At the outset it must be emphasized that the proposed syllabi in the respective subjects must be used as a guide only and must not be construed to be the final and only product in this regard. As mining operations are not of a static nature, candidates will be expected to keep pace with the latest technological developments, most recent innovations, practices, etc.

1. Plan reading

The following factors and features are important in examining a candidate’s ability to interpret and “read” a mine plan being part of a mine overseer’s responsibility: A candidate must be able to:

- recognise a north point on a plan and also be able to orientate himself on a plan, not having an indicated north point, by means of co-ordinate values,
- measure off distances as accurately as possible (depending on scale of plan) between given points on the plan, using a scale, or using the scale provided on the plan,
- explain the meaning of the word “scale” of a plan,
- measure, using a scale, the approximate co-ordinates of a point on the plan,
- determine approximate areas (mined or to be mined) from distances measured by means of a scale,
- interpret (recognize) an elevation of a survey station or survey point and determine the vertical distance between two points form their elevations,
- determine graphically, by means of a drawing, a vertical section and using any two sides of the right angled triangle (example horizontal or vertical components) to determine (measure by means of a procractor) the approximate dip between any two points on the plan,
- recognise geological disturbances such as faults, dykes and sills, and from information on a plan be able to judge any possible affects which these may have on the mining of the deposit (gain or loss of ground etc),
recognise or distinguish between features showing in accordance with the Second (or Third – monochrome) Schedule, e.g. the difference in the showing of an ore pass and a cross-cut, and recognise vertical and inclined workings, recognise immediately and without measurement, an inclined working (raises, ore passes, etc.), a vertical working (shaft or portion of a boxhole) or workings (especially development in the case of mines working inclined deposits) on the horizontal plane.

**Draw a section through any portion of the plan.**

In addition in respect of coal mining:
- Working knowledge of both surface and underground aspects of a plan.
- The ability to determine multi seam activities
- Elevation differences
- Complete knowledge of the Second (or Third – monochrome) Schedule.
- Subsidence, pillar sizes (Rock mechanics)

**2. Dust**

Physical properties.

State the size of airborne particles that are dangerous to health (\(\leq 5\) micro meter ?)

Name the principal dangers to humans of the dust encountered in mines.

Sources of dust production.

Name, the sources of dust underground (Blasting, drilling/reaming holes in rock, grinding/crushing rock). In short, the processes which reduce rock in size.

Dust sampling.

State the prime objective of taking dust samples.

What units are used to express the dust concentrations in the air and in water and what sampling methods are currently employed to determine worker exposure and the concentration of dust in water.

**What is done to prevent dust form being inhaled during:**

- Blasting (Persons are removed, i.e. re-entry period, thereafter watering down & ventilation)
- Drilling (Rock drill must comply with Regulation requirements)
- Other sources: Filters dust discharged directly into upcast airway, watering down, ventilation, respirators,
Name the five basic ways in which high dust exposures can be controlled or prevented.

Name three types of dust filters.

Calculate the filter area necessary for efficient filtration in a filter unit, installed at,

i.e. - rock tipping point (main)
       - workshop/truck repair bay/drill sharpening shop.
       - any other place where dust must be filtered (u/g crusher station)

In addition, with special reference to Coal:

Sources of coal and other harmful dusts, both on surface and underground.

Methods, instruments and equipment used to sample dust, assess samples and interpret results.

Methods of dust suppression and dust control.

Knowledge of underground coal dust explosions.

3. Gases

Without using references, the candidate must be able to name and give the approximate amount of the main constituent gases present in the air.

Knowledge of the

- Sources,
- Physical properties,
- Danger to and effects on persons,
- Practical tests and detection methods, and where applicable,
- Permissible quantities in terms of the Regulations, of the following gases:
  - Oxygen
  - Nitrogen
  - Hydrogen
  - Methane
  - Carbon monoxide
  - Carbon dioxide
  - Hydrogen sulphide
  - Nitrous fumes
The candidate should know how to recognize these gases under given circumstances, how to deal with them and how to protect persons from them as well as treatment of persons affected by them.

