Curriculum
For
Certificate in Surface Mining
(Certificate Level - 6 months)
Code:VE42S002
(2013)
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**Introduction**

Surface mining is a broad category of mining operations, which includes openpit, opencast, and quarrying techniques used for the extraction of near-surface valuable minerals and rocks from the earth. Surface mining is a largely practiced mining method throughout the world. In Pakistan, numerous economically important minerals and rocks such as copper, gold, iron, limestone, dolomite, silica sand, aluminum etc, are being extracted through surface mining methods.

This course titled “Surface mining” has been designed to provide a comprehensive understanding of surface mining systems, drilling & blasting operations, loading and transportations systems at surface mines, crushing operations, safety measures and preventive maintenance of different surface mining equipments. The prime objective of this course will be to train the work-force for existing surface mining projects as well as for the upcoming mega surface mining projects, i.e. Thar coal opencast mining project, Reko-diq copper-gold project, Dilband Iron ore project etc.

**Objectives of the Course**

The objectives of this course are to:

- Produce skilled manpower for the deployment at any surface mining project
- Develop the knowledge and operating skills of the trainees about various mining equipments
• Acquaint the trainees about safe blasting practices
• Provide comprehensive knowledge of maintenance of various mining equipments
• Enlighten workplace safety awareness for safe and productive mining operations

Competencies Gained After Completion of the Course

At the end of the course, the trainee must be able to attain the following competencies about surface mining operations:

• Identify the different types of surface mining methods
• Identify the different industrial minerals and rocks
• Identify the name and functions of various drilling equipments and their uses.
• Operate and maintain Top-hammer drills including start-up/Shut-down, positioning, vertical drilling, angle-drilling, drill rod changing, and drill rod retrieval
• Operate and maintain Down-the-Hole drills including start-up/shut-down, positioning, drilling, drill rod changing, and drill rod retrieval
• Operate and maintain Jack-hammer/Hand-held drills including start-up/shut-down, rock drilling, rod retrieval
• Operations and handling of Air Compressors, including start-up/shut-down, oiling/greasing, filter changing, pressure maintenance
• Exploratory core drilling operations for mineral explorations and resource evaluations
• Usage and preparation of High explosives and blasting agent
• Conduct safe blasting operations
• Proper storage of explosives and detonators
• Operate and maintain front-end loader including muck loading, bucket raising and lowering, bucket dumping procedure
• Operate and maintain loading and back-hoe shovels
• Operations and handling of dozer, including rock movement, rock cutting, haul road preparations, grade cutting etc
• Operate and maintain rear dump trucks/dumpers, including safe driving practice, positioning for loading, dumping practice etc
• Operations and maintenance of belt conveyor system, including installations, maintenance of roller drums, pulleys, trough rollers etc
• Operations and maintenance of primary crushers, including start-up/shut-down, controlling the feed rate, safety measures against hopper or screen chocking etc
• Awareness about safety procedure at mine site, including personal and co-worker’s safety, fire fighting, first-aid procedure, etc

Knowledge Proficiency Details
On successful completion of course, the trainees must have acquired the following knowledge:

• Different surface mining methods
• Industrial rocks and minerals
• Basic unit operations of surface mining
• Use of tools, equipment and machinery
• Different drilling equipments and their uses
• Explosive and blasting operations
• Transportation and logistics in mining operations
• Different crushing equipments
• Safety precautions in surface mining
• Preventive maintenance of different mining equipments

**Current and Future Job Opportunities**
The successful trainees may have numerous existing and future job opportunities in following areas/fields:

• Cement factories (limestone or shale quarries)
• Marble and Granite quarries
• Construction companies
• Mineral exploration companies
• Geotechnical services companies
• Pakistan Steel mills
• Thar coal project
• Reko-Diq copper/gold project
Trainee Entry Level Requirements
Preferably Matriculation or at least Middle pass

Minimum Qualification of Teacher/Trainer
3 years Diploma of Associate Engineer (DAE) in Mining Technology with 5 years experience at surface mine or quarries

OR

Bachelors of Engineering (B.E) in Mining Engineering with 2 years experience at surface mine or quarries

Medium of Instructions
Urdu/English

Sequence of Modules
Trainees must complete Module 1 (Introduction of Surface Mining) first
## Overview about the Program – Curriculum for Surface Mining

<table>
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<tr>
<th>Module Title and Aim</th>
<th>Learning Units</th>
<th>Theory¹ Days/hours</th>
<th>Workplace² Days/hours</th>
<th>Time frame of modules</th>
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<td><strong>Module 1</strong></td>
<td><strong>Introduction to surface mining</strong></td>
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<tr>
<td>LU1.</td>
<td>Introduction to surface mining operations</td>
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<tr>
<td>LU2.</td>
<td>Basic terminology used in surface mining</td>
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<td>LU3.</td>
<td>Surface mining methods</td>
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<td>LU4.</td>
<td>Basic unit operations in surface mining</td>
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<td>LU5.</td>
<td>Identifications of different industrial rocks and minerals</td>
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<td></td>
<td><strong>Module 2</strong> <strong>Drilling Operations</strong></td>
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<tr>
<td>LU1.</td>
<td>Introduction to rock drilling process</td>
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<td>LU2.</td>
<td>Basic functional components of drilling equipments</td>
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<td>LU3.</td>
<td>Identification of different drilling equipments used in surface mining</td>
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<td>LU4.</td>
<td>Operating procedure of Top-hammer/Drifter drills</td>
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<td>LU5.</td>
<td>Operating procedure of Down-the-hole hammer (DTH) drills</td>
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<td>LU6.</td>
<td>Operating procedure of Jack-hammer/Handheld drills</td>
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<td>LU7.</td>
<td>Operation and maintenance of air compressors</td>
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<td>LU8.</td>
<td>Exploratory core drilling procedure</td>
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<td>LU9.</td>
<td>Preventive maintenance of various drilling equipments</td>
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¹ Learning hours in training provider premises
² Training workshop, laboratory and on-the-job workplace
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<tr>
<th>Module Title and Aim</th>
<th>Learning Units</th>
<th>Theory Days/hours</th>
<th>Workplace Days/hours</th>
<th>Time frame of modules</th>
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<td>Blasting Operations</td>
<td>LU1. Introduction to explosives and blasting</td>
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<td>LU2. Types of explosive used in surface mining operations</td>
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<td>LU3. Safety precautions in usage/handling of explosives</td>
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<td>LU4. Blasting terminologies</td>
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<td>LU5. Blasting accessories</td>
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<td>LU6. Preparation of ANFO blasting agent</td>
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<td>LU7. Explosives charging procedure</td>
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<td>LU8. Stemming procedure</td>
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<td>LU9. Initiation/Firing procedure of explosives</td>
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<td>LU10. Storage of explosives and detonators</td>
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<td>44</td>
<td>160</td>
<td>Complete Module 1 first</td>
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<p>| <strong>Module 4</strong>         |                |                   |                      |                       |
| Loading and          |                |                   |                      |                       |
| Transportations      | LU1. Introduction to loading and transportation equipments | |                      |                       |
|                      | LU2. Operating procedure of front-end loader | |                      |                       |
|                      | LU3. Operating procedure of loading shovel | |                      |                       |
|                      | LU4. Operating procedure of dozer /ripper equipment | |                      |                       |
|                      | LU5. Operating procedure of Rear-dump trucks/dumpers | |                      |                       |
|                      | LU6. Operation and maintenance of Belt conveyors system | |                      |                       |
|                      | LU7. Preventive maintenance of front-end loader and shovels | |                      |                       |
|                      | LU8. Preventive maintenance of dozer | |                      |                       |
|                      | LU9. Preventive maintenance of dump trucks | |                      |                       |
|                      |                | 26                | 160                  | Complete Module 1 first |</p>
<table>
<thead>
<tr>
<th>Module Title and Aim</th>
<th>Learning Units</th>
<th>Theory Days/hours</th>
<th>Workplace Days/hours</th>
<th>Time frame of modules</th>
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</table>
| **Module 5** Crushing Operations | LU1. Introduction to crushing and screening of rocks  
LU2. Types of crushers and screens used in mining industry  
LU3. Operations of Primary Jaw crushers  
LU4. Operations of Rotary Impact crushers  
LU5. Preventive maintenance of crushers and screens | 25 | 90 | Complete Module 1 first |
| **Module 6** Health, Safety and Environment (HSE) | LU1. General workplace safety rules and procedures  
LU2. Appropriate use of personal protective equipments (PPEs)  
LU3. Fire fighting Techniques  
LU4. Communication skills (hand signals, radio communications etc)  
LU5. First-Aid training | 16 | 50 | Complete Module 1 first |
Objective of the Module 1: This module provides a general introduction to surface mining, different methods of surface mining, identification of different industrial minerals and rocks and brief understanding of basic unit operations of surface mining.

