

GUJARAT TECHNOLOGICAL UNIVERSITY

BE-6 SEMESTER – OLD PAPER – S22 TO W25 – QUESTION BANK

Subject Name & Code:

FOUNDATION ENGINEERING- 3160616

Unit 1: Foundation Classification and Soil Exploration/Investigation

Repeated Questions:

1. **Describe with a neat sketch wash boring method of sub-soil exploration. What are its merits and demerits?**
 - (S25 - Q1c, 07 marks)
 - (S23? - Q3c, 07 marks)
 - (S22 - Q1c, 07 marks)
 - (W24 - Q1c, 07 marks)
2. **Describe the standard penetration test (SPT). What corrections are applied to the observed N-value?**
 - (S23? - Q1c, 07 marks)
 - (W22 - Q2c, 07 marks)
3. **Differentiate between disturbed samples and undisturbed samples.**
 - (W25 - Q1a, 03 marks)
 - (Implied in S25 - Q2a, 03 marks)
4. **Define/Explain: Inside Clearance, Outside Clearance, Area Ratio.**
 - (W23 - Q2a, 03 marks)
 - (W22 - Q2a, 03 marks)
 - (S22 - Q3c, 07 marks)
5. **What is reconnaissance? What type of information is obtained?**
 - (S23? - Q1b, 04 marks)
 - (W23 - Q1a, 03 marks)

Other Important Questions:

1. **Classify the methods of sub-soil exploration and explain in detail Augur boring method.** (S22 - Q1c, 07 marks)
2. **Enlist different types of borings for soil exploration and describe any one in detail.** (S25 - Q1c, 07 marks)
3. **Explain the factors that affect sample disturbance.** (W25 - Q1b, 04 marks)
4. **Enumerate the factors affecting bearing capacity.** (S22 - Q1a, 03 marks)
5. **Provide information obtained in a Reconnaissance survey.** (W24 - Q1a, 03 marks)
6. **State the objectives of reconnaissance survey for exploration of soil.** (S25 - Q1a, 03 marks)
7. **Enlist direct methods of exploration and explain Pits and Trenches in brief.** (W24 - Q1b, 04 marks)
8. **Draw a sketch of a Split spoon sampler with notations.** (W25 - Q3a, 03 marks) [Diagram given - refer Question paper of W25]
9. **Describe the split spoon sampler. What is its use?** (W23 - Q2b, 04 marks)
10. **Describe the split spoon sampler. What is its use?** (W22 - Q1b, 04 marks)
11. **Elaborate the method to conduct SPT test in the field. Also explain the corrections required.** (S24? - Q2c, 07 marks)
12. **Discuss various corrections required in the SPT test.** (S22 - Q3a, 03 marks)
13. **Explain Dilatancy and Overburden pressure corrections for the SPT test.** (W24 - Q2a, 03 marks)

14. **The field N-value in a deposit of fully submerged fine sand was 38 at a depth of 5m. The avg. unit weight of sand is 17 kN/m^3 . Calculate corrected SPT value as per IS:2231-1981.** (W25 - Q2c, 07 marks)
 15. **Describe the Static Cone Penetration Test (SCPT).** (W23 - Q3c, 07 marks)
 16. **Discuss the Dynamic Cone Penetration Test (DCPT). What are its limitations?** (W22 - Q2c, 07 marks)
 17. **Describe the major differences between SPT, SCPT and DCPT.** (W25 - Q2c, 07 marks)
 18. **Explain the Electrical resistivity method in detail.** (S22 - Q3b, 04 marks)
 19. **Explain the Seismic refraction method.** (W23 - Q2c, 07 marks)
 20. **Explain Seismic refraction method in detail.** (S22 - Q5a, 03 marks)
 21. **Plan the exploration program for a project with the following details. Area of plot 6000 m^2 with almost square in shape. There will be 5 high-rise residential frame structures with G+10.** (S25 - Q2b, 04 marks)
 22. **How would you decide the depth of exploration and the lateral extent of the investigations?** (S23? - Q3b, 04 marks)
 23. **Summarize the salient features of a good sub-soil investigation report.** (S24? - Q2c OR, 07 marks)
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Unit 2: Shallow Foundation

Repeated Questions:

1. **Differentiate between General Shear Failure and Local Shear Failure.**
 - (W25 - Q2b, 04 marks)
 - (S23? - Q5b, 04 marks)
 - (S22 - Q2a, 03 marks)
 - (W24 - Q4b, 04 marks)
 - (W22 - Q2b, 04 marks)
2. **State/Explain Terzaghi's bearing capacity theory (assumptions/equation).**
 - (S23? - Q2c, 07 marks)
 - (W24 - Q4b, 04 marks)
 - (W22 - Q3c, 07 marks)
3. **Describe the Plate Load Test.**
 - (S23? - Q5c, 07 marks) [Diagram given - refer Question paper of S23?]
 - (S22 - Q2c, 07 marks) [Diagram given - refer Question paper of S22]
 - (S24? - Q3c, 07 marks) [Diagram given - refer Question paper of S24?]
4. **Define: Ultimate Bearing Capacity, Net Ultimate Bearing Capacity, Net Safe Bearing Capacity / Safe Bearing Capacity.**
 - (W25 - Q2a, 03 marks)
 - (W23 - Q2a, 03 marks)
5. **Explain the effect of the water table on the bearing capacity of soil.**
 - (S23? - Q3b, 04 marks)
 - (S25 - Q3a, 03 marks) [Diagram given - refer Question paper of S25]

Other Important Questions:

1. **Determine the safe bearing capacity of a strip footing (various dimensions and conditions given).** (Numerical problems from W25 Q3c, S22 Q2c, S25 Q3c, W24 Q4c, S24? Q3c, S24? Q3c (alternate))
2. **Explain "Types of shear failure of soil" with neat sketches.** (S24? - Q1c, 07 marks) [Diagram given - refer Question paper of S24?]
3. **Differentiate between Local Shear Failure and Punching Shear Failure.** (W24 - Q4b, 04 marks)
4. **Describe General Shear Failure with a sketch.** (S25 - Q3b, 04 marks) [Diagram given - refer Question paper of S25]
5. **Describe Punching Shear Failure with a sketch.** (S25 - Q3b OR, 04 marks) [Diagram given - refer Question paper of S25]
6. **Define: Gross Safe Bearing Capacity, Net Allowable Bearing Pressure, Net Safe Settlement Pressure.** (S23? - Q1a, 03 marks)
7. **Define bearing capacity, gross bearing capacity, and net bearing capacity.** (S22 - Q1b, 04 marks)
8. **How do you ascertain whether a foundation soil is likely to fail in local shear or in general shear?** (S23? - Q4b, 04 marks)
9. **What is the effect of an increase in the width of a footing on the bearing capacity of a footing resting on (a) sand and (b) clay?** (S24? - Q3b, 04 marks)
10. **Illustrate the water table effects on the bearing capacity of soil with a sketch.** (S25 - Q3a, 03 marks) [Diagram given - refer Question paper of S25]
11. **A strip footing 1.5m wide, rests on the surface of a dry cohesionless soil having $\phi=25^\circ$ and $\gamma=18 \text{ kN/m}^3$. If the water table rises temporarily to the surface due to flooding, calculate the percentage reduction in the ultimate capacity. Assume $N_\gamma = 9.0$.** (W22 - Q3c, 07 marks)
12. **Explain about Floating Foundation with a neat sketch.** (S22 - Q2b, 04 marks) [Diagram given - refer Question paper of S22]
13. **Write a short note on: Floating foundation.** (W23 - Q3b, 04 marks)
14. **Explain: Floating foundation.** (W22 - Q3a, 03 marks)

15. **Write a short note on: Raft Foundation.** (W23 - Q1b, 04 marks)
16. **In which conditions is a raft foundation preferred?** (W23 - Q3a, 03 marks)
17. **Write a short note on raft Foundation.** (S24? - Q3a, 03 marks)
18. **Explain the procedure for the design of a (1) Strip footing (2) Spread footing.** (S23? - Q1c, 07 marks)
19. **Enlist different conditions for Combined footing and discuss any one in detail. OR Describe Grillage foundation.** (W24 - Q2c, 07 marks)
20. **Differentiate between strip footing and strap footing.** (S23? - Q5a, 03 marks)
21. **Draw contact pressure diagram for flexible foundation on clay and sand. OR Draw contact pressure diagram for rigid foundation on clay and sand.** (S25 - Q5a, 03 marks / Q5a OR, 03 marks) [Diagram given - refer Question paper of S25]
22. **Discuss the merits and demerits of the plate load test.** (W22 - Q3b, 04 marks)
23. **Plate load tests were conducted in c- ϕ soil on plates of two different sizes... Find the size of square footing to carry a load of X kN.** (Numerical problems from S25 Q3c OR, W24 Q4c OR)
24. **State the bearing capacity equation given by IS 6403-1981, with details of each term.** (W24 - Q4a, 03 marks)
25. **How would you fix the depth of foundation?** (S23? - Q2a, 03 marks)
26. **Explain Rankine's theory of bearing capacity and derive the equation for depth of foundation by Rankine's theory.** (W23 - Q2c OR, 07 marks)

