



*National Competency Standards for “Supervisor in Mining Process Technology”*



**National Competency Standards  
for  
“Level 5- Mining Process Technology”**



**National Vocational and Technical Training Commission (NAVTTTC),  
Government of Pakistan**



## **ACKNOWLEDGEMENT**

National Vocational and Technical Training Commission (NAVTTTC) extends its gratitude and appreciation to representatives of business, industry, academia, government agencies, provincial TEVTAs, sector skill councils and trade associations who spared time and extended their expertise for the development of National Vocational Qualifications for the trade of **Mining Process Technology**. This work would not have been possible without the technical support of the above personnel.

NAVTTTC initiated development of CBT&A based qualifications for 200 traditional / hi-tech trades under the Prime **Minister’s Hunarmand Pakistan Program**, focusing on Development & Standardization of 200 Technical & Vocational Education & Training (TVET) Qualifications. NAVTTTC efforts have received full support from the Ministry of Federal Education and Professional Training, which highly facilitated progress under this initiative.

It may not be out of place to mention here that all the experts of Industry, Academia, VET TEVTAs, BTEs and PVTC work diligently for making this qualification worthy and error free for which all credit goes to them. However, NAVTTTC accepts the responsibility of all the errors and omissions still prevailing in the qualification document.

Development of Skill Standards is a dynamic and ongoing process, and the developed skill standards need periodic review and updating owing to the constant technological advancements, development in scientific knowledge, and growing experience of implementation at the grass root level as well as the demand of industry. NAVTTTC will ensure to keep the qualifications abreast with the changing demands of both national and international job markets.

**Executive Director,  
NAVTTTC**



*National Competency Standards for “Supervisor in Mining Process Technology”*



## Contents

<b>1. Introduction .....</b>	<b>4</b>
<b>2. Purpose of the Qualification .....</b>	<b>5</b>
<b>3. Date of Validation .....</b>	<b>6</b>
<b>4. Date of Review.....</b>	<b>6</b>
<b>5. Codes of Qualifications .....</b>	<b>6</b>
<b>6. Members of Qualification Development Committee .....</b>	<b>7</b>
<b>7. Members of Qualification Validation Committee.....</b>	<b>8</b>
<b>8. ENTRY REQUIREMENTS .....</b>	<b>8</b>
<b>9. Regulation of the Qualification and schedule of units .....</b>	<b>8</b>
<b>10. Summary of Competency Standards .....</b>	<b>8</b>
<b>11. Details of competency standards .....</b>	<b>10</b>
Level 5 - Supervisor in Mining Process.....	10
724MP15A-Manage Safety at Mining Site.....	10
724MP15B-Carry out Dewatering Activities .....	13
724MP15C-Perform Soil Profiling .....	15
724MP15 D- Interpret Geophysical Data Collection .....	17
724MP15 E-Perform Evaluation of Minerals .....	19
724MP15 F- Apply Arc GIS and Google Earth in Mining Technology .....	21
724MP15 G-Perform Quality Control of Aggregate, Concrete, Grout and Shotcrete .....	23
724MP15 H-Evaluate Rock Mechanics and Ground Control.....	26
724MP15I-Perform Mine Ventilation Design and Process .....	28
724CO11J -Competency Standard: Manage and Supervise the Job Activities .....	30
724CO11K- Competency Standard: Plan a Project in Primavera P6 .....	33
041300860L -Competency Standard: Develop Entrepreneurial Skills .....	35
724CO11M-Competency Standard: Practice Professionalism .....	37
Complete list of Tools and Equipment.....	37



## 1. Introduction

Mining technology is extraction of valuable minerals ores like Manganese, tantalum, Cassiterite, copper, tin, nickel, bauxite, iron, gold, silver, and diamonds or other geological materials from the surface or under the earth. Usually, these ore bodies in the form of lode, vein, seam, reef, or placer deposit. In other words, it is industrial activity that removes rock from the Earth's crust and processes it to remove valuable minerals for us to use. This technology in a wider sense also includes extraction of any non-renewable resource such as petroleum, natural gas, or even water.

Primarily, there are two types of mining methods being used for the extraction of minerals and ores; surface/opencast mining and underground mining. The choice of method is largely determined by factors such as depth, geology of the mineral deposit and the cost of equipment. When evaluating mineral deposits, it is extremely important to keep profit in mind. The total quantity of mineral in a given deposit is referred to as the mineral inventory, but only that quantity that can be mined at a profit is termed ore reserves.

The overall sequence of activities in modern mining is often compared with the five stages in the life of a mine: prospecting, exploration, development, exploitation, and reclamation. In the first Prospecting stage; geophysical, geochemical procedures, Location of favourable loci (maps, literature, and old mines), Air source/aerial photography, airborne geophysics, satellite, Surface/ground geophysics, geology and Spot anomaly is evaluated. Exploration (Ore body); Sample (drilling or excavation), assay, testing analysis, Estimation tonnage and grade, Valuate deposit: present value, income cost, Feasibility study: make decision to abandon or develop. Development (Prospect); Acquire mining rights (purchase or lease), File environmental impact statement, technology, assessment, permit, Construct access roads, transport system, Locate surface plant, construct facilities, Excavate deposit (strip or sink shaft). Exploitation (Mine); Factors in choice of methods like geologic, geographic, economic, environmental, societal safety, Types of mining methods. Surface: open pit, open cast, etc. Underground: room and pillar, block caving, etc. Monitor costs and economic payback. Reclamation (Real estate); Removal of plant and buildings. Reclamation of waste and tailings dumps, Monitoring of discharges

Being cognizant of this fact, National Vocational & Technical Training Commission (NAVTTTC) developed competency standards for Mining and mineral technology training under National Vocational Qualifications Framework (NVQF). These competency standards have been developed by a Qualifications Development Committee (QDC) and validated by the Qualifications Validation Committee (QVC) having representation from the leading development in mining area of the country.