Duration: 33 hours (Theory: 23 hours and Practice: 10 hours)

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<th>Learning Outcomes</th>
<th>Learning Elements</th>
<th>Duration</th>
<th>Materials Required</th>
<th>Learning Place</th>
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</thead>
</table>
| 1. Introduction to surface mining operations | Able to explain surface mining of rocks and minerals | **Knowledge of:**  
- Introduction  
- Basic concept | 03 | - Lecture notes | Classroom |
| 2. Basic terminologies used in surface mining | Able to explain and identify geometrical attributes of any surface mine and related technical terms | **Knowledge of:**  
- Definitions and explanation of technical terms, i.e. Burden, Spacing, stemming, toe, crest, bench, slope, ramp, haul road etc…  
**Ability to:**  
- Understand various technical terms related to surface mining | 10 | - Lecture notes  
- Audio/visual related to each technical term | Classroom & Workplace |
| 3. Surface mining methods | Identification of different methods of surface mining applicable to different minerals | **Knowledge of:**  
- Methods of surface mining  
- Explanations of openpit, opencast and quarrying methods  
- Metalliferous and non-metalliferous mines | 05 | - Lecture notes  
- Mining method charts  
- Audio/visuals | Classroom |
| 4. Basic unit operations in surface mining | Understand the important unit operations of surface mining | **Knowledge of:**  
- Sequence of unit operations  
- Introduction to drilling, blasting, loading, transportation and crushing | 05 | - Lecture notes  
- Audio/visuals | Classroom |
| 5. Identifications of different industrial rocks and minerals | Able to recognize different rocks and minerals | **Knowledge of:**  
- Rocks and minerals definitions  
- Important industrial minerals and rock and their uses | 10 | - Lecture notes  
- Specimens of various rocks and minerals | Classroom & Workplace |
Module 2: Drilling Operations

Objective of the Module 2: To develop the competency to understand rock drilling process, identification of basic drill components including operations and maintenance of various types of drilling equipments used in surface mining for mineral exploitations.

Duration: 196 hours (Theory: 26 hours and Practice: 170 hours)

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<th>Duration</th>
<th>Materials Required</th>
<th>Learning Place</th>
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<tr>
<td>1. Introduction to rock drilling process</td>
<td>Able to explain the rock drilling process</td>
<td>- Introduction&lt;br&gt; - Basic concept&lt;br&gt; - Rock-bit interaction</td>
<td>03</td>
<td>Lecture notes</td>
<td>Classroom</td>
</tr>
<tr>
<td>2. Basic functional components of drilling equipments</td>
<td>Able to recognize various components of a drilling equipment and explain their functions</td>
<td>- Components of drill&lt;br&gt; - Prime mover, drill pipes, drill bits, and circulations system&lt;br&gt; - Torque and thrust components</td>
<td>02</td>
<td>Lecture notes [Audio/visuals]</td>
<td>Classroom</td>
</tr>
<tr>
<td>3. Identification of different drilling equipments used in surface mining</td>
<td>Able to identify and classify different drilling equipments</td>
<td>- Types of drills&lt;br&gt; - Hydraulic and Pneumatic&lt;br&gt; - Truck-mounted and crawler mounted&lt;br&gt; - Handheld drills</td>
<td>13</td>
<td>Lecture notes [Audio/visuals of different drilling equipments]</td>
<td>Classroom &amp; Workplace</td>
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<td>equipments used in surface mining</td>
<td>Knowledge of:</td>
<td>Ability to:</td>
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</table>
| 4. Operating procedure of Top-hammer/ Drifter drills | Understand the working principle of Top-hammer drill, Identify different components, Able to fully operate the drill | - Basic working mechanism  
- Important components and their functions  
- Start-up and Shut-down  
- Drill boom raising and lowering  
- Vertical drilling  
- Angle drilling  
- Drill rod changing  
- Drilling in hard and soft rocks  
- Drill bit replacement | - Operate the top-hammer/ drifter drills | 33 |
| 5. Operating procedure of Down-the-hole hammer (DTH) drills | Understand the basic working mechanics of DTH drills, Identify different components and able to operate the DTH drill | - Basic working mechanism  
- Important components and their functions  
- Start-up and Shut-down  
- Down-hole hammer installation  
- Drill boom raising and lowering  
- Vertical drilling  
- Drill rod changing  
- Drilling in hard and soft rocks  
- Drill bit replacement | - Operate the down-the-hole hammer (DTH) drills | 33 |
| 6. Operating procedure of Jack-hammer / handheld drill | Able to operate the Jack-hammer handheld drill for | - Basic working mechanism  
- Important components and their functions | | 28 |
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<th>Handheld drills</th>
<th>boulder drilling and shallow drillholes</th>
<th>functions - Start-up and Shut-down - Safety precautions during drilling - Boulder drilling - Drilling for dimension stones <strong>Ability to:</strong> - Operate the jackhammer drills</th>
<th><strong>Knowledge of:</strong> - Basic air compression mechanism - Safety precautions with air compressors - Start-up and Shut-down - Air hose connections - Control of air quantity and pressure - Filter replacement - Oiling and greasing - Towing procedure <strong>Ability to:</strong> - Operate and maintain air compressors</th>
<th><strong>Drill rod sets</strong> <strong>Air compressor (800 cfm)</strong> <strong>Audio/visuals</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>7. Operations and maintenance of air compressors</td>
<td>Able to operate and maintain air compressors to be used with all pneumatic drilling units (i.e. Top hammer, DTH, Jackhammer etc)</td>
<td><strong>Knowledge of:</strong> - Basic air compression mechanism - Safety precautions with air compressors - Start-up and Shut-down - Air hose connections - Control of air quantity and pressure - Filter replacement - Oiling and greasing - Towing procedure <strong>Ability to:</strong> - Operate and maintain air compressors</td>
<td><strong>Air compressor (800 cfm) (e.g. Comp Air)</strong> <strong>Tool box</strong> <strong>Oil and grease</strong></td>
<td>Classroom &amp; Workplace</td>
</tr>
<tr>
<td>8. Exploratory core drilling procedure</td>
<td>Understand the drilling process conducted for mineral exploration and geotechnical site characterizations</td>
<td><strong>Knowledge of:</strong> - Basic working principle - Important components and their functions - Start-up and Shut-down - Core barrels - Drilling Mud and Fluids - Mud re-circulation - Drill boom raising and lowering - Drill rod changing - Drilling in hard and soft rocks</td>
<td><strong>Exploratory core drilling rig</strong> <strong>Core barrels</strong> <strong>Core boxes</strong></td>
<td>Classroom &amp; Workplace</td>
</tr>
</tbody>
</table>
| 9. Preventive maintenance of various drilling equipments | Understand the importance of maintenance procedures of different drilling equipments | - Drill bit replacement  
- Sample acquisition from core barrels  
- Waxing and preservation of obtained samples **Ability to:**  
- Perform exploratory core drilling unit | Knowledge of:  
- Principles and objectives of preventive maintenance  
- Scheduled maintenance  
- Use of maintenance logs  
- Oiling and greasing procedures  
- Lubrication points in different drilling equipment **Ability to:**  
- Conduct preventive maintenance of different drilling equipment | 23 | Lecture notes  
- Tool box  
- Oil and grease  
- Oiling and greasing gun  
- Industrial cotton wipes | Classroom & Workplace |

**Module 3:** Blasting Operations
**Objective of the Module 3:** This module develops competency to understand rock blasting procedure, safety precautions while blasting, identification of different explosives and blasting accessories, their proper use, stemming procedure and firing and initiation of a explosives.

