UTE NES057 A
Apply computation when using equipment/materials/concepts in an Electrotech environment

Descriptor: Undertake computations to produce appropriate results using a range of equipment, materials and concepts in carrying out Electrotechnology work activities, whilst ensuring work is completed in an agreed time, to a quality standard and with a minimum of waste.

Elements		Performance criteria	
057.1	Prepare to apply computations when using equipment, materials and concepts	057.1.1	Instructions for the preparation to apply computations when using equipment, materials or concepts are communicated and confirmed to ensure clear understanding
		057.1.2	*OH&S policies and procedures* are communicated and confirmed to ensure they are understood as to be applied in the carrying out of the work
		057.1.3	Tools, *equipment* and personnel protective equipment needed to do the work are identified, scheduled and checked, where appropriate, to ensure they work correctly as intended and are safe to use in accordance with *established procedures*
		057.1.4	*Appropriate personnel* are consulted to ensure computations when using equipment, materials or concepts is coordinated effectively with others involved
		057.1.5	Resources and materials needed to do the work are confirmed, scheduled and obtained in accordance with *established procedures*
		057.1.6	Schedule of computations to be applied when using equipment, materials or concepts including practices for working safely are confirmed as in accordance with instructions and *requirements*
057.2	Carry out computations when using equipment, materials and concepts	057.2.1	*OH&S policies and procedures* and safe work practices are followed to eliminate or minimise incidents
		057.2.2	Schedule of computations is followed to ensure the use equipment, materials or concepts is completed in an agreed time, to a quality standard and with a minimum of waste

Elements		Performance criteria	
		057.2.3	Further instructions are sought from *appropriate personnel* in the event of unplanned events or conditions occurring
		057.2.4	On going checks of quality of the computations are undertaken in accordance with instructions and *requirements*
057.3	Confirm results of computations when using equipment, materials and concepts	057.3.1	Final checks are made to ensure the computations applied when using equipment, materials or concepts conforms with instructions and to *requirements*
		057.3.2	*Appropriate personnel* are notified of completion of the computations
		057.3.3	Tools, *equipment* and any surplus resources and materials are, where appropriate, cleaned, checked and returned to storage in accordance with *established procedures*
		057.3.4	Work area is cleaned up and made safe and *sustainable energy practices* are followed
		057.3.5	Appropriate records are updated in accordance with instructions and *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.

Electrotechnology environment includes one or more the following *category* or allied industry areas:

Computer Systems

Data Communications

Electronics

Electrical

Instrumentation

Refrigeration and Air conditioning

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 one or more of the following *category* areas: *Computer Systems; Data Communications; Electronics; Electrical; Instrumentation; Refrigeration and Air conditioning 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 NES060 Carry out routine work activities in an Electrotech environment, UTE NES050 Identify & select components/ accessories/ materials for Electrotech work activities and UTE NES051 Use of routine equipment/ plant/ technologies in an Electrotech Environment.

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 the topic of *Electrotechnology Systems, Materials and Accessories* detailed below. Appropriate measures for this topic must be put in place to ensure 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 voltages that exceed extra low voltage. Extra low voltage is defined in Standards Australia publications, eg. SA/NZ 3000:2001. However, the use of such equipment does not negate the duty of care in treating electricity other than as a hazard.

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:

- **Projects for Electrotech Vocations**
- **Drawing Interpretation and Sketching**
- **Electrotechnology Systems, Materials and Accessories**
- **Workshop Practices**
- **Applied Mathematics Concepts 1**
- **Applied Mathematics Concepts 2**
- **Apply computation when using equipment/materials/concepts in an Electrotech 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.

Projects for Electrotech Vocations

Project Planning: research; aims and objectives of the project; application of project in the Electrotechnology industry

Reporting/Documentation: written; drawings/sketches

Project Building: material requirement; assembly; final testing

Presentation: overview of project; aims/objectives; operating principles; conclusion

Drawing Interpretation and Sketching

Technical drawing standards appropriate to the industry sector, conventions and specifications to AS 1100, with strong emphasis on interpretation: sheet types, title block information, materials parts list, revision table, grid referencing scales, line types – visible outlines, hidden outlines, dimensioning lines, centre lines; orthogonal projection of views – 3rd angle (detail and assembly drawings); mechanical conventions; fabrication conventions; three dimensional view drawings – axonometric, isometric, oblique; sectioning standards and conventions – whole, part; engineering drawing symbols, components and equipment – mechanical, electrical, electronic, computer, instrument, refrigeration; dimensioning – orthogonal, isometric; layout and plans; geometric tolerance interpretation (straightness, flatness, squareness, parallelism and concentricity only); engineering abbreviations; drawing interpretation techniques – detail drawings, orthogonal projection (3^{rd} angle only) and three dimensional, assembly drawings and three dimensions exploded (e.g. as in equipment manuals)

Equipment and service manuals: flow charts; assembly/disassembly diagrams; schematic diagrams; block diagrams; trouble shooting guides

Freehand drawing skills appropriate to the industry sector: 3^{rd} angle orthogonal projections; isometric; interpretation of drawing symbols; practical exercises

Electrotechnology Systems, Materials and Accessories

Overview of Electrical Power System: generation system – fossil fuel and renewable sources, co-generation and typical power station equipment; transmission system – types and equipment; distribution system – equipment; grid system

Overview of Telecommunication System: customer access network (CAN); customer premises equipment (CPE)

Statutory requirements and standards: scope of work permitted by various licences; legislated requirements; purpose of technical standards; role of standards bodies; use of technical standards

Cables: types – power, signal, communication; terms; colour coding; structure; identification; cable applications

Wiring systems: types; wiring looms; enclosures and supports

Terminating power, signal and communication cables: requirements; plugs/sockets and connectors types and applications; assembly/disassembly plugs/sockets and connectors

Accessories and fixings appropriate to industry sector: types of accessories and applications; fixing devices and methods

Workshop Practices

Identification and application of tools for: marking out a measuring; cutting; shaping; drilling; threading; tapping; finishing; dismantling/assembling

Tool use: hazards; safety procedures; techniques

Fabrication: materials, types, applications; techniques, marking out, cutting, bending, drilling/punching, soldering, cutting mitres

Assembly/disassembly techniques

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)

Apply computation when using equipment/materials/concepts in an Electrotech environment – Work performance

Apply computation when using equipment/materials/concepts in an Electrotech environment in any one or more of the above *categories* across a *representative range* of apparatus and associated systems must be appropriately demonstrated on-the-job in real work activities or equivalent simulated environment