## **2. Purpose of the Qualification**

The competency based NVQ has been developed to train the unskilled men and women of Pakistan on the technical and entrepreneurial skills to be employed / self-employed and inevitably set sustainable impact on their lives by enhancing their livelihood income.

The purpose of these qualifications is to set professional standards for upcoming experts, who will serve as key elements enhancing quality of Pakistan's mining sector. The specific objectives of developing these qualifications are as under:

- Improve the professional competencies of individual in metallurgy and cast metal technology
- Capacitate the local community and trainers in modern CBT trainings, methodologies and processes as envisaged under NVQF
- Provide flexible pathways and progressions in metallurgy and cast metal technology
- Enable the trainees to perform their duties in efficient manner
- Establish a standardized and sustainable system of training in Pakistan
- Enabling the youth with greater employment opportunities



*National Competency Standards for “Supervisor in Mining Process Technology”*



### 3. Date of Validation

The level 5 Mining Process Technology qualification has been validated on 04 Oct to 08 Oct, 2021 at PITAC, Lahore, by the qualification validation committee (QVC) members.

### 4. Date of Review

The qualification shall be reviewed after 3 years.

### 5. Codes of Qualifications

Qualification Title	Code
National Vocational Certificate Level 5 in Mining Process Technology “ <b>Supervisor</b> ”	<b>724MP15</b>



**National Competency Standards for “Supervisor in Mining Process Technology”**



## 6. Members of Qualification Development Committee

The following members participated in the qualification development process at PITAC, Lahore.

**Date:** 13 to 17 August 2021.

S#	Name	Designation
1.	Dr. Shahid Tufail Sheikh	Member Science, Ex-Head of MPRC Lahore
2.	Dr. Farhat Yasmeen	Professor, UET Lahore
3.	Dr. Muhammad Naeem Khan	AP, Govt Science College Wahdat Road, Lahore
4.	Dr. Irfan Hafeez	Senior Scientific Officer, PCSIR Lahore
5.	Dr. Asma Sheikh	Scientific Officer, PCSIR Lahore
6.	Dr. Shafialftikhar	AP, University of Sahiwal
7.	Muhammad Irfan Zubair	Deputy Director GSP, Lahore
8.	Shahbaz Muhammad	Assistant geophysicist GSP, Lahore
9.	Hafiz ZeeshanAkram	Assistant Director GSP, Lahore
10.	Muhammad Shahzad	Director, NAVTTC, Islamabad
11.	Engr.Saba Sadiq	DACUM FACILITATOR, Islamabad





## 7. Members of Qualification Validation Committee

The following members participated in the qualification development process at PITAC, Lahore. **Date: Oct 4<sup>th</sup> 2021 to Oct 8<sup>th</sup> 2021**

S#	Name	Designation
1.	Aftab Hussain	DACUM Facilitator/ Principal P-TEVTA Rawalpindi
2.	Dr. Shahid Tufail Sheikh	
3.	Dr. Farhat Yasmeen	Professor, UET Lahore
4.	Dr. Muhammad Naeem Khan	AP, Govt Science College Wahdat Road, Lahore
5.	Dr. Irfan Hafeez	Senior Scientific Officer, PCSIR Lahore
6.	Engr. Shafaat Ali	Lecturer (Mining) GCT KharBajaur
7.	Engr. M. Muneebur Rehman Khan	Measurement Engineer, ACC PVT Ltd
8.	Zeeshan Musadiq	Data Engineer/Mudlogger (Geologist) Petro Services
9.	Tariq Mehmoob	Incharge Operational Wing PBTE, Lahore
10.	Mr. Tahir Shah	Assistant Secretary TTB Peshawar
11.	Syed Mansoor Ahmed	Assistant Manager IT, NVQF Registry Incharge, SBTE Sindh

## 8. ENTRY REQUIREMENTS

. For National Vocational Certificate Level-5 in Mining process Technology “Supervisor”, the entry requirement is Level-4 in Mining process Technology “Assistant Supervisor” in formal institute. The entry in informal sector is not prescribed.

## 9. Regulation of the Qualification and schedule of units

Not applicable

## 10. Summary of Competency Standards





**National Competency Standards for “Supervisor in Mining Process Technology”**



Sr.N o	Competency Standards	NVQF Level	Category	Estimated Contact Hr.			Credit Hr.
				Th.	Pr.	Total	
Supervisor in Mining Process Technology -LEVEL 5							
1.	Carry out Dewatering Activities	5	Technical	32	48	80	8
2.	Perform Soil Performing	5	Technical	24	36	60	6
3.	Interpret Geophysical Data Collection	5	Technical	15	45	60	6
4.	Perform Evaluation of Minerals	5	Technical	40	60	100	10
5.	Apply Arc GIS and Google Earth in Mining Technology	5	Technical	27	33	60	6
6.	Perform Quality Control of Aggregate, Concrete, Grout and Shotcrete	5	Technical	43	57	100	10
7.	Evaluate Rock Mechanics and Ground Control	5	Technical	27	33	60	6
8.	Perform Mine Ventilation Design and Process	5	Technical	20	30	50	5
9.	Manage Safety at Mining Site	5	Generic	24	36	60	6
10.	Manage and Supervise the Job Activities	5	Generic	32	48	80	8
11.	Plan a Project in Primavera P6	5	Generic	60	90	150	15
12.	Develop Entrepreneurial Skills	5	Generic	16	24	40	40
13.	Practice Professionalism	5	Generic	120	180	300	30
Total				480	720	1200	120



