UTE NES064 A
Undertake computations in an Electrotechnology environment

Descriptor: Use computational and mathematical procedures to solve problems or to enhance given data

Elements		Performance criteria	
064.1	Prepare to undertake computations	064.1.1	Computational activities are planned and prepared to ensure *OH&S policies and procedures* are followed with the work appropriately sequenced in accordance with *requirements*
		064.1.2	Data for computations are obtained and verified in accordance with *established procedures* and to comply with *requirements*
		064.1.3	Location in which activities are undertaken or data gathered is determined from job *requirements*
		064.1.4	Materials/devices needed to carry out the computations are obtained in accordance with *established procedures*
064.2	Undertake computations	064.2.1	*OH&S policies and procedures* for undertaking monitoring activities are followed
		064.2.2	Computations are undertaken in accordance with *requirements.*
		064.2.3	Unplanned events or conditions are responded to in accordance with *established procedures*
		064.2.4	On-going checks of the quality/accuracy of the work are undertaken in accordance with *established procedures*
064.3	Complete monitoring activities	064.3.1	Computations are verified and checked against estimates
		064.3.2	Documentation/reports/computations are completed to ensure all *requirements* are met
		064.3.3	Work completion is *notified* in accordance with *established procedures*

Range statement

General

Generic items in this unit are shown in italics, *e.g. established procedures*. The definition and intended scope covered by generic items is described in the Glossary that forms an integral part of this range statement.

Computational and mathematical procedures are used to solve problems or to enhance given data. Data includes but is not limited to; records, figures, numbers, facts, statistics, and information. This also includes but is not limited to utilising a range of related computation applications and devices, which aid in the development of appropriate results.

Currency in unit of competence

In order to maintain currency in this Unit on-going competency development is to occur. This would include keeping abreast of any changes in legislation, regulations, procedures, technology and the like related to the scope and application of this unit.

Evidence guide

This Evidence guide is intended to include components defined within the Range Statement, of which the Glossary is an integral part. Terms in italics, e.g. *consistent performance*, with respect to the Evidence guide are also contained in the Glossary.

Critical aspects of evidence

Achieving competence

Achievement of this unit of competence is based on each of the following conditions being met:

- demonstrating *consistent performance* for each element of the unit exhibited across a *representative range* of applications; independently under direct supervision and to *requirements.*
- meeting the performance criteria associated with each element of competence by employing the techniques, procedures, information, and resources available in the workplace within the context of the Range Statement.
- demonstrating an understanding of the Underpinning knowledge and skills identified in the section, of this unit titled 'Underpinning knowledge and Skills'.

Reporting requirements

The reporting of the judgements about competence must be in the context of the individual unit being assessed and the qualification to be issued. Where regulatory requirements in individual jurisdictions require recording of additional information such as underpinning knowledge and skills specified, as well as related work performance evidence relevant to this unit, it is to be reported in accordance with the Regulator's requirements. For such requirements knowledge and skills that underpin this competency are to be recorded and issued as a part of the transcript of achievement.

Maintaining competence

Consideration should be given to periodic evaluations of skills and knowledge within this unit that are critical to safety, operation of plant and equipment and the like, particularly where relevant skills and knowledge are not frequently practiced.

Context of assessment

Competency in this unit will be determined on evidence of having *consistently performed* across a *representative range* of activities in the provision of sustainable energy solutions for energy reductions in domestic premises and/or allied industry areas.

Due regard must be given to Safety when developing assessment and delivery arrangements. Assessment is to be progressive reflecting an holistic approach. Competent performance with inherent safe working practices is expected in the Electrotechnology Industry. This requires that the specified underpinning knowledge and skills is developed and assessed in a structured environment which is primarily intended for learning and incorporates all necessary equipment and facilities for learners to develop the knowledge and skills described in this unit. Such environment must ensure appropriate controls, safety, and direct supervision is practiced.

The context must also embrace the requirements and characteristics for the applicable endorsed qualification, which references this unit, and, where required, support the outcomes of other units within the endorsed qualification structure.