**Duration:** 204 hours (Theory: 44 hours and Practice: 160 hours)

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<thead>
<tr>
<th>Learning Unit</th>
<th>Learning Outcomes</th>
<th>Learning Elements</th>
<th>Duration</th>
<th>Materials Required</th>
<th>Learning Place</th>
</tr>
</thead>
</table>
| 1. Introduction to explosives and blasting | Able to explain the explosives, their composition and blasting process | **Knowledge of:**  
- Introduction  
- Explosives composition  
- Theory of blasting | 03 | ▪ Lecture notes | Classroom |
| 2. Types of explosives used in surface mining operations | Identification of different types of explosives and blasting agents used in surface mining operations | **Knowledge of:**  
- Types of explosives  
- High and low explosives  
- Classification of high explosives  
**Ability to:**  
- Identify different explosives and blasting agents used in surface blasting | 08 | ▪ Lecture notes ▪ Audio/visuals | Classroom & Workplace |
| 3. Safety precautions in usage/handling of explosives | Understand the safety precautions during usage, transportations, charging and storage of explosive materials | **Knowledge of:**  
- Do’s and Don’t’s  
- Potential hazards associated with explosives | 10 | ▪ Lecture notes | Classroom |
| 4. Blasting terminologies | Able to explain and identify different technical terms related to explosives and blasting | **Knowledge of:**  
- Blasting patterns  
- Sub-drill, column charge, toe charge, boosters, blasting agents, trunk lines, downlines, back-break, over-break etc… | 05 | ▪ Lecture notes ▪ Audio/visuals related to each technical term | Classroom |
| 5. Blasting accessories | Able to recognize different blasting accessories | **Knowledge of:**  
- Introduction to blasting accessories  
- Detonating cords  
- Nonel detonators / Leher  
- Safety fuse  
- Delay relays  
- Plain detonators  
- Electric detonators  
- Electric blasting machine  
**Ability to:**  
- Recognize different blasting accessories and their uses. | 25 | Lecture notes  
Images of each blasting accessory | Classroom & Workplace |
|------------------------|--------------------------------------------------|---------------------|--------------------------|--------------------------|
| 6. Preparation of ANFO blasting agent | Able to prepare Ammonium nitrate with fuel oil ANFO blasting agent | **Knowledge of:**  
- Brief introduction  
- Ammonium Nitrate and fuel oil optimum ratio  
- Preparation procedure  
- Heavy ANFO  
**Ability to:**  
- Prepare ANFO and Heavy ANFO | 33 | Lecture notes  
Ammonium Nitrate (Blasting grade)  
Diesel oil | Classroom & Workplace |
| 7. Explosive charging procedure | Able to place/charge high explosives and blasting agent in drillholes | **Knowledge of:**  
- Basic concept  
- Connection of detonating cord or Nonel detonator with toe charge  
- Pouring of blasting agent as column charge  
- Placement of booster explosives within column charge  
**Ability to:**  
- Perform explosives charging in blastholes | 43 | Detonating cord  
Nonel / Leher detonators  
High explosive (Wabox, Wabonite, Tovex etc)  
ANFO | Classroom & Workplace |
<p>| 8. Stemming | Understand the | <strong>Knowledge of:</strong> | 17 | Stemming rod | Classroom &amp; Workplace |</p>
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<th>Procedure</th>
<th>Importance of Stemming / Confinement Procedure</th>
<th>Knowledge of:</th>
<th>Ability to:</th>
<th>Workplace/Classroom &amp; Workplace</th>
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<td>9. Initiation/Firing Procedure of Explosives</td>
<td>Able to initiate the blast, safely at any surface mining operation</td>
<td>- Initiation theory</td>
<td>- Conduct safe explosive initiation/firing</td>
<td>Classroom &amp; Workplace</td>
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<td></td>
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<td>- Proper trunk lines and down lines connections</td>
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<td>- Clove-hitch knot</td>
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<td>- Placement of delay relays</td>
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<td>- Safety fuse and plain detonator connection</td>
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<td>- Ignition of safety fuse</td>
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<td>10. Storage of Explosives and Detonators</td>
<td>Understand the importance of proper storage of explosive as per Rules and Regulations</td>
<td>- Storage magazine design</td>
<td>- Store the explosives and detonator as per rules and regulations</td>
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<td>- Ventilation requirements</td>
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<td>- Installation of lightening rod</td>
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<td>- Detonator storage</td>
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<td></td>
<td></td>
<td>- Security of magazine</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Sign-in and sign-out procedures</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Module 4: Loading and Transporations

<table>
<thead>
<tr>
<th>(Aluminum)</th>
<th>Tamping rod (Wooden)</th>
<th>Moisturized clay</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Wooden)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Detonating cords</th>
<th>Delay relays</th>
<th>Safety fuse</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plain detonators</td>
<td>Electric detonators</td>
<td>Electric blasting machine</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Lecture notes</th>
<th>Drawings</th>
<th>Lightning rods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wooden sheets</td>
<td>Face masks</td>
<td></td>
</tr>
</tbody>
</table>

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Page 18
**Objective of the Module 4:** This module provides brief introduction of loading and transportation of rocks at any surface mine including operations and maintenance of different loading and transportation equipments

