1. Module details

Module name

Applied Electricity 3

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

NUE055

Discipline code

2. Module purpose

This module helps prepare students for further learning in the power applications of electricity. It provides students with the laws of electromagnetism and inductance and how they apply to the basic principles of electrical devices and machines. Students will gain knowledge of magnetic terms and units and develop skills in solving basic problems involving electromagnetics and inductance.

3. Prerequisites

Applied Electricity 1

4. Relationship to competency standards

This module provides part of the underpinning knowledge and skills identified in the 'Evidence Guide' of specific units in the National Electrotechnology Competency Standards. The module provides similar support for equivalent units in the National Metals and Engineering Competency Standards.

5. Content

Magnetism
permanent magnets
field patterns
magnetic induction and screening
applications

Electromagnetism
magnetic field around a current-carrying conductor

Fleming's right-hand rules
forces between current carrying-conductors

Magnetic quantities
units (magnetomotive force, magnetising force, flux density, reluctance)
permeability

Magnetisation curve
magnetic characteristics of materials
saturation, hysteresis
comparing magnetic materials

Induced voltage
factors required to induce an emf (Faraday's law)
forces acting on a conductor (Lenz's law)

Inductance
concept
unit
factors affecting inductance
self-inductance and mutual inductance

Application of electromagnetic principles
generator action
motor action
applications
unwanted effects

6. Assessment strategy

Assessment methods

Assessment should be progressive reflecting an 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 classroom / laboratory environment.

7. Learning outcome details

Learning outcome 1

Demonstrate an understanding of magnetism, magnetic induction the nature of magnetic materials and their application.

Assessment criteria

1.1 Show the field patterns around given permanent magnets.

1.2 Explain magnetic induction and its effects.

1.3 Describe the principles of magnetic screening and its application.

1.4 List typical applications of permanent magnets.

Learning outcome 2	**Demonstrate an understanding of magnetic fields associated with straight and coiled carrying-current conductors and resultant forces between adjacent conductors carrying current.**	
Assessment criteria	2.1	Show the magnetic field patterns around a straight conductor and a solenoid carrying current.
	2.2	Apply Fleming's Right-hand rules to determine the direction in which the magnetic field around a current-carrying conductor acts.
	2.3	Describe the factors effecting the force between adjacent current-carrying conductors and how the force will act.
Learning outcome 3	**Describe the relationship between magnetomotive force, magnetising force, flux density, permeability and reluctance in magnetic circuits and perform calculations to determine these quantities.**	
Assessment criteria	3.1	Explain how the magnetic units for magnetomotive force, magnetising force, flux density and reluctance are defined.
	3.2	Explain the property of permeability and the meaning of actual and relative permeability.
	3.3	Calculate values of magnetomotive force, magnetising force, flux density, permeability and reluctance in given magnetic circuits.
Learning outcome 4	**Compare the magnetic characteristics of various materials and explain the terms "saturation", "hysteresis" and "losses" and their effect in the performance of electrical machines.**	
Assessment criteria	4.1	Define the terms "saturation", "hysteresis" and "losses' in relation to magnetic materials and circuits.
	4.2	Compare the magnetic characteristics of various materials from magnetisation curves and hysteresis loops.
	4.3	Explain how magnetic losses occur and the resulting effects on the performance of electrical machines.

Learning outcome 5	**Demonstrate an understanding of the principles by which an emf is induced in a conductor, the magnitude of the induced emf and the direction in which it acts.**	
Assessment criteria	5.1	List the factors required to induce an emf in a conductor.
	5.2	Explain the relationship between the forces acting on a closed conductor when an emf is induced in it. (Lenz's law).
Learning outcome 6	**Discuss the concepts of inductance, the units by which it is measured and the relationship between the factors determining the inductance of a circuit.**	
Assessment criteria	6.1	Describe the factors effecting inductance and how the unit of inductance is derived.
	6.2	Explain the concept of self-inductance and mutual inductance.
	6.3	Calculate the value of induced voltage in a given circuit.
Learning outcome 7	**Discuss the application of electromagnetic principles used in electrical machines and devices.**	
Assessment criteria	7.1	Describe concepts of "generator action" and "motor action".
	7.2	List applications where the principle of electromagnetism and induction are used.
	7.3	Identify situations where the effects of inductance and electromagnetism are unwanted

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 way to achieve this is by the integration of theory and practice where students learn by experimentation and through research and laboratory reports. It is recommended that learning and assessment be facilitated in a holistic manner which may require learning outcome sequence other than that indicated in the module.

Resource requirements	Resources should be sufficient for students to carry out experiments on an individual basis. This will require a range of experimental circuit devices and measuring instruments. Useful references include: Jenneson, J. R. 1995, *Electrical Principles for Electrical Trades*, McGraw Hill, Sydney Phillips, P. 1996, *Electrical Principles* 1. Thomas Nelsen, Melbourne. Batty, I. 1996, Electrical Principles. Prentice Hall, Sydney. Van den Bergen, B. 1996, Mathematics for the Electrical Trades. TAFE Publications, RMIT, Melbourne. Pethebridge, K., Neeson, I. 1998, *Electrical Wiring Practice*. 5th Ed. McGraw Hill, Sydney.
Occupational health and safety requirements	A safe and healthy environment will be provided for students and teachers as well as safety procedure with regard to learning / teaching activity