

GUJARAT TECHNOLOGICAL UNIVERSITY

DI -4 SEMESTER – OLD PAPER – S23 TO S25 – QUESTION BANK(English)

Subject Name & Code:

Soil Engineering- 4340602

Unit I - Overview of Soil Engineering

Repeated Questions:

1. Explain soil formation in the geological cycle.
 - Appeared in: S23 (Q1b, 04 marks), S25 (Q1b, 04 marks)
2. Explain the three-phase diagram of soil along with its assumptions.
 - Appeared in: S24 (Q2b, 04 marks), W24 (Q1b, 04 marks)

Other Important Questions:

3. Define the followings with its notations: a) Void ratio b) Porosity. (S24 - Q1a, 03 marks)
4. Explain the importance of soil engineering. (S24 - Q1b, 04 marks)
5. Define (1) Marine Soil (2) Black Cotton Soil (3) Aeoline Soil (W23 - Q1a, 03 marks)
6. State the type of failures due to soil in civil engineering work. (W24 - Q1a, 03 marks)
7. Write assumptions for drawing phase diagram of soil. (S23 - Q1a, 03 marks), (S25 - Q2a, 03 marks)
8. Establish relation among w , G , e & S_r . (S25 - Q1a, 03 marks)
9. Establish relation among S_r , w , G and e . (W23 - Q1b, 04 marks)
10. A soil sample has porosity 30% and specific gravity of soil 2.70. Calculate: a) void ratio b) dry density c) total density, if the soil is 50% saturated and d) total density, if the soil is completely saturated. (S24 - Q1c, 07 marks) [Numerical]
11. The total density of the soil is 16 kN/m^3 . The specific gravity of soil particles of the soil is 2.67. The water content of the soil is 17%. Calculate: a) Dry density b) Porosity c) Void ratio d) Degree of saturation. (S24 - Q1c(OR), 07 marks) [Numerical]
12. For a silty clay sample, bulk density is 18 kN/m^3 and water content is 20% with sp gravity 2.7. Calculate Void ratio, Degree of soil, Saturated density, submerged density and percentage air content. (W23 - Q1c, 07 marks) [Numerical]

13. 1cum of wet soil weights 20kN. Its dry weight is 18kN. Sp. gravity of solids is 2.67.
Determine the water content, void ratio and the degree of saturation. Draw a phase diagram.
(S23 - Q1c, 07 marks) *[Numerical]*
14. A soil sample has porosity 40% and specific gravity of soil 2.6 Find void ratio, dry density saturated density and submerged density. (S23 - Q1c(OR), 07 marks) *[Numerical]*
15. A soil sample has 0.65 void ratio, and 7% moisture content. If the sample has specific gravity 2.65, calculate the followings: (i) Porosity, (ii) Degree of saturation, (iii) Saturated density, and (iv) Submerged density. (W24 - Q1c(OR), 07 marks) *[Numerical]*
16. A soil sample has porosity 45 % and specific gravity of soil 2.7 Find void ratio, dry density saturated density and submerged density. (S25 - Q1c, 07 marks) *[Numerical]*
17. Enlist method of determine density and explain core cutter method. (W24 - Q1c, 07 marks)
18. Explain in detail Core Cutter method to determine dry density in laboratory. (S25 - Q1c(OR), 07 marks)
19. Explain in detail Sand Replacement method to determine dry density in laboratory. (W23 - Q1c(OR), 07 marks)

Unit II - Physical and Index Properties of Soil

Repeated Questions:

1. **Draw I.S. Plasticity chart with all parameters.**
 - Appeared in: W23 (Q2b, 04 marks), S25 (Q2b, 04 marks)
2. **Explain Liquid Limit Test in detail.**
 - Appeared in: W23 (Q2c, 07 marks), W24 (Q2c, 07 marks)
3. **Explain Plastic limit test of soil in detail.**
 - Appeared in: S25 (Q2b, 04 marks)

Other Important Questions:

4. Differentiate between fine grained soil and coarse grained soil. (S24 - Q2a, 03 marks)
5. Derive the following relationship: $\gamma_d = \gamma_b / (1+w)$, where all the parameters have their usual meanings. (S24 - Q2b, 04 marks)
6. A grading curve of a soil sample represents effective grain size 0.17 mm, 30% finer size $D_{30} = 0.34$ mm and 60% finer size $D_{60} = 0.70$ mm. Calculate uniformity coefficient and coefficient of curvature. State given soil sample is well graded or poorly graded soil. Calculate also the plasticity index and consistency index, if the soil sample was found its natural water content=24%, liquid limit=49%, Plastic limit=28% during its consistency test. (S24 - Q2c, 07 marks) [Numerical]
7. Differentiate between well graded soil and poorly graded soil on the basis of particle size distribution curve. (S24 - Q2a(OR), 03 marks)
8. Explain the laboratory test to determine the liquid limit and plastic limit of a soil sample. (S24 - Q2c(OR), 07 marks)
9. Explain Particle Size Distribution Curve. (W23 - Q2a, 03 marks)
10. List the sieve sizes to be used in sieve analysis. (W23 - Q2a(OR), 03 marks)
11. Explain Coefficient of Curvature and Coefficient of Uniformity. (W23 - Q2b(OR), 04 marks)
12. A clayed soil sample has water content 45%, Liquid limit 52% and Plastic limit 27%. Calculate Plasticity Index, Liquidity Index and Consistency Index. (W23 - Q2c(OR), 07 marks) [Numerical]
13. Prove it $Y_d = G \cdot Y_w / (1+e)$. (W24 - Q2a, 03 marks)
14. Why soil classification is done ? Explain IS Classification method. (W24 - Q2b, 04 marks)
15. Derive the relationship between e , S_r , w & G . (W24 - Q2a(OR), 03 marks)
16. Test on a soil sample gave the followings result water content = 26%, liquid limit = 48%, plastic limit = 29% and $D_{60} = 0.06$ mm, $D_{30} = 0.04$ mm, $D_{10} = 0.009$ mm. Calculate plasticity index, uniformity coefficient, coefficient of curvature and consistency index for a soil. (W24 - Q2b(OR), 04 marks) [Numerical]
17. Explain consistency limits of soil With Figure. (W24 - Q2c(OR), 07 marks)

18. A clayed soil sample has water content 40%, Liquid limit 48% and Plastic limit 23%. Calculate Plasticity Index, Liquidity Index and Consistency Index. (S25 - Q2c, 07 marks) *[Numerical]*
19. Draw two phase and three phase diagram of soil. (S25 - Q2a(OR), 03 marks)
20. Test on a soil sample gave the following results: Natural water content = 23%, liquid limit = 50%, Plastic limit = 27%, $D_{60} = 0.06\text{mm}$, $D_{30} = 0.04\text{mm}$, $D_{10} = 0.008\text{mm}$. Calculate Plasticity index, Uniformity coefficient, Coefficient of curvature and Consistency index for the soil. (S25 - Q2c(OR), 07 marks) *[Numerical]*
21. Derive a formula that expresses the following relationship. $n = e / 1 + e$ (S23 - Q2a, 03 marks)
22. Draw the scale of soil classification as per Indian standard. (S23 - Q2b, 04 marks)
23. Test on a soil sample gave the following properties: Natural water content=24%, liquid limit=49%, Plastic limit=28%, $D_{60} = 0.06\text{mm}$, $D_{30} = 0.04\text{mm}$, $D_{10} = 0.008\text{mm}$. Calculate the plasticity index, uniformity coefficient, coefficient of curvature and consistency index for the soil. (S23 - Q2c, 07 marks) *[Numerical]*
24. Explain three phase system in soil with diagram. (S23 - Q2a(OR), 03 marks)
25. Draw and explain the particle size distribution curves for different types of soil. (S23 - Q2b(OR), 04 marks)
26. Two soil samples were tested for liquid limit and plastic limit and following result were noted. Sample(A) Liquid limit-41%, Plastic limit-22% Sample(B) Liquid limit-68%, Plastic limit-35% Calculate plasticity Index for both the sample. Also find type of soil from I.S plasticity chart. (S23 - Q2c(OR), 07 marks) *[Numerical]*

Unit III - Classification of Soil

Repeated Questions:

1. **Why soil classification is done? Explain IS Classification method.**

- Appeared in: W24 (Q2b, 04 marks)

Other Important Questions:

2. Differentiate between fine grained soil and coarse grained soil. (S24 - Q2a, 03 marks) *[Also listed in Unit II]*
3. Differentiate between well graded soil and poorly graded soil on the basis of particle size distribution curve. (S24 - Q2a(OR), 03 marks) *[Also listed in Unit II]*
4. Draw the scale of soil classification as per Indian standard. (S23 - Q2b, 04 marks) *[Also listed in Unit II]*
5. Draw I.S. Plasticity chart with all parameters. (W23 - Q2b, 04 marks), (S25 - Q2b, 04 marks) *[Also listed in Unit II]*

Unit IV - Permeability and Seepage

Repeated Questions:

1. **Explain Constant Head Permeability Test.**
 - Appeared in: W23 (Q4c(OR), 07 marks), S25 (Q3c, 07 marks)
2. **Explain factors affecting permeability of soil.**
 - Appeared in: S23 (Q3a, 03 marks), W24 (Q3b, 04 marks), S25 (Q3a, 03 marks)

Other Important Questions:

3. Define: a) Discharge velocity b) Seepage velocity (S24 - Q3a, 03 marks)
4. Explain Coulomb's law for shear strength. (S24 - Q3b, 04 marks)
5. Calculate the co-efficient of permeability of a soil sample, 6 cm in height and 50 cm² in cross-sectional area, if a quantity of water equal to 430 ml passed down in 10 minutes, under an effective constant head of 40 cm. (S24 - Q3c, 07 marks) *[Numerical]*
6. Write Darcy's law with its equation. (S24 - Q3a(OR), 03 marks)
7. Explain: C-soil, ϕ -soil and C- ϕ soil. (S24 - Q3b(OR), 04 marks)
8. Explain the constant head permeability test to determine the coefficient of permeability. (S24 - Q3c(OR), 07 marks)
9. Define Compaction. State different methods of Compaction. (W23 - Q3a, 03 marks) *[Related to Compaction, often grouped with Permeability]*
10. Explain Compaction Curve. (W23 - Q3b, 04 marks) *[Related to Compaction]*
11. Explain Light Compaction Test carried out in laboratory. (W23 - Q3c, 07 marks) *[Related to Compaction]*
12. Explain different types of rollers and their uses. (W23 - Q3a(OR), 03 marks) *[Related to Compaction]*
13. How is stabilization done for loose soil? Explain. (W23 - Q3b(OR), 04 marks) *[Related to Stabilization]*
14. Define (1) Total Head (2) Hydraulic gradient (3) Seepage Pressure. (W23 - Q4a, 03 marks)
15. Explain Field Tests to find coefficient of permeability. (W23 - Q4b, 04 marks)
16. A soil sample is tested for permeability and following data were taken. Find Coefficient of permeability. 1. Hydraulic Head : 30 cm 2. Length of specimen : 20 cm 3. Diameter of sample: 5 cm 4. Quantity of water collected: 50 cc 5. Time taken : 10 minutes. (W23 - Q4c, 07 marks) *[Numerical]*
17. Explain Permeability and how it is dangerous for soil? (W23 - Q4a(OR), 03 marks)
18. Differentiate between Laminar flow and Turbulent Flow. (W23 - Q4b(OR), 04 marks)
19. State the applications of flow net. (S23 - Q3b, 04 marks)

20. A construction of a flow net for a dam gave $N_f=4.5$ and $N_d=12$. The head of water lost during seepage as 2m. If $k=3 \times 10^{-4}$ cm/sec, estimate the seepage loss per day per meter length of dam. (S23 - Q3c, 07 marks) [Numerical]
21. Explain method for determine the falling head to find out coefficient of permeability. (S23 - Q3a(OR), 03 marks)
22. During permeability test on soil in laboratory the following observations were recorded. Length of sample=40cm, Diameter of sample =12cm, Constant head of water=25cm, Discharge of water=60cm³, Time=12minutes. Calculate coefficient of permeability. (S23 - Q3b(OR), 04 marks) [Numerical]
23. Explain the method of finding the permeability constant of soil by falling head method. (S23 - Q3c(OR), 07 marks)
24. Enlist importance of Permeability in Civil Engineering. (S25 - Q3a(OR), 03 marks)
25. A soil sample is tested for permeability and following data were taken. Find Coefficient of permeability. 1. Hydraulic Head : 22 cm 2. Length of specimen : 10 cm 3. Diameter of sample: 4 cm 4. Quantity of water collected: 60 cc 5. Time taken: 10 minutes. (S25 - Q3c(OR), 07 marks) [Numerical]
26. Write Characteristics of flownet. (W24 - Q4a(OR), 03 marks)
27. Enlist Methods for Finding Coefficient of permeability, And Explain Constant head Method with Figure. (W24 - Q3c(OR), 07 marks)

Unit V - Compaction and Stabilization of Soil

Repeated Questions:

1. **Explain Standard Proctor test in detail.**
 - Appeared in: S25 (Q4c(OR), 07 marks), W24 (Q3c, 07 marks)
2. **Explain Compaction Curve. Also Explain O.M.C. & M.D.D.**
 - Appeared in: S25 (Q3b, 04 marks), W23 (Q3b, 04 marks)

Other Important Questions:

3. Differentiate between compaction and consolidation of soil. (S24 - Q4a, 03 marks)
4. Explain Mechanical soil stabilization and Chemical soil stabilization. (S24 - Q4b, 04 marks), (S25 - Q3b(OR), 04 marks)
5. Following observations were made during Proctor Compaction Test. Plot the Compaction curve and calculate maximum dry density and optimum water content. (S24 - Q4c, 07 marks) *[Numerical]*
6. Differentiate between light compaction test and heavy compaction test. (S24 - Q4a(OR), 03 marks)
7. State what is the purpose of soil exploration and how will you plan for execution of soil exploration on site. (S24 - Q4b(OR), 04 marks)
8. Explain standard compaction test carried out in laboratory. Also, draw compaction curve. (S24 - Q4c(OR), 07 marks)
9. Following observations were made during Proctor Compaction Test. Plot the Compaction curve and calculate Max. Dry Density and Optimum Water Content. (W23 - Q3c(OR), 07 marks) *[Numerical]*
10. Write factor affecting compaction. (W24 - Q3b(OR), 04 marks)
11. Write method of compaction in field. (W24 - Q4a, 03 marks)
12. Following observations were made in a proctor compaction test. Draw the graph and find OMC and MDD. (W24 - Q3a(OR), 07 marks) *[Numerical]*
13. Following observations were made during Proctor Compaction Test. Plot the Compaction curve and calculate Max. Dry Density and Optimum Water Content. (S25 - Q4c, 07 marks) *[Numerical]*
14. Write the factors affecting compaction and discuss any four. (S23 - Q4c, 07 marks)

Unit VI - Shear Strength of Soil

Repeated Questions:

1. **Explain Coulomb's law for shear strength.**
 - Appeared in: S24 (Q3b, 04 marks), S25 (Q5b, 04 marks), W24 (Q5a, 03 marks)
2. **Explain Direct Shear Test.**
 - Appeared in: W23 (Q5c, 07 marks), W24 (Q4c, 07 marks)

Other Important Questions:

3. During direct shear test on C- ϕ soil, the sample fails at shear stress 15kN/m^2 and normal stress 22kN/m^2 . If angle of internal friction is 25° , find cohesion of soil. (S23 - Q4a, 03 marks) *[Numerical]*
4. Draw and explain shear strength Envelop of different types of soils. (S23 - Q4b, 04 marks)
5. Explain Merits and Limitations of Box shear Test. (S23 - Q4a(OR), 03 marks), (S25 - Q4b(OR), 04 marks)
6. Define cohesion and angle of internal friction with their notations. (S25 - Q5a, 03 marks)
7. Differentiate between general shear failure and local shear failure. (S25 - Q5b, 04 marks), (W23 - Q5e, 04 marks)
8. Find shear strength of cohesionless soil if normal stress is 5 N/mm^2 and angle of friction is 45° . (S25 - Q5b(OR), 04 marks) *[Numerical]*
9. Define Internal Friction and Angle of Internal friction. (W23 - Q5a, 03 marks)
10. Explain types of soil based on total strength. (W23 - Q5b, 04 marks), (W24 - Q4b, 04 marks)
11. Write Types of soil based on total strength. (W24 - Q4b, 04 marks)
12. List the shear strength tests of a soil sample. Why shear strength parameters are important in soil report? (W24 - Q5a(OR), 03 marks)

Unit VII - Bearing Capacity of Soil and Earth Pressure

Repeated Questions:

1. **Explain plate load test to find bearing capacity of soil.**
 - Appeared in: S25 (Q5c(OR), 07 marks), W24 (Q4c(OR), 07 marks)
2. **Explain Liquefaction, its causes, effect and state remedies for Liquefaction.**
 - Appeared in: S25 (Q5c, 07 marks), W24 (Q5c, 07 marks)

Other Important Questions:

3. Define: 1. Active Earth Pressure 2. Passive Earth Pressure 3. Earth Pressure at rest (S25 - Q5a, 03 marks)
4. Enlist types of foundation. (S25 - Q5a(OR), 03 marks), (W24 - Q5b, 04 marks)
5. Write assumptions of the Rankine's earth pressure theory. (S23 - Q5a, 03 marks)
6. State the parameters that are used for determining the bearing capacity of soil. (S23 - Q5b, 04 marks)
7. Discuss Terzaghi's theory of bearing capacity of soil. (S23 - Q5c, 07 marks)
8. Explain different types Deep foundations with their sketches. (S23 - Q5a(OR), 03 marks)
9. Describe because of which reason liquefaction occurs and effects of liquefaction and what are remedial measure. (S23 - Q5b(OR), 04 marks)
10. Explain plate load test to find bearing capacity of soil. (S23 - Q5c(OR), 07 marks)
11. State only names of different types of Bearing Capacities. (W23 - Q5d, 03 marks)
12. Explain types of foundation and describe any two in detail. (W23 - Q5f, 07 marks)
13. Define the liquefaction of soil. What are the reasons of liquefaction phenomenon? (W24 - Q5b(OR), 04 marks)
14. Give Difference Between Disturbed Sample and Undisturbed Sample. (W24 - Q5a(OR), 03 marks)
15. Write a Method of Sub soil Exploration. (W24 - Q5b(OR), 04 marks)
16. Enlist Method of improving Bearing Capacity of Soil, and Explain Any three Method. (W24 - Q5c(OR), 07 marks)
17. Enlist objectives of Site Exploration. (S25 - Q4a, 03 marks)
18. Enlist methods of sub-soil exploration. (S25 - Q4a(OR), 03 marks)
