

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 atleast 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

Module Title and Aim	Learning Units	Theory ¹ Days/hours	Workplace ² Days/hours	Time frame of modules
Module 1 Introduction to surface mining	LU1. Introduction to surface mining operations LU2. Basic terminology used in surface mining LU3. Surface mining methods LU4. Basic unit operations in surface mining LU5. Identifications of different industrial rocks and minerals	23	10	Complete first
Module 2 Drilling Operations	LU1. Introduction to rock drilling process LU2. Basic functional components of drilling equipments LU3. Identification of different drilling equipments used in surface mining LU4. Operating procedure of Top-hammer/Drifter drills LU5. Operating procedure of Down-the-hole hammer (DTH) drills LU6. Operating procedure of Jack-hammer/Handheld drills LU7. Operation and maintenance of air compressors LU8. Exploratory core drilling procedure LU9. Preventive maintenance of various drilling equipments	26	170	Complete Module 1 first

¹ Learning hours in training provider premises

² Training workshop, laboratory and on-the-job workplace

Module Title and Aim	Learning Units	Theory Days/hours	Workplace Days/hours	Time frame of modules
Module 3 Blasting Operations	LU1. Introduction to explosives and blasting LU2. Types of explosive used in surface mining operations LU3. Safety precautions in usage/handling of explosives LU4. Blasting terminologies LU5. Blasting accessories LU6. Preparation of ANFO blasting agent LU7. Explosives charging procedure LU8. Stemming procedure LU9. Initiation/Firing procedure of explosives LU10. Storage of explosives and detonators	44	160	Complete Module 1 first
Module 4 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

Module Title and Aim	Learning Units	Theory Days/hours	Workplace Days/hours	Time frame of modules
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

Surface Mining-Curriculum Contents (Teaching and Learning Guide)

Module 1: Introduction to Surface Mining

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)

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
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

		<ul style="list-style-type: none"> - Physical properties of rocks and minerals for identification <p>Ability to:</p> <ul style="list-style-type: none"> - Identify different rocks and minerals 			
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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)

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
1. Introduction to rock drilling process	Able to explain the rock drilling process	<p>Knowledge of:</p> <ul style="list-style-type: none"> - Introduction - Basic concept - Rock-bit interaction 	03	<ul style="list-style-type: none"> ▪ Lecture notes 	Classroom
2. Basic functional components of drilling equipments	Able to recognize various components of a drilling equipment and explain their functions	<p>Knowledge of:</p> <ul style="list-style-type: none"> - Components of drill - Prime mover, drill pipes, drill bits, and circulations system - Torque and thrust components 	02	<ul style="list-style-type: none"> ▪ Lecture notes ▪ Audio/visuals 	Classroom
3. Identification of different drilling equipments used in surface mining	Able to identify and classify different drilling equipments	<p>Knowledge of:</p> <ul style="list-style-type: none"> - Types of drills - Hydraulic and Pneumatic - Truck-mounted and crawler mounted - Handheld drills <p>Ability to:</p> <ul style="list-style-type: none"> - Classify different drilling 	13	<ul style="list-style-type: none"> ▪ Lecture notes ▪ Audio/visuals of different drilling equipments 	Classroom & Workplace

		equipments used in surface mining			
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	<p>Knowledge of:</p> <ul style="list-style-type: none"> - 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 <p>Ability to:</p> <ul style="list-style-type: none"> - Operate the top-hammer/ drifter drills 	33	<ul style="list-style-type: none"> ▪ Equipment Manual ▪ Top-hammer drilling unit with all drilling accessories (e.g. LM300 Ingersoll rand) ▪ Air compressor (800 cfm) ▪ Audio/visuals 	Classroom & Workplace
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	<p>Knowledge of:</p> <ul style="list-style-type: none"> - 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 <p>Ability to:</p> <ul style="list-style-type: none"> - Operate the down-the-hole hammer (DTH) drills 	33	<ul style="list-style-type: none"> ▪ Equipment Manual ▪ Down-the-Hole Hammer (DTH) drilling unit with all essential accessories, (e.g. Ingersoll rand or Atlas copco) ▪ Air compressor (800 cfm) ▪ Audio/visuals 	Classroom & Workplace
6. Operating procedure of Jack-hammer /	Able to operate the Jack-hammer handheld drill for	<p>Knowledge of:</p> <ul style="list-style-type: none"> - Basic working mechanism - Important components and their 	28	<ul style="list-style-type: none"> ▪ Equipment manual ▪ Jack-hammer handheld drill 	Classroom & Workplace