## 11. Details of competency standards

### Level 5 - Supervisor in Mining Process

#### 724MP15A-Manage Safety at Mining Site

**Overview:** This competency standard covers the skills and knowledge required to implement and maintain safe working practices at site. Your underpinning knowledge will be sufficient to provide you the basis for your work.

Competency Units	Performance Criteria
<b>CU1.</b> Implement safe working practices at site	<b>You must be able to:</b> <b>P1.</b> Carry out tool box talks which require discussion on critical safety matters and hazardous site conditions pertaining to particular work etc. <b>P2.</b> Practice of Personal Protective Equipment (PPE) <b>P3.</b> Implement health and safety practices and ensure it is followed by subordinates <b>P4.</b> Implement safe handling and stacking methods at workplace / store <b>P5.</b> Perform appropriate posting of safety signs and boards at designated places) <b>P6.</b> Barricade all un-protected openings at the workplace <b>P7.</b> Implement and check near miss reporting <b>P8.</b> Provide safe access at work place for movement of workers & materials. <b>P9.</b> Conduct emergency response drill for enhancing importance of safety among the workers as per the policy of organization
<b>CU2.</b> Maintain safe work environment	<b>You must be able to:</b> <b>P1.</b> Use defined safe work practices and personal protective equipment to ensure personal safety at the workplace <b>P2.</b> Collect and/or dispose of all waste in accordance with environmental requirements and workplace procedures



	<b>P3.</b> Check condition and serviceability of equipment before storage.
<b>CU3.</b> Report and Investigate the accident at plant site	<p><b><i>You must be able to:</i></b></p> <p><b>P1.</b> Identify any injured employee and check severity of the injury</p> <p><b>P2.</b> Provide first aid treatment if required</p> <p><b>P3.</b> Interview injured person and other involved personnel in the accident</p> <p><b>P4.</b> Collect all information related to the incident/accident at workplace</p> <p><b>P5.</b> Analyze the facts and figures by observing the accident scene</p> <p><b>P6.</b> Review your recording</p> <p><b>P7.</b> Perform risk assessment and hazard identification at the workplace</p> <p><b>P8.</b> Develop the incident report along with corrective measures to avoid future accidents</p>
<b>CU4.</b> Follow vehicle safety at workplace	<p><b><i>You must be able to:</i></b></p> <p><b>P1.</b> Follow the speed limit as per the company policy while driving vehicle at site</p> <p><b>P2.</b> Use high visibility safety vest</p> <p><b>P3.</b> Keep flag man while driving/reversing vehicle in operational areas</p> <p><b>P4.</b> Follow standard procedure related to vehicle safety at workplace</p>

### Knowledge & Understanding:

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes the knowledge of:

- Unsafe act and unsafe conditions
- Physical hazards at work site and its controlling measures
- Standard procedure of handling, storing and stacking of hazardous materials
- Safe disposal of hazardous waste
- Effect of air pollution on health
- Procedures in cases of breaches of site safety, accidents, and emergency situations



*National Competency Standards for “Supervisor in Mining Process Technology”*



as per guidelines

- Risk assessment and hazard identification
- Accident investigation procedure and format of accident report.
- Vehicle safety at workplace

### **Critical Evidence(s) Required**

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Investigate work site accident and develop the incident report along with corrective measures to avoid future accident.
- Perform risk assessment at the workplace
- Demonstrate vehicle driving safety as per policy of the organization



## 724MP15B-Carry out Dewatering Activities

**Overview:** This competency standard covers the skills and knowledge required to carry out dewatering activities. Your underpinning knowledge will be sufficient to provide you the basis for your work.

Competency Units	Performance Criteria
<b>CU1.</b> Organize Dewatering Activities	<p><b>You must be able to:</b></p> <ul style="list-style-type: none"> <li><b>P1.</b> Select equipment and attachments</li> <li><b>P2.</b> Use PPEs</li> <li><b>P3.</b> Conduct equipment pre-start (visual) checks</li> </ul>
<b>CU2.</b> Control Surface Water Run-off	<p><b>You must be able to:</b></p> <ul style="list-style-type: none"> <li><b>P1.</b> Control surface runoff using watering mechanisms</li> <li><b>P2.</b> Direct runoff to storage areas to allow settling of sediments</li> </ul>
<b>CU3.</b> Lower Water Table	<p><b>You must be able to:</b></p> <ul style="list-style-type: none"> <li><b>P1.</b> Locate and mark high water table in the given area</li> <li><b>P2.</b> Isolate dewatering area by erecting physical barricades and signage</li> <li><b>P3.</b> Construct sumps to collect water at required location</li> <li><b>P4.</b> Erect pumps, lines, fittings and ancillary equipment as required</li> <li><b>P5.</b> Use equipment to maximize dewatering</li> <li><b>P6.</b> Monitor and adjust pumping system</li> <li><b>P7.</b> Manage water table at desired level</li> </ul>
<b>U4.</b> Conduct Housekeeping Activities	<p><b>You must be able to:</b></p> <ul style="list-style-type: none"> <li><b>P1.</b> Clean attachments and other ancillary equipment</li> <li><b>P2.</b> Complete all required documentation as per given format</li> </ul>



