mm.
Time for decreasing the water heard
Soil -1 = 500 second
Soil -2 = 15 second
If these two soils form adjunctions parallel and orthogogonal to the layers. **Q15**. Write note on
i) Quick sand condition.
ii) Determination of permeability in the field.
Q16. Due to rise of temperature, viscosity and unit weight of percolating fluid are reduced to 75% & 97% respectively. Other factors being constant, Calculate percentage change in coefficient of permeability.
Q17 what is discharge velocity and seepage velocity? State the relation between them.
Q18 Write short not on Effective pressure, Neutral pressure and total pressure
(W.96,S.97,W.98)

SEEPAGE AND FLOWNET
Q1. What is flownet? Describe its characteristics.
Q2. For a homogenous earth dam 50m high with a free board 2.0m. The flow net was constructed and Following result was obtained.
No. of equipotent drops = 28
No. of flow lines = 6.0
The dam has a horizontal filter at down stream end. Calculate discharge per meter length of dam if k = 3.2X 10-3cm/sec.
Q3. Show that the equation - $\delta 2\varphi + \delta 2\varphi$
$\delta 2x + \delta 2x$

COMPACTION
Q1 Define compaction. Discuss the effect of compaction on soil properties.
Q2 How will you measure compaction in field? (field compaction control)
Q3 State the difference between Compaction and Consolidation.
Q4 The soil in a barrow pit has a void ratio of 0.90.A fill in place volume of 20000 m3 is to be constructed with an in place dry density of 18.84 KN/m3 if the owner of barrow area is to be compensated at Rs 1.50 per m3 of excavation , determine the cost of compensation.
(Ans-27.027 m3)
Q5 Following are the results for standard Procter test.
Moisture content (%) 13.90 18.80 19.40 22.80 23.40
Wet of weight soil in
mould (gms)
1663 1779 1851 1893 1898
Take volume of mould = 1000 cc
Plot the following
i) Moisture- dry density curve)
iii) zero air void curve and
iv) 10% air content curve (90 % saturation) **Q6** Write note on
i) Standard Procter Test
ii) Effect of compaction on soil properties. Difference between Standard Procter test & Modified Procter test.

CONSOLIDATION

Q1 Explain Terzaghis one-dimensional consolidation. State its assumptions & limitations.

Q2 Write note on

i) Spring analogy

ii) Methods for determination of coefficient of consolidation

iii) Determination of pre- consolidation pressure by Casagrande's method.

Q3 Define i) coefficient of consolidation

i) Compression index

ii) Coefficient of volume change

Q4 A 3.0 m thick layer beneath a building is overlain by a permeable stratum and is underlain by an impervious rock. The coefficient of consolidation for the clay was found to be 0.025 cm2/min. The final expected settlement for a layer is 8.0 cm. a) How much time will it take for 80% of the total settlement to take place? b) Determine the time required for settlement of 2.5 cm to occur. c) Calculate the settlement that would occur in one year?

Q5 In a consolidation test following results have been obtained. When the load was changed from 50KN/m2 to 100 KN/m2 , the void ratio changes from 0.70 to 0.65. Determine the coefficient of volume change and compression index. **(Ans- 5.88x 10-4 m2 /KN, 0.166)**

Q6 A clay layer whose settlement under a given loading is expected to be 10 cm, settles by 2.5 cm at the end of one month after application of load increment. How many months will be required to reach the settlement of 5.0 cm? How much settlement will occur in one year? Assume double drainage.

(Ans- 4 months, 0.59, 8.2 cm)

Q.7 (a) Explain the following terms:-

(i) Compression Index

(ii) Coefficient consolidation

(b) A normally consolidated clay stratum of 3 m thickness has two permeable layers at its top and bottom. The liquid limit and the initial voids ratio of the clay are 36 5 and 0.82 respectively while the initial overburden pressure at the middle of clay layer is 2 kg/cm 2 Due to the construction of a new building this pressure increases by 1.5 kg /gm cm2. Compute the probable consolidation settlement of the building. **Q8 A**laboratory specimen of clay 20mm thick, drained at top and bottom has got its initial void ratio

0.81 changed to 0.45 within a range of stress increment 75 KN/m2 to 150 KN/m2, rd=1.68, G=2.59. Determine the Cvand mv.

SHEAR STRENGTH

Q1. Explain direct shear strength. State its advantages and disadvantages.

Q2. Explain the basic difference between shear stress and tri-axial stress.

Q3. Describe in detail drainage condition in shear stress.

Q4. Prove that

$\sigma 1 = \sigma 3 N\emptyset + 2C N\emptyset$

Q5. Explain the procedure to find the shear stress parameter for sandy soil using direct shear stress.

Q6. Write a note on

i) Stress strain behavior of sand.

ii) Shear strength of sand and clay.

iii) Sensitivity of the clay.

iv) Vane shear test.

Q7. What is shear box test.