Handheld drills	boulder drilling and shallow drillholes	<ul style="list-style-type: none"> functions - Start-up and Shut-down - Safety precautions during drilling - Boulder drilling - Drilling for dimension stones <p>Ability to:</p> <ul style="list-style-type: none"> - Operate the jack-hammer drills 		<ul style="list-style-type: none"> ▪ Drill rod sets ▪ Air compressor (800 cfm) ▪ Audio/visuals 	
7. Operations and maintenance of air compressors	Able to operate and maintain air compressors to be used with all pneumatic drilling units (i.e. Top hammer, DTH, Jack-hammer etc)	<p>Knowledge of:</p> <ul style="list-style-type: none"> - 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 <p>Ability to:</p> <ul style="list-style-type: none"> - Operate and maintain air compressors 	28	<ul style="list-style-type: none"> ▪ Air compressor (800 cfm) (e.g. Comp Air) ▪ Tool box ▪ Oil and grease 	Classroom & Workplace
8. Exploratory core drilling procedure	Understand the drilling process conducted for mineral exploration and geotechnical site characterizations	<p>Knowledge of:</p> <ul style="list-style-type: none"> - 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 	33	<ul style="list-style-type: none"> ▪ Exploratory core drilling rig ▪ Core barrels ▪ Core boxes 	Classroom & Workplace

		<ul style="list-style-type: none"> - Drill bit replacement - Sample acquisition from core barrels - Waxing and preservation of obtained samples <p>Ability to:</p> <ul style="list-style-type: none"> - Perform exploratory core drilling unit 			
9. Preventive maintenance of various drilling equipments	Understand the importance of maintenance procedures of different drilling equipments	<p>Knowledge of:</p> <ul style="list-style-type: none"> - Principles and objectives of preventive maintenance - Scheduled maintenance - Use of maintenance logs - Oiling and greasing procedures - Lubrication points in different drilling equipment <p>Ability to:</p> <ul style="list-style-type: none"> - Conduct preventive maintenance of different drilling equipment 	23	<ul style="list-style-type: none"> ▪ 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)

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
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 Dont'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	<p>Knowledge of:</p> <ul style="list-style-type: none"> - Introduction to blasting accessories - Detonating cords - Nonel detonators / Leher - Safety fuse - Delay relays - Plain detonators - Electric detonators - Electric blasting machine <p>Ability to:</p> <ul style="list-style-type: none"> - Recognize different blasting accessories and their uses. 	25	<ul style="list-style-type: none"> ▪ 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	<p>Knowledge of:</p> <ul style="list-style-type: none"> - Brief introduction - Ammonium Nitrate and fuel oil optimum ratio - Preparation procedure - Heavy ANFO <p>Ability to:</p> <ul style="list-style-type: none"> - Prepare ANFO and Heavy ANFO 	33	<ul style="list-style-type: none"> ▪ 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	<p>Knowledge of:</p> <ul style="list-style-type: none"> - 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 <p>Ability to:</p> <ul style="list-style-type: none"> - Perform explosives charging in blastholes 	43	<ul style="list-style-type: none"> ▪ Detonating cord ▪ Nonel / Leher detonators ▪ High explosive (Wabox, Wabonite, Tovex etc) ▪ ANFO 	Classroom & Workplace
8. Stemming	Understand the	<p>Knowledge of:</p>	17	<ul style="list-style-type: none"> ▪ Stemming rod 	Classroom &

