



Australian Government

UEENEEH145A Develop engineering solutions to analogue electronic problems

Release 2

UEENEEH145A Develop engineering solutions to analogue electronic problems

Modification History

Not applicable.

Unit Descriptor

Unit Descriptor

1) Scope:

1.1) Descriptor

This competency standard unit covers developing engineering solutions to solve problems with analogue electronics. It encompasses working safely, apply extensive knowledge of analogue electronics circuit and device operation and their application, gathering and analysing data, applying problem solving techniques, developing and documenting solutions and alternatives.

Note.

Typical analogue electronic problems are those encountered in meeting performance requirements and compliance standards, revising analogue electronics operating parameters and dealing with analogue electronic malfunctions.

Application of the Unit

Application of the Unit 2)

This competency standard unit is intended to apply to any recognised development program that leads to the acquisition of a formal award at AQF level 5 or higher.

Licensing/Regulatory Information

License to practice 3)

The skills and knowledge described in this unit require a

License to practice**3)**

licence to practice in the workplace for work plant and equipment which is directly connected to installation wiring that operates at voltages above 50 V a.c. or 120 V d.c. However other conditions may apply in some jurisdictions subject to regulations related to electrical work. Practice in the workplace and during training is also subject to regulations directly related to occupational health and safety and where applicable contracts of training such as apprenticeships and the like.

Note:

1. Compliance with permits may be required in various jurisdictions and typically relates to the operation of plant, machinery and equipment such as elevating work platforms, powder operated fixing tools, power operated tools, vehicles, road signage and traffic control, lifting equipment and the like. Permits may also be required for some work environments such as confined spaces, working aloft, near live electrical apparatus, site rehabilitation and the like.

2. Compliance may be required in various jurisdictions relating to currency in first aid, confined space, lifting, risk safety measure and the like.

Pre-Requisites**Prerequisite Unit(s)****4)****Competencies****4.1)**

Granting competency in this unit shall be made only after competency in the following unit(s) has/have been confirmed.

UEENEEH1 Troubleshoot basic amplifier circuits
39A

Literacy and numeracy skills**4.2)**

Participants are best equipped to achieve this unit if they have reading, writing and numeracy skills indicated by the following scales. Description of each scale is given in

Volume 2, Part 3 ‘Literacy and Numeracy’

Reading 5 Writing 5 Numeracy 5

Employability Skills Information**Employability Skills 5)**

This unit contains Employability Skills

The required outcomes described in this unit of competency contain applicable facets of Employability Skills. The Employability Skills Summary of the qualification in which this unit of competency is packaged will assist in identifying Employability Skill requirements.

Elements and Performance Criteria Pre-Content

6) Elements describe the essential outcomes of a competency standard unit

Performance Criteria describe the required performance needed to demonstrate achievement of the element.

Assessment of performance is to be consistent with the Evidence Guide.

Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1 Prepare to develop engineering solution for analogue electronic problems.	1.1 OHS processes and procedures for a given work area are obtained and understood.
	1.2 Established OHS risk control measures and procedures in preparation for the work are followed.
	1.3 The extent of the analogue electronic problem is determined from performance specifications and situation reports and in consultations with relevant persons.
	1.4 Activities are planned to meet scheduled timelines in consultation with others involved in

ELEMENT	PERFORMANCE CRITERIA
	the work.
	1.5 Effective strategies are formed to ensure solution development and implementation is carried out efficiently.
2 Develop engineering solution for analogue electronic problems.	2.1 OHS risk control measures and procedures for carrying out the work are followed.
	2.2 Knowledge of analogue electronics circuit, device operation, characteristics and applications are applied to developing solutions to analogue electronic problems.
	2.3 Parameters, specifications and performance requirements in relation to each analogue electronic problem are obtained in accordance with established procedures.
	2.4 Approaches to resolving analogue electronic problems are analysed to provide most effective solutions.
	2.5 Unplanned events are dealt with safely and effectively consistent with regulatory requirements and enterprise policy.
	2.6 Quality of work is monitored against personal performance agreement and/or established organizational or professional standards
3 Test, document and implement engineering solution for analogue electronic problems.	3.1 Solutions to analogue electronic problems are tested to determine their effectiveness and modified where necessary.
	3.2 Adopted solutions are documented including instruction for their implementation that incorporates risk control measure to be followed.
	3.3 Appropriately competent and qualified person(s) required to implement solutions to analogue electronic problems are coordinated in accordance with regulatory requirements and enterprise policy. (See Note)

ELEMENT**PERFORMANCE CRITERIA**

- 3.4 Justification for solutions used to solve analogue electronic problems is documented for inclusion in work/project development records in accordance with professional standards.

