1. Module details

Module name

Light, Power and Load Management

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

NUE956

Discipline code

0703120

2. Module purpose

The module provides the underpinning knowledge and skills for the management of lighting, power and electrical loads in domestic, commercial and industrial installations.

3. Prerequisites

NUE057 Applied Electricity 5.

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

Overview of energy management systems
Commercial units of energy
Cost of energy

Major energy consumers
Lifts, mechanical plants, lighting, power, building energy deficiencies

Lift management
Lift optimisation
Standards relevant to power for lifts

Plant management - mechanical services
Controllers and sensing circuits
Computer controlled systems
Codes
Test equipment

Lighting management
Control strategies
Lighting control devices
Lighting systems
Test equipment

Load management
Load reduction methods
Load sharing
Power factor correction
Harmonics
UPS systems
Test equipment

Building structure
Thermal efficiency
Energy audit process

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

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

7. Learning outcome details

Learning outcome 1

Outline types of energy management systems.

Assessment criteria

1.1 List commercial units of energy.

1.2 Calculate typical energy costs for installations given unit cost and usage patterns.

Learning outcome 2

Determine the equipment in domestic, industrial and commercial installations that are the main users of energy.

Assessment criteria

2.1 Identify major consumers of energy in building services.

2.2 Determine the energy consumption of specific devices given power ratings and typical usage patterns.

2.3 Identify major energy losses in buildings of various types.

Learning outcome 3	**Investigate the effect of lift operation on building energy use.**	
Assessment criteria	3.1	Determine the approximate energy consumption of a lift system in a multi-storey building.
	3.2	Select usage patterns that restrict operation and energy use but still provide satisfactory service to users.
	3.3	Review standards that relate to lift operation and power supply to determine the minimum requirements for a lift system.
Learning outcome 4	**Describe control elements and systems that are used for efficient mechanical plant operation.**	
Assessment criteria	4.1	Outline basic control methods for AC plant including time limit systems.
	4.2	Describe basic sensor layout for efficient temperature and humidity control in small commercial installations.
	4.3	Describe the use of waste heat recovery systems and co-generation used to minimise energy usage in commercial and industrial applications.
	4.4	Outline the main features of a building automated control system.
	4.5	Draw a schematic or block diagram of a building automation system.
	4.6	Describe test equipment and its use for testing and balancing air conditioning services in accordance with appropriate standards.

Learning outcome 5	**Outline lighting management systems designed to minimise energy usage without causing harm or discomfort to occupants of buildings.**
Assessment criteria	5.1 Describe basic light control systems operating on a single circuit.
	5.2 Compare more complex microprocessor based energy control systems to basic control systems.
	5.3 List and describe accessories that may be used with energy management systems including timers and programmable control elements.
	5.4 Suggest lighting options that could reduce energy used by a lighting installation without reducing light levels.
	5.5 Describe lighting control systems using controlled dimmers and passive infra-red detectors that may be used in more complex lighting installations with a mix of artificial and natural light.
	5.6 Design a basic lighting operation schedule for a large office to cover yearly usage given dates for public holidays and daylight saving variations.
	5.7 Test lighting installations for compliance with lighting standards using basic test equipment and practices.

Learning outcome 6	**Develop load management strategy for buildings with a mix of tenants.**	
Assessment criteria	6.1	List methods that will reduce current and switching transients caused by the operation of major equipment.
	6.2	Detail load tariff and billing schemes applied by supply authorities.
	6.3	Suggest hierarchy of load types that may be shed to maintain maximum demand below a set point.
	6.4	Outline methods commonly used to monitor power factor and describe power factor correction schemes.
	6.5	List equipment that is likely to cause high harmonic content in building supply systems and describe prevention or compensation techniques.
	6.6	Describe the operation and application of UPS systems.
	6.7	Use test equipment to check power wiring and quality of power supply including transients and harmonic content.
Learning outcome 7	**Describe general features of a building that are likely to reduce usage of artificial lighting and air conditioning.**	
Assessment criteria	7.1	Outline the effects of building thermal efficiency on the operation of AC plant.
	7.2	List steps involved in an energy audit process.
	7.3	Perform an energy audit for a selected building.
	7.4	Outline maintenance practices that will maintain efficient building systems including filter maintenance, set point and dead bands.

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 learning outcome sequence other than that indicated in the module.

Resource requirements

Suggested Learning Resources:

Standards Australia, Standards New Zealand, Australian/ New Zealand Wiring Rules AS/NZS 3000:2000.

Petherbridge, K., Neeson, I. 1998 Electrical Wiring Practice. 5th Ed. McGraw Hill Sydney.

Walsh, Monroe and Spencer. An Australian climatic Data Base for use in the Estimation of Building Energy Use, CSIRO 1993.

AIRAH/ACS DESIGN Aid DA9: Air conditioning systems-Load Estimation and Psychometrics.

ASHRAE Fundamentals 1989, Chapters 24 and 26
State Projects NSW Building Energy Manual, NSW Public Works, 1993.

AS1668 parts 1 and 2 The use of mechanical ventilation and air conditioning in buildings.

AS1861 parts 1 and 2. Air Conditioning units - Methods of Assessing and Rating Performance.

Clipsal CBUS manual software and equipment.

Honeywell 1989 Engineering Manual of Automatic Control - SI edition for Commercial Buildings.

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.