**Duration:** 186 hours (Theory: 26 hours and Practice: 160 hours)

<table>
<thead>
<tr>
<th>Learning Unit</th>
<th>Learning Outcomes</th>
<th>Learning Elements</th>
<th>Duration</th>
<th>Materials Required</th>
<th>Learning Place</th>
</tr>
</thead>
</table>
| 1. Introduction to loading and transportation equipments | Able to identify various loading and transportation equipments used in mining operations | **Knowledge of:**  
  - Introduction to logistics in surface mining  
  - Loading equipments  
  - Transportation equipments | 05 | L Lecture notes  
  - Audio/visuals | Classroom |
| 2. Operating procedure of front-end loader | Able to operate the front-end loader for loading the raw material at mine site | **Knowledge of:**  
  - Introduction  
  - Machinery specifications  
  - Safety precautions  
  - Start-up / shut-down  
  - Hydraulic controller  
  - Filling the bucket  
  - Lifting the load  
  - Rollback carrying load  
  - Dumping the bucket  
  - Back grading  
  - Digging with bucket  
  - Back filling  
  **Ability to:**  
  - Operate the front-end loader for loading the raw material | 28 | Equipment manual  
  - Front-end loader (Caterpillar 950F etc) | Classroom & Workplace |
| 3. Operating procedure of loading shovel | Able to operate the loading shovel for loading the raw materials and excavations | **Knowledge of:**  
  - Introduction  
  - Machinery specifications  
  - Safety precautions  
  - Start-up / shut-down | 28 | Equipment manual  
  - Loading shovel (Caterpillar 966H or Volvo L150 etc) | Classroom & Workplace |
| 4. **Operating procedure of Dozer/Ripper equipment** | Understand the workings of dozer/ripper, rock cuttings, haul road preparations and grade/slope preparations | **Knowledge of:**  
- Introduction  
- Machinery specifications  
- Safety precautions  
- Start-up / shut-down  
- Blade raising and lower  
- Digging with blade  
- Use of ripper  
- Material movement  
- Grade cutting  
- Haul road preparations  
**Ability to:**  
- Operate the dozer/ripper  
- Prepare haul roads | 28 | Equipment manual  
Dozer/Ripper (Caterpillar D9) | Classroom & Workplace |
|---|---|---|---|---|---|
| 5. **Operating procedure of Rear-dump trucks / Dumper** | Able to operate rear-dump trucks / dumper for transportations of raw material from mine site to crusher or stock yard | **Knowledge of:**  
- Introduction  
- Machinery specifications  
- Safety precautions  
- Start-up / shut-down  
- Safe driving practices  
- Preparing for loading  
- Driving upgrade  
- Driving downgrade | 28 | Equipment manual  
Rear-Dump trucks / Dumper (Nissan or Caterpillar) | Classroom & Workplace |
| 6. Operation and maintenance of Belt conveyors system | Able to operate the belt conveying system including parts replacement and maintenance | - Driving at curves/ blind turns  
- Dumping  
- Controlled spreading  
- Operations in extreme weather conditions  
**Ability to:**  
- Operate the rear-dump trucks/dumper for raw material transportation  |
|---|---|---|
| **Knowledge of:** | | 18  
- Basic mechanism  
- Functional components  
- Running empty belts  
- Running loaded belts  
- Cleanup and lubrications  
- Parts replacement (e.g. Main pulley, tail pulley, side idlers, take-up pulley, side roller etc)  
**Ability to:**  
- Operate and maintain the belt conveyors  |
| | | **Classroom & Workplace**  
- Belt conveyor system  
- Tool box  
- Oil and lubricants  |
| 7. Preventive maintenance of front-end loader and shovels | Able to conduct preventive maintenance of front-end loader and shovels | **Knowledge of:**  
- Bucket frame attachment and detachment  
- Cutter teeth replacement  
- Lubrication at all moving and hinge points  
- Hydraulic oil checking and replacement  
- Boom cylinders lubrication  
**Ability to:**  
- Carry out preventive maintenance  |
| | | 17  
- Tool box  
- Oil and grease  
- Oiling and greasing gun  
- Industrial cotton wipes  
- Hydraulic oils  |
| | | **Classroom & Workplace**  
- Tool box  
- Oil and grease  
- Oiling and greasing gun  
- Industrial cotton wipes  
- Hydraulic oils  |
| 8. Preventive maintenance of dozer/rippers | Able to conduct preventive maintenance of dozer/ripper | **Knowledge of:**  
- Front blade attachment and detachment  
- Rear shank (ripper) attachment and detachment  
- Lubrication at all moving and hinge points  
- Hydraulic oil checking and replacement  
- Boom cylinders lubrication  
**Ability to:**  
- Perform preventive maintenance of dozer/rippers | 17 | ▪ Tool box  
▪ Oil and grease  
▪ Oiling and greasing gun  
▪ Industrial cotton wipes  
▪ Hydraulic oils | Classroom & Workplace |

| 9. Preventive maintenance of dump trucks | Able to conduct preventive maintenance of dumpers | **Knowledge of:**  
- General auto maintenance procedure  
- Boom cylinder lubrications  
- Hydraulic pump maintenance  
- Hydraulic oil checking and replacement  
**Ability to:**  
- Carry out preventive maintenance of dumpers | 17 | ▪ Tool box  
▪ Oil and grease  
▪ Oiling and greasing gun  
▪ Industrial cotton wipes  
▪ Hydraulic oils | Classroom & Workplace |

Module 5: Crushing operations
**Objective of the Module 5:** This module develops competency to understand the basics of crushing operations, to recognize the functional components of different crushers, and to operate different crushers

**Duration:** 115 hours (Theory: 25 hours and Practice: 90 hours)

<table>
<thead>
<tr>
<th>Learning Unit</th>
<th>Learning Outcomes</th>
<th>Learning Elements</th>
<th>Duration</th>
<th>Materials Required</th>
<th>Learning Place</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Introduction to crushing and screening of rocks</td>
<td>Able to explain the crushing and screening of rocks</td>
<td>Knowledge of:  - Introduction  - Basic comminution concept  - Open circuit and close circuit crushing  - Screens</td>
<td>05</td>
<td>▪ Lecture notes  ▪ Audio/visuals</td>
<td>Classroom</td>
</tr>
<tr>
<td>2. Types of crushers and screens used in mining industry</td>
<td>Recognition and identification of different crushers and screens and their functional components</td>
<td>Knowledge of:  - Classification of crushers  - Primary crushers  - Secondary crushers  - Tertiary crushers  - Grizzlies, vibrating and shaking screens</td>
<td>05</td>
<td>▪ Lecture notes  ▪ Audio/visuals</td>
<td>Classroom</td>
</tr>
</tbody>
</table>
| 5. Preventive maintenance of crushers and screens | - Product size control  
**Ability to:**  
- Operate the rotary impact crushers | Knowledge of:  
- Safety precautions  
- Jaw die replacement  
- Jaw guard replacement  
- Cheek plate replacement  
- Flywheel removal / installations  
- Tension rod removal / installations  
- Toggle and toggle seat replacement and installations  
- Thrust shaft removal and installations  
- Hammer removal and installation  
- Hammer shaft removal and installation  
- Screen mesh replacement/installation  
- Oiling and lubrications  
**Ability to:**  
- Conduct the preventive maintenance of different crushers and screens | 35  
- Tool box  
- Oil and grease  
- Oiling and greasing gun  
- Industrial cotton wipes  
- Hydraulic oils | Classroom & Workplace |

**Module 6:** Health, Safety and Environment (HSE)
**Objective of the Module 6:** This module develops competency to understand the importance of health and safety precautions and basic first aid

**Duration:** 66 hours (Theory: 16 hours and Practice: 50 hours)

<table>
<thead>
<tr>
<th>Learning Unit</th>
<th>Learning Outcomes</th>
<th>Knowledge of:</th>
<th>Ability to:</th>
<th>Duration</th>
<th>Materials Required</th>
<th>Learning Place</th>
</tr>
</thead>
</table>
| 1. General workplace safety rules and procedures | Understand the possible dangerous situations which might lead to accidents/disaster in and around the surface mining operations | - Hazardous situations  
- Recognition of dangerous occurrences  
- Emergency plans  
- General workplace safety precautions  
- Warning signs | - Use different personal protective equipments (PPE’s) | 05 | ▪ Lecture notes  
▪ Audio/Visuals  
▪ Warning signs | Classroom |
| 2. Appropriate use of personal protective equipments (PPE’s) | Able to use properly various personal protective equipments PPE’s | - Helmets and safety shoes  
- Half and full face dust masks  
- Hard and soft gloves  
- Safety goggles/glasses  
- Hearing protections  
- Oxygen breathing apparatus | - Perform fire fighting in event of fire extinguishers | 15 | ▪ Helmets  
▪ Safety footwares  
▪ Dust masks  
▪ Hearing protection  
▪ Safety goggles  
▪ BG-164 breathing apparatus | Classroom & Workplace |
| 3. Fire fighting techniques | Able to conduct fire-fighting and proper use of fire extinguishers | - Causes of fire  
- Fire triangle  
- Extinguishing different materials fire (oil, wood, plastic etc)  
- Use of CO₂, water and foaming fire extinguishers  
- Fire escaping procedures | - Perform fire fighting in event of fire extinguishers | 12 | ▪ Different materials (i.e. oil, wood, plastics etc)  
▪ Fire extinguishers (CO₂, water and foam) | Classroom & Workplace |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th>any emergency</th>
</tr>
</thead>
</table>
| 4. Communication skills (hand signals, radio communications etc) | Able to communicate non-verbally and verbally in the field | Knowledge of:  
- Hand signs for different work activities  
- Walkie-talkie radio 2 way communications  