Describe the action to be taken when Vh4 is detected in a working place:
<table>
<thead>
<tr>
<th>Gas</th>
<th>Chemical composition</th>
<th>Characteristics</th>
<th>Specific gravity relative to air</th>
<th>Sources and occurrence</th>
<th>Maximum allowable concentration by volume (parts per mil)</th>
<th>Methods of detection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxygen</td>
<td>O2</td>
<td>Necessary for life. Deficiency caused by oxidation of timber and pyrites</td>
<td>1.1</td>
<td>Constituent of air</td>
<td>-----</td>
<td>Deficiency of oxygen is detected by a flame safety lamp or oxygen deficiency detector</td>
</tr>
<tr>
<td>Carbon Dioxide</td>
<td>CO2</td>
<td>Asphyxiant. High percentages are usually associated with oxygen deficiency. Causes headaches</td>
<td>1.5</td>
<td>Slow oxidation of organic matter, breathing, fires and explosions, operation of diesel locomotives. Occurs in poorly ventilated working places</td>
<td>5 000 ′</td>
<td>Detector tubes and chemical analysis</td>
</tr>
<tr>
<td>Carbon Monoxide</td>
<td>CO</td>
<td>Poisonous Explosive 12.5% to 74.2%</td>
<td>0.97</td>
<td>Fires, explosions, blasting operations. Exhaust fumes from diesel locomotives</td>
<td>General air: 100 Diesel exhaust: 2000</td>
<td>Detector tubes and canaries</td>
</tr>
<tr>
<td>Oxides of nitro</td>
<td>NO</td>
<td>Poisonous</td>
<td>1.04</td>
<td>Blasting operations, exhaust fumes from diesel locos, arc welding, burning of explosives</td>
<td>General air : 5 Diesel exhaust: 1000</td>
<td>Detector tube, smell. Palasum iodite starch papers</td>
</tr>
<tr>
<td>Nitrous fumes</td>
<td>NO2, NO4, NO3</td>
<td></td>
<td>1.6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Methane</td>
<td>CH4</td>
<td>Non-toxic Explosive 5% to 15%. High concentrations can be associated with an oxygen deficiency</td>
<td>0.55</td>
<td>Water fissures, dykes, faults, blowers and coal strata</td>
<td>One part per hundred by volume</td>
<td>Methanometer or flame safety lamp</td>
</tr>
<tr>
<td>Hydrogen sulphide</td>
<td>H2S</td>
<td>Poisonous Explosive 4.0% to 44.0%</td>
<td>1.2</td>
<td></td>
<td>20</td>
<td>Smell Lead acetate paper Detector tube</td>
</tr>
<tr>
<td>Chlorine</td>
<td>Cl2</td>
<td>Poisonous Causing intense irritation of eyes, nose and throat</td>
<td>2.5</td>
<td>Water purification plants</td>
<td>-----</td>
<td>Smell Detector tubes</td>
</tr>
<tr>
<td>Hydrogen</td>
<td>H2</td>
<td>Non-toxic Explosive 4% to 75%. High concentrations can be associated with an oxygen deficiency</td>
<td>0.07</td>
<td>Battery charging stations, Sometimes associated with Methane</td>
<td>-----</td>
<td>Detector tubes Laboratory analysis</td>
</tr>
<tr>
<td>Sulphur dioxide</td>
<td>SO2</td>
<td>Poisonous irritant. High concentrations poisonous. Burns throat, eyes, nose, and lungs</td>
<td>2.22</td>
<td>Smelling operations</td>
<td>2ppm(TL-V-TWA)</td>
<td>Smell Chemical detector tube</td>
</tr>
<tr>
<td>Hydrogen cyanide</td>
<td>HCN</td>
<td>Poisonous Can be absorbed through skin Explosive 5.6 – 40.0%</td>
<td>0.94</td>
<td>Gold recovery using cyanide processes Burning of plastic</td>
<td>10 ppm(TL-C)</td>
<td>Smell Chemical detector tube</td>
</tr>
<tr>
<td>Ammonia</td>
<td>NH3</td>
<td>Poisonous irritant. Burns throat, eyes, nose, and lungs</td>
<td>0.59</td>
<td>Explosive based on ammonia. Ammonia used as refrigerant Additive to refining process</td>
<td>25ppm (TL-V-TWA) 35ppm (TL-V-STEL)</td>
<td>Smell Chemical detector tube</td>
</tr>
<tr>
<td>Arseen</td>
<td>AsH3</td>
<td>Colorless disagreeable garlic odour. Highly poisonous(250ppm is instantly lethal) 25ppm -1/2 Hour</td>
<td>2.71</td>
<td>Arsenic in acid solutions used in refining process(Platinum) By product from chemical processes</td>
<td>5.0ppm (TL-C)</td>
<td>Smell Chemical detector tube</td>
</tr>
<tr>
<td>Hydrogen chloride</td>
<td>HCl</td>
<td>Poisonous irritant. throat, eyes, nose and skin. Severe exposure result in pulmonary problems</td>
<td>1.27</td>
<td>Burning of PVC products. Ignition of platinum salts used in refining process</td>
<td>5.0ppm (TL-C)</td>
<td></td>
</tr>
<tr>
<td>Sulphuric acid mist</td>
<td>H2SO4</td>
<td>Poisonous irritant. throat, eyes, nose and skin. Colorless only liquid</td>
<td>---</td>
<td>Chemical processes using sulphuric acid</td>
<td>1mg/m3 (TLV) (Present as a mist in air)</td>
<td>Chemical detector tube</td>
</tr>
<tr>
<td>Mercury vapour</td>
<td>Hg</td>
<td>Poisonous Can be absorbed through skin</td>
<td>------</td>
<td>Gold smelting</td>
<td>0.05g/m3 (TLV) (Present as a vapour in air)</td>
<td>Chemical detector tube</td>
</tr>
</tbody>
</table>
4. **Ventilation**

