1. Module details

Module name

ElectroComms Principles

Suggested structured learning time

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

Module code

NUE189

Discipline code

031309 Communication Equipment Installation and Maintenance

2. Module purpose

This module provides the knowledge and skills to enable learners to develop basic skills in connecting, measuring and working with basic dc series, parallel and series/parallel circuits. It also provides students with the fundamental concepts of capacitance, inductance and alternating current principles used in the Telecommunication industry. Additionally, it provides students with the basic construction and operation of transformers used in Telecommunication equipment.

3. Learning pathway

Intended use in the structured learning program

This module is intended as an introduction to electrical theory and to supplement exposure to telecommunication work. Before undertaking this module a learner should have a general understanding of what telecommunication cabling work entails and the need for safety, particularly when working with electricity.

Recommended prerequisites

For the most effective learning, students should have skills in number systems & estimation, summarising and interpreting data, algebraic statements, indices, area, linear relationships, ratios and rates and its applications, graphs, and transposition of equations.

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 other National Competency Standards. For details refer to the module to unit maps available from EE-Oz Training Standards (formerly EEQSBA).

This module supports the development of essential capabilities required for telecommunications cabling registration.

5. Content

1. The basic electrical circuit
   - basic circuit components
   - function of basic circuit components
   - connection of components
   - measurement of circuit parameters
   - open-circuit, closed-circuit and short-circuits.

2. Circuit parameter relationships
   - Ohms Law
   - calculation of voltage, current and resistance
   - power dissipated
   - calculation of power.
3. Measurement instruments (voltage, current & resistance)
   - safe working procedures
   - handling and storing instruments
   - selecting and set up of instruments
   - connecting instruments
   - read analogue scales and digital readouts.
4. Effects of electrical current
   - physiological effect
   - heating effect
   - magnetic effect
   - chemical effect
   - typical uses
5. EMF sources
   - basic generator
   - basic thermocouple
   - photovoltaic cells
   - piezo electric
   - primary and secondary cells.
6. d.c. resistive circuits
   - series circuits (set-up, measurement and calculations)
   - parallel circuits (set-up, measurement and calculations)
   - series-parallel circuits (set-up, measurement and calculations).
7. Capacitance
   - construction of capacitors
   - operation of capacitors
   - units
   - charge of a capacitor
   - RC series circuit.
8. Magnetism and electromagnetic induction
   - permanent magnets
   - electromagnetism
   - induced emf
   - inductors
   - principles of inductance
   - unit of inductance
   - electromagnetic radiation (EMR)
   - cross talk.
9. a.c. principles
   - generation of sinusoidal voltage

- a.c. circuit parameters – frequency, period, amplitude, instantaneous value, maximum value, peak value, peak to peak value and rms value
- calculation of frequency and rms values
- effects of frequency on inductors $\left(X_L = 2\pi f_L\right)$
- effects of frequency on capacitors $\left(Xc = \frac{1}{2\pi fc}\right)$
- transformers construction and operating principles.

7. Learning outcome details

On completion of this module the learner will be able to:

Learning outcome 1

Identify basic circuit components and connect a basic circuit using identified components and measure circuit parameters.

Assessment criteria

1.1 Identify sources of electrical supply, control switches, circuit protection devices and consuming devices.

1.2 State the function of sources of electrical supply, control switches, circuit protection devices, conductors, insulators and consuming devices

1.3 Connect a single resistive load with a load switch to source terminals using a circuit diagram as a guide

1.4 Measure voltage, current and resistance in a basic circuit.

1.5 Observe and describe the effects of an open-circuit, a closed-circuit and a short-circuit in a basic circuit.

Learning outcome 2

Demonstrate an understanding of the relationships between voltage, current and resistance and the power dissipated in a circuit.

Assessment criteria

2.1 Show the relationship between voltage and current from measured values in a simple circuit.

2.2 Calculate the voltage, current and resistance in a circuit given any two of these quantities.

2.3 Explain the relationship between voltage, current and resistance and the power dissipated in a circuit.

2.4 Calculate the power dissipated in a circuit from voltage, current and resistance values.

Learning outcome 3

Use digital and analogue instruments to measure voltage, current and resistance.

Assessment criteria

3.1 Apply safe working procedures when working with instruments.

3.2 Handle and store instruments to ensure they are protected from damaged.

	3.3 Select and set-up an instrument to measure voltage, current or resistance.
	3.4 Connect instruments into a circuit to measure voltage, current and resistance.
	3.5 Read analogue scales and digital readouts in measuring voltage, current and resistance.
Learning outcome 4	Demonstrate an understanding of the effects of electric current and typical uses of these effects.
Assessment criteria	4.1 Describe the physiological effects of electrical current.
	4.2 Describe the heating effects of electrical current.
	4.3 Describe the magnetic effects of electrical current
	4.4 Describe the chemical effects of electrical current
	4.5 List typical uses of the effects of current.
Learning outcome 5	Describe how other forms of energy are converted to electrical energy and where each is used.
Assessment criteria	5.1 Describe the basic principles of producing an emf from the interaction of a moving conductor in a magnetic field.
	5.2 Describe the basic principles of producing an emf from the heating of one junction of a thermocouple.
	5.3 Describe the basic principles of producing a emf by the application of sun light falling on the surface of photovoltaic cells
	5.4 Describe the basic principles of generating a emf when a mechanical force is applied to a crystal (piezo electric effect)
	5.5 Describe the principles of producing a electrical current from primary and secondary cells
Learning outcome 6	Describe the effects of voltage, current and resistance in simple single source DC series, parallel and series-parallel resistive circuits.
Assessment criteria	6.1 Set up and connect a simple single source DC series resistive circuit.
	6.2 Demonstrate by measurement the relationships between voltage, current and resistance in a DC series circuit.
	6.3 Calculate current, voltage and resistance in a simple series resistive circuit.
	6.4 Set up and connect a simple single source DC parallel resistive circuit.
	6.5 Demonstrate by measurement the relationships between voltage, current and resistance in a DC parallel circuit.