**Ability to:**  
- Use different communication tools at workplace |
|   |   | 12 |
|   |   | [Hand signal images]  
[Hand-held Transceivers (Walkie-talkie)] |
|   |   | Classroom & Workplace |
| 5. First-Aid training | Able to respond against any accident and provide basic first aid to the injured workers | Knowledge of:  
- Managing a casualty  
- Priorities in first aid  
- First aid to an unconscious casualty  
- First aid to bleeding injuries  
- First aid to electrical shocks  
- First aid to burn injuries  
- Dealing with fractures  
- Resuscitation procedure  

**Ability to:**  
- Respond to any accident and provide basic first aid to an injured worker |
|   |   | 22 |
|   |   | [Lecture notes]  
[Audio/visuals]  
[First-Aid kits] |
|   |   | Classroom & Workplace |
## Assessment
### MODULE 1: INTRODUCTION TO SURFACE MINING

<table>
<thead>
<tr>
<th>Learning Units</th>
<th>Theory Days /hours</th>
<th>Work place Days /hours</th>
<th>Recommended formative assessment</th>
<th>Recommended methodology</th>
<th>Scheduled dates</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Introduction to surface mining operations</td>
<td>03</td>
<td>--</td>
<td>Trainee will: Explain basic concepts of surface mining operations</td>
<td>• Oral</td>
<td>At the end of module</td>
</tr>
<tr>
<td>2. Basic terminology used in surface mining</td>
<td>05</td>
<td>05</td>
<td>Trainee will: Explain and identify different geometrical attributes of any surface mine and related technical terms (i.e. Burden, spacing, toe, crest, slope etc)</td>
<td>• Oral</td>
<td>At the end of module</td>
</tr>
<tr>
<td>3. Surface mining methods</td>
<td>05</td>
<td>--</td>
<td>Trainee will: Recognize and differentiate between various surface mining methods applicable to different types of minerals/rocks</td>
<td>• Oral</td>
<td>At the end of module</td>
</tr>
<tr>
<td>4. Basic unit operations in surface mining</td>
<td>05</td>
<td>--</td>
<td>Trainee will: Demonstrate clear understanding of all the important unit operations at any surface mine</td>
<td>• Oral</td>
<td>At the end of module</td>
</tr>
<tr>
<td>5. Identifications of different industrial rocks and minerals</td>
<td>05</td>
<td>05</td>
<td>Trainee will: Recognize different rocks and minerals</td>
<td>• Oral</td>
<td>At the end of module</td>
</tr>
</tbody>
</table>

### Supportive notes

- **Assessment context:**
  This module provides an overall introduction to surface mining. All lectures will be conducted in classroom although for terminology and identification of minerals/rocks, trainee should be taken to workplace for clear understanding and first hand knowledge.

- **Critical aspects:**
  The trainer must focus on developing a clear idea of surface mining operations as most of the trainees may be very much novice to mining industry.
- **Assessment condition:**
  Lecture notes and mining methods posters should be provided to the trainees
- **Resources required for assessment**
  The module is mostly theory based; hence no tool or equipment required but for Learning unit 05, rock and mineral specimens are required

### MODULE 2: DRILLING OPERATIONS

<table>
<thead>
<tr>
<th>Learning Units</th>
<th>Theory Days /hours</th>
<th>Work place Days /hours</th>
<th>Recommended formative assessment</th>
<th>Recommended methodology</th>
<th>Scheduled dates</th>
</tr>
</thead>
</table>
| 1. Introduction to rock drilling process | 03                | --                     | Trainee will:  
✓ Explain the rock drilling process                                                             | • Oral  
• MCQs  
• Short questions                                  | At the end of module                             |
| 2. Basic functional components of drilling equipments | 02                | --                     | Trainee will:  
✓ Recognize various components of a drilling equipment  
✓ Explain functions of each component             | • Oral  
• MCQs  
• Short questions                                  | At the end of module                             |
| 3. Identification of different drilling equipments used in surface mining | 03 10 | | Trainee will:  
✓ Identify and classify different drilling equipments                                             | • Oral  
• Practical/Demonstration  
• MCQs  
• Short questions                                  | At the end of module                             |
| 4. Operating procedure of Top-hammer/ Drifter drills | 03 30              |                        | Trainee will:  
✓ Explain basic working principle of Top-hammer drill  
✓ Identify different functional components  
✓ Demonstrate complete operations of the drill, including startup and shut down, drill rod changing, raising and lowering, crawling etc | • Oral  
• Practical/Demonstration  
• MCQs  
• Short questions                                  | At the end of module                             |
| 5. Operating procedure of | 03 30              |                        | Trainee will:  
✓ Explain basic working principle of Down-hole                                                     | • Oral  
• Practical/Demonstration                          | At the end of module                             |
<table>
<thead>
<tr>
<th>Module</th>
<th>Training Content</th>
<th>Duration</th>
<th>Trainee Activities</th>
<th>Assessment Methods</th>
<th>Review Method</th>
</tr>
</thead>
</table>
| 4. DTH Drills | Down-the-hole hammer (DTH) drills | 03 25 | hammer drill (DTH)  
✓ Identify different functional components  
✓ Demonstrate full operations of the drill, including startup and shutdown, drill rod changing, raising and lowering, crawling etc | ▪ MCQs  
▪ Short questions | At the end of module |
| 6. Operating Procedure of Jackhammer / Handheld drills | Trainee will:  
✓ Explain basic working principle of Jackhammer drill  
✓ Identify different functional components  
✓ Demonstrate complete operation of the drill, including startup and shutdown, drill rod changing, raising and lowering, crawling etc | 03 25 | ▪ Oral  
▪ Practical/Demonstration  
▪ MCQs  
▪ Short questions | At the end of module |
| 7. Operations and Maintenance of Air Compressors | Trainee will:  
✓ Explain basic working principle of Air Compressors  
✓ Identify different functional components  
✓ Demonstrate full operations of the air compressors, including startup and shutdown, air hose connections, quantity and pressure control  
✓ Explain the maintenance procedures for air compressors | 03 25 | ▪ Oral  
▪ Practical/Demonstration  
▪ MCQs  
▪ Short questions | At the end of module |
| 8. Exploratory Core Drilling Procedure | Trainee will:  
✓ Explain basic working principle of Exploratory core drilling equipments  
✓ Identify different functional components  
✓ Demonstrate full operations of the exploratory drilling including startup and shutdown, handling of core barrels, drill boom raising and lowering, drill rod changing, etc. | 03 30 | ▪ Oral  
▪ Practical/Demonstration  
▪ MCQs  
▪ Short questions | At the end of module |
| 9. Preventive | Trainee will:  
✓ | 03 20 | ▪ Oral | At the end of module |
Supportive notes

- **Assessment context:**
  This module provides understanding of rock drilling process, identification of basic drill components including operations and maintenance of various types of drilling equipments used in surface mining for mineral exploitation. Both classroom and workplace will be used for this module.

- **Critical aspects:**
  Drilling is the most important and critical unit operation of surface mining. Special care should be given to safety procedures for equipment and personnel.