Note:

A licence to practice in the workplace is required for work involving direct access to plant and equipment connected to installation wiring at voltages above 50 V a.c. or 120 V d.c.

Required Skills and Knowledge

REQUIRED SKILLS AND KNOWLEDGE

8) This describes the essential skills and knowledge and their level, required for this unit.

Evidence shall show that knowledge has been acquired of safe working practices and developing solutions to analogue electronic problems.

All knowledge and skills detailed in this unit should be contextualised to current industry practices and technologies.

KS01-EH145A

Analogue electronic circuits and systems

Evidence shall show an understanding of analogue electronic circuits, applying safe working practices and relevant Standards, Codes and Regulations to an extent indicated by the following aspects:

Single-stage analogue electronics

T1. Understanding of differential amplifiers using discrete components (transistors) of suitable characteristics to meet system objective

- differential gain, common mode rejection ratio and the required CMRR
- variable gain input stage

T2. Operational amplifier circuits

- use of d.c. offset
- operation of single-supply inverting and non-inverting amplifiers employing DC offset bias at the input and blocking capacitors
- operation of a high input resistance unity gain
- areas of use for single-supply amplifiers.

T3. Comparator circuits (open loop, limited swing and hysteresis) using operational amplifiers:

- ideal op-amp comparator
- typical uses of the comparator.
- comparators with limited (i) negative swing and (ii) both positive negative swing
- hysteresis comparator with positive resistor divider feedback and calculate the input switching voltages.
- desirable properties of an operational amplifier for use as comparator and the characteristics of comparator op amps.

T4. Amplifiers with given piecewise linear transfer characteristics

T5. Operation and building precision of half-wave and fullwave rectifiers

- precision two-diode half-wave and full-wave rectifier
- typical applications of precision rectifiers.

T6. Oscillators

- Operation of oscillators

REQUIRED SKILLS AND KNOWLEDGE

- Purpose of oscillators
- Conditions for sustained oscillation
- Operation of phase shift oscillators
- The operation and characteristics of a Colpitts oscillator
- Conditions that cause instability in amplifier circuits

Advanced power amplifiers

- Analysing the performance of power amplifiers
- Minimum power, voltage and current rating of an output transistor.
- Aspects of heat transfer related to heat sinking.
- Common forms of distortion encountered in power amplifiers. (eg. Total harmonic distortion)
- Techniques for overcoming common forms of distortion.

T9. (is the number correct?)Classes of power amplifiers and indicate typical maximum efficiencies for each class

- conduction, angle, output power and efficiency of a power amp.
- typical and/or maximum efficiencies of each class of power Amp.
- d.c and/or a.c load line,
- output power and efficiency of a large signal amplifier

T10. Operation of each class and type of power amplifier circuit

- load line operation.
- Class A – direct, RC, transformer coupled. Class B – Complementary symmetry, drivers, single supply/dual supply. Class C and Class D.
- measure the characteristics of a fully integrated operational power Amplifiers.

T11. Active filters

- frequency response of low-pass, high-pass, low-Q band-pass, high-Q bandpass, notch and all-pass filters and define pass-band, stop-band and rate of roll-off.
- main features in the amplitude and phase plots of Butterworth, Chebyshev, Cauer-Elliptic and Bessel filter responses.
- pros and cons of active and passive filters.
- non-unity gain Sallen-Key low-pass filter.
- Types of active filters available in IC form - Variable filter, Switched Capacitor Filters and digital (sampled data) filters.
- Low-Q (i.e. cascade of lowpass and high-pass) and/or narrow bandpass filters

Evidence Guide

EVIDENCE GUIDE

9) The evidence guide provides advice on assessment and must be read in conjunction with the Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment Guidelines for this Training Package.

The Evidence Guide forms an integral part of this Competency Standard Unit and shall be used in conjunction with all components parts of this unit and, performed in accordance with the Assessment Guidelines of this Training Package.

Overview of Assessment 9.1)

Longitudinal competency development approaches to assessment, such as Profiling, require data to be reliably gathered in a form that can be consistently interpreted over time. This approach is best utilised in Apprenticeship programs and reduces assessment intervention. It is the Industry's preferred model for apprenticeships. However, where summative (or final) assessment is used it is to include the application of the competency in the normal work environment or, at a minimum, the application of the competency in a realistically simulated work environment. It is recognised that, in some circumstances, assessment in part or full can occur outside the workplace. However, it must be in accord with Industry and, Regulatory policy in this regard.

Methods chosen for a particular assessment will be influenced by various factors. These include the extent of the assessment, the most effective locations for the assessment activities to take place, access to physical resources, additional safety measures that may be required and the critical nature of the competencies being assessed.

