Geotechnical Engineer Interview Questions Part 1A: Soil Basics and Strength

Common interview questions with short, clear answers.

1. What is geotechnical engineering, and how is it different from soil mechanics?

Answer: Geotechnical engineering applies soil and rock mechanics, together with site investigation and engineering geology, to design foundations, slopes, retaining walls and tunnels. Soil mechanics provides the principles and tests; geotechnical engineering uses them to make safe, economical decisions for real ground, where the properties are uncertain and must be assessed on site.

2. What are the three phases of soil?

Answer: Solids, water and air. Dry soil has solids and air. Fully saturated soil has solids and water only.

3. What is the difference between cohesive and non-cohesive soils?

Answer: Cohesive soils (clays) get strength mainly from cohesion between particles. Non-cohesive soils (sands and gravels) get strength mainly from friction between grains.

4. What are Atterberg limits?

Answer: The water contents at which a fine-grained soil changes state: liquid limit, plastic limit and shrinkage limit. Plasticity index equals liquid limit minus plastic limit.

5. What is the Unified Soil Classification System (USCS)?

Answer: A system that names soil with letter symbols based on grain size, gradation and plasticity, for example SW for well-graded sand and CH for high-plasticity clay.

6. What is effective stress, and why does it matter?

Answer: Effective stress equals total stress minus pore water pressure. It, not total stress, controls soil strength and settlement.

7. What is the Mohr-Coulomb shear strength equation?

Answer: Shear strength equals cohesion plus effective normal stress times the tangent of the friction angle.

8. What is the difference between drained and undrained analysis?

Answer: Drained: water can escape, so effective-stress parameters are used for long-term conditions. Undrained: water cannot escape quickly, so undrained strength is used for short-term loading on clay.

9. What are the three main triaxial tests?

Answer: UU (unconsolidated undrained), CU (consolidated undrained) and CD (consolidated drained). They differ in whether drainage is allowed during consolidation and during shearing.

10. What is the difference between quicksand condition and liquefaction?

Answer: Quicksand: upward seepage in sand cancels the effective stress. Liquefaction: shaking raises pore pressure in loose saturated sand until it loses its strength.

Sources: Knappett and Craig, Craig's Soil Mechanics, 8th ed. (2012); Das and Sobhan, Principles of Geotechnical Engineering, 9th ed.

Geotechnical Engineer Interview Questions Part 1B: Settlement and Foundations

Common interview questions with short, clear answers.

11. What is Darcy's law, and how is permeability measured?

Answer: Darcy's Law is defined as a model that describes the flow behavior of fluids in porous media. Flow velocity equals permeability times hydraulic gradient. Constant head tests suit coarse soils; falling head tests suit fine soils.

12. What is the difference between compaction and consolidation?

Answer: Compaction makes soil denser quickly by pushing out air with mechanical energy. Consolidation is the slow squeezing of water out of saturated clay under a sustained load.

13. What are the three components of total settlement?

Answer: Immediate settlement (elastic settlement), primary consolidation settlement, and secondary compression settlement (creep settlement).

14. What is the overconsolidation ratio (OCR)?

Answer: It is defined as the ratio of the preconsolidation stress to the overburden vertical effective stress in soils. An OCR above 1 means the clay has carried higher stress before, so it settles less under moderate new loads.

15. What is bearing capacity?

Answer: The pressure the ground can carry before shear failure. Allowable bearing pressure equals ultimate bearing capacity divided by a factor of safety, and settlement is checked too.

16. How does the water table affect bearing capacity?

Answer: A rising water table lowers effective stress, so bearing capacity drops and settlement can increase.

17. When would you choose a deep foundation instead of a shallow one?

Answer: When near-surface soil is weak or compressible, loads are heavy or settlement limits are tight, so the load must reach deeper, stronger layers.

18. What is the Standard Penetration Test (SPT)?

Answer: It determines soil resistance by driving a split-barrel sampler into the ground using a standard hammer. The number of blows required to penetrate a specified distance is recorded as the SPT N-value.

19. What are the three modes of shear failure under a footing?

Answer: General shear (dense soil), local shear (medium soil) and punching shear (loose soil).

20. What steps would you follow in a basic site investigation?

Answer: Desk study, site walkover, boreholes with SPT and sampling, laboratory tests, groundwater readings, then interpretation and a report.

Sources: Knappett and Craig, Craig's Soil Mechanics, 8th ed. (2012);
Das and Sobhan, Principles of Geotechnical Engineering, 9th ed.