procedure	importance of stemming / confinement procedure	<ul style="list-style-type: none"> - Basic concept - Stemming materials - Stemming procedure Ability to: <ul style="list-style-type: none"> - Perform stemming procedure 		(Aluminum) <ul style="list-style-type: none"> ▪ Tamping rod (Wooden) ▪ Moisturized clay 	Workplace
9. Initiation/Firing procedure of explosives	Able to initiate the blast, safely at any surface mining operation	Knowledge of: <ul style="list-style-type: none"> - Initiation theory - Proper trunk lines and down lines connections - Clove-hitch knot - Placement of delay relays - Safety fuse and plain detonator connection - Ignition of safety fuse - Electric initiations Ability to: <ul style="list-style-type: none"> - Conduct safe explosive initiation/firing 	35	<ul style="list-style-type: none"> ▪ Detonating cords ▪ Delay relays ▪ Safety fuse ▪ Plain detonators ▪ Electric detonators ▪ Electric blasting machine 	Classroom & Workplace
10. Storage of explosives and detonators	Understand the importance of proper storage of explosive as per Rules and Regulations	Knowledge of: <ul style="list-style-type: none"> - Storage magazine design - Ventilation requirements - Floor preparations - Installation of lightening rod - Detonator storage - Security of magazine - Sign-in and sign-out procedures Ability to: <ul style="list-style-type: none"> - Store the explosives and detonator as per rules and regulations 	25	<ul style="list-style-type: none"> ▪ Lecture notes ▪ Drawings ▪ Lightning rods ▪ Wooden sheets ▪ Face masks 	Classroom & Workplace

Module 4: Loading and Transporations

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)

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
1. Introduction to loading and transportation equipments	Able to identify various loading and transportation equipments used in mining operations	Knowledge of: <ul style="list-style-type: none"> - Introduction to logistics in surface mining - Loading equipments - Transportation equipments 	05	<ul style="list-style-type: none"> ▪ 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: <ul style="list-style-type: none"> - 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: <ul style="list-style-type: none"> - Operate the front-end loader for loading the raw material 	28	<ul style="list-style-type: none"> ▪ 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: <ul style="list-style-type: none"> - Introduction - Machinery specifications - Safety precautions - Start-up / shut-down 	28	<ul style="list-style-type: none"> ▪ Equipment manual ▪ Loading shovel (Caterpillar 966H or Volvo L150 etc) 	Classroom & Workplace

		<ul style="list-style-type: none"> - Hydraulic controller - Filling the bucket - Lifting the load - Rollback carrying load - Dumping the bucket - Face cutting <p>Ability to:</p> <ul style="list-style-type: none"> - Operate the loading shovel - Perform face cutting 			
4. Operating procedure of Dozer/Ripper equipment	Understand the workings of dozer/ripper, rock cuttings, haul road preparations and grade/slope preparations	<p>Knowledge of:</p> <ul style="list-style-type: none"> - 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 <p>Ability to:</p> <ul style="list-style-type: none"> - Operate the dozer/ripper - Prepare haul roads 	28	<ul style="list-style-type: none"> ▪ Equipment manual ▪ Dozer/Ripper (Caterpillar D9) 	Classroom & Workplace
5. Operating procedure of Rear-dump trucks / Dumpers	Able to operate rear-dump trucks / dumper for transportations of raw material from mine site to crusher or stock yard	<p>Knowledge of:</p> <ul style="list-style-type: none"> - Introduction - Machinery specifications - Safety precautions - Start-up / shut-down - Safe driving practices - Preparing for loading - Driving upgrade - Driving downgrade 	28	<ul style="list-style-type: none"> ▪ Equipment manual ▪ Rear-Dump trucks / Dumper (Nissan or Caterpillar) 	Classroom & Workplace