**Instruments**

State the name of and describe the instrument, and the method used to determine:
- Air volume
- Air velocity
- Air temperature (wet/dry)
- Fan pressure
- Cooling power
- Presence of methane

**Ventilation**

Sketch and describe the methods of ventilating:

- Development ends (single & multi blast)
- Stopes – including “back Stopes”
- Main tips, Raise bore machine drill sites, workshops.

What is the minimum legal requirement in the following instances?

- Air velocity along stope faces
- Air volume in development ends

State Atkinson’s formula and the units in which the symbols are expressed.

Determine the operating pressure of a fan, if resistance and volume are known, or any variable if the other constants are known.

**Heat**

Mention at least 3 sources of heat in mines.

How is heat measured?

How does the human body rid itself of heat?

What are the three possible consequences if a person works at a high rate in hot conditions?

What steps can be taken to reduce humidity and heat.

**Mine fires**

Mention at least 4 main causes of fires in mines. What precautions can be taken to reduce the risk of fires underground?

In addition with special reference to Coal:
Instruments and calculations used to determine quantities and velocities of underground ventilation currents.

The employment and control of main ventilation currents.

A detailed knowledge of the equipment and methods used in ventilating the working coal faces in all types of underground coal extraction methods.

Basic design and protection of main fans.

Reasons, methods, sampling and dangers of sealing and reopening worked out panels.

Causes, effects and methods of dealing with underground fires.

Causes of spontaneous combustion.

5. Shaft Practice:

This subject will include all types of shafts under the sub headings of site preparation, shaft sinking and cementation through various types of geological strata, shaft operation and equipment, drop raising and major raise bore operations incidental to shafts, together with the modification to the parameters of operating shafts.

Shaft Sinking:

**Vertical Shafts:**

Section of a shaft known to candidate

Function of shaft members

How are members joined together

Pipe anchoring brackets

Pipe bearer set

Pipe ducks foot

Timbered shaft members

Shaft examination total procedure

Spillage arrangements

Replace a divider

Contact wire signaling
Loading box arrangement
Water ring construction & why
Safety devices in and around shaft stations
Humble hook, spectacle plate & jack catches
Raise bore – slide into shaft – safety
Material transport including slinging

**Shaft Sinking:**

Kibble tipping
Bank doors and tracks
Signalling systems
Stage, ropes & stage safety
Crosshead and separation device
Cover drilling, method & why
Curbing and concreting
Concrete lining & sequence
Concrete transport system
Blowing over and sketch
Water control and pumping system
Station cutting & method

**Inclined Shafts:**

Section of a shaft known to candidate
Function of shaft members
How are members joined together
Pipe anchoring brackets
Still fixing and tracks
Travelling way
Shaft examination procedure – steeply dipping and flat
Material transport and safety
Replace a sill
Marshall wire systems
Loading box arrangement
Water control and why
Safety devices in and around shaft stations
Skip tipping – how and sketch
Carnel back on bank & tipping

**Inclined shaft sinking:**

Cleaning method
Concrete lining method 25 degrees dip
Station cutting
Cover drilling
Safety devices during sinking

**Drop Raising and major raise bore operations:**

**Drop Raising:**

**Planning:**

Give reasons why this exercise is resorted to
Pros and cons as opposed to shaft sinking
Other considerations
Sequence of events

**Ventilation:**
Ventilation layout. How is blasting fumes removed from the advancing face.

How is pollution of intake ventilation to other workings prevented.

Dust control

**Mining:**

Effective control over face advance, explosives, procedure during changing up, precautions and blasting.

Regulations to be considered

Removal of broken rock at discharge end & blockages?

Final utilization of shaft

**Major raise bore operations:**

**Planning:**

Reasons for electing this practice.

