

Geotechnical Engineering Roadmap (12 Weeks)

Week 1: Introduction to Geotechnical Engineering

- Scope and importance.
 - Soil formation and classification.
 - Index properties of soil.
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Week 2: Soil Mechanics Fundamentals

- Phase relationships and soil composition.
 - Permeability and seepage.
 - Effective stress principle.
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Week 3: Soil Compaction and Consolidation

- Compaction theory and methods.
 - Laboratory and field compaction tests.
 - One-dimensional consolidation and settlement analysis.
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Week 4: Shear Strength of Soils

- Mohr-Coulomb failure criterion.
 - Direct shear test, triaxial test.
 - Factors affecting shear strength.
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Week 5: Earth Pressure Theories

- Active, passive, and at-rest earth pressures.
 - Rankine and Coulomb theories.
 - Retaining wall design basics.
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Week 6: Slope Stability

- Types of slopes and failures.

- Methods of slope stability analysis (method of slices).
 - Stabilization techniques.
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Week 7: Foundation Engineering Basics

- Types of foundations: shallow and deep.
 - Bearing capacity theories.
 - Settlement analysis.
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Week 8: Pile Foundations

- Types of piles and installation methods.
 - Load carrying capacity of piles.
 - Pile group behavior.
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Week 9: Soil Improvement Techniques

- Grouting, vibro-compaction.
 - Soil stabilization with chemicals.
 - Geosynthetics in soil reinforcement.
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Week 10: Groundwater and Seepage

- Flow nets.
 - Seepage through soils.
 - Control of seepage.
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Week 11: Instrumentation and Monitoring

- Soil testing equipment.
 - Field and laboratory tests.
 - Monitoring settlement and pore pressure.
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Week 12: Project / Case Study

- Foundation design for a building or bridge.
 - Slope stability analysis project.
 - Field investigation report preparation.
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 Tools and Software:

- PLAXIS, GeoStudio, SLOPE/W
- AutoCAD for drafting
- MATLAB for calculations