- **Assessment condition:**
  Each trainee should have appropriate access to all equipments

- **Resources required for assessment**
  Drilling equipments, air compressors, tool boxes, oil and lubricants etc should be provided to the trainees
<table>
<thead>
<tr>
<th>Learning Units</th>
<th>Theory Days /hours</th>
<th>Work place Days/ hours</th>
<th>Recommended formative assessment</th>
<th>Recommended methodology</th>
<th>Scheduled dates</th>
</tr>
</thead>
</table>
| 1. Introduction to explosives and blasting | 03                 | --                     | Trainee will:  
✓ Explain the explosives and their composition  
✓ Explain the rock blasting procedures | ▪ Oral  
▪ MCQs  
▪ Short questions | At the end of module |
| 2. Types of explosives used in surface mining operations | 03     | 05                     | Trainee will:  
✓ Identify different types of explosives and blasting agents | ▪ Oral  
▪ Practical/Demonstration  
▪ MCQs  
▪ Short questions | At the end of module |
| 3. Safety precautions in usage/handling of explosives | 10     | --                     | Trainee will:  
✓ Explain the safety precautions during usage, transportations, charging and storage of explosives | ▪ Oral  
▪ MCQs  
▪ Short questions | At the end of module |
| 4. Blasting terminologies                | 05                 | --                     | Trainee will:  
✓ Identify and explain different blasting and explosive terms | ▪ Oral  
▪ MCQs  
▪ Short questions | At the end of module |
| 5. Blasting accessories                  | 05                 | 20                     | Trainee will:  
✓ Identify and explain different blasting accessories used in rock blasting  
✓ Demonstrate safe use of each blasting accessory | ▪ Oral  
▪ Practical/Demonstration  
▪ MCQs  
▪ Short questions | At the end of module |
| 6. Preparation of ANFO blasting agent    | 03                 | 30                     | Trainee will:  
✓ Explain the composition of ANFO  
✓ Demonstrate the preparation procedure of ANFO  
✓ Demonstrate the preparation of heavy ANFO | ▪ Oral  
▪ Practical/Demonstration  
▪ MCQs  
▪ Short questions | At the end of module |
| 7. Explosive charging procedure          | 03                 | 40                     | Trainee will:  
✓ Explain the blast hole charging procedure  
✓ Demonstrate the placement of toe charge | ▪ Oral  
▪ Practical/Demonstration  
▪ MCQs | At the end of module |
<table>
<thead>
<tr>
<th>Module</th>
<th>Duration</th>
<th>Activity Details</th>
<th>Assessment Methods</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>8. Stemming procedure</td>
<td>02 15</td>
<td>✓ Demonstrate the pouring of blasting agent in blast holes &lt;br&gt;Trainee will: &lt;ul&gt;&lt;li&gt;Explain the basic concept of stemming procedure&lt;/li&gt;&lt;li&gt;Demonstrate the proper selection of stemming material&lt;/li&gt;&lt;li&gt;Demonstrate the stemming and tamping procedure&lt;/li&gt;&lt;/ul&gt;</td>
<td>✓ Short questions</td>
<td>At the end of module</td>
</tr>
<tr>
<td>9. Initiation/Firing procedure of explosives</td>
<td>05 30</td>
<td>✓ Demonstrate the layout of trunk and downline detonating cord &lt;br&gt; ✓ Demonstrate the knotting procedure of detonating cord &lt;br&gt; ✓ Demonstrate the placement of delay relays &lt;br&gt; ✓ Demonstrate the connection of safety fuse and plain detonator &lt;br&gt; ✓ Demonstrate ignition of safety fuse &lt;br&gt;Trainee will: &lt;ul&gt;&lt;li&gt;Explain the initiation theory&lt;/li&gt;&lt;li&gt;Demonstrate the layout of trunk and downline detonating cord&lt;/li&gt;&lt;li&gt;Demonstrate the knotting procedure of detonating cord&lt;/li&gt;&lt;li&gt;Demonstrate the placement of delay relays&lt;/li&gt;&lt;li&gt;Demonstrate the connection of safety fuse and plain detonator&lt;/li&gt;&lt;li&gt;Demonstrate ignition of safety fuse&lt;/li&gt;&lt;/ul&gt;</td>
<td>✓ Oral &lt;br&gt; ✓ Practical/Demonstration &lt;br&gt; ✓ MCQs &lt;br&gt; ✓ Short questions</td>
<td>At the end of module</td>
</tr>
<tr>
<td>10. Storage of explosives and detonators</td>
<td>05 20</td>
<td>✓ Explain the safety procedure for storage and handling of explosive and detonators &lt;br&gt; ✓ Explain the magazine design and ventilation requirements &lt;br&gt; ✓ Demonstrate the installations of wooden floors and lightning rods &lt;br&gt;Trainee will: &lt;ul&gt;&lt;li&gt;Explain the safety procedure for storage and handling of explosive and detonators&lt;/li&gt;&lt;li&gt;Explain the magazine design and ventilation requirements&lt;/li&gt;&lt;li&gt;Demonstrate the installations of wooden floors and lightning rods&lt;/li&gt;&lt;/ul&gt;</td>
<td>✓ Oral &lt;br&gt; ✓ Practical/Demonstration &lt;br&gt; ✓ MCQs &lt;br&gt; ✓ Short questions</td>
<td>At the end of module</td>
</tr>
</tbody>
</table>

Supportive notes
- **Assessment context:**
  This module provides understanding rock blasting procedure; safety precautions while blasting, identification of different explosives and blasting accessories, their proper use, stemming procedure and firing/initiation of explosives. Both classroom and workplace will be used for this module.
• **Critical aspects:**
Blasting operations are critical due to current law and order situations. All the trainees and trainer should be properly scanned/checked by security officers at entry and exit to the blasting area and explosives magazine.

• **Assessment condition:**
Trainee should be taken to existing limestone quarries for blasting module assessment

• **Resources required for assessment**
All the explosives, blasting accessories, stemming rods etc should be provided to trainees under the strict supervision of trainers

### MODULE 4: LOADING AND TRANSPORTATIONS

<table>
<thead>
<tr>
<th>Learning Units</th>
<th>Theory Days/Hours</th>
<th>Workplace Days/Hours</th>
<th>Recommended formative assessment</th>
<th>Recommended methodology</th>
<th>Scheduled dates</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Introduction to loading and transportation equipments</td>
<td>05</td>
<td>--</td>
<td>Trainee will: Identify various loading and transportation equipments used in mining operations</td>
<td>Oral, MCQs, Short questions</td>
<td>At the end of module</td>
</tr>
<tr>
<td>2. Operating procedure of front-end loader</td>
<td>03</td>
<td>25</td>
<td>Trainee will: Explain basic working principle of front-end loader Identify and explain different functional components and machine specifications Demonstrate complete operations of front-end loader including startup and shutdown, hydraulic controls, bucket filling, lifting, rollback, dumping, digging, back filling etc.</td>
<td>Oral, Practical/Demonstration, MCQs, Short questions</td>
<td>At the end of module</td>
</tr>
<tr>
<td>3. Operating procedure of loading shovel</td>
<td>03</td>
<td>25</td>
<td>Trainee will: Explain basic working principle of loading shovel Identify and explain different functional</td>
<td>Oral, Practical/Demonstration, MCQs, Short questions</td>
<td>At the end of module</td>
</tr>
</tbody>
</table>
| 4. Operating procedure of Dozer/Ripper equipment | 03 | 25 | Trainee will:  
✓ Explain basic working principle of dozer/ripper  
✓ Identify and explain different functional components and machine specifications  
✓ Demonstrate complete operations of dozers including startup and shutdown, hydraulic controls, blade raising and lowering, digging, material movement, grade cutting, haul road preparations, etc. | Oral  
Practical/Demonstration  
MCQs  
Short questions | At the end of module |
| 5. Operating procedure of Rear-dump trucks / Dumpers | 03 | 25 | Trainee will:  
✓ Explain basic working principle of dumpers  
✓ Identify and explain different functional components and machine specifications  
✓ Demonstrate complete operations of rear-dump trucks including startup and shutdown, hydraulic controls, upgrade driving, downgrade driving, dumping, controlled spreading, etc | Oral  
Practical/Demonstration  
MCQs  
Short questions | At the end of module |
| 6. Operation and maintenance of Belt conveyors system | 03 | 15 | Trainee will:  
✓ Explain basic working principle of belt conveyors  
✓ Identify different functional components  
✓ Demonstrate complete operations of belt conveyor system including startup and shutdown, empty running, loaded running, | Oral  
Practical/Demonstration  
MCQs  
Short questions | At the end of module |
<p>| | | | |</p>
<table>
<thead>
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</table>

**Supportive notes**

- **Assessment context:**
  This module provides brief introduction of loading and transportation of rocks at any surface mine including operations and maintenance of different loading and transportation equipments. Both classroom and workplace will be used for this module.

