

1. Module details**Module name****Electrical Mines Safety.****Module duration**

It is expected that students with the appropriate entry knowledge and skills will successfully complete this module in 36 - 40 hours.

Module code

NUE605

Discipline code

0703110

2. Module purpose

This module provides advanced knowledge and skills appropriate to Mine Electrical Systems. In particular the module addresses various faults on a typical electrical distribution system in both underground and surface mines, protection systems, and basic fault study analysis. The module also addresses environmental monitoring systems, equipment monitoring techniques, electrical equipment implications of methane drainage requirements for both underground and surface mines, and fire considerations.

3. Prerequisites

NUE602 Electrical Systems for Mines 1

4. Relationship to competency standards

This module provides part of the underpinning knowledge and skills in the 'Evidence Guide' of specific units of competency in the National Electrotechnology Training Package and provides similar support, where mapped, to equivalent units in the National Metals and Engineering Competency Standards. For details refer to the module to unit maps, available from NUEITAB.

5. Content**Faults and Protection Systems**

Earth fault and earth leakage protection (including restricted earth fault systems)

Overload protection for motors and cabling

Short circuits

Over and under voltage protection

Loss of phase protection/unbalance

Voltage (potential) and current transformers

Differential protection

Harmonics and associated problems

Earth continuity protection and application

Shunt trip versus undervoltage trip

Bushholz and gas overpressure protection and temperature

Earth fault lockout for protecting cables

Discrimination

Reverse power

Applicable regulatory requirements

Applicable emergent technologies

Fault Levels Analysis

Expected outcomes from fault studies

Simple protection/fault level calculations involving typical equipment

Familiarisation with and interpretation of typical computer generated fault studies for typical mine systems

Implications for equipment and cables

Environmental monitoring

Basic principles of fixed installations including:

- Individual (discrete) sensor systems (including machine mounted)
- Multiplexed sensor systems
- Tube bundle systems
- New technologies (eg use of fibre optics)

Portable hand held sensors

Types of sensors and principles of operation

- Methane (CH₄) – various types and determinations of % LEL (Percent of lower explosive limit)
- Methane (CH₄) for high % measurement (0 – 100%)
- Oxygen
- Hydrogen sulphide
- Nitrogen dioxide and nitrous oxides
- Carbon monoxide
- Carbon dioxide
- Air velocity and quantity
- Others
- Cross contamination and other problems

Application of Standards particularly to maintenance requirements

Application of regulations

Typical applications

Computer based monitoring systems for data manipulation, and records

Methane gas drainage

Principles of techniques and terminology

Codes of Practice, Standards, legislation

Electrical equipment implications/requirements

Fire systems

Fire detection systems and methods

Sprinkler systems and applications

Gas release/ flooding systems and applications

Fire extinguishers and applications

Legislative/standards requirements

Equipment monitoring

Principles

Microprocessor based systems

Range of sensors and status indications including but not limited to running, stopped, fault, temperature, pressure, vibration etc.

Data gathering techniques

Calibration/accuracy

6. Learning outcome details

Learning outcome 1

Nominate the types and nature of electrical faults that may occur on a typical distribution system in underground and/or surface coal mines.

Assessment criteria

- 1.1 List common electrical faults that may occur on a typical distribution system in underground and/or surface coal mines.
- 1.2 Explain the nature and implications of the faults listed in 1.1.
- 1.3 Identify any relevant regulatory requirements in regards to the faults listed in 1.1.

Learning outcome 2

Outline the use of protection systems utilised on typical mine electrical distribution systems.

Assessment criteria

- 2.1 Nominate appropriate protection systems for common electrical faults that may occur on a typical distribution system in underground and/or surface coal mines.
- 2.2 Explain the function and operation of the protection systems identified in 2.1.
- 2.3 Match appropriate protection systems to given electrical faults from 2.1.
- 2.4 Explain protection systems used with reference to protection schematic diagrams.
- 2.5 Identify any regulatory requirements in regards to the protection systems identified.

Learning outcome 3

Perform a basic fault study analysis.

Assessment criteria

- 3.1 Explain fault levels.
- 3.2 Nominate the expected outcome from a fault study.
- 3.3 Perform basic fault study calculations.
- 3.4 Interpret a typical computer generated fault study.
- 3.5 Investigate and detail the implications of the outcomes of a fault level study on equipment and cable ratings.

Learning outcome 4

Outline the basic elements of mine environmental monitoring systems.

Assessment criteria

- 4.1 Outline the basic nature, elements and principles of common fixed environmental monitoring installations.
- 4.2 Outline the basic nature, elements and principles of hand held sensors for environmental monitoring.
- 4.3 Identify common issues/problems in the utilisation of environmental monitoring systems.
- 4.4 List the maintenance and operational requirements of fixed and portable systems.
- 4.5 Outline relevant regulatory requirements in regard to the usage of mine environmental monitoring systems.

Learning outcome 5

Detail, with an emphasis on the electrical aspects of equipment utilised, the basic requirements (both underground and surface mining) of methane gas drainage.

Assessment criteria

- 5.1 Outline the basic principles of gas drainage and terminology.
- 5.2 Explain, with an emphasis on the electrical equipment utilised, the basic elements of gas drainage systems including protection and operation.
- 5.3 Detail the requirements of current Codes of Practice, Standards and legislation in regards to methane gas drainage.

Learning outcome 6

Explain the principles and requirements of fire fighting systems and fire detection.

Assessment criteria

- 6.1 Outline the principles of fire detection systems.
- 6.2 Outline the types and applications of appropriate fire fighting systems for both underground and surface mines.

	6.3	Detail legislative/standards requirements in regards to fire detection and fire fighting systems.
Learning outcome 7		Outline the principles of equipment monitoring.
Assessment criteria	7.1	Explain the principles of equipment monitoring for operating status and machine condition.
	7.2	Explain the basic elements and function of microprocessor based equipment used in equipment monitoring.
	7.3	List the various status, conditions and functions typically monitored.
	7.4	Detail and compare data gathering techniques.
	7.5	Outline requirements in terms of calibration and accuracy.
7. Delivery of the module		
Delivery strategy		Delivery strategies must be suitable for learning both theoretical and practical aspects described in the module purpose. It is considered that the most effective method to achieve this is by integration of theory and practice where students learn by experimentation, research and reports. It is recommended that learning and assessment be facilitated in a holistic manner that may require learning outcome sequence other than that indicated in the module.

Resource requirements

Resources should be sufficient for students to carry out learning activities on an individual basis.

Suggested Learning Resource:

Relevant manufacturers' equipment specifications/data

Relevant regulatory documentation

Access to computer generated fault studies.

Occupational health and safety requirements

A safe and healthy environment will be provided for students and teachers as well as the particular safety procedures followed as part of the learning / teaching activity and content.

8. Assessment strategy

Assessment methods

Assessment should be progressive reflecting a holistic approach to ensure the module purpose is met. To assist in ensuring validity, reliability and fairness assessment instruments should include practical exercises, assignments and written tests consisting of a number of item types, such as multiple choice, short answer and problem solving.

Conditions of assessment

Learning and assessment will take place in an environment that is conducive to a learner's development.