		<ul style="list-style-type: none"> - Driving at curves/ blind turns - Dumping - Controlled spreading - Operations in extreme weather conditions <p>Ability to:</p> <ul style="list-style-type: none"> - Operate the rear-dump trucks/dumper for raw material transportation 			
6. Operation and maintenance of Belt conveyors system	Able to operate the belt conveying system including parts replacement and maintenance	<p>Knowledge of:</p> <ul style="list-style-type: none"> - 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) <p>Ability to:</p> <ul style="list-style-type: none"> - Operate and maintain the belt conveyors 	18	<ul style="list-style-type: none"> ▪ Belt conveyor system ▪ Tool box ▪ Oil and lubricants 	Classroom & Workplace
7. Preventive maintenance of front-end loader and shovels	Able to conduct preventive maintenance of front-end loader and shovels	<p>Knowledge of:</p> <ul style="list-style-type: none"> - Bucket frame attachment and detachment - Cutter teeth replacement - Lubrication at all moving and hinge points - Hydraulic oil checking and replacement - Boom cylinders lubrication <p>Ability to:</p> <ul style="list-style-type: none"> - Carry out preventive maintenance 	17	<ul style="list-style-type: none"> ▪ Tool box ▪ Oil and grease ▪ Oiling and greasing gun ▪ Industrial cotton wipes ▪ Hydraulic oils 	Classroom & Workplace

		of front-end loaders and shovels			
8. Preventive maintenance of dozer/rippers	Able to conduct preventive maintenance of dozer/ripper	<p>Knowledge of:</p> <ul style="list-style-type: none"> - 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 <p>Ability to:</p> <ul style="list-style-type: none"> - Perform preventive maintenance of dozer/rippers 	17	<ul style="list-style-type: none"> ▪ 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	<p>Knowledge of:</p> <ul style="list-style-type: none"> - General auto maintenance procedure - Boom cylinder lubrications - Hydraulic pump maintenance - Hydraulic oil checking and replacement <p>Ability to:</p> <ul style="list-style-type: none"> - Carry out preventive maintenance of dumpers 	17	<ul style="list-style-type: none"> ▪ Tool box ▪ Oil and grease ▪ Oiling and greasing gun ▪ Industrial cotton wipes ▪ Hydraulic oils 	Classroom & Workplace

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)

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
1. Introduction to crushing and screening of rocks	Able to explain the crushing and screening of rocks	Knowledge of: <ul style="list-style-type: none"> - Introduction - Basic comminution concept - Open circuit and close circuit crushing - Screens 	05	<ul style="list-style-type: none"> ▪ Lecture notes ▪ Audio/visuals 	Classroom
2. Types of crushers and screens used in mining industry	Recognition and identification of different crushers and screens and their functional components	Knowledge of: <ul style="list-style-type: none"> - Classification of crushers - Primary crushers - Secondary crushers - Tertiary crushers - Grizzlies, vibrating and shaking screens 	05	<ul style="list-style-type: none"> ▪ Lecture notes ▪ Audio/visuals 	Classroom
3. Operations of Primary Jaw crushers	Able to perform crushing of run-of-mine rocks using Jaw crusher	Knowledge of: <ul style="list-style-type: none"> - Basic components - Start-up / Shut-down - Feed/hopper control - Gap-set ratio adjustment - Product size control Ability to: <ul style="list-style-type: none"> - Operate primary jaw crushers 	35	<ul style="list-style-type: none"> ▪ Equipment manual ▪ Jaw crusher 	Classroom & Workplace
4. Operations of Rotary Impact crushers	Able to perform crushing of run-of-mine rocks using rotary impact crusher	Knowledge of: <ul style="list-style-type: none"> - Basic components - Start-up / Shut-down - Feed/hopper control - Hammer speed control - Gap-set ratio adjustment 	35	<ul style="list-style-type: none"> ▪ Equipment manual ▪ Rotary impact crusher 	Classroom & Workplace

