1. Module details

Module name

Electronic Power and Control 1

Suggested structured learning time

A learner possessing the prerequisite skills and knowledge should achieve the module purpose in 36 to 40 hours.

Module code

NUE064

Discipline code

0703110

2. Module purpose

This module provides the Learner with the knowledge of common electronic devices and circuits used for power and control. They will also gain the knowledge and skills of basic electronic control system components such as PLC's, transducers and microprocessor controllers.

3. Learning Pathway

Intended use in the structured learning program

This module is intended to supplement workplace exposure to electrical work. Therefore before undertaking this module a student should have a clear understanding and experience of electrical maintenance and installations and how the fundamental principles for safety apply.

Recommended prerequisite modules

For the most effective learning this module should be undertaken only after modules in the applied electricity series have been completed.

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 EEQSBA.

This module supports the development of essential capabilities required for electrical licensing.

5. Content

1. Single and three phase rectifiers and filters
    - circuits
    - operating principles
    - measurement of circuit parameters

2. Inverters
   - block diagram
   - basic operating principles
   - common types
   - electrical safety precautions
3. Transducers
   - basic operating principles
   - purpose of transducers
   - applications
4. Microprocessor control systems
   - block diagram – basic operating principles
   - advantages
   - field bus systems – purpose and configuration
   - energy management systems (C-Bus, Oscar, I Control) – major component
5. Semiconductor devices
   - diodes, transistors, (switching), thyristors (SCR's, triac's and diac's) and three terminal voltage regulator symbols
   - operating principles
   - applications
6. Programmable Controllers (PLC's)
   - advantages of PLC's compared to relay systems
   - applications of PLC's
   - block diagram of PLC system and basic operation
   - connections of input and output devices to PLC
   - basic programming of PLC's (hand programmer) – inputs contacts, output relays and timers.

6. 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	Normally learning and assessment will take place in a formal learning environment.

7. Learning outcome details

Learning outcome 1	Explain the principle of operation and list typical applications for the following common semiconductor devices: rectifier diodes, zener diodes, transistors (switching), SCR's, triac's, diac's and three terminal voltage regulator IC.
Assessment criteria	1.1 Identify and draw the Australian standard symbols for each device. 1.2 Explain the basic operating principle for each device. 1.3 List two typical applications for each device.
Learning outcome 2	Describe the operating principle and characteristics for single phase half wave and full wave rectifiers, three phase rectifiers and low pass passive filters.
Assessment criteria	2.1 Draw, using Australian standard symbols the circuit for each rectifier type. 2.2 Explain the operating principles of each rectifier circuit. 2.3 Measure input and output voltage values and waveforms for each circuit.
Learning outcome 3	Describe the operating principles and safety precautions for low voltage inverter systems.
Assessment criteria	3.1 Draw the block diagram representation of an inverter. 3.2 Explain the operating principles of an inverter. 3.3 List the common types of inverters. 3.4 State the safety precautions for low voltage inverter systems.

Learning outcome 4	Describe the operating principles and applications of common types of transducers.
Assessment criteria	4.1 Explain the basic operating principle of transducers.
	4.2 State the purpose of transducers.
	4.3 List applications for the following types of transducers: proximity switches, photoelectric switches, limit switches, thermocouples, thermistors and tachogenerators.
Learning outcome 5	State the purpose of microprocessor systems.
Assessment criteria	5.1 Draw the block diagram representation of a microprocessor controller.
	5.2 List the advantages of microprocessor systems.
	5.3 State the purpose of field bus systems and the basic configuration.
	5.4 Describe the major components of an energy management system using C-Bus, Oscar or Icontrol as examples.
Learning outcome 6	Describe the application of PLC's when used in electrical control circuits to replace relay logic circuits.
Assessment criteria	6.1 List advantages of programmable logic controllers over relay circuit control.
	6.2 List applications for programmable logic controllers.
	6.3 Draw the block diagram representation of a programmable logic controller and explain its basic operation.
	6.4 With the aid of a diagram, connect inputs and outputs devices to a programmable logic controller.
	6.5 Enter a basic program using a hand programmer consisting of input contacts, output relays and timers into a programmable logic controller.

8. 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 a learning outcome sequence other than that indicated in the module.
Resource requirements	Resources should be sufficient for students to carry out exercises on an individual basis. Useful references include: Jenneson, J. R. 1996, *Electrical Principles for Electrical Trades,* 4th Ed., McGraw Hill, Sydney Standards Australia, Standards New Zealand: AS/NZS 3000:2000 *Wiring rules* AS/NZS 4836 *Safe working practice on low-voltage electrical installations* WorkCover Codes of Practice Local electricity distributor and authority regulations Where this module is used in an approved Traineeship or Apprenticeship program learners should be advised to obtain, where available, respective EEQSBA[1] ***User Guides*** (*these outline in detail what training and work performance the Learner is required to undertake for the program*)
Occupational health and safety requirements	A safe and healthy environment will be provided for learners and teachers. Safety procedures for the particular learning facilities shall be followed as part of the learning / teaching activity and assessment.

[1] EEQSBA – ElectroComms and EnergyUtilities Qualifications Standards Body of Australia Ltd.