Stress-Strain in Rock Masses Training Course

Professional Development Training Course Outline

Category	General Training	**Duration**	5 Days
Base Fee	$1,500 USD	**Delivery Mode**	Online / On-site Hybrid

Course Introduction

Understanding the stress–strain behavior of rock masses is fundamental to modern geotechnical engineering, mining engineering, and underground construction. Rock masses exhibit complex, non-linear, anisotropic, and discontinuous mechanical responses under varying stress conditions. Stress-Strain in Rock Masses Training Course provides an advanced yet practical foundation in rock mechanics, geomechanics, and constitutive modeling, focusing on how rock materials deform, yield, and fail under in-situ and induced stress fields. Key theoretical frameworks such as Mohr–Coulomb failure criteria, Hoek–Brown failure criterion, elasticity theory, and plasticity models are explored alongside real-world applications.

With increasing demand for safe and efficient underground excavations, this course integrates numerical modelling techniques (FEM, FDM, DEM), in-situ stress measurement interpretation, and rock mass classification systems like RMR and GSI. Participants will gain hands-on insight into tunnel stability, slope failure mechanisms, rock support design, and mining-induced stress redistribution. The course bridges theory and practice using case studies from tunneling, mining collapse analysis, dam foundations, and deep excavation projects, equipping professionals with industry-ready analytical and decision-making skills.

Programme Curriculum

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Course Duration

5 days

Course Objectives

1. Understand rock mass stress–strain behavior under loading conditions
2. Apply Mohr–Coulomb and Hoek–Brown failure criteria
3. Analyze elastic, plastic, and viscoelastic deformation in rocks
4. Interpret in-situ stress measurement data
5. Evaluate rock mass classification systems
6. Perform slope stability and failure mechanism analysis
7. Design tunnel support systems based on deformation analysis
8. Develop numerical models using FEM/FDM/DEM tools
9. Assess fracture propagation and discontinuity behavior
10. Understand ground response curves in underground excavations
11. Evaluate stress redistribution in mining operations
12. Conduct risk assessment for rock mass instability
13. Apply case-based geotechnical decision-making techniques

Target Audience

1. Geotechnical Engineers
2. Mining Engineers
3. Civil Engineers (Infrastructure & Underground Works)
4. Geological Engineers
5. Rock Mechanics Specialists
6. Tunnel Design Engineers
7. Construction Project Managers
8. Engineering Geologists

Course Modules

Module 1: Fundamentals of Rock Mechanics & Geomechanics

- Stress and strain definitions in rock media
- Elastic, plastic, and brittle behavior of rocks
- Rock mass vs intact rock concepts
- Role of discontinuities and joints
- **Case Study:** Hard rock deformation in deep gold mining operations

Module 2: Stress–Strain Theory in Rock Masses

- 3D stress states and Mohr’s circle applications
- Constitutive stress–strain relationships
- Time-dependent deformation behavior
- Failure initiation mechanisms
- **Case Study:** Tunnel deformation in Himalayan rock formations

Module 3: Failure Criteria in Rock Masses

- Mohr–Coulomb failure theory
- Hoek–Brown failure criterion
- Griffith crack theory
- Peak vs residual strength behavior
- **Case Study:** Slope failure in open-pit mining excavation

Module 4: Rock Mass Classification Systems

- RMR system fundamentals
- GSI structural interpretation
- Q-system and tunneling quality index
- Mapping geological discontinuities
- **Case Study:** Rock mass classification for metro tunnel design

Module 5: In-Situ Stress Measurement & Field Analysis

- Overcoring and hydraulic fracturing methods
- Stress orientation and magnitude interpretation
- Borehole deformation analysis
- Field instrumentation techniques
- **Case Study:** Stress mapping in deep underground caverns

Module 6: Numerical Modelling Techniques

- Finite Element Method (FEM) basics
- Finite Difference Method (FDM) applications
- Discrete Element Method (DEM) for fractured rocks
- Model calibration and validation
- **Case Study:** FEM analysis of dam foundation stability

Module 7: Rock Support Design & Excavation Stability

- Rock bolting and shotcrete systems
- Support selection based on deformation response
- Ground response curves
- Tunnel convergence monitoring
- **Case Study:** Support design in NATM tunneling projects

Module 8: Advanced Rock Mass Behavior & Failure Analysis

- Time-dependent creep in rock masses
- Seismic response of rock structures
- Rock burst and dynamic failure
- Risk-based geotechnical design

- **Case Study:** Rock burst events in deep underground mining

Training Methodology

- Interactive lectures and presentations.
- Group discussions and brainstorming sessions.
- Hands-on exercises using real-world datasets.
- Role-playing and scenario-based simulations.
- Analysis of case studies to bridge theory and practice.
- Peer-to-peer learning and networking.
- Expert-led Q&A sessions.
- Continuous feedback and personalized guidance.

Register as a group from 3 participants for a Discount

Send us an email: info@fineskilltrainingcenter.org or call *+254769199797*

Certification

Upon successful completion of this training, participants will be issued with a globally- recognized certificate.

Tailor-Made Course

We also offer tailor-made courses based on your needs.

Key Notes

a. The participant must be conversant with English.

b. Upon completion of training the participant will be issued with an Authorized Training Certificate

c. Course duration is flexible and the contents can be modified to fit any number of days.

d. The course fee includes facilitation training materials, 2 coffee breaks, buffet lunch and A Certificate upon successful completion of Training.

e. One-year post-training support Consultation and Coaching provided after the course.

f. Payment should be done at least a week before commence of the training, to Fineskill Training Center account, as indicated in the invoice so as to enable us prepare better for you.

Upcoming Scheduled Sessions

Start Date	End Date	Location	Price
23 Nov 2026	27 Nov 2026	Online	$1,000
23 Nov 2026	27 Nov 2026	Physical	$1,500

Start Date	End Date	Location	Price
23 Nov 2026	27 Nov 2026	Physical	$3,000
23 Nov 2026	27 Nov 2026	Physical	$3,000
23 Nov 2026	27 Nov 2026	Physical	$6,000
23 Nov 2026	27 Nov 2026	Physical	$4,500
23 Nov 2026	27 Nov 2026	Physical	$6,000
23 Nov 2026	27 Nov 2026	Physical	$6,000

Ready to enroll or request a customized program? Book online or contact us:

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