		<ul style="list-style-type: none"> - Product size control <p>Ability to:</p> <ul style="list-style-type: none"> - Operate the rotary impact crushers 			
5. Preventive maintenance of crushers and screens	Able to conduct preventive maintenance of different types of crushers and screens	<p>Knowledge of:</p> <ul style="list-style-type: none"> - 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 <p>Ability to:</p> <ul style="list-style-type: none"> - Conduct the preventive maintenance of different crushers and screens 	35	<ul style="list-style-type: none"> ▪ Tool box ▪ Oil and grease ▪ Oiling and greasing gun ▪ Industrial cotton wipes ▪ Hydraulic oils 	Classroom & Workplace

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)

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
1. General workplace safety rules and procedures	Understand the possible dangerous situations which might leads to accidents/disaster in and around the surface mining operations	Knowledge of: <ul style="list-style-type: none"> - Hazardous situations - Recognition of dangerous occurrences - Emergency plans - General workplace safety precautions - Warning signs 	05	<ul style="list-style-type: none"> ▪ 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	Knowledge of: <ul style="list-style-type: none"> - Helmets and safety shoes - Half and full face dust masks - Hard and soft gloves - Safety goggles/glasses - Hearing protections - Oxygen breathing apparatus Ability to: <ul style="list-style-type: none"> - Use different personal protective equipments (PPE's) 	15	<ul style="list-style-type: none"> ▪ 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	Knowledge of: <ul style="list-style-type: none"> - Causes of fire - Fire triangle - Extinguishing different materials fire (oil, wood, plastic etc) - Use of CO₂, water and foaming fire extinguishers - Fire escaping procedures Ability to: <ul style="list-style-type: none"> - Perform fire fighting in event of 	12	<ul style="list-style-type: none"> ▪ Different materials (i.e. oil, wood, plastics etc) ▪ Fire extinguishers (CO₂, water and foam) 	Classroom & Workplace

		any emergency			
4. Communication skills (hand signals, radio communications etc)	Able to communicate non-verbally and verbally in the field	Knowledge of: <ul style="list-style-type: none"> - Hand signs for different work activities - Walkie-talkie radio 2 way communications Ability to: <ul style="list-style-type: none"> - Use different communication tools at workplace 	12	<ul style="list-style-type: none"> ▪ 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: <ul style="list-style-type: none"> - 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: <ul style="list-style-type: none"> - Respond to any accident and provide basic first aid to an injured worker 	22	<ul style="list-style-type: none"> ▪ Lecture notes ▪ Audio/visuals ▪ First-Aid kits 	Classroom & Workplace

Assessment

MODULE 1: INTRODUCTION TO SURFACE MINING

Learning Units	Theory Days /hours	Work place Days /hours	Recommended formative assessment	Recommended methodology	Scheduled dates
1. Introduction to surface mining operations	03	--	Trainee will: ✓ Explain basic concepts of surface mining operations	<ul style="list-style-type: none"> ▪ Oral ▪ MCQs ▪ Short questions 	At the end of module
2. Basic terminology used in surface mining	05	05	Trainee will: ✓ Explain and identify different geometrical attributes of any surface mine and related technical terms (i.e. Burden, spacing, toe, crest, slope etc)	<ul style="list-style-type: none"> ▪ Oral ▪ Practical/Demonstration ▪ MCQs ▪ Short questions 	At the end of module
3. Surface mining methods	05	--	Trainee will: ✓ Recognize and differentiate between various surface mining methods applicable to different types of minerals/rocks	<ul style="list-style-type: none"> ▪ Oral ▪ MCQs ▪ Short questions 	At the end of module
4. Basic unit operations in surface mining	05	--	Trainee will: ✓ Demonstrate clear understanding of all the important unit operations at any surface mine	<ul style="list-style-type: none"> ▪ Oral ▪ MCQs ▪ Short questions 	At the end of module
5. Identifications of different industrial rocks and minerals	05	05	Trainee will: ✓ Recognize different rocks and minerals	<ul style="list-style-type: none"> ▪ Oral ▪ Practical/Demonstration 	At the end of module