### **Knowledge & Understanding**

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes the knowledge of:

- K1.** Dewatering methods and limitations
- K2.** Shutdown procedures
- K3.** Site procedures
- K4.** Site safety requirements

### **Tools and Equipment**

- De-watering equipment may include:
  - Ancillary equipment
  - Fittings
  - Lines
- Pads
  - Piping
  - Pumps
  - Submersible pumps

### **Critical Evidence(s) Required**

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Control surface water run-off
- Lower water table



## 724MP15C-Perform Soil Profiling

**Overview:** This competency standard covers the skills and knowledge required to perform soil profiling. Your underpinning knowledge will be sufficient to provide you the basis for your work.

Competency Units	Performance Criteria
<b>CU1.</b> Organize Area for Soil Profile Construction	<b>You must be able to:</b>  <b>P1.</b> Select equipment and attachments <b>P2.</b> Select & wear PPEs <b>P3.</b> Conduct equipment pre-start (visual) checks
<b>CU2.</b> Construct Soil Profile	<b>You must be able to:</b>  <b>P1.</b> Add materials to soil as per local vegetation requirements <b>P2.</b> Stabilize soil profile <b>P3.</b> Replicate the construction of soil profile horizons in the surrounding environment <b>P4.</b> Check landform construction <b>P5.</b> Place final soil layer <b>P6.</b> Construct soil horizon following land contour <b>P7.</b> Add nutrients to soil

### Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes the knowledge of:

- K1.** Landform
- K2.** Soil profiling
- K3.** Soil profiling techniques
- K4.** Nutrient application
- K5.** Soil requirements
- K6.** Geological and technical data
- K7.** Principals of erosion and water runoff
- K8.** Soil horizon construction methods





### **K9. Soil profiling methods**

#### **Tools & Equipment:**

- pH meter
- Conductivity meter
- Shovels
- Electronic Weighing Balance
- PPEs

#### **Critical Evidence(s) Required**

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Perform soil profiling



## 724MP15 D- Interpret Geophysical Data Collection

**Overview:** This competency standard covers the skills and knowledge required to interpret geophysical data collection. Your underpinning knowledge will be sufficient to provide you the basis for your work.

Competency Units	Performance Criteria
<b>CU1.</b> Select Geophysical Method	<b>You must be able to:</b>  <b>P1.</b> Identify geology, tectonic setting and geomorphology of the area <b>P2.</b> Identify targeted mineral zone
<b>CU2.</b> Recognize Data Acquisition	<b>You must be able to:</b>  <b>P1.</b> Layout plan of geophysical profiles targeting the mine area <b>P2.</b> Select on ground site for geophysical survey <b>P3.</b> Identify depth of penetration of targeted zone
<b>CU3.</b> Comprehend Geophysical Interpreted Models	<b>You must be able to:</b>  <b>P1.</b> Interpret 2D/3D and sub-surface of anomalous mineral zone as per given models <b>P2.</b> Measure depth and area of anomalous zones <b>P3.</b> Analyze electrical resistivity <b>P4.</b> Analyze seismic velocity <b>P5.</b> Recognize density contrast <b>P6.</b> Analyze magnetic response

### Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes the knowledge of:

- K1.** Different geophysical methods related to mining industry (gravity survey, Magnetic survey, electrical resistivity survey, induced polarization survey, gravity survey, seismic reflection/refraction survey and geophysical logging)

### Tools and Equipment

- Geophysical equipment
- Seismograph
- Gravimeter



*National Competency Standards for “Supervisor in Mining Process Technology”*



- Magnetometer
- Metal detector

### **Critical Evidence(s) Required**

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Comprehend geophysical interpreted models



## 724MP15 E-Perform Evaluation of Minerals

**Overview:** This competency standard covers the skills and knowledge required to perform physical, optical and chemical evaluation of minerals. Your underpinning knowledge will be sufficient to provide you the basis for your work.

Competency Units	Performance Criteria
<b>CU1.</b> Perform Physical Evaluation of Ore	<b>You must be able to:</b>  <b>P1.</b> Observe lustre of ore as per standard parameters <b>P2.</b> Observe Colour of ore as per standard parameters <b>P3.</b> Measure Streak for ore as per given table <b>P4.</b> Measure (MOHS) Hardness of ore <b>P5.</b> Estimate specific gravity as per standard
<b>CU2.</b> Perform Optical Evaluation of Ore	<b>You must be able to:</b>  <b>P1.</b> Carry out visual inspection for ore identification <b>P2.</b> Carry out Optical Microscopy of ore <b>P3.</b> Perform Polarized Microscopy (Pleochroism) <b>P4.</b> Carry out Birefringence
<b>CU3.</b> Perform Petrographic Studies	<b>You must be able to:</b>  <b>P1.</b> Select sample for test <b>P2.</b> Prepare the equipment for testing <b>P3.</b> Mount sample on glass slide/acrylic button <b>P4.</b> Perform grinding and polishing of the sample <b>P5.</b> Carry out microscopic studies <b>P6.</b> Perform electro-microscopic studies

### Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes the knowledge of:

**K1.**Physical, optical and chemical evaluation of minerals

### Tools and Equipment



**National Competency Standards for “Supervisor in Mining Process Technology”**



- Hardness tester
- Optical microscope
- Polarize microscope
- Electron microscope
- Thin section cutter, grinder and polisher
- Rock cutting machine
- Glass slides
- Electronic balance
- UV-VIS Spectrophotometer

**Critical Evidence(s) Required**

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Perform physical, optical and chemical evaluation of minerals



## 724MP15 F- Apply Arc GIS and Google Earth in Mining Technology

**Overview:** This competency standard covers the skills and knowledge required to apply GIS (Geographical Information System) in Mining Technology. Your underpinning knowledge will be sufficient to provide you the basis for your work.

Competency Units	Performance Criteria
<b>CU1.</b> Use of Google Earth	<b>You must be able to:</b>  <b>P1.</b> Setup Google earth as per job requirements <b>P2.</b> Access the location of the given area <b>P3.</b> Manipulate the coordinates as required <b>P4.</b> Calculate the area of the given site <b>P5.</b> Calculate the distance between different points
<b>CU2.</b> Apply Geo referencing in Arc GIS	<b>You must be able to:</b>  <b>P1.</b> Upload map sheet as required <b>P2.</b> Assign coordinate system to uploaded sheet <b>P3.</b> Apply different commands in GIS as per requirement
<b>CU3.</b> Perform analysis In Arc GIS	<b>You must be able to:</b>  <b>P1.</b> Select area for analysis <b>P2.</b> Outline the position of selected area <b>P3.</b> Identify mineral showings offshoots <b>P4.</b> Differentiate metallic and non-metallic mineral zones <b>P5.</b> Develop subsurface cross-section

### Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes the knowledge of:

- K1.** Installation of Google Earth Application
- K2.** installation of Arc GIS software
- K3.** uploading of map sheet
- K4.** Basic commands of Arc GIS
- K5.** GIS analysis



### **Tools and Equipment**

- Google Earth Application
- GIS software
- Hard copies of different map sheets
- Stationary items

### **Critical Evidence(s) Required**

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Perform analysis in GIS





## 724MP15 G-Perform Quality Control of Aggregate, Concrete, Grout and Shotcrete

**Overview:** This competency standard covers the skills and knowledge required for quality control in aggregate, concrete, grout and Shotcrete. Your underpinning knowledge will be sufficient to provide you the basis for your work.

Competency Units	Performance Criteria
<b>CU1.</b> Perform Crushing and Grinding of Ore	<b>You must be able to:</b>  <b>P1.</b> Perform crushing and grinding of the given rock sample <b>P2.</b> Perform sieve analysis using required mesh sizes <b>P3.</b> Collect and calculate the different fractions using weighing balance <b>P4.</b> Note down all values for given sample
<b>CU2.</b> Perform Impact Test	<b>You must be able to:</b>  <b>P1.</b> Place sample under the knob of impact tester <b>P2.</b> Apply the weight and obtain the reading <b>P3.</b> Note down all values, displaying on screen
<b>CU3.</b> Perform Soundness Test	<b>You must be able to:</b>  <b>P1.</b> Prepare the solution of different concentration of alkalies <b>P2.</b> Perform sodium and potassium reactivity test <b>P3.</b> Estimate the loss of material after standardized time period <b>P4.</b> Calculate the weight difference before and after treatment using weighing digital balance
<b>CU4.</b> Perform Shape Test	<b>You must be able to:</b>  <b>P1.</b> Select the rock sample for testing <b>P2.</b> Add rock sample in flakiness gauge <b>P3.</b> Calculate flakiness index
<b>CU5.</b> Perform Specific gravity test	<b>You must be able to:</b>  <b>P1.</b> Weigh the given dried sample in Air <b>P2.</b> Weigh the dried sample in water <b>P3.</b> Calculate specific gravity
<b>CU6.</b> Perform	<b>You must be able to:</b>



Absorption test	<p><b>P1.</b> Weigh the dried sample in Air</p> <p><b>P2.</b> Add the dried sample in water</p> <p><b>P3.</b> Calculate the percentage of absorption</p>
<b>CU7.</b> Perform slump test for concrete and Shotcrete	<p><b>You must be able to:</b></p> <p><b>P1.</b> Collect fresh concrete sample in slump cone at given site</p> <p><b>P2.</b> Place the concrete in cone</p> <p><b>P3.</b> Perform Roding in the concrete with temping rod</p> <p><b>P4.</b> Remove the slump cone and observe concrete flow</p> <p><b>P5.</b> Measure the value with scale as per standard</p>
<b>CU8.</b> Perform Compressive strength test of concrete and Grout	<p><b>You must be able to:</b></p> <p><b>P1.</b> Prepare cylinder/cubes of concrete for compressive strength test</p> <p><b>P2.</b> Dip cylinder/cubes in water</p> <p><b>P3.</b> Crush the cylinder/cubes in compressive strength machine</p> <p><b>P4.</b> Note down the value as per given format</p>

### Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes the knowledge of:

- K1.** Types of aggregate
- K2.** Knowledge about the weathering of Rocks.
- K3.** Knowledge about the Flaky and elongated Particles
- K4.** Archimedes' law

