Underground Blasting Techniques 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

Underground Blasting Techniques Training Course is designed to develop advanced competencies in rock fragmentation, controlled blasting, tunnel excavation, and precision explosives engineering. This training focuses on modern industry practices used in underground mining, hard rock excavation, shaft sinking, and civil tunneling projects, where safety, accuracy, and efficiency are critical. Learners are introduced to blast design optimization, explosive energy control, delay sequencing, vibration reduction, and regulatory compliance, ensuring alignment with global mining safety standards and digital mining transformation trends.

This course integrates cutting-edge methodologies such as digital blast simulation, AI-assisted drilling pattern design, vibration monitoring systems, and sustainable blasting practices. It prepares professionals to handle real-world operational challenges in deep-level mining, metro rail tunneling, quarry development, and infrastructure excavation projects. With a strong emphasis on risk mitigation, environmental impact reduction, and productivity enhancement, this program builds globally competitive blasting engineers capable of delivering safe, cost-effective, and high-performance underground blasting operations.

Programme Curriculum

Underground Blasting Techniques Training Course

Introduction

Underground Blasting Techniques Training Course is designed to develop advanced competencies in rock fragmentation, controlled blasting, tunnel excavation, and precision explosives engineering. This training focuses on modern industry practices used in underground mining, hard rock excavation, shaft sinking, and civil tunneling projects, where safety, accuracy, and efficiency are critical. Learners are introduced to blast design optimization, explosive energy control, delay sequencing, vibration reduction, and regulatory compliance, ensuring alignment with global mining safety standards and digital mining transformation trends.

This course integrates cutting-edge methodologies such as digital blast simulation, AI-assisted drilling pattern design, vibration monitoring systems, and sustainable blasting practices. It prepares professionals to handle real-world operational challenges in deep-level mining, metro rail tunneling, quarry development, and infrastructure excavation projects. With a strong emphasis on risk mitigation, environmental impact reduction, and productivity enhancement, this program builds globally competitive blasting engineers capable of delivering safe, cost-effective, and high-performance underground blasting operations.

Course Duration

5 days

Course Objectives

1. Master advanced underground blast design optimization techniques
2. Apply AI-driven drilling and blasting simulation tools
3. Understand explosive energy control and fragmentation mechanics
4. Implement controlled blasting for vibration and shockwave reduction
5. Enhance skills in tunnel excavation and shaft blasting operations
6. Develop competency in rock mass characterization and geotechnical analysis
7. Execute precision delay sequencing and detonator timing systems
8. Ensure compliance with mining safety regulations and ISO blasting standards
9. Improve cost efficiency in drilling and blasting cycles
10. Utilize real-time blast monitoring and IoT-based sensor systems
11. Reduce environmental impact using green blasting technologies
12. Strengthen risk assessment and hazard identification in underground operations
13. Build expertise in digital twin-based mining and smart blasting systems

Target Audience

1. Mining engineers and mining engineering students
2. Blasting supervisors and shotfirers
3. Civil tunneling and underground construction engineers
4. Quarry and aggregate production managers
5. Geotechnical and rock mechanics professionals
6. Safety officers in mining and construction industries
7. Explosives handling and operations technicians
8. Government mining inspectors and regulatory compliance officers

Course Modules

Module 1: Fundamentals of Underground Blasting

- Principles of rock fragmentation and stress wave theory
- Types of explosives used in underground environments
- Blast hole drilling patterns and geometry basics
- Energy transfer and burden/spacing concepts
- Case Study: Hard rock gold mine fragmentation improvement project

Module 2: Explosives Technology and Handling

- Emulsion, ANFO, slurry, and gel explosives properties
- Safe transport, storage, and handling protocols

- Detonation systems and blasting caps technology
- Sensitivity, velocity of detonation (VOD) analysis
- Case Study: Explosive efficiency optimization in platinum mine

Module 3: Blast Design Engineering

- Advanced blast pattern design for underground tunnels
- Burden, spacing, and hole depth optimization
- 3D blast design modeling tools
- Energy distribution and fragmentation control
- Case Study: Metro tunnel excavation blast redesign project

Module 4: Controlled Blasting Techniques

- Pre-splitting, smooth blasting, and cushion blasting methods
- Vibration control techniques in urban mining zones
- Fly rock and air blast mitigation strategies
- Controlled delay sequencing systems
- Case Study: Underground blasting near residential infrastructure

Module 5: Drill and Blast Optimization

- Drill rig performance and penetration rate analysis
- Cycle time reduction techniques
- Cost-per-ton optimization strategies
- Blast efficiency KPIs and benchmarking
- Case Study: Productivity increase in limestone quarry tunneling

Module 6: Safety, Risk and Regulatory Compliance

- Explosives safety legislation and mining codes
- Hazard identification and risk assessment (HIRA)
- Emergency response and blast incident management
- Ventilation safety post-blast protocols
- Case Study: Accident prevention redesign in deep-level mine

Module 7: Digital and Smart Blasting Systems

- AI-based blast design and prediction tools
- IoT sensors for vibration and airblast monitoring
- Digital twin modeling in underground mining
- Real-time blast analytics and reporting systems
- Case Study: Smart blasting implementation in copper mine

Module 8: Environmental and Sustainable Blasting

- Dust, noise, and vibration reduction strategies
- Eco-friendly explosive alternatives
- Groundwater protection during blasting operations
- Sustainable mining compliance frameworks
- Case Study: Environmental compliance upgrade in urban tunneling project

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
23 Nov 2026	27 Nov 2026	Physical	$3,000

Start Date	End Date	Location	Price
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:

Register Online Now

Email: info@fineskilltrainingcenter.com | Website: www.fineskilltrainingcenter.com