Sequence of events

**Mining:**

Dust control during drilling/reaming

Disposal of broken rock at discharge end

Reaming/removal of final plug (reaming of pilot hole)

Final utilization (Hoisting in a bore hole)

6. **Mining operations**

General

- Aspects on mine economics;
- Mine call factor and factors affecting MCF;
- Importance of maintaining optimum stoping widths;
- Definitions such as cm.g/t and relationship with grade
- Control, storage and use of underground water
- Construction of dams

Ventilation aspects associated with mine layouts:

Importance of sizes of tunnels: footwall haulages versus reef drives; back Stopes; negotiating dykes and faults while maintaining optimum environmental conditions; influence of certain support mediums, such as backfill, on ventilation, prevention of heat stroke.

**Stoping operations:**

Deep mines (relatively unfaulted)

Longwalling option:

- panel and stabilizing pillars design aspects;
- Stabilising pillars and permanent stope support options;
- Rockburst control strategies
- Negotiating displacements on faults and dykes.

Deep mines (Faulted)

**Scattered mining options:**

- overall stoping configurations
- methods of coping with faults and dykes
- rock burst control strategies

Detailed practice on permanent support and face support.

Detailed stoping options in flat, medium dipping and steep orebodies, multireef mining, wide reef mining.

**Ledging procedures:**
- sequence of mining
- support requirements
- establishing leads and lags between panels and sidings

**Remnant mining:**

- declaration of areas to be special areas
- stoping layouts
- sequence or mining
- special safety measures

**Blasting operations:**

- drilling patterns;
- different options to obtain sequential firing;
- different types of explosives options;
- the storage and handling of explosives.

Methods of handling and transporting ore and material.

Utilisation of labour.

**Mechanised (trackless mining options)**

Shallow mining:

- regional support (pillars)
- panel support (pillars)
- face configuration in relation to geology

Shaft pillar mining and Remnant Mining
Development:

Standard development and shapes, rounds and support.

Minimum lag distance of footwall drives face behind the longwall face.

Siting of tunnels in relation to abutments, future remnants etc., and expected changes in stress regime with subsequent alterations to support.

Break-a-ways: Support at bull noses; construction of tracks etc;

Antiflooding measures: pilot holes, ventilation requirements.

Labour utilization

Multi blast conditions

Cleaning operations

Coal Mining Practice:

A detailed knowledge of the mining methods, equipment and expected results of the following types of coal mining:

Opencast – strip mining

Underground

Handgot - board and pillar
- stooping

Mechanised - conventional shuttlecar & loader

Development - mechanical miners
- L.H.D. systems

Mechanical:

Stooping
- conventional shuttlecar & loader
- mechanical miners
Stone and dyke:

Development
- within coal seams

The candidate must, in all the above methods have a knowledge of the effects of various seam thicknesses and of seams in close proximity to each other. A knowledge of:

The allocation i.e. complements and the control of all labour both inbye and outbye of the production sections.

Underground support systems
- immediate roof strata
- sand and ash filling
- safety factors

Water reticulation systems

Methods of transporting coal and materials, the use transport and storage of underground explosives

Other matters relating to the duties of a mine overseer.

7. Underground machinery:

Candidate will be required to have a working knowledge of:

Small Winding Plant:

Operation and control
Brake
Maintenance
Rope care
Training and appointment of driver
Responsible persons
Safety devices
Signaling arrangements
Tracks
Traveling ways

**Mechanised Mining Machinery**

Types of machines and capacities
Braking systems and method of testing brakes
Permitted gradients
Lighting
Safety devices and alarms
Training and authorisation of operators
Required clearances
Workshops
Refueling bays
Conveyance of persons

**Locomotives**

Types of locomotives
Operation of each type
Advantages and disadvantages of each type
Working of a diesel engine
Exhaust systems
Changing of batteries and charging bays
Permitted speeds
Lighting
Warning devices
Fire prevention
Brakes and testing of brakes
Training and authorization of drivers
Using of man carriages
Track lay out and maintenance
Track switches and points

**Pumping**

Types of pumps and operation
Layout of pumping stations
Suction arrangements and heads
Starting up procedures
Safety precautions
Knowledge of:
Water Hammer
Causes of water
Slip
End Thrust
Multistage operation
Encrustation of pumps columns
Priming

**Calculations of:**
Pressure
K W rating
Static head

**Scraper winches:**

- Layout
- Signaling arrangements
- Safety and protection
- Operation
- Foundation requirements
- Anchoring of snatchblocks
- Clutch lever operation – double drum
- Legal requirements
- Training and authorization
- Ropes and cross-overs
- Multiple installations