### Tools and Equipment

- Jaw crusher
- Roll crusher
- Ball mill
- Rod Mill
- Dry sieve Analyzer
- Wet sieve Analyzer
- SS Cylinder for Alkali silica
- Universal testing machine
- Slump cone, rod, scale
- Digital balance
- Glass ware
- Specific Gravity bottle



- Viscometer
- pH Meter

### **Critical Evidence(s) Required**

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Perform crushing and grinding of the given rock sample by using jaw and roll crusher
- Perform sieve analysis using required mesh sizes
- Perform Soundness Test
- Calculate the weight after specific time period
- Measure the value with scale as per standard
- Prepare cylinder/cubes of Concrete/Grout for compressive strength test



## 724MP15 H-Evaluate Rock Mechanics and Ground Control

### Overview:

This competency standard covers the skills and knowledge required to evaluate rock mechanics and ground control. Your underpinning knowledge will be sufficient to provide you the basis for your work.

Competency Units	Performance Criteria
<b>CU1.</b> Evaluate The Mechanical Properties of Rock	<b>You must be able to:</b>  <b>P1.</b> Identify the mechanical properties of rock (brittle, ductile) <b>P2.</b> Carry out Tri-axial test (to bear load strength of rock material) <b>P3.</b> Calculate Unconfined compressive strength (UCS) (to find the compressive strength of rock material) <b>P4.</b> Carry out Ring shear test (gives shear strength of rock as a function of confining pressure) <b>P5.</b> Carry out Split tensile test (tensile strength of material e.g., Concrete and rock like material) <b>P6.</b> Perform Beam bending test for flexure / flexure test (rock specimen is subjected to bending till failure occurs)
<b>CU2.</b> Perform geological services	<b>You must be able to:</b>  <b>P1.</b> Prepare rock sample for microscopy <b>P2.</b> Perform petrography of given sample

### Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes the knowledge of:

- K1.** Shear strength formula for rock material
- K2.** Tensile strength formula for rock material
- K3.** Modulus of rupture (flexure strength)

### Tools and Equipment

- Universal testing machine (UTM)
- Test cell, hydraulic pump
- Straight circular cylinder



***National Competency Standards for “Supervisor in Mining Process Technology”***



- Brazilian test apparatus
- Pressure jack and gauge
- Optical microscope
- Polarize microscope
- Chemicals

**Critical Evidence(s) Required**

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Evaluate The Mechanical Properties of Rock



## 724MP15I-Perform Mine Ventilation Design and Process

**Overview:** This competency standard covers the skills and knowledge required to perform mine ventilation design and process. Your underpinning knowledge will be sufficient to provide you the basis for your work.

Competency Units	Performance Criteria
<b>CU1.</b> Perform Qualitative Survey	<b>You must be able to:</b>  <b>P1.</b> Use portable gas detector <b>P2.</b> Detect gas hazard in mine <b>P3.</b> Use PPEs as required
<b>CU2.</b> Layout The Basic Mine Ventilation System	<b>You must be able to:</b>  <b>P1.</b> Perform survey for installation of ventilation system <b>P2.</b> Collect ventilation data base <b>P3.</b> Check optimization through simulator <b>P4.</b> Develop model for ventilation system
<b>CU3.</b> Comprehend The Basic Rules for Ventilation System	<b>You must be able to:</b>  <b>P1.</b> Identify the air flow system of ventilation system <b>P2.</b> Make a layout on paper of ventilation system <b>P3.</b> Outline the layout of single and double split system <b>P4.</b> Calculate area, volume and velocity of air for specified mine location

### Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes the knowledge of:

**K1.** Ventilation system

**K2.** Design of mine ventilation system

### Tools and Equipment:

- Anemometer
- Multi Gas Detector
- Tube Detector
- Gas Mask
- Brattice cloth
- Axial Flow Fan
- Centrifugal Flow Fan



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**Critical Evidence(s) Required**

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Layout the basic mine ventilation system





## 724CO11J -Competency Standard: Manage and Supervise the Job Activities

**Overview:** This competency standard covers the skills and knowledge required to manage and supervise the job activities. You will be able to plan and supervise on-site operations / activities and doing the on -site inspection and prepare a report .Your underpinning knowledge will be sufficient to provide you the basis for your work.

Competency Unit	Performance Criteria
<b>CU1.</b> Plan for on-site operations	<b><i>You must be able to:</i></b> <b>P1.</b> Consult with the client to obtain required information <b>P2.</b> Prepare SOP’s in accordance with the identified requirements. <b>P3.</b> Prepare the process flow diagram in order to achieve Quality outcome. <b>P4.</b> Break down work of activities into small achievable components and efficient sequences <b>P5.</b> Recognize site hazards and the personal protective equipment (PPE) and safety procedures specified for job <b>P6.</b> Organize site induction for support personnel as required <b>P7.</b> Plan housekeeping activities prior to and post completion of work
<b>CU2.</b> Supervise work activities to achieve desired results	<b><i>You must be able to:</i></b> <b>P1.</b> List and arrange required resources prior to commencement of work <b>P2.</b> Recognize the areas of work which could result in a delay of work, wastage of material or damage to tools. <b>P3.</b> Allocate responsibility to required team members to avoid conflicts <b>P4.</b> Review work plan in response to new information, urgent requests, changed situations or instructions from concern personnel <b>P5.</b> Cooperate with team members to achieve common goals
<b>CU3.</b> Perform on- site inspection	<b><i>You must be able to:</i></b> <b>P1.</b> Conduct inspection of processes & materials according to