Unit 3: Pile Classifications & Load Transfer Principle of Pile Foundation

Repeated Questions:

1. **Define Negative Skin Friction. What is its effect on the pile?**
 - (W25 - Q3a, 03 marks)
 - (S23? - Q2b, 04 marks)
 - (S22 - Q3b, 04 marks)
2. **Write a short note on Under-reamed pile.**
 - (W25 - Q3b, 04 marks)
 - (S22 - Q4b, 04 marks)
3. **Enlist various dynamic formulas for pile capacity / Write short note on pile driving equipment.**
 - (W25 - Q3b, 04 marks)
 - (S23? - Q3a, 03 marks)
 - (S22 - Q3a, 03 marks)
 - (W23 - Q4a, 03 marks)
4. **In which conditions is a pile foundation more suitable than a shallow foundation? / Enlist situations where pile foundations are preferred.**
 - (S23? - Q3a, 03 marks)
 - (S24? - Q4b, 04 marks)
 - (W23 - Q5a, 03 marks)
 - (W22 - Q3b, 04 marks)
5. **How do you estimate the group capacity of piles in sand and clay?**
 - (S23? - Q5b, 04 marks)
 - (W23 - Q4b, 04 marks)
 - (W22 - Q4b, 04 marks)

Other Important Questions:

1. **Determine the safe load/ultimate load carrying capacity of a pile (various dimensions and conditions given).** (Numerical problems from W25 Q4c, S22 Q4c, S25 Q4c, W24 Q5c, S24? Q4c, S24? Q4c (alternate))
2. **A drop hammer... drives an RCC pile... Determine ultimate bearing capacity and allowable load using Hiley's Formula.** (Numerical problems from W25 Q4c, S22 Q5c, W22 Q4c)
3. **Explain with a neat sketch the function of Bearing pile and Friction pile.** (W22 - Q4a, 03 marks) [Diagram given - refer Question paper of W22]
4. **Differentiate between End bearing and Friction Pile.** (W24 - Q5b, 04 marks)
5. **Describe Displacement and Non-displacement Pile.** (W24 - Q5a, 03 marks)
6. **Classify piles according to method of installation and their load carrying characteristics.** (S24? - Q1b, 04 marks)
7. **Describe various types of pile foundations / piles based on method of installation.** (S23? - Q5c, 07 marks / W23 - Q5c, 07 marks)
8. **Explain pile load test to determine the bearing resistance of a pile.** (W23 - Q3c, 07 marks)
9. **Define Group efficiency of piles and explain Feld's rule.** (W23 - Q4c, 07 marks)
10. **What do you mean by pile group efficiency? What are the various formulae to find it?** (S24? - Q4a, 03 marks)
11. **State Feld's rule for group efficiency of piles and explain in detail with a sketch.** (S25 - Q4b, 04 marks) [Diagram given - refer Question paper of S25]
12. **Write a short note on Group action and efficiency of pile group.** (W25 - Q5a, 03 marks)
13. **Explain group action of pile.** (S22 - Q4a, 03 marks)
14. **A group of friction piles... estimate the group capacity of pile.** (Numerical problems from W22 Q4c, W24 Q5c, S24? Q4c)
15. **Explain in detail the types of failure of a pile group.** (S23? - Q5c, 07 marks)
16. **Give method to determine the pile capacity and explain any one in detail.** (W23 - Q4b, 04 marks)

17. **Discuss various dynamic formulas for load carrying capacity of pile with their limitations.** (S23? - Q3a, 03 marks / S24? - Q4b, 04 marks)
 18. **Describe Hiley's formula for calculating the ultimate bearing capacity of a pile.** (S22 - Q4b, 04 marks)
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Unit 4: Foundations on Problematic Soil & Introduction to Geosynthetics

Repeated Questions:

1. **Define/Explain: Free Swell Index, Swelling Potential, Swelling Pressure.**
 - (W25 - Q4a, 03 marks)
 - (W23 - Q5a, 03 marks)
2. **Enlist tests for identification of expansive soil and explain any one. / Describe the free swell test / swell test.**
 - (S23? - Q3c, 07 marks)
 - (W25 - Q4a, 03 marks)
 - (S23? - Q4c, 07 marks)
3. **What is the 'active zone' in black cotton soil? Explain the properties of black cotton soil.**
 - (S22 - Q5c, 07 marks)
 - (S24? - Q5b, 04 marks)
4. **Give classification of Geosynthetics. Describe basic function of Geosynthetics. / Enlist different functions of Geosynthetics and explain any two.**
 - (W25 - Q5c, 07 marks)
 - (S24? - Q5b, 04 marks)
5. **Explain applications of Geosynthetics in roads.**
 - (W25 - Q5b, 04 marks)
 - (W22 - Q3b, 04 marks)

Other Important Questions:

1. **Write a short note on Soldier piles and laggings.** (W25 - Q5a OR, 03 marks)
2. **Discuss various types of anchors used for sheet pile wall.** (W25 - Q5b, 04 marks)
3. **Explain anchors used in sheet pile walls.** (S23? - Q4a, 03 marks / W22 - Q3a, 04 marks)
4. **State the objectives of Sheet Pile. Where is it used?** (W24 - Q5a, 03 marks / S22 - Q5a, 03 marks)
5. **Write a short note on "Guide walls".** (S22 - Q5b, 04 marks)
6. **Write a short note on: CNS layer.** (W22 - Q3a, 03 marks)
7. **Explain the concept of CNS layer.** (S22 - Q4a, 03 marks)
8. **Enlist different foundations for Expansive soil and describe any one.** (W24 - Q3a, 03 marks)
9. **Enlist different types of foundations provided in expansive soils and explain any one.** (W23 - Q4c, 07 marks)
10. **State the measures taken to rest foundation in expansive soil.** (S25 - Q5b, 04 marks)
11. **State the measures to be taken for treatment of expansive soil.** (W24 - Q2b, 04 marks)
12. **Discuss characteristics of expansive soils.** (S23? - Q4b, 04 marks)
13. **Define expansive soil and Collapsible soil.** (S24? - Q5a, 03 marks)
14. **Describe behavior of collapsible soils.** (W22 - Q4a, 03 marks)
15. **Enlist minerals available in clayey soil and describe Montmorillonite.** (W24 - Q3a OR, 03 marks)
16. **Describe Hydrometer test.** (S25 - Q1b, 04 marks)
17. **Write a short note on Geomembrane / Describe Geomembrane with its application.** (S24? - Q5a, 03 marks / W24 - Q3c OR, 07 marks)
18. **State the application of Geomembrane in civil engineering.** (S25 - Q5c, 04 marks)
19. **Describe Geogrids with their application.** (W24 - Q3c, 07 marks)
20. **State the application of Geogrid in civil engineering.** (S25 - Q5c OR, 04 marks)
21. **Enlist various application areas of geosynthetics.** (W23 - Q5b, 04 marks)

Unit 5: Retaining Walls and Diaphragm Walls

Repeated Questions:

1. **Differentiate between Counterfort and Cantilever type retaining wall.**
 - (S22 - Q5b, 04 marks)
 - (W24 - Q3b, 04 marks)
 - (S25 - Q5b OR, 04 marks)
2. **Explain types of retaining walls with neat sketches.**
 - (S23? - Q2c, 07 marks)
 - (W23 - Q5b, 04 marks)
3. **Enlist types of retaining wall and explain any one in detail.**
 - (W25 - Q5b, 04 marks)
 - (S24? - Q1a, 03 marks) [Diagram given - refer Question paper of S24?]
4. **Discuss stability criteria of cantilever retaining wall.**
 - (W23 - Q5c, 07 marks)
 - (S24? - Q5c, 07 marks) [Diagram given - refer Question paper of S24?]

Other Important Questions:

1. **Discuss stability criteria of gravity retaining wall with neat sketch.** (S24? - Q5c, 07 marks) [Diagram given - refer Question paper of S24?]
2. **Draw a neat sketch of gravity retaining wall showing forces acting on it. Explain stability checks.** (W22 - Q3c, 07 marks) [Diagram given - refer Question paper of W22]
3. **Enlist various forces acting on Gravity type retaining wall with its effect on stability.** (W24 - Q3b OR, 04 marks)
4. **Why drainage of the backfill is necessary? Explain different methods of providing drainage for retaining wall?** (W22 - Q3c OR, 07 marks)
5. **Write short note on Drilled pier foundation.** (W25 - Q4b, 04 marks)
6. **Describe Skempton's theory for cohesive soil.** (W24 - Q4a, 03 marks)
7. **List various methods of flexible pavement design and explain CBR method.** (W22 - Q2c OR, 07 marks)