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

Learning Units	Theory Days /hours	Work place Days/ hours	Recommended formative assessment	Recommended methodology	Scheduled dates
1. Introduction to rock drilling process	03	--	Trainee will: ✓ Explain the rock drilling process	<ul style="list-style-type: none"> ▪ 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	<ul style="list-style-type: none"> ▪ 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	<ul style="list-style-type: none"> ▪ 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	<ul style="list-style-type: none"> ▪ 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	<ul style="list-style-type: none"> ▪ Oral ▪ Practical/Demonstration 	At the end of module

Down-the-hole hammer (DTH) drills			<p>hammer drill (DTH)</p> <ul style="list-style-type: none"> ✓ Identify different functional components ✓ Demonstrate full operations of the drill, including startup and shut down, drill rod changing, raising and lowering, crawling etc 	<ul style="list-style-type: none"> ▪ MCQs ▪ Short questions 	
6. Operating procedure of Jack-hammer / Handheld drills	03	25	<p>Trainee will:</p> <ul style="list-style-type: none"> ✓ Explain basic working principle of Jack hammer drill ✓ Identify different functional components ✓ Demonstrate complete operation of the drill, including startup and shut down, drill rod changing, raising and lowering, crawling etc 	<ul style="list-style-type: none"> ▪ Oral ▪ Practical/Demonstration ▪ MCQs ▪ Short questions 	At the end of module
7. Operations and maintenance of air compressors	03	25	<p>Trainee will:</p> <ul style="list-style-type: none"> ✓ Explain basic working principle of Air Compressors ✓ Identify different functional components ✓ Demonstrate full operations of the air compressors, including startup and shut down, air hose connections, quantity and pressure control ✓ Explain the maintenance procedures for air compressors 	<ul style="list-style-type: none"> ▪ Oral ▪ Practical/Demonstration ▪ MCQs ▪ Short questions 	At the end of module
8. Exploratory core drilling procedure	03	30	<p>Trainee will:</p> <ul style="list-style-type: none"> ✓ 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. 	<ul style="list-style-type: none"> ▪ Oral ▪ Practical/Demonstration ▪ MCQs ▪ Short questions 	At the end of module
9. Preventive	03	20	Trainee will:	<ul style="list-style-type: none"> ▪ Oral 	At the end of

maintenance of various drilling equipments			<ul style="list-style-type: none"> ✓ Explain preventive and scheduled maintenance procedure of different drilling equipment ✓ Demonstrate oiling and greasing procedure ✓ Explain the use of maintenance log 	<ul style="list-style-type: none"> ▪ Practical/Demonstration ▪ MCQs ▪ Short questions 	module
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Supportive notes

- **Assessment context:**
This module provide understanding 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 procedure for equipment and personals.
- **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

Learning Units	Theory Days /hours	Work place Days/ hours	Recommended formative assessment	Recommended methodology	Scheduled dates
1. Introduction to explosives and blasting	03	--	Trainee will: ✓ Explain the explosives and their composition ✓ Explain the rock blasting procedures	<ul style="list-style-type: none"> ▪ 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	<ul style="list-style-type: none"> ▪ 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	<ul style="list-style-type: none"> ▪ Oral ▪ MCQs ▪ Short questions 	At the end of module
4. Blasting terminologies	05	--	Trainee will: ✓ Identify and explain different blasting and explosive terms	<ul style="list-style-type: none"> ▪ 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	<ul style="list-style-type: none"> ▪ 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	<ul style="list-style-type: none"> ▪ 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	<ul style="list-style-type: none"> ▪ Oral ▪ Practical/Demonstration ▪ MCQs 	At the end of module