- **Critical aspects:**
  In this module, trainees are required to work around hydraulic powered equipment carrying heavier loads, hence safety precautions should be taken to avoid any mishap.

- **Assessment condition:**
Trainee should be taken to existing limestone quarries or surface mining operations where they demonstrate their abilities to operate various equipments

- **Resources required for assessment**
  Front-end loader, shovels, dumper, dozers, tool boxes, lubricants etc should be provided to the trainees.

## MODULE 5: CRUSHING OPERATIONS

<table>
<thead>
<tr>
<th>Learning Units</th>
<th>Theory Days /hours</th>
<th>Workplace Days /hours</th>
<th>Recommended formative assessment</th>
<th>Recommended methodology</th>
<th>Scheduled dates</th>
</tr>
</thead>
</table>
| 1. Introduction to crushing and screening of rocks | 05                | --                    | Trainee will:  
  ✓ Explain the basic rock crushing and screening process  
  ✓ Differentiate between open and close circuit crushing | ▪ Oral  
  ▪ MCQs  
  ▪ Short questions | At the end of module |
| 2. Types of crushers and screens used in mining industry | 05                | --                    | Trainee will:  
  ✓ Identification of different types of crushers and screens and their functional components | ▪ Oral  
  ▪ MCQs  
  ▪ Short questions | At the end of module |
| 3. Operations of Primary Jaw crushers   | 05                | 30                    | Trainee will:  
  ✓ Explain basic working principle of primary jaw crushers  
  ✓ Identify different functional components  
  ✓ Demonstrate complete operations of primary jaw crushers, including startup and shutdown, feed control, gap-set adjustment, product size control, etc | ▪ Oral  
  ▪ Practical/Demonstration  
  ▪ MCQs  
  ▪ Short questions | At the end of module |
| 4. Operations of Rotary Impact crushers | 05                | 30                    | Trainee will:  
  ✓ Explain basic working principle of rotary impact crushers  
  ✓ Identify different functional components | ▪ Oral  
  ▪ Practical/Demonstration  
  ▪ MCQs  
  ▪ Short questions | At the end of module |
### Module 6: Health, Safety and Environment (HSE)

<table>
<thead>
<tr>
<th>Assessment context:</th>
<th>Instruction to trainees should be followed for proper safety procedures.</th>
<th>Critical aspects:</th>
<th>Trainees should be taken to existing limestone quarries or stone crushing plants for hands-on assessment.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resources required for assessment:</td>
<td>Access to primary jaw crushers, rotary impact crushers, tool boxes, lubricants etc should be provided to the trainees.</td>
<td>Assessment condition:</td>
<td>Trainees should be taken to existing limestone quarries or stone crushing plants for hands-on assessment.</td>
</tr>
</tbody>
</table>

Supportive notes

- Assessment context:
  This module provides comprehensive understanding of the basics of crushing operations, to recognize the functional components of different crushers, and to operate different crushers. Both classroom and workplace will be used for this module.
- Critical aspects:
  In this module, trainees are required to work with heavy duty crushers operated at high voltage, hence proper safety procedures should be followed.
- Assessment condition:
  Trainees should be taken to existing limestone quarries or stone crushing plants for hands-on assessment.

5. Preventive maintenance of crushers and screens

<table>
<thead>
<tr>
<th>Trainee will:</th>
<th></th>
<th>Evaluation methods:</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓ Demonstrate complete operations of rotary impact crushers, including startup and shutdown, feed control, gap-set adjustment, product size control, hammer speed control etc.</td>
<td></td>
<td>Oral</td>
</tr>
<tr>
<td>✓ Explain preventive and scheduled maintenance procedure of different types of crushers and screens</td>
<td>Practical/Demonstration</td>
<td></td>
</tr>
<tr>
<td>✓ Demonstrate parts replacement procedures</td>
<td>MCQs</td>
<td></td>
</tr>
<tr>
<td>✓ Demonstrate oiling and greasing procedure</td>
<td>Short questions</td>
<td></td>
</tr>
<tr>
<td>✓ Explain the use of maintenance log</td>
<td>At the end of module</td>
<td></td>
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</tbody>
</table>

| 05 | 30 | Oral | Practical/Demonstration | MCQs | Short questions |

MODULE 6: HEALTH, SAFETY AND ENVIRONMENT (HSE)
<table>
<thead>
<tr>
<th>Learning Units</th>
<th>Theory Days /hours</th>
<th>Workplace Days/ hours</th>
<th>Recommended formative assessment</th>
<th>Recommended methodology</th>
<th>Scheduled dates</th>
</tr>
</thead>
</table>
| 1. General workplace safety rules and procedures | 05 | -- | Trainee will:  
- Explain possible dangerous situations which might lead to accidents/disasters in and around the surface mining operations  
- Identify different warning signs | ▪ Oral  
▪ MCQs  
▪ Short questions | At the end of module |
| 2. Appropriate use of personal protective equipments (PPEs) | 05 | 10 | Trainee will:  
- Identify various personal protective equipments (PPEs)  
- Explain basic functions of different personal protective equipments (PPEs)  
- Demonstrate the appropriate use of helmets, dust masks, safety goggles, hearing protection and oxygen breathing apparatus | ▪ Oral  
▪ Practical/Demonstration  
▪ MCQs  
▪ Short questions | At the end of module |
| 3. Fire fighting Techniques | 02 | 10 | Trainee will:  
- Identify potential sources of fire around any surface mining operations.  
- Explain the fire triangle and its breakage  
- Demonstrate fire extinguishing procedure for different types of material fires (oil, wood, plastic etc)  
- Demonstrate appropriate use and inspection of fire extinguishers | ▪ Oral  
▪ Practical/Demonstration  
▪ MCQs  
▪ Short questions | At the end of module |
| 4. Communication skills (hand signals, radio communications) | 02 | 10 | Trainee will:  
- Explain different hand signals often used at surface mining  
- Demonstrate proper use of walkie-talkie radio | ▪ Oral  
▪ Practical/Demonstration  
▪ MCQs  
▪ Short questions | At the end of module |
5. First-Aid training

<p>| | | | |</p>
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<tbody>
<tr>
<td>etc)</td>
<td>transceivers</td>
<td>Trainee will:</td>
<td>At the end of module</td>
</tr>
<tr>
<td>5. First-Aid training</td>
<td>02</td>
<td>20</td>
<td>Oral</td>
</tr>
<tr>
<td></td>
<td></td>
<td>✓ Distinguish priorities in first aid procedure</td>
<td>Practical/Demonstration</td>
</tr>
<tr>
<td></td>
<td></td>
<td>✓ Demonstrate appropriate use and handling of first aid kits</td>
<td>MCQs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>✓ Demonstrate first aid to unconscious person, bleeding injuries, electrical shocks, burn injuries, fractures and resuscitation procedure</td>
<td>Short questions</td>
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</table>

Supportive notes

- **Assessment context:**
  This module provides comprehensive understanding of health and safety precautions and basic first aid. Both classroom and workplace will be used for this module.