The critical safety nature of working with electricity, electrical equipment, gas or any other hazardous substance/material carries risk in deeming a person competent. Hence, sources of evidence need to be 'rich' in nature so as to minimise error in judgment.

Activities associated with normal every day work have a bearing on the decision as to how much and how detailed the data gathered will contribute to its 'richness'. Some skills are more critical to safety and operational requirements while the same skills may be more or less frequently practiced. These points are raised for the assessors to consider when choosing an assessment method and developing assessment instruments. Sample assessment instruments are included for Assessors in the Assessment Guidelines of this Training Package.

**Critical aspects
of evidence
required to
demonstrate
competency in
this unit**

Before the critical aspects of evidence are considered all prerequisites shall be met.

Evidence for competence in this unit shall be considered holistically. Each element and associated performance criteria shall be demonstrated on at least two occasions in accordance with the “Assessment Guidelines – UEE11”. Evidence shall also comprise:

- A representative body of work performance demonstrated within the timeframes typically expected of the discipline, work function and industrial environment. In particular this shall incorporate evidence that shows a candidate is able to:
 - Implement Occupational Health and Safety workplace procedures and practices including the use of risk control measures as specified in the performance criteria and range; and
 - Apply sustainable energy principles and practices as specified in the performance criteria and range; and
 - Demonstrate an understanding of the essential knowledge and associated skills as described in this unit. It may be required by some jurisdictions that RTOs provide a percentile graded result for the purpose of regulatory or licensing requirements.
 - Demonstrate an appropriate level of skills enabling employment; and
 - Conduct work observing the relevant Anti Discrimination legislation, regulations, policies and workplace procedures; and
- Demonstrated consistent performance across a representative range of contexts from the prescribed items below:
 - Develop solutions to analogue electronic problems as described in 8) and including:

- A Understanding the extent of the analogue electronic problem.
- B Forming effective strategies for solution development and implementation.
- C Obtaining analogue electronic parameters, specifications and performance requirements appropriate to each problem.
- D Testing and solutions to analogue electronic problems.
- E Documenting instruction for implementation of solutions that incorporate risk control measure to be followed.
- F Documenting justification of solutions implemented in accordance with professional standards.
- G Dealing with unplanned events by drawing on essential knowledge and skills to provide appropriate solutions incorporated in the holistic assessment with the above listed items.

Note:

Successful completion of relevant vendor training may be used to contribute to evidence on which competency is deemed. In these cases the alignment of outcomes of vendor training with performance criteria and critical aspects of evidence shall be clearly identified.

Context of and specific resources for assessment 9.3)

This unit should be assessed as it relates to normal work practice using procedures, information and resources typical of a workplace. This should include:

- OHS policy and work procedures and instructions.
- Suitable work environment, facilities, equipment and materials to undertake actual work as prescribed by this competency standard unit.

Resources required to assess this unit are listed above in context of assessment', which should also be used in the formal learning/assessment environment.

Note:

Where simulation is considered a suitable strategy for assessment it must ensure that the conditions for assessment are authentic and as far as possible reproduce and replicate the workplace and is consistent with the approved industry simulation policy.

The resources used for assessment should reflect current industry practices in relation to developing solutions to analogue electronic problems.

**Method of
assessment**

9.4)

This competency standard unit shall be assessed by methods given in Volume 1, Part 3 “Assessment Guidelines”.

Note:

Competent performance with inherent safe working practices is expected in the Industry to which this competency standard unit applies. This requires that the specified essential knowledge and associated skills are assessed in a structured environment which is primarily intended for learning/assessment and incorporates all necessary equipment and facilities for learners to develop and demonstrate the essential knowledge and skills described in this unit.

**Concurrent
assessment and
relationship with
other units**

9.5)

There are no concurrent assessment recommendations for this unit.

The critical aspects of occupational health and safety covered in unit UEENEEE101A and other discipline specific occupational health and safety units shall be incorporated in relation to this unit.

Range Statement

RANGE STATEMENT

10) This relates to the unit of competency as a whole providing the range of contexts and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

This competency standard unit shall be demonstrated in relation to developing engineering solution for at least four analogue electronic problems.

Note.

Typical analogue electronic problems are those encountered in meeting performance requirements and compliance standards, revising an analogue electronic operating parameters and dealing with analogue electronic malfunctions.

Generic terms are used throughout this Vocational Standard shall be regarded as part of the Range of Variables in which competency is demonstrated. The definition of these and other terms that apply are given in Volume 2, Part 2.1.

Unit Sector(s)

Not applicable.

Competency Field

Competency Field	11)
	Electronics