	<p>inspection plan</p> <p><b>P2.</b> Identify defects and deficiencies in product &amp; processes</p> <p><b>P3.</b> Record defects and deficiencies with evidence in product &amp; processes (if required)</p> <p><b>P4.</b> Perform test as per standard procedure for determining the physical properties of materials and product.</p> <p><b>P5.</b> Collect the samples of materials &amp; products for lab testing as per standards</p> <p><b>P6.</b> Complete the sampling document as per requirement</p> <p><b>P7.</b> Check the actions taken for rectification of snag list</p> <p><b>P8.</b> Record the non-compliance and expected breaches of contract as per SOPs.</p>
<p><b>CU4.</b> Prepare the inspection report.</p>	<p><b><i>You must be able to:</i></b></p> <p><b>P1.</b> Collect and review the information relevant to inspection activities for recoding inspection results</p> <p><b>P2.</b> Verify the integrity of information supplied by other party as a part of the inspection process</p> <p><b>P3.</b> Record inspection observations and findings</p> <p><b>P4.</b> Recommend the necessary corrective actions for tackling the identified problems</p>

### Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out the tasks covered in this competency standard. This includes the knowledge of:

- Principles of planning and project management
- Roles and responsibilities for different levels of site supervision.
- Information relevant to inspection activities and work document preparation for recoding inspection results.
- Documentation and record system of the inspection body
- Different types of deficiencies in inspection activities
- Site problems and recommended corrective actions
- Awareness of environmental sustainability issues as they relate to the work task.

### Critical Evidence(s) Required



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The candidate needs to produce any or all of the following documents/evidences:

- Design effectively the supervision and inspection program in accordance with specifications
- Handle inspection items and samples by appropriate methods to meet the traceability requirements.
- Collaborate with the team members for allied works at site.



## 724CO11K- Competency Standard: Plan a Project in Primavera P6

**Overview:** This competency standard deal with learning the competencies needed to plan a project in Primavera P6. You can perform basic operation, project activities scheduling and resources costing and planning Primavera P6. You will manage project in Primavera P6. Your underpinning knowledge will be sufficient to provide you the basis for your work.

Competency Unit	Performance Criteria
<b>CU1.</b> Perform Basic operation in Primavera P6	<b><i>You must be able to:</i></b>  <b>P1.</b> Load & unload primavera P6 Software. <b>P2.</b> Prepare interface of software <b>P3.</b> Customize P6 Screen Layout <b>P4.</b> Create WBS of project in Primavera.
<b>CU2.</b> Perform Project Activities Scheduling in Primavera P6	<b><i>You must be able to:</i></b>  <b>P1.</b> Add Project in Primavera <b>P2.</b> Create Activities of project in Primavera. <b>P3.</b> Create Relationships between activities of project in Primavera. <b>P4.</b> Create Schedule of activities of project in Primavera. <b>P5.</b> Display Gantt Chart
<b>CU3.</b> Perform Project Resources Costing & Planning in Primavera P6	<b><i>You must be able to:</i></b>  <b>P1.</b> Add constraints of activities of project in Primavera. <b>P2.</b> Create Calendar for activities of project in Primavera. <b>P3.</b> Assign Calendars to activities of project in Primavera. <b>P4.</b> Add Resources to activities of project in Primavera. <b>P5.</b> Assign Resources of activities of project in Primavera. <b>P6.</b> Add Cost of activities of project in Primavera. <b>P7.</b> Analyze Resources of activities of project in Primavera. <b>P8.</b> Perform Baseline process for Project.
<b>CU4.</b> Manage Project in Primavera P6	<b><i>You must be able to:</i></b>  <b>P1.</b> Status the Project <b>P2.</b> Mitigate the schedule

### Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out the tasks covered in this competency standard. This includes the knowledge of:

- Physical performance to Customized screen layout
- Activity Constraints
- Work calendar, work/non-work days, working hours
- Roles and Hourly Rates



*National Competency Standards for “Supervisor in Mining Process Technology”*



- Baselines and describe their use in evaluating project performance
- Stages of project execution
- Project monitoring and control

**Critical Evidence(s) Required**

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Managed Project - project progress, planned baseline, Resource leveling and describe its purpose, comparison graphically, project progress for a specified time period



## 041300860L -Competency Standard: Develop Entrepreneurial Skills

**Overview:** This Competency Standard identifies the competencies required to develop entrepreneurial skills, in accordance with the organization’s approved guidelines and procedures. You will be expected to develop a business plan, collect information regarding funding sources, develop a marketing plan and develop basic business communication skills. Your underpinning knowledge regarding entrepreneurial skills will be sufficient to provide you the basis for your work.