Interdependent assessment of units

Assessment in this unit should include related underpinning specified knowledge and skills associated with other units within the respective endorsed qualification structure, where appropriate.

Additionally, this unit should be assessed in conjunction with or after competency has been demonstrated in UTE NES061 Provide basic sustainable energy solutions for energy reduction in domestic premises, UTE NES062 Apply sustainable energy practices in daily activities and UTE NES065 Promote sustainable/renewable energy practice in the community.

Underpinning knowledge and skills

This section provides the specification of underpinning knowledge and skills required to underpin the elements, performance criteria, and range statement of this unit. More detailed information related to the breadth and depth of underpinning knowledge and skills is included in the Knowledge and Skills Specification, which forms an integral part of this unit.

Note: The Electrotechnology Industry is a hazardous industry which is demonstrated by the need for regulation in respect of electrical safety and regulation, and therefore, due regard must be given to the environment in which the development of underpinning knowledge and skills and its application occurs. Thus development and assessment of underpinning knowledge and skills is to be arranged in manner, which ensures appropriate control measures of safety and regulatory requirements are in place and observed. In particular, special attention is to be given to ensuring a

structured environment for learning and practice includes the use of equipment that is designed for instructional purposes, and which does not expose the learner to any unsafe conditions. The use of such equipment does not negate the duty of care responsibilities that apply.

This, with other aspects of evidence, will ensure that an individual has the appropriate underpinning knowledge and skills that support the ability to undertake activities as a competent person.

Underpinning knowledge and skills topics pertaining to this unit – *listed below are underpinning knowledge and skills topics, which are required to be exhibited by individuals for the purposes of attaining appropriate knowledge and skills underpinning performance in this unit. The relevant detail for each topic that must be exhibited by an individual is included under Knowledge and Skills Specification topics, which follows the list*:

Topics:

- **Applied Electricity 1**
- **Electrical Concepts and Applications**
- **Applied Mathematics Concepts 1**
- **Applied Mathematics Concepts 2**
- **Undertake computations in an Electrotechnology environment – Work performance**

Knowledge and Skills Specification

This Knowledge and Skills Specification details the requisite knowledge and skills that is to be developed and achieved for each topic specified and listed within the Evidence Guide of this unit of competency under the heading Underpinning knowledge and skills. This section provides information regarding the depth and breadth of knowledge and skills to be developed and exhibited thus, forming an integral part of the respective Unit of Competency.

More detailed information regarding strategies for learning, development and assessment of content breadth and depth, delivery and resourcing issues is included in associated Training Package Support Materials and, where developed advice can be obtained from ANTA's website.

Applied Electricity 1

Fundamental and derived units: basic units; SI derived units; multiples and sub-multiples

Power, work and energy: conservation of energy; torque; losses and efficiency; maximum efficiency of machines

Electrical characteristics of materials: conductors, insulators, semi-conductors; electric charge; electric current; electromotive force

The simple circuit: source, load, current path and control; open-circuit; short-circuit

Resistance: Ohm's law; determine V, I, R; power dissipation

Effects of current: physiological effects; principles of protection from physiological effects; conversion of electrical energy to other forms (heating, light, magnetic, chemical)Sources of electrical energy - conversion of other forms to electrical energy

Using measuring instruments: handling measuring instruments; selecting an instrument; setting-up and connecting into circuits; reading scales and read-outs; setting up a CRO

Electrical Concepts and Applications

DC resistive circuits: series; parallel; series parallel; measurement of V, I and R; calculation of R, V, I, and P

Capacitance: concept; unit; time constant; capacitors – basic construction and types

Magnetism: magnetic and non magnetic materials; magnetic field patterns; force between magnetic fields; applications

Electromagnetism: magnetic field around a current-carrying conductor and solenoid; force between current-carrying conductors; applications

Electromagnetic induction: induced EMF; inductance, concept, unit, time constant, applications

AC principles: sine waves; frequency; amplitude; peak voltage; peak to peak voltage; RMS voltage; single phase; three phase; generation of AC voltages; circuit measurement; earthing; electrical supply system

Transformers: construction; principles of operation; primary and secondary voltage and current; applications

Motors: motor action; generator action; DC motors; AC motors; applications

Electrical safety testing: regulations.