			✓ Demonstrate the pouring of blasting agent in blast holes	▪ Short questions	
8. Stemming procedure	02	15	Trainee will: ✓ Explain the basic concept of stemming procedure ✓ Demonstrate the proper selection of stemming material ✓ Demonstrate the stemming and tamping procedure	▪ Oral ▪ Practical/Demonstration ▪ MCQs ▪ Short questions	At the end of module
9. Initiation/Firing procedure of explosives	05	30	Trainee will: ✓ Explain the initiation theory ✓ Demonstrate the layout of trunk and downline detonating cord ✓ Demonstrate the knotting procedure of detonating cord ✓ Demonstrate the placement of delay relays ✓ Demonstrate the connection of safety fuse and plain detonator ✓ Demonstrate ignition of safety fuse	▪ Oral ▪ Practical/Demonstration ▪ MCQs ▪ Short questions	At the end of module
10. Storage of explosives and detonators	05	20	Trainee will: ✓ Explain the safety procedure for storage and handling of explosive and detonators ✓ Explain the magazine design and ventilation requirements ✓ Demonstrate the installations of wooden floors and lightning rods	▪ Oral ▪ Practical/Demonstration ▪ MCQs ▪ Short questions	At the end of module

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

Learning Units	Theory Days /hours	Work place Days/ hours	Recommended formative assessment	Recommended methodology	Scheduled dates
1. Introduction to loading and transportation equipments	05	--	Trainee will: ✓ Identify various loading and transportation equipments used in mining operations	<ul style="list-style-type: none"> ▪ Oral ▪ MCQs ▪ Short questions 	At the end of module
2. Operating procedure of front-end loader	03	25	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.	<ul style="list-style-type: none"> ▪ Oral ▪ Practical/Demonstration ▪ MCQs ▪ Short questions 	At the end of module
3. Operating procedure of loading shovel	03	25	Trainee will: ✓ Explain basic working principle of loading shovel ✓ Identify and explain different functional	<ul style="list-style-type: none"> ▪ Oral ▪ Practical/Demonstration ▪ MCQs ▪ Short questions 	At the end of module

			<p>components and machine specifications</p> <ul style="list-style-type: none"> ✓ Demonstrate complete operations of loading shovel including startup and shutdown, hydraulic controls, bucket filling, lifting, rollback, dumping, digging, back filling, face cutting etc. 		
4. Operating procedure of Dozer/Ripper equipment	03	25	<p>Trainee will:</p> <ul style="list-style-type: none"> ✓ 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 	<ul style="list-style-type: none"> ▪ Oral ▪ Practical/Demonstration ▪ MCQs ▪ Short questions 	At the end of module
5. Operating procedure of Rear-dump trucks / Dumpers	03	25	<p>Trainee will:</p> <ul style="list-style-type: none"> ✓ 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 	<ul style="list-style-type: none"> ▪ Oral ▪ Practical/Demonstration ▪ MCQs ▪ Short questions 	At the end of module
6. Operation and maintenance of Belt conveyors system	03	15	<p>Trainee will:</p> <ul style="list-style-type: none"> ✓ 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, 	<ul style="list-style-type: none"> ▪ Oral ▪ Practical/Demonstration ▪ MCQs ▪ Short questions 	At the end of module

			cleanup, lubrication, parts replacement etc.		
7. Preventive maintenance of front-end loader and shovels	02	15	Trainee will: ✓ Explain preventive and scheduled maintenance procedure of front-end loader and loading shovels ✓ Demonstrate parts replacement procedures ✓ Demonstrate oiling and greasing procedure ✓ Explain the use of maintenance log	▪ Oral ▪ Practical/Demonstration ▪ MCQs ▪ Short questions	At the end of module
8. Preventive maintenance of dozer/rippers	02	15	Trainee will: ✓ Explain preventive and scheduled maintenance procedure of dozer/ripper ✓ Demonstrate parts replacement procedures ✓ Demonstrate oiling and greasing procedure ✓ Explain the use of maintenance log	▪ Oral ▪ Practical/Demonstration ▪ MCQs ▪ Short questions	At the end of module
9. Preventive maintenance of dump trucks	02	15	Trainee will: ✓ Explain preventive and scheduled maintenance procedure of dumpers ✓ Demonstrate parts replacement procedures ✓ Demonstrate oiling and greasing procedure ✓ Explain the use of maintenance log	▪ Oral ▪ Practical/Demonstration ▪ MCQs ▪ Short questions	At the end of module