Competency Unit	Performance Criteria
<b>CU1.</b> Develop a business plan	<b><i>You must be able to:</i></b> <b>P1.</b> Conduct market survey to collect information <b>P2.</b> Select the best option in terms of cost, service, quality, sales, profit margin, overall expenses <b>P3.</b> Compile the information collected through the market survey, in the business plan format
<b>CU2.</b> Collect information regarding funding sources	<b><i>You must be able to:</i></b> <b>P1.</b> Identify the available funding sources based on their terms and conditions, maximum loan limit, payback time, interest rate <b>P2.</b> Choose the best available option according to investment requirement <b>P3.</b> Prepare documents according to the loan agreement requirement <b>P4.</b> Include the information of funding sources in the business plan
<b>CU3.</b> Develop a marketing plan	<b><i>You must be able to:</i></b> <b>P1.</b> Collect information required to devise marketing plan <b>P2.</b> Prepare marketing plan for new business
<b>CU4.</b> Develop basic business communication skills	<b><i>You must be able to:</i></b> <b>P1.</b> Communicate with internal customers and external customers <b>P2.</b> Use different modes of communication to communicate internally and externally e.g.: presentation, speaking, writing, listening, visual representation, reading etc. <b>P3.</b> Use specific business terms used in the market

### Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes the knowledge of:

- 7ps of marketing including product, price, placement, promotion, people, packaging and positioning
- 7Cs of business communication
- Different modes of communication and their application in the industry



**National Competency Standards for “Supervisor in Mining Process Technology”**



- Business terms used in the industry
- Funding sources
- How to get loan to start a new business
- Market survey and its tools e.g.: questionnaire, interview, observation etc
- Market trends for specific product offering
- Elements of business plan
- How to fill the business plan format

**Critical Evidence(s) Required**

The candidate needs to produce following critical evidence(s) to be competent in this competency standard:

- Conduct market survey and formulate business plans in terms of feasibility, investment potential, risk, and completeness.
- Effectively present business ideas and profile





## 724CO11M-Competency Standard: Practice Professionalism

**Overview:** This competency standard deal with learning the competencies needed to develop portfolio for industry. You can perform internship. Your underpinning knowledge will be sufficient to provide you the basis for your work.

Competency Unit	Performance Criteria
<b>CU1.</b> Develop Portfolio for industry	<b>You must be able to:</b>  <b>P1.</b> Select previous assignments for portfolio <b>P2.</b> Work on previous selected assignments for portfolio <b>P3.</b> Compile variety of assignments for portfolio <b>P4.</b> Make Professional Portfolio for industry <b>P5.</b> Develop Digital Portfolio for industry
<b>CU2.</b> Perform Internship	<b>You must be able to:</b>  <b>P1.</b> Prepare for internship <ul style="list-style-type: none"><li>• Personal Presentation</li><li>• Portfolio Presentation</li></ul> <b>P2.</b> Interview preparation <b>P3.</b> Demonstrate Ethics for Internship <b>P4.</b> Identify Industry for internship <b>P5.</b> Perform Internship in Industry <ul style="list-style-type: none"><li>• Fill the Performa of Internship</li><li>• Report the performance of internship</li></ul>

### Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out the tasks covered in this competency standard. This includes the knowledge of:

- Importance of portfolio
- Ethics for Internship

### Critical Evidence(s) Required

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Professional
- Portfolio



## COMPLETE LIST OF TOOLS AND EQUIPMENT

Sr. #	Description
1.	Computer system
2.	White board
3.	Printer
4.	Scanner
5.	Multimedia
6.	Safety Helmets
7.	Blankets
8.	Board of Safety instructions.
9.	Ear Plug
10.	Face mask
11.	Fire Buckets.
12.	Fire Extinguishers
13.	First aid Kit
14.	Hand gloves
15.	Hooks / Anchors
16.	Manufacturers Operation and Maintenance Manual & Video;
17.	Measuring Tape
18.	Safety Apron
19.	Safety Belts
20.	Safety goggles



**National Competency Standards for “Supervisor in Mining Process Technology”**



21.	Safety harness
22.	Safety net
23.	Safety Shoes
24.	Geophysical equipment
25.	Seismograph
26.	Gravimeter
27.	Magnetometer
28.	Metal detector
29.	pH meter
30.	Conductivity meter
31.	Shovels
32.	Electronic Weighing Balance
33.	<p>De-watering equipment may include:</p> <ul style="list-style-type: none"> <li>• Ancillary equipment</li> <li>• Fittings</li> <li>• Lines</li> <li>• Pads</li> <li>• Piping</li> <li>• Pumps</li> <li>• Submersible pumps</li> </ul>
34.	Hardness tester
35.	Rock cutting machine
36.	Thin section cutter, grinder and polisher
37.	Electron microscope
38.	Glass slides



**National Competency Standards for “Supervisor in Mining Process Technology”**



39.	Electronic balance
40.	UV-VIS Spectrophotometer
41.	Google Earth Application
42.	GIS software
43.	Hard copies of different map sheets
44.	Jaw crusher
45.	Roll crusher
46.	Ball mill
47.	Rod Mill
48.	Dry sieve Analyzer
49.	Wet sieve Analyzer
50.	SS Cylinder for Alkali silica
51.	Universal testing machine
52.	Slump cone, rod, scale
53.	Digital balance
54.	Glass ware
55.	Specific Gravity bottle
56.	Viscometer
57.	Straight circular cylinder
58.	Brazilian test apparatus
59.	Pressure jack and gauge
60.	Optical microscope



**National Competency Standards for “Supervisor in Mining Process Technology”**



61.	Polarize microscope
62.	Chemicals
63.	Universal testing machine (UTM)
64.	Test cell, hydraulic pump
65.	Anemometer
66.	Multi Gas Detector
67.	Tube Detector
68.	Gas Mask
69.	Brattice cloth
70.	Axial Flow Fan
71.	Centrifugal Flow Fan