Applied Mathematics Concepts 1

Linear Measurement: Precision and error of measurement - significant figures, relative and % errors, scientific notation on a calculator; Conversion of linear units - review of perimeter of plane figures; Pythagoras' theorem; Perimeter of polygons; Arc lengths; Perimeter of shapes involving arcs

Spatial Measurement: Areas of combined shapes; Volume and surface area of solids; Applied problems

Right triangle trigonometry: Revision of right-angled triangles trigonometry; Angles of elevation/depression, and compass directions (bearings); Vocational problems involving both trigonometric ratios and Pythagora's Rule; Applications to the inclined plane

Sine and Cosine Rule: Sine rule and area of a triangle rule; Cosine rule; Applications of the three rules

Surveying: Radial survey; Triangulation survey using sine rule; Use of Simpson's rule to find the area between a curve and a straight line

Algebra: Algebraic operations; Solutions of linear equations; Substitution into simple non-linear equations; Transposition of non-linear equations

Linear Graphs: Graphing linear functions; Application of the linear function - derive formula from graphs and tables; Simultaneous equations – both graphical and algebraic solutions; Practical applications (cost/revenue, supply/demand); Find line of best fit graphically, then determine equation

Polynomials: Types of polynomials - add/subtract, multiply polynomials; Factorising trinomials; Solution of quadratic equations using both factorising method and formula

Quadratic Graphs: Properties of the parabola – symmetry, axis of symmetry, turning point; Graphic quadratic functions $y = ax^2 + bx + c$; Finding maximum and minimum values of quadratic functions by using axis of symmetry/turning point; Application of quadratic functions to problems - maxima and minima problems, solution of quadratic equations graphically

Applications: Graphic trig functions (sine/cosine only); Applications in the physical sciences

Or equivalent Year 12 High School Mathematics 1 that meets respective University Admittance Index (UAI) or Tertiary Entrance Rank (TER)

Applied Mathematics Concepts 2

Presentation of Data: What are statistics and who uses them?; Frequency distributions - frequency tables, histograms and polygons, stem and leaf plots; Range of visual presentations - comparisons – tables versus graphs, introduction to spreadsheets to present data graphically

Sampling (collecting data): Design and use of experiments, surveys and census; Selecting a sample using various sampling techniques**;** Coding and tabulating responses

Describing Distributions: Measures of central tendency - determination and uses of mode, median and mean; Estimating percentiles and deciles from cumulative frequency polygons (ogives); Interpreting data from tables and graphs - interpolation/extrapolation; Analysis of misleading graphs

Measures of Dispersion: Box-and-whisker graphs; Measuring dispersion - variance & standard deviation; Standardisation – using Z-scores to compare different sets of scores and standardising scores

Correlation and Linear Regression: Correlation - scatter diagrams, calculation of correlation coefficient for a set of data; Regression lines - calculation of the regression equation, using the regression line for prediction

Experimental and Theoretical Probability: Simple experiments with dice, spinners etc. to investigate equally likely outcomes; The addition theory of probability; Complementary events; Compound events – probability trees, arrays, etc.; Simple counting techniques - use of "box filling" method

Applications of Probability: Gambling games; Expected outcomes – the use of probability in real life situations such as insurance, investments etc.; Counting techniques – factorial, permutations, combinations

Pascal's Triangle and the Normal Curve: Pascal's triangle; Applications; Normal probability distribution - probabilities using 1, 2 and 3 standard deviations

Or equivalent Year 12 High School Mathematics 2 that meets respective University Admittance Index (UAI) or Tertiary Entrance Rank (TER)

Undertake computations in an Electrotechnology environment – Work performance

Undertaking computations in an Electrotechnology environment in the Sustainable and/or Renewable Energy sector across a *representative range* of apparatus and associated systems must be appropriately demonstrated on-the-job in real work activities or equivalent simulated environment