- **Critical aspects:**
  The learning unit#03 deals with actual fire fighting procedure, hence a backup emergency fire fighting plan should be devised.

- **Assessment condition:**
  Trainees should be taken to fire fighting department for appropriate assessment

- **Resources required for assessment**
  Access to water hoses, water tankers, CO2 extinguishers, foam extinguishers, etc should be provided to the trainees.

### List of Tools, Machinery & Equipment

<table>
<thead>
<tr>
<th>Name of Trade</th>
<th>SURFACE MINING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duration</td>
<td>06 Months</td>
</tr>
<tr>
<td>Sr. No.</td>
<td>Name of Item/ Equipment / Tools</td>
</tr>
<tr>
<td>--------</td>
<td>-----------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>1.</td>
<td>Rocks and Minerals Display Specimens (Box)</td>
</tr>
<tr>
<td>2.</td>
<td>Top-hammer drilling unit with all drilling accessories (LM300 Ingersoll rand) (can be hired)</td>
</tr>
<tr>
<td>3.</td>
<td>Down-the-Hole Hammer (DTH) drilling unit with all essential accessories, (e.g. Ingersoll rand or Atlas copco) (can be hired)</td>
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<tr>
<td>4.</td>
<td>Jack-hammer handheld drill</td>
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<tr>
<td>5.</td>
<td>Air compressor (800 cfm) (e.g. Comp Air)</td>
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<tr>
<td>6.</td>
<td>Standard Toolbox</td>
</tr>
<tr>
<td>7.</td>
<td>Exploratory Core drilling rig (can be hired)</td>
</tr>
<tr>
<td>8.</td>
<td>Greasing gun</td>
</tr>
<tr>
<td>9.</td>
<td>Oiling gun</td>
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<tr>
<td>10.</td>
<td>Stemming rod &amp; Tamping rods</td>
</tr>
<tr>
<td>11.</td>
<td>Front-end loader (Caterpillar 950F etc) (can be hired)</td>
</tr>
<tr>
<td>12.</td>
<td>Loading shovel (Caterpillar 966H or Volvo L150 etc) (can be hired)</td>
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<tr>
<td>13.</td>
<td>Dozer/Ripper (Caterpillar D9) (can be hired)</td>
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<tr>
<td>14.</td>
<td>Rear-Dump trucks / Dumper (Nissan or Caterpillar) (can be hired)</td>
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<tr>
<td>15.</td>
<td>Jaw crusher (can be hired)</td>
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<tr>
<td>16.</td>
<td>Rotary Impact crusher (can be hired)</td>
</tr>
<tr>
<td>17.</td>
<td>BG-164 Breathing Apparatus</td>
</tr>
<tr>
<td>18.</td>
<td>CO2 and Foam Fire Extinguisher</td>
</tr>
<tr>
<td>19.</td>
<td>Belt Conveyor System (site visit)</td>
</tr>
</tbody>
</table>
List of Consumable Supplies

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Name of Consumable Supplies</th>
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</thead>
<tbody>
<tr>
<td>1.</td>
<td>Drill bits for Top-hammer and Downhole hammer drills</td>
</tr>
<tr>
<td>2.</td>
<td>Core boxes for rock and soil samples</td>
</tr>
<tr>
<td>3.</td>
<td>Lubricant oil</td>
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<tr>
<td>4.</td>
<td>Hydraulic oil</td>
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<tr>
<td>5.</td>
<td>Industrial Grease</td>
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<tr>
<td>6.</td>
<td>Industrial cotton wipes</td>
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<tr>
<td>7.</td>
<td>Ammonium Nitrate (AN)</td>
</tr>
<tr>
<td>8.</td>
<td>Diesel oil</td>
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<tr>
<td>9.</td>
<td>Blasting accessories (Detonating cord, safety fuse, detonators, high explosives)</td>
</tr>
<tr>
<td>10.</td>
<td>Wooden sheets (5’x5’)</td>
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<tr>
<td>11.</td>
<td>Dust mask</td>
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<tr>
<td>12.</td>
<td>Safety Helmets</td>
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<tr>
<td>13.</td>
<td>Safety footwares</td>
</tr>
<tr>
<td>14.</td>
<td>Dust masks</td>
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<tr>
<td>15.</td>
<td>Hearing protection</td>
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<tr>
<td>16.</td>
<td>Safety goggles</td>
</tr>
</tbody>
</table>

Name of Trade | SURFACE MINING
--- | ---
Duration | 06 Months
Reference Books

1. “Introductory Mining Engineering” By H.L. Hartman
2. “Surface Mining” B.A. Kennedy
4. Equipment Manuals
## Contributions for Development of This Curriculum

### DACUM Working Group

<table>
<thead>
<tr>
<th>Name</th>
<th>Company/Project</th>
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<tbody>
<tr>
<td>Mr. Ali Muhammad Solangi</td>
<td>Lakhra Coal Development Company</td>
</tr>
<tr>
<td>Mr. Shahnawaz Khan</td>
<td>Pakistan Mineral Development Corporation</td>
</tr>
<tr>
<td>Mr. Ali Muhammad</td>
<td>Faiz Coal Mining</td>
</tr>
<tr>
<td>Mr. Shahid Mughal</td>
<td>Unique Engineering Pvt Ltd</td>
</tr>
<tr>
<td>Mr. Abdur Shakoor</td>
<td>Fateh Coal Mines Pvt. Ltd</td>
</tr>
<tr>
<td>Mr. Munawar Ali</td>
<td>Mehran University of Engineering &amp; Technology, Jamshoro</td>
</tr>
<tr>
<td>Engr. Abdul Haseeb</td>
<td>Dada Bhoi Coal Project</td>
</tr>
<tr>
<td>Mr. Murad Ali</td>
<td>Lakhra Coal Development Company</td>
</tr>
<tr>
<td>Mr. Nawab, M Jamil &amp; Co</td>
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### Curriculum Developer

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<tr>
<th>Name</th>
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<tr>
<td>Mr. Fahad Irfan Siddiqui</td>
<td>Department of Mining Engineering, Jamshoro</td>
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### National Curriculum Review Committee (NCRC) Members

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Engr. Fahad Awan Siddiqi</td>
<td>Assistant Professor, Mehran University of Engineering &amp; Technology, Jamshoro</td>
</tr>
<tr>
<td>Mr. Furqa Jan</td>
<td>Assistant Director, AJK TEVTA, Muzafarabad</td>
</tr>
<tr>
<td>Engr. Muhammad Asif</td>
<td>Assistant Director, Mineral Wing M/o Petroleum, Huma Plaza Islamabad</td>
</tr>
<tr>
<td>Engr. Amjad Hussain Solangi</td>
<td>Hussain Coal Company, Lakhra</td>
</tr>
<tr>
<td>Engr. Abdul Rasheed Qureshi</td>
<td>Lecturer, BUITEMS, Quetta</td>
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### DACUM Facilitator

<table>
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<tr>
<th>Name</th>
<th>Department/Institution</th>
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<tbody>
<tr>
<td>Mr. Atif Mahmood</td>
<td>Assistant Director, NAVTTC, Islamabad</td>
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### DACUM Coordinator

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<td>Mr. Muhammad Nasir Khan</td>
<td>Deputy Director, NAVTTC, Islamabad</td>
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