	6.6 Calculate current, voltage and resistance in a simple parallel resistive circuit.
	6.7 Set up and connect a simple single source DC series - parallel resistive circuit.
	6.8 Demonstrate by measurement the relationships between voltage, current and resistance in a DC series-parallel circuit.
	6.9 Calculate current, voltage and resistances in a simple series-parallel resistive circuit.
Learning outcome 7	Demonstrate an understanding of the concepts of capacitance, the units by which it is measured, and the characteristics of series DC circuits containing resistance and capacitance.
Assessment criteria	7.1 Describe the construction of capacitors and list common types together with their application.
	7.2 Define capacitance and explain how a capacitor is charged and discharged in terms of its electrostatic field.
	7.3 State the unit by which capacitance is measured.
	7.4 State the relationship between capacitance, voltage and charge.
	7.5 Briefly describe the behaviour of a series DC circuit containing resistance and capacitance.
Learning outcome 8	Demonstrate an understanding of the principles of magnetism, electromagnetism, magnetic fields associated with straight and coiled current-carrying conductors, electromagnetic induction and inductance.
Assessment criteria	8.1 Sketch the magnetic flux pattern around a bar magnet.
	8.2 Show the magnetic field patterns around a straight conductor and a solenoid carrying current.
	8.3 List the factors required and describe the process by which an EMF is induced in a conductor.
	8.4 Describe the construction of an inductor.
	8.5 Describe the concept of inductance and list the factors affecting the inductance of a conductor and coil.
	8.6 Define the unit of inductance.
	8.7 Explain the effects of electromagnetic radiation.
	8.8 Describe the term cross talk in association with communication equipment.
Learning outcome 9	Describe alternating current and voltage waveforms and their means of generation.

Assessment criteria	9.1 Describe how a sinusoidal voltage is generated in a simple alternator with a single turn coil in a uniform magnetic field. 9.2 Define the terms 'frequency', 'period', 'amplitude', 'instantaneous value', 'maximum value', 'peak value', 'peak-to-peak value' and 'root-mean-square (rms) value' in relation to a sinusoidal waveform. 9.3 Calculate the rms value and frequency of a sinusoidal waveform from peak value and period. 9.4 Describe the effect of frequency on inductive components $\left(X_L = 2\pi f_L\right)$. 9.5 Describe the effect of frequency on capacitive components $\left(Xc = \frac{1}{2\pi fc}\right)$. 9.6 Describe the operating principles and function of an ideal transformer and the construction of a practical transformer. 9.7 List typical applications of transformers in telecommunication systems.

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 Learners 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.
Assessment strategy	
Assessment methods	Assessment should be progressive reflecting a holistic and integrated approach to ensure the module purpose is met. To assist in ensuring validity, reliability and fairness assessment instruments is to include monitoring learner progress; practical exercises, assignments and written tests consisting of a number of item types, such as multiple choice, short answer and problem solving. "Checklist" or atomistic assessment approaches are to be avoided.
Conditions of assessment	Learning and assessment is to take place in a formal learning environment that is conducive to learning.
Resource requirements	Resources should be sufficient for learners to carry out learning activities on an individual basis.

	Trainers/teachers/facilitators must have qualifications in the relevant subject area for the AQF level program being delivered and, they are engaged to deliver recognised trainer and assessment training and at least three to five years relevant work experience. Useful references include: • Class notes, workbook, calculator • Relevant standards Jenneson, J. R. 1996, *Electrical Principles for Electrical Trades ,* 4th Ed., McGraw Hill, Sydney Phillips, Peter 1996, *Electrical Principles 1* ISBN 0 17 0092127 Thomas Nelsen, Melbourne, Victoria. Batty, Ian, *Electrical Principles* ISBN 0 72 4803904 Prentice Hall, 1997, Sydney, NSW. Van Den Bergen, B *Mathematics for the Electrical Trades* ISBN 0 73 0687244 TAFE Publications, RMIT, Melbourne, Victoria. Where this module is used in an approved Traineeship or Apprenticeship program learners should be advised to obtain, where available, respective EE-Oz Training Standards[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/participants and teacher/trainers/assessors, as well safety procedures with regard to learning and assessment activities shall be formally advised.

[1] EE-Oz Training Standards – ElectroComms and EnergyUtilities Industry Skills Council Ltd formerly ElectroComms and EnergyUtilities Qualifications Standards Body of Australia Ltd (EEQSBA)