Australian Government

UEENEEE128A Develop engineering solutions to photonic system problems

Release: 2

INDUSTRY SKILLS COUNCILS
Creating Australia's Future

UEENEEE128A Develop engineering solutions to photonic system problems

Modification History

Not applicable.

Unit Descriptor

Unit Descriptor **1) Scope:**

1.1) Descriptor

This unit covers developing engineering solutions to resolve problems with photonic systems. It encompasses working safely; apply extensive knowledge of photonic technologies and their application, gathering and analysing data, and applying problem solving techniques, developing and documenting solutions and alternatives.

Application of the Unit

Application of the Unit **2)**

This unit is intended for competency development entry-level employment based programs incorporated in approved contracts of training. It is intended to apply to any formal recognition for this standard at the aligned AQF 5 level or higher.

Licensing/Regulatory Information

License to practice **3)**

The skills and knowledge described in this unit do not require a license to practice in the workplace. However, practice in this unit is subject to regulations directly related to occupational health and safety and where applicable contracts of training such as apprenticeships.

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.

UEENEEE125A	Provide engineering solutions for problems in complex multiple path circuit
UEENEEE126A	Provide solutions to basic engineering computational problems
AND	
UEENEEE129A	Solve electrotechnical engineering problems
OR	
UEENEEE101A	Apply Occupational Health and Safety regulations, codes and practices in the workplace
UEENEEE104A	Solve problems in d.c. circuits
UEENEEG101A	Solve problems in electromagnetic devices and related circuits
OR	
UEENEEH114A	Troubleshoot resonance circuits in an electronic apparatus
UEENEEE101A	Apply Occupational Health and Safety regulations, codes and practices in the workplace
AND	
UEENEEE104A	Solve problems in d.c. circuits
OR	
UEENEEH1	Solve problems in basic electronic circuits

Prerequisite Unit(s) **4)**

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Literacy and numeracy skills **4.2)**

Participants are best equipped to achieve competency in 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 photonic systems problems.	1.1 OHS processes and procedures for a given work area are identified, 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 photonic systems problem is determined from performance specifications and situation reports and in consultation with relevant persons.
	1.4 Activities are planned to meet scheduled timelines in consultation with others involved in the work.
	1.5 Strategies are identified to ensure efficient development and implementation of solution(s).
2 Develop engineering solutions for photonic system problems.	2.1 OHS risk control measures and procedures for carrying out the work are followed.
	2.2 Knowledge of photonic technology, operation, device characteristics and applications are applied to developing solutions to photonic system problems.
	2.3 Parameters, specifications and performance requirements in relation to each photonic system problem are obtained in accordance with established procedures.
	2.4 Approaches to resolving photonic system 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.

ELEMENT	PERFORMANCE CRITERIA
3 Test, document and implement engineering solution for photonic problems.	3.1 Solutions to photonic 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 photonic system problems are coordinated in accordance with regulatory requirements and enterprise policy. (See Note) 3.4 Justification for solutions used to solve photonic systems is documented for inclusion in work/project development records in accordance with professional standards. Note: A license 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 engineering solutions to photonic problems.

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

KS01-EE128A Photonic principles and applications

Evidence shall show an understanding of photonic principles and applications to an extent indicated by the following aspects:

T1 Photonic principles

- Measurements on the optical devices that are used in a basic fibre optic link
- Optical devices making up an optical fibre link
- The interconnection of optical devices that make up a one way optical fibre link
- The construction of an LED optical light source
- The electrical and optical parameters of LASERs
- LED and LASER light sources
- PN photodiodes and phototransistors
- The electrical and optical parameter
- The basic capability of optical technology involving energy transfer, communications, sensing, miniaturisation and signal processing

T2 The environmental advantages and impacts of optical technology

- The nature and importance of innovation
- The triple bottom line of business: economic, social and environmental as it relates to optical technology
- Scenario development using a variety of expressive methods to explore alternatives.
- Information networking
- Medical applications.
- Teleworking applications.
- Education applications
- Opportunities in the optical industry in Australia
- Innovations in business using optical technology
- Innovations in the provision of infrastructure in Australia

T3 Basic geometric optics

T4 Introduction to photonic components

T5 The basic concepts of optical transmission encompassing:

REQUIRED SKILLS AND KNOWLEDGE

- 'Atmospheric' and 'guided' optical transmission systems
- Fibre 'guided' systems compared to 'atmospheric' systems

T6 Photonic components and component technologies encompassing:

- Differentiate between 'passive' and 'active' photonic components
- Identify and describe optical component technologies

T7 Photonic components and their roles in photonic devices encompassing:

- Operational concepts of components and devices,
- Active verses passive devices
- Available photonic devices and their constituent components
- Photonic device operation

T8 Operating principles of optical couplers and their characteristics encompassing:

- Optical couplers.
- Loss
- Number of ports
- Directionality
- Wavelength selectivity
- 'T' and 'Y' couplers
- '1-to-N' or 'Tree' couplers
- Star couplers
- Wavelength selective couplers
- Bulk and micro-optic technologies
- Fused fibre technology
- Planar waveguides technology
- Fibre-grating technology

T9 Components for WDM systems encompassing:

- Passive and active components for WDM systems
- Filters (Interference and Absorption)
- Bulk optical gratings
- Arrayed waveguides
- Attenuators
- Line and Band filters
- Equalising filters
- Fixed and Tunable filters
- Optical Isolators (including Faraday Effect)
- Dispersion compensators
- Multiplexers or combiners
- Demultiplexers or splitters

REQUIRED SKILLS AND KNOWLEDGE

- Routers
- Add/Drop multiplexers
- Interconnection techniques used between optical components used in each optical
- Devices

T10 Operational principles of key photonic devices encompassing:

- The difference between multimode and single mode fibre,
- Attenuation,
- Dispersion
- Spontaneous and stimulated emission of light

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 unit. It must be used in conjunction with all parts of the 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-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 accordance with industry and regulatory policy.

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. Sources of evidence need to be 'rich' in nature to minimise error in judgment.

Activities associated with normal everyday 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 practised. 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 **9.2)**

Before the critical aspects of evidence are considered all prerequisites must 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 statement
  - Apply sustainable energy principles and practices as specified in the performance criteria and range statement
  - 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
  - Conduct work observing the relevant Anti Discrimination legislation, regulations, polices and workplace procedures
- Demonstrated consistent performance across a representative range of contexts from the prescribed items below:
  - Develop engineering solutions to photonic problems as described in 8) and including:

A Understanding the extent of the photonic system problems.

B Forming effective strategies for solution development and implementation.

C Obtaining photonic system parameters,

specifications and performance requirements appropriate to each problem.

D Testing and solutions to photonic system 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 a 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 in this unit.

These should be used in the formal learning/assessment environment.

Note:

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

The resources used for assessment should reflect current industry

practices in relation to developing engineering solutions to photonic problems.

Method of assessment **9.4)**

This 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 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.

Range Statement

RANGE STATEMENT

10) This relates to the unit 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 unit shall be demonstrated in relation to developing engineering solution for at least four photonic system problems.

Note.

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

Generic terms used throughout this Vocational Standard shall be regarded as part of the Range Statement in which competency is demonstrated. The definition of these and other terms that apply are given in Section 1, Clause 1.4.

Unit Sector(s)

Not applicable.

Competency Field

Competency Field **11)**

Electrotechnology