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

Learning Units	Theory Days /hours	Work place Days/ hours	Recommended formative assessment	Recommended methodology	Scheduled dates
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	<ul style="list-style-type: none"> ▪ 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	<ul style="list-style-type: none"> ▪ 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	<ul style="list-style-type: none"> ▪ 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	<ul style="list-style-type: none"> ▪ Oral ▪ Practical/Demonstration ▪ MCQs ▪ Short questions 	At the end of module

			✓ Demonstrate complete operations of rotary impact crushers, including startup and shutdown, feed control, gap-set adjustment, product size control, hammer speed control etc		
5. Preventive maintenance of crushers and screens	05	30	Trainee will: ✓ Explain preventive and scheduled maintenance procedure of different types of crushers and screens ✓ Demonstrate parts replacement procedures ✓ Demonstrate oiling and greasing procedure ✓ Explain the use of maintenance log	▪ Oral ▪ Practical/Demonstration ▪ MCQs ▪ Short questions	At the end of module

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
- **Resources required for assessment**
Access to primary jaw crushers, rotary impact crushers, tool boxes, lubricants etc should be provided to the trainees.

MODULE 6: HEALTH, SAFETY AND ENVIRONMENT (HSE)

Learning Units	Theory Days /hours	Work place Days/ hours	Recommended formative assessment	Recommended methodology	Scheduled dates
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	<ul style="list-style-type: none"> ▪ 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	<ul style="list-style-type: none"> ▪ 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	<ul style="list-style-type: none"> ▪ 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	<ul style="list-style-type: none"> ▪ Oral ▪ Practical/Demonstration ▪ MCQs ▪ Short questions 	At the end of module

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

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

Name of Trade	SURFACE MINING
Duration	06 Months

Sr. No.	Name of Item/ Equipment / Tools	Qty.
1.	Rocks and Minerals Display Specimens (Box)	05
2.	Top-hammer drilling unit with all drilling accessories (LM300 Ingersoll rand) (<i>can be hired</i>)	02
3.	Down-the-Hole Hammer (DTH) drilling unit with all essential accessories, (e.g. Ingersoll rand or Atlas copco) (<i>can be hired</i>)	02
4.	Jack-hammer handheld drill	02
5.	Air compressor (800 cfm) (e.g. Comp Air)	02
6.	Standard Toolbox	10
7.	Exploratory Core drilling rig (<i>can be hired</i>)	02
8.	Greasing gun	08
9.	Oiling gun	08
10.	Stemming rod & Tamping rods	10
11.	Front-end loader (Caterpillar 950F etc) (<i>can be hired</i>)	02
12.	Loading shovel (Caterpillar 966H or Volvo L150 etc) (<i>can be hired</i>)	02
13.	Dozer/Ripper (Caterpillar D9) (<i>can be hired</i>)	02
14.	Rear-Dump trucks / Dumper (Nissan or Caterpillar) (<i>can be hired</i>)	06
15.	Jaw crusher (<i>can be hired</i>)	01
16.	Rotary Impact crusher (<i>can be hired</i>)	01
17.	BG-164 Breathing Apparatus	02
18.	CO2 and Foam Fire Extinguisher	10
19.	Belt Conveyor System (<i>site visit</i>)	01

List of Consumable Supplies

Name of Trade	SURFACE MINING
Duration	06 Months

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

Reference Books

1. “Introductory Mining Engineering” By H.L. Hartman
2. “Surface Mining” B.A. Kennedy
3. “SME- Mining Engineering Handbook” By Society of Mining, Metallurgy and Exploration Inc.
4. Equipment Manuals

Contributions for Development of This Curriculum

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