**Monorope:**

- Layout
- Legal requirements
- Guarding
- Travelling way
- Signalling arrangements
- Attachment of load
- Lock-out system
- Starting up alarm
- Safety precautions

**Drill rigs:**
Types and Operation
Trailing cable
Safety precautions

**Conveyor Belts:**

Types of conveyors
Drives
Guarding
Safety devices and interlocks
Precautions against fire
Illumination
Starting up
Idlers and training of belts

**Lifting equipment:**

Types of equipment
Operation of each type
Slinging of equipment & safety precautions

**Welding and Flame cutting:**

Operation of a cutting torch
Gases used
Types of connections
Pressure in cylinders
Training
Fire precautions and emergency procedures
Regulators
Flashback arrestors
Arc Welding
Safety precautions

**Electricity:**

Basic distribution layout
Earthing
Earth leakage Rely basic operation
Types of cables and protection of cables, safety & fire prevention
Substations
Entrance
Notices
Locking
Fire precautions
Basic theory of electricity
Single phase AC
Three phase AC
Direct Current
Conductors
Insulators

**General:**

Knowledge of metric system international
Calculations
Mass
Volume
Pressure
Weight
Definitions

**Flame proofing – Collieries only:**

Reasons for flameproofing

Hazardous areas

Basic principle of flame proofing
Explosion protected apparatus

Flameproof apparatus

Intrincically safe apparatus

Trailing cables

Types of cables

Protection in workings

Flameproof diesel engines

Basic principle of operation

Exhaust system

Safety systems

Inlet systems

Fire precaution

Workshops

8. Legal Knowledge

Minerals act 1991:
Chapter I: Definitions of manager, mine, mining area, underground, mineral, material, shaft, etc

Chapter II: Nil

Chapter III: The candidates must know that before mining commences the mine owner requires a permit issued by the Regional Director, and that a permit will not be issued unless the Regional Director is satisfied that mining will be done safely and that where mining is completed the land will be rehabilitated.

The candidate need not know the relevant sections word by word – applies to the entire examination.

Chapter IV: Nil

Chapter V: The candidate must know that a mine Safety Committee, appointed by the Minister, exists, and that the function of the Committee is to advise the Director General on safety and health in mine matters.

Sect 27 - The candidate must know that a Regional Mining Engineer can stop any practice at a mine which may result in bodily harm or may be injurious to health, or the Regional Mining Engineer may order that rectifying/remedial steps be taken.

Sect 28 - The candidate must know that a Regional Mining Engineer may investigate any accident, and the Regional Mining Engineer must investigate fatal and accidents in which persons are seriously injured/killed.

Sect 30 - It is an offence to hinder/obstruct the Regional Mining Engineer holding an inquiry.

Sect 31 - Appointment of manager by Owner. Appointment of prescribed persons by manager.

Sect 32 - Prohibitions: No person under 16 year shall work underground, no females shall work underground, no females shall work underground (with exceptions).

Sect 34 - Candidate must know that the Regional Director may require codes of practice for any health and safety related mining activity, and that it is an offense punishable (fine R10 000) not to submit such codes of practice.
Sect 35 - Apparatus, machinery and Safety equipment can only be repaired or supplied in accordance with the Manager’s requirements.

Sect 38 - Rehabilitation to be done in accordance with an approved Rehabilitation programme and to the Satisfaction of the Regional Director.

Sect 51 - Any person authorized by Director General (and this includes the Regional Director and Regional Mining Engineer) may enter any mine.

Sect 52 - Any license, permit or any other document which is required in terms of the Minerals Act Shall be produced if required by the Regional Director and Regional Mining Engineer.

Sect 54 - Notification of commencement or cessation of work.

Sect 58 - Persons not to be victimised.

Sect 59 - Regional Director, Regional Mining Engineer not to be hindered, opposed, obstructed.

Sect 67 - “MOSACT” not applicable to mines/works. “Sunday labour” of old Act still applicable.

Regulations:

The Regulations framed under the Minerals Act 1991, in so far as they affect the duties of a Mine Overseer, but with the omission of Chapter 12, 14 and 20 to 23 inclusive, excepting Regulations 20.1.1 to 20.8, and 21.16.

In respect of Coal mining the emphasis should be based on coal mining practice.

Limited Certificate:

A candidate for a Limited Scope Mine Overseer's Certificate of Competency will be examined in so much of the foregoing as is applicable to the subjects appropriate to his work, e.g. certificates limited for Diamond Mines.